# PROJECT MANUAL

# CALCASIEU PASS PHASE 2 CHEMICAL STORAGE BUILDING

**Architect**
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# SECTION 00 01 02
# PROJECT INFORMATION

## PART 1 GENERAL

### 1.01 PROJECT IDENTIFICATION

A. Project Name: Venture Global CP2 Chemical Storage Building, located in: Cameron, LA.

B. The Owner, hereinafter referred to as Owner: Venture Global LNG, LLC

### 1.02 PROJECT DESCRIPTION

A. Summary Project Description: A new chemical storage building with a open pre-engineered metal building structure and CMU dividing walls. The building will be fully sprinkled..

B. Contract Scope: Construction.

C. The Owner's Contract, Terms, and associated Exhibits take precedence over the requirements of this Project Manual.

### 1.03 PROJECT CONSULTANTS

A. Architect

Energy Architecture, Inc
2777 Allen Parkway, Suite 460
Houston, Texas 77019

B. Structural Engineer

Pinnacle Structural Engineers
3120 Southwest Freeway, Suite 410
Houston, Texas 77098

C. MEP Enginner

IMEG Corporation
4630 North Loop 1604 West, Suite 209
San Antonio, Texas 78249

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION (NOT USED)

**END OF SECTION**

**SECTION 00 01 07.01**
**SEALS PAGE - ARCHITECT**

SECTIONS LISTED BELOW IN THIS PROJECT WERE PREPARED BY THE ARCHITECT.

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| 079200 | Joint Sealants |
| 08 71 00 | Door Hardware |
| 099723 | Concrete and Masonry Coatings |
| 13 34 19 | Metal Building Systems |

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| 230500 | Basic HVAC Requirements |
| 230503 | Through Penetration Firestopping |
| 230513 | Motors |
| 230529 | HVAC Supports and Anchors |
| 230530 | Roof Support and Wind Bracing |
| 230548 | HVAC Vibration Isolation |
| 230553 | HVAC Identification |
| 230593 | Testing, Adjusting, and Balancing |
| 230713 | Ductwork Insulation |
| 230716 | HVAC Equipment Insulation |
| 230719 | HVAC Piping Insulation |
| 230900 | Controls |
| 230920 | Venturi Valve Airflow Control System |
| 232100 | Hydronic Piping |
| 232116 | Hydronic Specialties |
| 232123 | HVAC Pumps |
| 232300 | Refrigerant Piping and Specialties |
| 232500 | Chemical (Water) Treatment |
| 233100 | Ductwork |
| 233300 | Ductwork Accessories |
| 233413.13 | Mixed Flow Laboratory Exhaust Fans |
| 233423 | Power Ventilators |
| 233600 | Air Terminal Units |
| 233700 | Air Inlets and Outlets |
| 234000 | Air Cleaning |
| 236426.13 | Air-Cooled, Rotary-Screw Water Chillers |
| 237313 | Non-ERV Indoor and Outdoor Climate Changer AHU-1 to 3; 5 to 7 |
| 237313.20 | Large AHU, DOAS, ERV Climate Change AHU-4, DOAS-1 to 4, ERV-1 |
| 238121 | Computer Room Air Conditioning Units |
| 238126 | Split-System Air-Conditioners |
| 238216 | Air Coils |

**END OF SECTION**

**SECTION 00 01 07.03**
**SEALS PAGE – PLUMBING**

SECTIONS LISTED BELOW IN THIS PROJECT WERE PREPARED BY THE PLUMBING ENGINEER.

| Section Number | Section Name |
|---|---|
| 220500 | Basic Plumbing Requirements |
| 220503 | Through Penetration Firestopping |
| 220513 | Motors |
| 220529 | Plumbing Supports and Anchors |
| 220553 | Plumbing Identification |
| 220593 | Plumbing Testing, Adjusting, and Balancing |
| 220716 | Plumbing Equipment Insulation |
| 220719 | Plumbing Piping Insulation |
| 221000 | Plumbing Piping |
| 221030 | Plumbing Specialties |
| 221123 | Domestic Water Pumps |
| 221429 | Sump Pumps |
| 223000 | Plumbing Equipment |
| 224000 | Plumbing Fixtures |

**END OF SECTION**

**SECTION 00 01 07.04**
**SEALS PAGE - ELECTRICAL**

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| 260500 | Basic Electrical Requirements |
| 260503 | Through Penetration Firestopping |
| 260513 | Wire and Cable |
| 260526 | Grounding and Bonding |
| 260527 | Supporting Devices |
| 260533 | Conduit and Boxes |
| 260553 | Electrical Identification |
| 260573 | Power System Study |
| 260933 | Lighting Control Systems |
| 262200 | Dry Type Transformers |
| 262413 | Switchboards |
| 262416 | Panelboards |
| 262726 | Wiring Devices |
| 262813 | Fuses |
| 262816 | Disconnect Switches |
| 262923 | Variable Frequency Drives |
| 263353 | Static Uninterruptible Power Supply |
| 264300 | Surge Protection Devices |
| 265119 | LED Lighting |
| 265215 | Emergency Lighting Inverter |

**END OF SECTION**

**SECTION 00 01 15**
**LIST OF DRAWING SHEETS**

**REFER TO DRAWING INDEX FOR LIST OF DRAWING SHEETS.**

**END OF SECTION**

**SECTION 00 01 07.01**
**SEALS PAGE - ARCHITECT**

SECTIONS LISTED BELOW IN THIS PROJECT WERE PREPARED BY THE ARCHITECT.

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| 015000 | Temporary Facilities and Controls |
| 016000 | Product Requirements |
| 017000 | Execution and Closeout Requirements |
| 017123 | Field Engineering |
| 017610 | Temporary Protective Coverings |
| 017800 | Closeout Submittals |
| 017900 | Demonstration and Training |
| 033600 | Polished Concrete |
| 054000 | Cold-Formed Metal Framing |
| 055000 | Metal Fabrications |
| 055100 | Metal Stairs |
| 055133 | Metal Ladders |
| 057311 | Decorative Metal and Glazed Metal Railings |
| 061000 | Rough Carpentry |
| 064100 | Architectural Wood Casework |
| 064200 | Wood Paneling |
| 071300 | Sheet Waterproofing |
| 072100 | Thermal Insulation |
| 072500 | Weather Barriers |
| 074213 | Metal Composite Material Panels |
| 075400 | Thermoplastic Membrane Roofing |
| 076200 | Sheet Metal Flashing and Trim |
| 077100 | Roof Specialties |
| 077200 | Roof Accessories |
| 077233 | Roof Hatches |
| 078400 | Firestopping |

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|---|---|
| 079100 | Preformed Joint Seals |
| 079200 | Joint Sealants |
| 079513 | Expansion Joint Cover Assemblies |
| 081113 | Hollow Metal Doors and Frames |
| 081116 | Aluminum Doors and Frames |
| 081416 | Flush Wood Doors |
| 083323 | Overhead Coiling Doors |
| 084229 | Automatic Entrances |
| 084413 | Glazed Aluminum Curtain Walls |
| 087100 | Door Hardware |
| 088000 | Glazing |
| 088300 | Mirrors |
| 090561 | Common Work Results for Flooring Preparation |
| 091000 | Materials Manual |
| 092116 | Gypsum Board Assemblies |
| 092216 | Non-Structural Metal Framing |
| 093000 | Tiling |
| 095100 | Acoustical Ceilings |
| 095426 | Specialty Acoustical Ceilings |
| 096500 | Resilient Flooring |
| 096566 | Resilient Athletic Flooring |
| 096700 | Fluid-Applied Flooring |
| 096813 | Tile Carpeting |
| 096900 | Access Flooring |
| 097200 | Wall Coverings |
| 098000 | Custom Aluminum Metal Wall System |
| 098316 | Sprayed Cellulose Acoustical Insulation |
| 098414 | Acoustic Stretched-Fabric Wall Systems |
| 099000 | Painting and Coating |
| 099723 | Concrete and Masonry Coatings |
| 101100 | Visual Display Boards |
| 102113.17 | Phenolic Toilet Compartments |
| 102229 | Full Height Glazed Partition System |
| 102239 | Folding Panel Partitions |
| 102600 | Wall and Door Protection |
| 102800 | Toilet, Bath, and Laundry Accessories |
| 104400 | Fire Protection Specialties |
| 105113 | Metal Lockers |
| 105626 | Mobile Storage Shelving |
| 107300 | Protective Covers |

| | |
|---|---|
| 111313 | Loading Dock Bumpers |
| 111316 | Loading Dock Seals and Shelters |
| 111319 | Stationary Loading Dock Equipment |
| 111400 | Pedestrian Control Equipment |
| 115313 | Laboratory Fume Hoods |
| 115314 | Fume Extractors |
| 122400 | Window Shades |
| 123553.13 | Metal Laboratory Casework |
| 123600 | Countertops |
| 142123.16 | Electric Traction Passenger Elevators |
| 142700 | Elevator Cab Interior Systems |

**END OF SECTION**

# SECTION 00 52 00
# AGREEMENT FORM

## PART 1 GENERAL

### 1.01 FORM OF AGREEMENT

A. The Agreement for the construction of the O&M Building to be provided by the Owner.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION (NOT USED)

**END OF SECTION**

# SECTION 01 76 10
# TEMPORARY PROTECTIVE COVERINGS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Temporary protective coverings for installed floors, walls, and other surfaces.

### 1.02 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: Coordination of requirements for materials specified in this section.

### 1.03 REFERENCE STANDARDS

A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023b.

C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

## PART 2 PRODUCTS

### 2.01 GENERAL

A. Provide materials that are easily removed without damage to the surfaces covered and with the following characteristics:
   1. Water resistant.
   2. Vapor permeable.
   3. Impact resistant.
   4. Slip resistant.
   5. Flame retardant.

### 2.02 MATERIALS

A. Sheet Materials:
   1. Corrugated polypropylene sheet.
   2. Recycled paperboard/plastic composite sheet.
   3. Recycled paperboard sheet.
   4. Wood Hardboard: ANSI A135.4, tempered, 1/4 inch thick nominal.
   5. Plywood, 1/2 inch thick nominal.
   6. Flame Retardance: Meet requirements of NFPA 701.

B. Rolled Materials:
   1. Self-adhering polyethylene film.
   2. Recycled cellulose fiberboard paper.
   3. Laminated glass fiber reinforced kraft paper.
   4. Flame Retardance: Meet requirements of NFPA 701.

C. Corner and Door Jamb Protection Materials:
   1. Cardboard, shaped specifically for application.

D. Tape: Type recommended by protective covering material manufacturer.

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Remove dirt and debris from surfaces to be protected.

### 3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Trim or overlap sheet materials to fit area to be covered.

C. Roll out and cut rolled materials to fit area to be covered.

D. Stretch self-adhering film materials to completely cover surface.

E. Install door jamb protection to full height of opening.

**3.03 REMOVAL**

A. Remove protective coverings prior to Date of Substantial Completion. Reuse or recycle materials if possible.

**END OF SECTION**

# SECTION 01 10 00
# SUMMARY

## PART 1 GENERAL

### 1.01 PROJECT

A. Project Name: Venture Global CP2 Chemical Storage Building.

B. Owner's Name: Venture Global LNG, LLC.

### 1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract.

### 1.03 WORK BY GENERAL CONTRACTOR

A. General Contractor to supply and install all item indicated in the Contract Documents unless speciffically noted as by others or indicated as "Work By Owner" in section 1.04 below.

B. All raceways for cabling provided by Owner or Owner's vendor as noted below will be provided by the General Contractor as described in the Contract Documents.

### 1.04 WORK BY OWNER

A. Owner or Owner's vendor will supply and install the following (GC to coordinate with Owner's force):
   1. Any required network equipment and cabling.

B. Owner will supply the following for installation by Contractor:
   1. TBD.

### 1.05 WORK SCHEDULE

A. General Contractor will have access to the site at all times subject to Owner notification at least 24 hours in advance.

B. No work can take place on Site without a Site and Safety Supervisor present.

C. Normal Work Hours: 6:30am - 5:00pm, Monday through Saturday.

D. Changes to normal work hours are to be submitted to the Owner in writing.

E. Sundays may be used as a makeup day for weather events and Holidays subject to Owner approval.

### 1.06 POST CONTRACT AWARD SUBMITTALS

A. Within 20 days after date of the Agreement, submit the following for Owner review and approval:
   1. Site Execution Plan
   2. Safety Plan in compliance with the Agreement.
   3. Organizational Chart and Indirect Staffing Plan.
   4. Quality Plan in accordance with Section "01 20 00 - Quality Requirements" of the Project Manual.
   5. Construction Equipment Plan.
   6. Preliminary Schedule in accordance with Section XX XX XX - Administrative Requirements.
   7. List of proposed subcontractors.
   8. Preparation and provisions for required construction permit applications.

### 1.07 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

# SECTION 01 25 00
# SUBSTITUTION PROCEDURES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

### 1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.

B. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

### 1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. No specific form is required. Contractor's Substitution Request documentation must include the following:
      a. Project Information:
         1) Official project name and number, and any additional required identifiers established in Contract Documents.
         2) Owner's, Architect's, and Contractor's names.
      b. Substitution Request Information:
         1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
         2) Indication of whether the substitution is for cause or convenience.
         3) Issue date.
         4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).

5) Description of Substitution.
6) Reason why the specified item cannot be provided.
7) Differences between proposed substitution and specified item.
8) Description of how proposed substitution affects other parts of work.

c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
1) Physical characteristics.
2) In-service performance.
3) Expected durability.
4) Visual effect.
5) Other salient features and requirements.
6) Include, as appropriate or requested, the following types of documentation:
(a) Product Data:
(b) Samples.
(c) Certificates, test, reports or similar qualification data.
(d) Drawings, when required to show impact on adjacent construction elements.

d. Impact of Substitution:
1) Savings to Owner for accepting substitution.
2) Change to Contract Time due to accepting substitution.

D. Limit each request to a single proposed substitution item.
1. Submit an electronic document, combining the request form with supporting data into single document.

**3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

A. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

B. Submit request for Substitution for Convenience within 14 days of discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
3. Bear the costs engendered by proposed substitution of:
a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
b. Other construction by Owner.
c. Other unanticipated project considerations.

C. Substitutions will not be considered under one or more of the following circumstances:
1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
2. Without a separate written request.
3. When acceptance will require revisions to Contract Documents.

**3.03 RESOLUTION**

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
1. Architect's decision following review of proposed substitution will be noted on the submitted form.

### 3.04 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

### 3.05 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

**END OF SECTION**

# SECTION 01 30 00
# ADMINISTRATIVE REQUIREMENTS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. General administrative requirements.

B. Web-based project software service.

C. Electronic document submittal service.

D. Preconstruction meeting.

E. Site mobilization meeting.

F. Progress meetings.

G. Construction progress schedule.

H. Contractor's daily reports.

I. Progress photographs.

J. Coordination drawings.

K. Submittals for review, information, and project closeout.

L. Requests for Interpretation (RFI) procedures.

M. Submittal procedures.

### 1.02 RELATED REQUIREMENTS

A. Section 01 60 00 - Product Requirements: General product requirements.

B. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

C. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

### 1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 WEB-BASED PROJECT SOFTWARE SERVICE

A. Web-Based Project Software Service: Provide, administer, and use web-based project software to host and manage project communication and documentation.
   1. Include, at minimum, the following features:

a. Project directory, including Owner, Contractor, subcontractors, Architect, Architect's consultants, and other entities involved in the project. Include names of contact persons and contact information for each entity.
b. Access control for each entity and for each workflow process to determine each entity's digital rights to create, modify, view, and print documents.
c. Workflow planning, allowing customization of workflow for each project entity.
d. Creation, logging, tracking, and notification for project communications.
e. Tracking of project communication statuses in real time, including timestamped response log.
f. Procedures for viewing PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
g. Processing and tracking of payment applications.
h. Processing and tracking of contract modifications.
i. Creation and distribution of meeting minutes.
j. Document management for drawings, specifications, and coordination drawings, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility.
m. Creation of data analytics reports.
n. Creation and export of editable logs for software functions. Provide Owner, Architect, and Architect's consultants with rights and ability to download logs when requested.

2. Provide user licenses for use by Owner, Architect, Architect's consultants, and other entities involved in the project.
3. Comply with the software service's current published licensing agreements.
4. Training: Provide one-hour, web-based training session for users of software service. Further training is the responsibility of the user.
   a. Representatives of Owner are scheduled and included in this training.
5. Project Closeout: Architect determines when to terminate the software service for the project and is responsible for obtaining archive copies of files for Owner.
6. Web-Based Project Software Services: The selected service is:
   a. Procore Technologies, Inc..
   b. Substitutions: See Section 01 60 00 - Product Requirements.

**3.02 PRECONSTRUCTION MEETING**

A. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

B. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Submission of initial Submittal schedule.
   6. Designation of personnel representing the parties to Contract, _____ and Architect.
   7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   8. Scheduling.

C. 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.

**3.03 SITE MOBILIZATION MEETING**

A. Schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Special consultants.
   5. Contractor's superintendent.
   6. Major subcontractors.

C. Agenda:
   1. Use of premises by Owner and Contractor.
   2. Owner's requirements.
   3. Construction facilities and controls provided by Owner.
   4. Temporary utilities provided by Owner.
   5. Survey and building layout.
   6. Security and housekeeping procedures.
   7. Schedules.
   8. Application for payment procedures.
   9. Procedures for testing.
   10. Procedures for maintaining record documents.
   11. Requirements for start-up of equipment.
   12. Inspection and acceptance of equipment put into service during construction period.

D. 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.

**3.04 PROGRESS MEETINGS**

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings and make arrangements for virtual attendees.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of RFIs log and status of responses.
   7. Review of off-site fabrication and delivery schedules.
   8. Maintenance of progress schedule.
   9. Corrective measures to regain projected schedules.
   10. Planned progress during succeeding work period.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to work.

E. 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.

### 3.05 CONSTRUCTION PROGRESS SCHEDULE

A. Within 15 days after date of the Agreement, submit preliminary schedule.
   1. Schedule is to be executed using Primavera P6 to a level 3 and resource loaded.
   2. Schedule to be submitted to Owner in native format for inclusion in the overall project schedule.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

### 3.06 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
   1. Date.
   2. High and low temperatures, and general weather conditions.
   3. List of subcontractors at Project site.
   4. List of separate contractors at Project site.
   5. Major equipment at Project site.
   6. Material deliveries.
   7. Safety, environmental, or industrial relations incidents.
   8. Meetings and significant decisions.
   9. Unusual events (submit a separate special report).
   10. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
   11. Emergency procedures.
   12. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
   13. Testing and/or inspections performed.
   14. Signature of Contractor's authorized representative.

### 3.07 PROGRESS PHOTOGRAPHS

A. Submit new photographs weekly, within 3 days after being taken.

B. Photography Type: Digital; electronic files.

C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

D. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Excavations in progress.
   2. Foundations in progress and upon completion.
   3. Structural framing in progress and upon completion.
   4. Enclosure of building, upon completion.
   5. Final completion, minimum of ten (10) photos.

E. Views:
   1. Provide aerial photographs from four cardinal views at each specified time, until structure is enclosed.

2. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
3. Consult with Architect for instructions on views required.
4. Provide factual presentation.
5. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Web-Based Project Software.
2. File Naming: Include project identification, date and time of view, and view identification.

**3.08 REQUESTS FOR INTERPRETATION (RFI)**

A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
b. Do not forward requests which solely require internal coordination between subcontractors.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
a. Approval of submittals (use procedures specified elsewhere in this section).
b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.

2. Owner's, Architect's, and Contractor's names.
3. Discrete and consecutive RFI number, and descriptive subject/title.
4. Issue date, and requested reply date.
5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Highlight items requiring priority or expedited response.
4. Highlight items for which a timely response has not been received to date.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

### 3.09 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
1. Coordinate with Contractor's construction schedule and schedule of values.
2. Format schedule to allow tracking of status of submittals throughout duration of construction.
3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make

corrections or revisions to initial submittals, and time for their review.

### 3.10 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Design data.
   3. Shop drawings.
   4. Samples for selection.
   5. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

### 3.11 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Certificates.
   2. Test reports.
   3. Inspection reports.
   4. Manufacturer's instructions.
   5. Manufacturer's field reports.
   6. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

### 3.12 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

### 3.13 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a separate transmittal for each item.
   2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
   3. Transmit using approved form.
      a. Use form generated by Electronic Document Submittal Service software.
   4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
   5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.

a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.

7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
   a. Upload submittals in electronic form to Electronic Document Submittal Service website.
8. Schedule submittals to expedite the Project, and coordinate submission of related items.
   a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
   b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
   c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
10. Provide space for Contractor and Architect review stamps.
11. When revised for resubmission, identify all changes made since previous submission.
12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
14. Submittals not requested will not be recognized or processed.

B. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Do not reproduce Contract Documents to create shop drawings.
   3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
   1. Transmit related items together as single package.
   2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

### 3.14 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

D. Architect's and consultants' actions on items submitted for review:
   1. Authorizing purchasing, fabrication, delivery, and installation:
      a. "Reviewed", or language with same legal meaning.
      b. "Reviewed as Noted", or language with same legal meaning.
         1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
      c. "Reviewed as Noted, Resubmit for Record", or language with same legal meaning.

1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
2) Non-responsive resubmittals may be rejected.

2. Not Authorizing fabrication, delivery, and installation:
   a. "Revise and Resubmit".
      1) Resubmit revised item, with review notations acknowledged and incorporated.
      2) Non-responsive resubmittals may be rejected.
   b. "Rejected".
      1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:
   1. Items for which no action was taken:
      a. "Received" - to notify the Contractor that the submittal has been received for record only.
   2. Items for which action was taken:
      a. "Reviewed" - no further action is required from Contractor.

**END OF SECTION**

# SECTION 01 40 00
# QUALITY REQUIREMENTS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

### 1.02 RELATED REQUIREMENTS

A. Section 01 21 00 - Allowances: Allowance for payment of testing services.

B. Section 01 30 00 - Administrative Requirements: Submittal procedures.

C. Section 01 42 19 - Reference Standards.

D. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

### 1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2024.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2023.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2021.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

H. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.

### 1.04 DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

B. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

### 1.05 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
   1. Temporary sheeting, shoring, or supports.
   2. Temporary scaffolding.
   3. Temporary bracing.
   4. Temporary falsework for support of spanning or arched structures.
   5. Temporary foundation underpinning.
   6. Temporary stairs or steps required for construction access only.
   7. Temporary hoist(s) and rigging.
   8. Investigation of soil conditions to support construction equipment.

## 1.06 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.
   1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
   1. Concrete Mix Design: As described in Construction Documents. No specific designer qualifications are required.
   2. Concrete Mix and Structural Design: As described in Construction Documents.
   3. Structural Design of Steel Connections: As described in Construction Documents.
   4. Structural Design of Steel Connections: As described in Construction Documents.
   5. Structural Design of Steel Decking: As described in Construction Documents.
   6. Structural Design of Metal Framing: As described in Section 05 40 00 - Cold-Formed Metal Framing.
   7. Structural Design of Metal Fabrications: As described in Construction Documents.
   8. Structural Design of Stairs: As described in Section 05 51 00 - Metal Stairs.
   9. Structural Design of Railings: As described in Construction Documents.
   10. Structural Calculations: As described in Section 07 42 13.23 - Metal Composite Material Panels.
   11. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 08 43 13 - Aluminum-Framed Storefronts.
   12. Structural Design: Include calculations for resisting wind loads, anchor locations, loads at points of attachment to building structure, physical characteristics, resulting dimensional limitations as described in Section 08 44 13 - Glazed Aluminum Curtain Walls.
   13. Sprinkler Layout: Coordinate with ceiling installation, detailed pipe layout, and hydraulic calculations as described in Construction Documents.
   14. System Design: As described in Construction Documents.

## 1.07 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
   1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
      a. Full name.
      b. Professional licensure information.
      c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the

Contract Documents, or for Owner's information.

1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
2. Include required product data and shop drawings.
3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.

D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.

1. Include:
   a. Date issued.
   b. Project title and number.
   c. Name of inspector.
   d. Date and time of sampling or inspection.
   e. Identification of product and specifications section.
   f. Location in the Project.
   g. Type of test/inspection.
   h. Date of test/inspection.
   i. Results of test/inspection.
   j. Compliance with Contract Documents.
   k. When requested by Architect, provide interpretation of results.
2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

## 1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Contractor's Quality Control (CQC) Plan:
   1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
      a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
         1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
      b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
         1) Management and control of documents and records relating to quality.
         2) Communications.
         3) Coordination procedures.
         4) Resource management.
         5) Process control.
         6) Inspection and testing procedures and scheduling.
         7) Control of noncomplying work.
         8) Tracking deficiencies from identification, through acceptable corrective action, and verification.
         9) Control of testing and measuring equipment.
         10) Project materials certification.
         11) Managerial continuity and flexibility.
      c. Inspection and Test Plans: Develop specific Inspection and Test Plans for each scope of work as required. Proposed ITPs will be submitted to the Owner with the Quality Plan for review and approval.
      d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

**1.09 REFERENCES AND STANDARDS**

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise

in any reference document.

### 1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ services of an independent testing agency to perform certain specified testing and inspections.

B. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

D. Contractor Employed Agency:
   1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
   2. Inspection agency: Comply with requirements of ASTM D3740, ASTM E329, and _____.
   3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
   4. Laboratory: Authorized to operate in the State in which the Project is located.
   5. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   6. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

### 3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.

D. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

F. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

G. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

**3.03 TOLERANCES**

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

**3.04 TESTING AND INSPECTION**

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
   5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
   6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

### 3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### 3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Owner, it is not practical to remove and replace the work, Owner will direct an appropriate remedy or adjust payment.

**END OF SECTION**

# SECTION 01 41 00
# REGULATORY REQUIREMENTS

## PART 1 GENERAL

### 1.01 SUMMARY OF REFERENCE STANDARDS

A. Refer to Drawings and Owner's contract and Exhibits for additional regulatory requirements.

B. Regulatory requirements applicable to this project are the following:

C. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

D. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

E. 29 CFR 1910 - Occupational Safety and Health Standards; Current Edition.

F. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

G. ICC (IFC) - International Fire Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

### 1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

### 1.03 QUALITY ASSURANCE

A. Contractor's Designer Qualifications: Refer to Section - 01 40 00 - Quality Requirements.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

**END OF SECTION**

# SECTION 01 45 33
# CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Code-required special inspections.

B. Testing services incidental to special inspections.

C. Submittals.

D. Manufacturers' field services.

E. Fabricators' field services.

### 1.02 RELATED REQUIREMENTS

A. Document 00 31 00 - Available Project Information: Soil investigation data.

B. Section 01 30 00 - Administrative Requirements: Submittal procedures.

C. Section 01 40 00 - Quality Requirements.

D. Section 01 42 19 - Reference Standards.

E. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

### 1.03 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authority having jurisdiction.

B. IAS: International Accreditation Service, Inc.

C. NIST: National Institute of Standards and Technology.

### 1.04 DEFINITIONS

A. Code or Building Code: ICC (IBC)-2018, Edition of the International Building Code and specifically, Chapter 17 - Special Inspections and Tests.

B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.

C. Special Inspection:

1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

### 1.05 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. AISC 360 - Specification for Structural Steel Buildings; 2022.

C. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2023.

D. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.

E. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.

F. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2021.

G. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.

H. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 2019 (Reapproved 2023).

I. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).

J. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.

K. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

M. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

N. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).

O. ICC (IBC)-2018 - International Building Code; 2018.

P. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck; 2017.

Q. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

**1.06 SUBMITTALS**

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
   1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Submit certification that Special Inspection Agency is acceptable to AHJ.

C. Testing Agency Qualifications: Prior to the start of work, the Testing Agency is required to:
   1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
   3. Submit certification that Testing Agency is acceptable to AHJ.

D. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to the AHJ.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of Special Inspector.
      d. Date and time of special inspection.
      e. Identification of product and specifications section.
      f. Location in the Project.
      g. Type of special inspection.
      h. Date of special inspection.
      i. Results of special inspection.
      j. Compliance with Contract Documents.

E. Test Reports: After each test or inspection, promptly submit at least two copies of report; one to Architect and one to AHJ.

1. Include:
    a. Date issued.
    b. Project title and number.
    c. Name of inspector.
    d. Date and time of sampling or inspection.
    e. Identification of product and specifications section.
    f. Location in the Project.
    g. Type of test or inspection.
    h. Date of test or inspection.
    i. Results of test or inspection.
    j. Compliance with Contract Documents.

F. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
    1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

G. Manufacturer's Field Reports: Submit reports to Architect and AHJ.
    1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

H. Fabricator's Field Reports: Submit reports to Architect and AHJ.
    1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in Contract Documents.

## 1.07 SPECIAL INSPECTION AGENCY

A. Owner or Architect will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.

B. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.

C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

## 1.08 TESTING AND INSPECTION AGENCIES

A. Owner or Architect may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.

B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

## 1.09 QUALITY ASSURANCE

A. Special Inspection Agency Qualifications:
    1. Independent firm specializing in performing testing and inspections of the type specified in this section.

B. Testing Agency Qualifications:
    1. Independent firm specializing in performing testing and inspections of the type specified in this section.

# PART 2 PRODUCTS - NOT USED

# PART 3 EXECUTION

## 3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.

1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

**3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION**

A. Structural Steel: Comply with quality assurance inspection requirements of ICC (IBC)-2018.

B. Cold-Formed Steel Deck: Comply with quality assurance inspection requirements of SDI (QA/QC).

C. Open-Web Joists and Joist Girders: Comply with requirements of ICC (IBC), Table 1705.2.3.
   1. End Connections - Welding or Bolted: Comply with requirements of SJI 100; periodic.
   2. Bridging - Horizontal or Diagonal:
      a. Standard Bridging: Comply with requirements of SJI 100; periodic.
      b. Bridging That Differs From the SJI Specifications: Periodic inspection.

D. High-Strength Bolt, Nut and Washer Material:
   1. Verify identification markings comply with ASTM standards specified in the approved contract and to AISC 360, Section A3.3; periodic.
   2. Submit manufacturer's certificates of compliance; periodic.

E. High-Strength Bolting Installation: Verify items listed below comply with AISC 360, Section M2.5.
   1. Snug tight joints; periodic.
   2. Pretensioned and slip-critical joints with matchmarking, twist-off bolt or direct tension indicator method of installation; periodic.
   3. Pretensioned and slip-critical joints without matchmarking or calibrated wrench method of installation; continuous.

F. Structural Steel and Cold Formed Steel Deck Material:
   1. Structural Steel: Verify identification markings comply with AISC 360, Section M3.5; periodic.
   2. Other Steel: Verify identification markings comply with ASTM standards specified in the approved Contract Documents; periodic.
   3. Submit manufacturer's certificates of compliance and test reports; periodic.

G. Weld Filler Material:
   1. Verify identification markings comply with AWS standards specified in the approved Contract Documents and to AISC 360, Section A3.5; periodic.
   2. Submit manufacturer's certificates of compliance; periodic.

H. Welding:
   1. Structural Steel and Cold Formed Steel Deck:
      a. Complete and Partial Joint Penetration Groove Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
      b. Multipass Fillet Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
      c. Single Pass Fillet Welds Less than 5/16 inch Wide: Verify compliance with AWS D1.1/D1.1M; periodic.
      d. Plug and Slot Welds: Verify compliance with AWS D1.1/D1.1M; continuous.
      e. Single Pass Fillet Welds 5/16 inch or Greater: Verify compliance with AWS D1.1/D1.1M; continuous.
      f. Floor and Roof Deck Welds: Verify compliance with AWS D1.3/D1.3M; continuous.

I. Steel Frame Joint Details: Verify compliance with approved Contract Documents.
   1. Details, bracing and stiffening; periodic.
   2. Member locations; periodic.

3. Application of joint details at each connection; periodic.

**3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION**

A. Reinforcement, and Verification of Placement: Verify compliance with ACI CODE-318, Chapters 20, 25.2, 25.3, 26.6.1-26.6.3; periodic.

B. Reinforcing Steel and Placement: Verify compliance with approved Contract Documents and ACI CODE-318, Sections 3.5 and 7.1 through 7.7; periodic.

C. Reinforcing Steel Welding: Verify compliance with AWS D1.4/D1.4M and ACI CODE-318, Section 3.5.2; periodic.

D. Anchors Cast in Concrete: Verify compliance with ACI CODE-318; periodic.

E. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI CODE-318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.

F. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI CODE-318.
   1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
   2. Other Mechanical and Adhesive Anchors: Verify as per Chapter 17.8.2; periodic.

G. Anchors Installed in Hardened Concrete: Verify compliance with ACI CODE-318, Sections 3.8.6, 8.1.3, and 21.2.8; periodic.

H. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI CODE-318, Chapter 19, 16.4.3, 26.4.4; periodic.

I. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI CODE-318, Chapter 4 and 5.2; periodic.

J. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M, and ACI CODE-318, Chapter 26.5, 26.12, and record the following, continuous:
   1. Slump.
   2. Air content.
   3. Temperature of concrete.

K. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M, and ACI CODE-318, Sections 5.6 and 5.8 and record the following, continuous:
   1. Slump.
   2. Air content.
   3. Temperature of concrete.

L. Concrete and Shotcrete Placement: Verify application techniques comply with approved Contract Documents and ACI CODE-318, Chapter 26.5; continuous.

M. Concrete and Shotcrete Placement: Verify application techniques comply with approved Contract Documents and ACI CODE-318, Sections 5.9 and 5.10; continuous.

N. Specified Curing Temperature and Techniques: Verify compliance with ACI CODE-318, Chapter 26.5.3 through 26.5.5; periodic.

O. Specified Curing Temperature and Techniques: Verify compliance with approved Contract Documents and ACI CODE-318, Sections 5.11 through 5.13; periodic.

P. Precast Concrete Members: Verify erection techniques and placement comply with approved Contract Documents and ACI CODE-318, Chapter 26.9; periodic.

Q. Precast Concrete Members: Verify erection techniques and placement comply with approved Contract Documents and ACI CODE-318, Chapter 16; periodic.

R. Concrete Strength in Situ: Verify concrete strength complies with approved Contract Documents and ACI CODE-318, Chapter 26.11.2, for the following:

1. Beams and structural slabs, prior to removal of shores and forms; periodic.

S. Concrete Strength in Situ: Verify concrete strength complies with approved Contract Documents and ACI CODE-318, Section 6.2, for the following.
   1. Beams and structural slabs, prior to removal of shores and forms; periodic.

T. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI CODE-318, Chapter 26.11.1.2(b); periodic.

U. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI CODE-318, Section 6.1.1; periodic.

V. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials comply with the quality standards of ACI CODE-318, the AHJ will require testing of materials in accordance with the appropriate standards and criteria in ACI CODE-318, Chapters 19 and 20.

W. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials comply with the quality standards of ACI CODE-318, the AHJ will require that the Special Inspector verify compliance with the appropriate standards and criteria in , Chapter 3.

## 3.04 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

A. Masonry Structures Subject to Special Inspection:
   1. Masonry construction when required by the quality assurance program of TMS 402/602.
   2. Empirically designed masonry and masonry veneer in structures designated as "essential facilities".
      a. Perform inspections in accordance with Level B Quality Assurance.
   3. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".

B. Verify each item below complies with approved Contract Documents and the applicable articles of TMS 402/602.
   1. Inspections and Approvals:
      a. Verify compliance with the required inspection provisions of the approved Contract Documents; periodic.
      b. Verify approval of submittals required by Contract Documents; periodic.
   2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
   3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
   4. Joints and Accessories: When masonry construction begins, verify:
      a. Proportions of site prepared mortar; periodic.
      b. Construction of mortar joints; periodic.
      c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.
   5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
      a. Size and location of structural elements; periodic.
      b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
      c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
      d. Welding of reinforcing bars; continuous.
   6. Grouting Preparation: Prior to grouting, verify:
      a. Grout space is clean; periodic.
      b. Correct placement of reinforcing, connectors, prestressing tendons and anchorages; periodic.

c. Correctly proportioned site prepared grouts and prestressing grout for bonded tendons; periodic.
d. Correctly constructed mortar joints; periodic.

7. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; periodic.

C. Engineered Masonry in Buildings Designated as "Essential Facilities": Verify compliance of each item below with approved Contract Documents and the applicable articles of TMS 402/602.

1. Inspections and Approvals:
   a. Verify compliance with the required inspection provisions of the approved Contract Documents; periodic.
   b. Verify approval of submittals required by Contract Documents; periodic.
2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction and upon completion of each 5,000 square feet increment of masonry erected during construction; periodic.
3. Preblended Mortar and Grout: Verify proportions of materials upon delivery to site; periodic.
4. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
5. Engineered Elements, Joints, Anchors, Grouting, Protection: Verify compliance of each item below with approved Contract Documents and referenced standards.
   a. Proportions of site prepared mortar; periodic.
   b. Placement of masonry units and construction of mortar joints; periodic.
   c. Placement of reinforcement, connectors, prestressing tendons, anchorages, etc.; periodic.
   d. Size and location of structural elements; periodic.
   e. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; continuous.
   f. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
   g. Welding of reinforcing bars; continuous.
6. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; continuous.

## 3.05 SPECIAL INSPECTIONS FOR SOILS

A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.

1. Design bearing capacity of material below shallow foundations; periodic.
2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.

B. Testing: Classify and test excavated material; periodic.

## 3.06 SPECIAL INSPECTIONS FOR CAST-IN-PLACE DEEP FOUNDATIONS

A. Materials, Equipment and Final Placement: Verify each item below complies with approved construction documents and approved geotechnical report.

1. Element length; continuous.
2. Element diameters and bell diameters; continuous.
3. Embedment into bedrock; continuous.
4. End bearing strata capacity; continuous.
5. Placement locations and plumbness; continuous.
6. Type and size of hammer; continuous.

B. Drilling Operations: Observe and maintain complete and accurate records for each element; continuous.

C. Material Volume: Record concrete and grout volumes.

D. Concrete Elements Associated with Cast-in-Place Deep Foundations: Perform additional inspections as required by the Special Inspections for Concrete Construction article of this section.

### 3.07 SPECIAL INSPECTIONS FOR SPRAYED FIRE RESISTANT MATERIALS

A. Sprayed Fire Resistant Materials, General:
   1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies indicated in approved Contract Documents, and with applicable requirements of the building code.
   2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.

B. Physical and visual tests: Verify compliance with fire resistance rating.
   1. Condition of substrates; periodic.
   2. Thickness of sprayed fire resistant material; periodic.
   3. Density of sprayed fire resistant material in pounds per cubic foot; periodic.
   4. Bond strength (adhesion and cohesion); periodic.
   5. Condition of finished application; periodic.

C. Structural member surface conditions:
   1. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
   2. Verify preparation of structural member surfaces complies with approved Contract Documents and manufacturer's written instructions; periodic.

D. Application:
   1. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
   2. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.

E. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved Contract Documents. In no case shall the thickness of the sprayed fire resistant material be less than the minimum below.
   1. Minimum Allowable Thickness: Tested according to ASTM E605/E605M, periodic.

F. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved Contract Documents.

G. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot when in-place samples of the cured material are tested according to ASTM E736/E736M and as described below.

### 3.08 SPECIAL INSPECTIONS FOR FIRE RESISTANT PENETRATIONS AND JOINTS

A. Verify penetration firestops in accordance with ASTM E2174.

B. Verify fire resistant joints in accordance with ASTM E2393.

### 3.09 SPECIAL INSPECTIONS FOR WIND RESISTANCE

A. Cold-Formed Steel Light Frame Construction:
   1. Field welding; periodic.
   2. Screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic

B. Wind Resisting Components:
   1. Roof covering, roof deck, and floor framing connections; periodic.

2. Exterior wall covering and wall connections to roof and floor diaphragms and framing; periodic.

C. Structural Observations for Wind Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

### 3.10 OTHER SPECIAL INSPECTIONS

A. Provide for special inspection of work that, in the opinion of the AHJ, is unusual in nature.

B. For the purposes of this section, work unusual in nature includes, but is not limited to:
1. Construction materials and systems that are alternatives to materials and systems prescribed by the building code.
2. Unusual design applications of materials described in the building code.
3. Materials and systems required to be installed in accordance with the manufacturer's instructions when said instructions prescribe requirements not included in the building code or in standards referenced by the building code.

### 3.11 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

A. Special Inspection Agency shall:
1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified reference standards.
3. Ascertain compliance of materials and products with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests or inspections specified.

B. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

C. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

### 3.12 TESTING AGENCY DUTIES AND RESPONSIBILITIES

A. Testing Agency Duties:
1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified standards.
3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests or inspections specified.

B. Limits on Testing or Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the work.

C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.

D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

### 3.13 CONTRACTOR DUTIES AND RESPONSIBILITIES

A. Contractor Responsibilities, General:
   1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
   2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
   3. Provide incidental labor and facilities:
      a. To provide access to work to be tested or inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
      c. To facilitate tests or inspections.
      d. To provide storage and curing of test samples.
   4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
   5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

B. Contractor Responsibilities, Wind Force-Resisting System and Wind Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

### 3.14 MANUFACTURERS' AND FABRICATORS' FIELD SERVICES

A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, to test, adjust, and balance equipment and _____ as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

**END OF SECTION**

# SECTION 01 50 00
# TEMPORARY FACILITIES AND CONTROLS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Dewatering

B. Temporary utilities.

C. Temporary telecommunications services.

D. Temporary sanitary facilities.

E. Temporary Controls: Barriers, enclosures, and fencing.

F. Security requirements.

G. Vehicular access and parking.

H. Waste removal facilities and services.

I. Field offices.

### 1.02 TEMPORARY UTILITIES

A. All temporary power and lighting will be the responsibility of the General Contractor.

B. Access to water will be provided on-site. It is the General Contractor's responsibility to transport the water to the work area as required.

### 1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

### 1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

### 1.05 EMPLOYEE FACILITIES

A. Provide lunch tent or trailer facilities including tables, chairs or benches, and microwaves for their employees use.

B. Provide potable water, cups, and associated waste receptacles.

C. Maintain daily in clean and sanitary condition.

### 1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

### 1.07 FENCING

A. Provide temporary fencing around the building site and laydown areas until such time that the building is Mechanically Complete. Temporary fencing to be designed to resist high wind loads present at the site.

B. Provide Owner with a spare set of keys for all locks on entry gates.

### 1.08 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

### 1.09 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with Owner.

B. If additional temporary roads are required outside of the supplied temporary roads, General Contractor shall submit a plan to the Owner for approval prior to proceeding.

C. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

### 1.10 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide and maintain concrete wash out areas.

C. Provide containers with lids. Remove trash from site periodically.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

### 1.11 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION - NOT USED

**END OF SECTION**

# SECTION 01 60 00
# PRODUCT REQUIREMENTS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Procedures for Owner-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

### 1.02 RELATED REQUIREMENTS

A. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

B. Section 01 40 00 - Quality Requirements: Product quality monitoring.

### 1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

## PART 2 PRODUCTS

### 2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. See Section 01 40 00 - Quality Requirements, for additional source quality control requirements.

C. Use of products having any of the following characteristics is not permitted:
   1. Made using or containing CFC's or HCFC's.
   2. Made of wood from newly cut old growth timber.
   3. Containing lead, cadmium, or asbestos.

D. Where other criteria are met, Contractor shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.

### 2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

### 2.03 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

## PART 3 EXECUTION

### 3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 25 00 - Substitution Procedures.

### 3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

### 3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### 3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

# SECTION 01 70 00
# EXECUTION AND CLOSEOUT REQUIREMENTS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of Owner personnel.

H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

I. General requirements for maintenance service.

### 1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

B. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

C. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

D. Section 07 84 00 - Firestopping.

### 1.03 REFERENCE STANDARDS

### 1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

### 1.05 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or

complexity.

C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

**1.06 PROJECT CONDITIONS**

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

**1.07 COORDINATION**

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

**PART 2 PRODUCTS**

**2.01 PATCHING MATERIALS**

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### 3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### 3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. 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.

### 3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and _____.

2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations, and _____.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

**3.05 GENERAL INSTALLATION REQUIREMENTS**

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

**3.06 CUTTING AND PATCHING**

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

I. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

**3.07 PROGRESS CLEANING**

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### 3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### 3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### 3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

### 3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

### 3.12 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and _____.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### 3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

### 3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION**

# SECTION 01 71 23
# FIELD ENGINEERING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Field engineering services by Contractor.

B. Land surveying services by Contractor.

C. Construction surveying by Contractor.

D. Support and bracing.

### 1.02 DESCRIPTION OF SERVICES

A. Specific services listed in this section are in addition to, and do not supersede, general Execution and Closeout Requirements.

B. Sole responsibility for establishing all locations, dimensions and levels of items of work.

C. Sole responsibility for provision of all materials required to establish and maintain benchmarks and control points, including batter boards, grade stakes, structure elevation stakes, and other items.

D. Keeping a transit, theodolite, or TST (total station theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the project site at all times.

E. Provision of facilities and assistance necessary for Architect to check lines and grade points placed by Contractor.
   1. Performance of excavation or embankment work until after all cross-sectioning necessary for determining payment quantities for Unit Price work have been completed and accepted by Architect.

F. Preparation and maintenance of daily reports of activity on the work. Submission of reports containing key progress indicators and job conditions to Architect.
   1. Major equipment and materials installed as part of the work.
   2. Location of areas in which construction was performed.
   3. Work performed, including field quality control measures and testing.
   4. Weather conditions.
   5. Instructions received from Architect or Owner, if any.

G. Preparation and maintenance of professional-quality, accurate, well organized, legible notes of all measurements and calculations made while surveying and laying out the work.

### 1.03 REFERENCE STANDARDS

A. FGDC-STD-007.1 - Geospatial Positioning Accuracy Standards - Part 1: Reporting Methodology; 1998.

B. FGDC-STD-007.2 - Geospatial Positioning Accuracy Standards - Part 2: Standards for Geodetic Networks; 1998.

C. FGDC-STD-007.4 - Geospatial Positioning Accuracy Standards - Part 4: Architecture, Engineering, Construction, and Facilities Measurement; 2002.

D. State Plane Coordinate System for the State in which the Project is located.

### 1.04 QUALITY ASSURANCE

A. Field Engineer's Qualifications: As established in Section 01 70 00 - Execution and Closeout Requirements.

B. Use adequate number of skilled and thoroughly-trained workers to perform the work of this section in a timely and comprehensive manner.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify layout information shown on drawings in relation to property survey and existing benchmarks.

B. Notify Owner’s representative and Architect of discrepancies immediately in writing before proceeding to lay out work.

C. Locate and protect existing benchmarks, base lines, and demarcations. Preserve permanent reference points during construction.

D. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify existing conditions.

### 3.02 FIELD ENGINEERING

A. Maintain field office files, drawings, specifications, and record documents.

B. Coordinate field engineering services with Contractor's subcontractors, installers, and suppliers as appropriate.

C. Prepare layout and coordination drawings for construction operations.

D. Check and coordinate the work for conflicts and interferences, and immediately advise Architect and Owner of all discrepancies of which Contractor is aware.

E. Cooperate as required with Architect and Owner in observing the work and performing field inspections.

F. Review and coordinate work on a regular basis with shop drawings and Contractor's other submittals.

G. Check the location, line and grade of every major element as the work progresses. Notify the Architect when deviations from required lines or grades exceed allowable tolerances. Include in such notifications a thorough explanation of the problem, and a proposed plan and schedule for remedying the deviation. Do not proceed with remedial work without Owner’s concurrence of the remediation plan.

### 3.03 LAND SURVEYING

A. General: Follow standards for geospatial positioning accuracy.
   1. FGDC-STD-007.1 as amended by Authority Having Jurisdiction.
   2. FGDC-STD-007.2 as amended by Authority Having Jurisdiction.
   3. FGDC-STD-007.4 as amended by Authority Having Jurisdiction.

B. Coordinate survey data with the State Plane Coordinate System of the State in which the Project is located.

C. Contractor is responsible for the restoration of all property corners and control monuments damaged or destroyed by construction-related activities. Any disturbed monuments must be replaced at Contractor’s expense by a surveyor licensed in the State in which the Project is located, and approved by the Architect.
   1. Temporarily suspend work at such points and for such reasonable times as the Owner may require for resetting monuments. The Contractor will not be entitled to any additional compensation or extension of time.

### 3.04 CONSTRUCTION SURVEYING

A. General: Perform surveying as applicable to specific items necessary for proper execution of work.
   1. Alignment Staking: Provide alignment stakes at 50 foot intervals on tangent, and at 25 foot intervals on curves.

2. Slope Staking: Provide slope staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. Re-stake at every ten-foot difference in elevation.
3. Structure: Stake out structures, including elevations, and check prior to and during construction.
4. Road: Stake out roadway elevations at 50 foot50-foot intervals on tangent, and at 25 foot intervals on curves.
5. Cross-sections: Provide original, intermediate, and final staking as required, for site work and other locations as necessary for quantity surveys.
6. Easement Staking: Provide easement staking at 50 foot intervals on tangent, and at 25 foot intervals on curves. If required by project conditions, provide wooden laths with flagging at 100 foot intervals.

B. Record Log: Maintain a log of layout control work. Record any deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used.

C. Accuracy:
1. Establish Contractor's temporary survey references points for Contractor's use to at least second-order accuracy (e.g., 1:10000). Set construction staking used as a guide for the work to at least third-order accuracy (e.g., 1:5000). Provide the absolute margin for error specified below on the basis established by such orders.
a. Accuracy of Other Staking: Plus/minus 0.04 foot horizontally and plus/minus 0.02 foot vertically.
b. Include an error analysis sufficient to demonstrate required accuracy in survey calculations.
2. Owner reserves the right to check the Contractor's survey, measurements, and calculations. The requirement for accuracy will not be waived, whether this right is exercised or not.

**3.05 SUPPORT AND BRACING**

A. General requirements: Design all support and bracing systems, if required. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design systems to not overstress the building structure.

**3.06 REPORTS**

A. Submit two copies of Contractor's daily reports at Architect's field office (or electronically) by 9:00 AM the next working day after the day covered in the associated report. Daily report shall be signed by responsible member of Contractor's staff, such as project manager or superintendent, or foreman designated by Contractor as having authority to sign daily reports.

**3.07 RECORDS**

A. Maintain at the Site a complete and accurate log of control and survey work as it progresses.
1. Organize and record survey data in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standards of practice in the State in which the Project is located. Record Contractor's surveyor's original field notes, computations, and other surveying data in Contractor-furnished hard-bound field books. Contractor is solely responsible for completeness and accuracy of survey work, and completeness and accuracy of survey records, including field books. Survey records,(including field books) may be rejected by Owner due to failure to organize and maintain survey records in a manner that allows reasonable and independent verification of calculations, and/or allows identification of elevations, dimensions, and grades of the work.
2. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by Architect.

B. Submit three copies of final property survey to Owner. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey. Include the following information:
   1. Structure locations from property lines, and distances to adjacent buildings.
   2. Dimensions and locations of drives, walks, walls, underground utilities, appurtenances, and major site features.
   3. Location of easements.
   4. Final grading topographic survey.

**3.08 CLOSEOUT ACTIVITIES**

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

**END OF SECTION**

# SECTION 01 78 00
# CLOSEOUT SUBMITTALS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

### 1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

### 1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

**3.02 OPERATION AND MAINTENANCE DATA**

A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

**3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

A. For Each Product, Applied Material, and Finish:
   1. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

**3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

### 3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Operation and maintenance data.
      c. Field quality control data.
      d. Photocopies of warranties and bonds.

### 3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

**END OF SECTION**

# SECTION 01 79 00
# DEMONSTRATION AND TRAINING

## PART 1 GENERAL

### 1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Landscape irrigation.
   7. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Finishes, including flooring, wall finishes, ceiling finishes.
   2. Fixtures and fittings.
   3. Items specified in individual product Sections.

### 1.02 RELATED REQUIREMENTS

A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

### 1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit not less than four weeks prior to start of training.
   2. Revise and resubmit until acceptable.
   3. Provide an overall schedule showing all training sessions.
   4. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

### 1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.

2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

### 3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION**

# SECTION 05 50 00
# METAL FABRICATIONS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

### 1.02 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2023.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

G. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2021.

H. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

I. 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; 2023.

J. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.

K. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.

L. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2018, with Editorial Revision.

M. ASTM B85/B85M - Standard Specification for Aluminum-Alloy Die Castings; 2018, with Editorial Revision.

N. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

O. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

P. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

Q. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

S. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

T. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

U. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

### 1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

## PART 2 PRODUCTS

### 2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Stainless Steel, General: ASTM A666, Type 304.

F. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch minimum metal thickness, 1-1/2 inch diameter.

G. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

H. Slotted Channel Fittings: ASTM A1011/A1011M.

I. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

J. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

K. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

L. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

M. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

N. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

### 2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.

E. Aluminum-Alloy Sand Castings: ASTM B26/B26M.

F. Aluminum-Alloy Die Castings: ASTM B85/B85M.

G. Bolts, Nuts, and Washers: Stainless steel.

H. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

### 2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

### 2.04 FABRICATED ITEMS

A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

B. Door Frames for Overhead Door Openings: Channel sections; prime paint finish.

C. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

D. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

### 3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

### 3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

**END OF SECTION**

**SECTION 07 92 00**
**JOINT SEALANTS**

## PART 1 – GENERAL

### 1.01 SUMMARY

A. Section Includes:
   1. Liquid joint sealants.
   2. Field quality control.

B. Related Sections:
   1. Section 07 84 00 – Firestopping: Firestopping sealants.
   2. Section 07 95 13 – Expansion Joint Cover Assemblies: Sealants forming part of expansion joint cover assemblies.
   3. Section 09 21 16 – Gypsum Board Assemblies: Sealing acoustical and sound rated walls and ceilings.

### 1.02 REFERENCE STANDARDS

A. ASTM International (ASTM): www.astm.org :
   1. ASTM C 661 - Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer.
   2. ASTM C 794 - Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
   3. ASTM C834 - Specification for Latex Sealants.
   4. ASTM C 920 - Specification for Elastomeric Joint Sealants.
   5. ASTM C 1087 - Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems
   6. ASTM C 1193 - Guide for Use of Joint Sealants.
   7. ASTM C 1248 - Test Method for Staining of Porous Substrate by Joint Sealants.
   8. ASTM C 1311 - Specification for Solvent Release Sealants.
   9. ASTM C 1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
   10. ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
   11. ASTM D 624 - Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
   12. ASTM D 2240 - Test Method for Rubber Property - Durometer Hardness.
   13. ASTM E 283 - Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   14. ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by

B. NSF International (NSF): www.nsf.org :NSF International (NSF): www.nsf.org :
   1. Standard 51: Food Equipment Materials.

C. Sealant, Waterproofing, and Restoration Institute (SWRI): www.swrionline.org :
   1. SWRI Validation Program.

D. US Environmental Protection Agency (EPA): www.epa.gov :
   1. 40 CFR 59, Subpart D: National Volatile Organic Compound Emission Standards for Architectural Coatings.

E. US Food and Drug Administration (FDA): www.fda.gov :
   1. 21 CFR 177.2600: Title 21 Part 177 Indirect Food Additives: Polymers.

F. US Green Building Council (USGBC): www.usgbc.org
   1. Leadership in Energy and Environmental Design (LEED) Green Building Rating System

### 1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.

B. Preinstallation Conference: Conduct conference at Project Site.

### 1.04 ACTION SUBMITTALS

A. Product Data: For each type of joint sealant product specified, including:
   1. Preparation instructions and recommendations.
   2. Standard drawings illustrating manufacturer's recommended sealant joint profiles and dimensions applicable to Project.

B. Joint Sealant Schedule: Indicate joint sealant location, joint sealant type, manufacturer and product name, and color, for each application. Utilize joint sealant designations included in this Section.

C. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgement that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.

D. Samples for Color Selection: For each joint sealant type.

E. Samples for Verification: For each exterior joint sealant product, for each color selected.

### 1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified applicator.

B. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

C. Preconstruction compatibility and adhesion test reports.

D. Preconstruction field-adhesion test reports.

E. Field quality control adhesion test reports.

F. Warranty: Sample of unexecuted manufacturer and installer special warranties.

### 1.06 QUALITY ASSURANCE

A. Installer Qualifications: Experienced Installer equipped and trained for application of joint sealants required for this Project with minimum three years documented experience.

B. Single Source Responsibility: Provide glazing sealants by a single manufacturer responsible for testing of Project substrates to verify compatibility and adhesion of joint sealants.

C. Preconstruction Manufacturer Laboratory Compatibility, Staining, and Adhesion Testing: Submit four (4) samples of each material that will be in contact with or affect joint sealants. Test sealants with substrate materials using ASTM C794 or manufacturer's standard test methods to determine requirements for joint preparation, including cleaning and priming. Test sealants with related materials to verify compatibility.

D. Owner will employ an independent testing agency to perform the field quality inspection and testing as referenced in Part 3 of this Section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.

E. Preconstruction Field Adhesion Testing: Prior to installing joint sealants, field test adhesion to joint substrates using ASTM C1193 Method A or method recommended by manufacturer. Verify adhesion is adequate. Modify joint preparation recommendations for failed joints and re-test. Submit written report to Architect.

F. Mockups: Provide joint sealant application within mockups required in other sections identical to specified joint sealants and installation methods.

### 1.07 WARRANTY

A. Special Installer's Warranty: Original statement on Installer's letterhead in which Installer agrees to repair or replace joint sealants that demonstrate deterioration or failure within warranty period specified.
   1. Warranty Period: Two (2) years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate deterioration or failure under normal use within warranty period specified.
   1. Warranty Period for Silicone Sealants: Twenty (20) years from date of Substantial Completion.

C. Warranty Conditions: Special warranties exclude deterioration or failure of joint sealants in normal use due to structural movement resulting in stresses on joint sealants exceeding sealant manufacturer's written specifications, joint substrate deterioration, mechanical damage, or normal accumulation of dirt or other contaminants.

## PART 2 – PRODUCTS

### 2.01 MANUFACTURERS

A. Silicone Sealants:
   1. Basis of Design: Provide joint sealant products manufactured by The Dow Chemical Company, Midland MI; (877) SEALANT ((877) 732-5268); email: construction@dowcorning.com; consumer.dow.com/construction

B. Non-silicone Sealants:
   1. Basis of Design: Provide joint sealant products manufactured by Tremco, Inc., Commercial Sealants and Waterproofing Division, An RPM Company, Beachwood OH; (866) 321-6357; email: techresources@tremcoinc.com; www.tremcosealants.com

### 2.02 MATERIALS, GENERAL

A. VOC Content for Interior Applications: Provide sealants and sealant primers complying with the following VOC content limits per 40 CFR 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

B. Compatibility: Provide joint sealants and accessory materials that are compatible with one another, with joint substrates, and with materials in close proximity under use conditions, as demonstrated by sealant manufacturer by testing and related experience.

C. Joint Sealant Standard: Comply with ASTM C 920 and other specified requirements for each liquid- applied joint sealant.

D. Stain Test Characteristics: Where sealants are required to be nonstaining, provide sealants tested per ASTM C 1248 as non-staining on porous joint substrates indicated for Project.

E. Food Contact Suitability: Where sealants are required to be suitable for contact with food provide sealants complying with 21 CFR 177.2600.

### 2.03 LIQUID JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant **JS-1**: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T, NT; SWRI validation.
   1. Basis of Design Product: DOWSIL 790 Silicone Building Sealant.
   2. Hardness, ASTM C 661: 15 durometer Shore A.
   3. Volatile Organic Compound (VOC) Content: 26 g/L maximum.
   4. Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
   5. Color: As selected by Architect from manufacturer's full line of not less than 10 colors.

B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant **JS-2:** ASTM C 920, Type S, Grade NS, Class 50, for Use NT; SWRI validation.

1. Basis of Design Product: DOWSIL 756 SMS Building Sealant.
2. Hardness, ASTM C 661: 35 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 60 g/L maximum
4. Staining, ASTM C 1248: None on white marble.
5. Color: As selected by Architect from manufacturers full line of not less than 8.

C. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant **JS-3**: ASTM C 920, Type S, Grade NS, Class 50, Use NT, G, M and A; SWRI validation.
1. Basis of Design Product: DOWSIL 791 Silicone Weatherproofing Sealant.
2. Hardness, ASTM C 661: 34 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 30 g/L maximum
4. Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturer's full line of not less than 6 colors.

D. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant **JS-4**: ASTM C 920, Type S, Grade NS, Class 50, for Use NT, G, A, and O; SWRI validation.
1. Basis of Design Product: DOWSIL 795 Silicone Building Sealant.
2. Hardness, ASTM C 661: 35 - 45 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 32 g/L maximum.
4. Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
5. Color: As selected by Architect from manufacturers full line of not less than 10.

E. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant **JS-5**: ASTM C 920, Type S, Grade NS, Class 25, for Use NT; SWRI validation.
1. Basis of Design Product: DOWSIL 758 Silicone Weather Barrier Sealant.
2. Hardness, ASTM D 2240: 45 durometer Shore A.
3. Volatile Organic Compound (VOC) Content: 61 g/L maximum
4. Color: White.

F. Latex Joint Sealant **LJS**: Siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
1. Basis of Design Product: Tremco, Inc., Tremflex 834.
2. Volatile Organic Compound (VOC) Content: 160 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Color: White, paintable.

G. Butyl-Rubber-Based Joint Sealant **BJS**: ASTM C 1311.
1. Basis of Design Product: Tremco, Inc., Tremco Butyl Sealant.
2. Volatile Organic Compound (VOC) Content: 250 g/L maximum.
3. Color: As selected by Architect from manufacturer's standard colors.

H. Single-Component, Nonsag, Non-hardening paintable synthetic rubber acoustical sealant **AJS**: Tested to reduce airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing of similar assemblies according to ASTM E 90.
1. Basis of Design Product: Tremco, Inc., Tremco Acoustical Sealant.
2. Volatile Organic Compound (VOC) Content: 160 g/L maximum.
3. Color: White, paintable.

## 2.04 ACCESSORIES

A. Joint Substrate Primers: Substrate primer recommended by sealant manufacturer for application.

B. Cylindrical Sealant Backing: ASTM C 1330, Type B non-absorbent, bi-cellular material with surface skin, or Type O open-cell polyurethane, as recommended by sealant manufacturer for application.

C. Bond Breaker Tape: Polymer tape compatible with joint sealant materials and recommended by sealant manufacturer.

## PART 3 – EXECUTION

### 3.01 EXAMINATION

A. Examine joint profiles and surfaces to determine if work is ready to receive joint sealants. Verify joint dimensions are adequate for development of sealant movement capability. Proceed with joint sealant work once conditions meet sealant manufacturer's recommendations.

### 3.02 PREPARATION

A. Joint Surface Cleaning: Clean joints prior to installing joint sealants using materials and methods recommended by sealant manufacturer.
   1. Remove laitance, form-release agents, dust, and other contaminants.
   2. Clean nonporous and porous surfaces utilizing chemical cleaners acceptable to sealant manufacturer.
   3. Prime exterior substrates as required by the manufacturer.

### 3.03 SEALANT APPLICATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items:
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items:
      a. Joints between door, window, and other frames and adjacent construction.
      b. Other joints indicated below.
   3. Do not seal the following types of joints:
      a. Intentional weepholes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      d. Joints where installation of sealant is specified in another Section.
      e. Joints between suspended panel ceilings/grid and walls.

B. Masking: Mask adjacent surfaces to prevent staining or damage by contact with sealant or primer.

C. Joint Priming: Prime joint substrates when recommended by sealant manufacturer or when indicated by preconstruction testing or experience. Apply recommended primer using sealant manufacturer's recommended application techniques.

D. Joint Backing: Select joint backing materials recommended by sealant manufacturer to be compatible with sealant material. Install backing material at depth required to produce profile of joint sealant allowing optimal sealant movement.
   1. Install bond breaker tape over substrates when sealant backings are not used.

E. Liquid Sealant Application: Install sealants using methods recommended by sealant manufacturer, in depths recommended for application. Apply in continuous operation from bottom to top of joint vertically and horizontally in a single direction. Apply using adequate pressure to fill and seal joint width.
   1. Tool sealants immediately with appropriately shaped tool to force sealants against joint backing and joint substrates, eliminating voids and ensuring full contact.

2. Using tooling agents approved by sealant manufacturer for application.

F. Cleaning: Remove excess sealant using materials and methods approved by sealant manufacturer that will not damage joint substrate materials.
1. Remove masking tape immediately after tooling joint without disturbing seal.
2. Remove excess sealant from surfaces while still uncured.

## 3.04 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Perform adhesion tests in accordance with manufacturer's instructions and with ASTM C 1193, Method A.
1. Perform 5 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate, and one test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per building elevation, minimum.
2. For sealant applied between dissimilar materials, test both sides of joint.

B. Remove sealants failing adhesion test, clean substrates, reapply sealants, and re-test. Test adjacent sealants to failed sealants.

C. Submit report of field adhesion testing to Architect indicating tests, locations, dates, results, and remedial actions taken.

## 3.05 EXTERIOR JOINT-SEALANT SCHEDULE

A. Exterior construction joints in cast-in-place concrete.
1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant **JS-1**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B. Exterior perimeter joints at frames of doors, windows, storefront frames, curtain wall frames, and louvers.
1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant **JS-1/JS-2/JS-4**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
3. Multiple colors required to match several conditions.

C. Exterior joints within aluminum storefront framing, curtain walls, and window systems:
1. Joint Sealant: Single-component neutral-curing non-staining silicone sealant **JS-1/JS-2/JS-4**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

D. Exterior joints within structural glazing: See Section 08 85 13 – Structural Glazing.

E. All other exterior non-traffic joints.
1. Joint Sealant: Single-component neutral-curing silicone sealant **JS-1**.

F. Exterior horizontal traffic and traffic isolation joints: Refer to Division 32 Section: Concrete Paving Joint Sealants.
1. Joint Sealant: Single-component pourable silicone sealant **JS-1**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

## 3.06 INTERIOR JOINT-SEALANT SCHEDULE

A. Interior movement joints in exterior concrete and unit masonry.
1. Joint Sealant: Single-component neutral-curing silicone sealant **JS-1/JS-4**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B. Interior perimeter joints of exterior frames.
1. Joint Sealant: Single-component neutral-curing silicone sealant **JS-3**.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

**END OF SECTION**

# SECTION 08 71 00
# DOOR HARDWARE

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, and hollow metal doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

### 1.02 RELATED REQUIREMENTS

A. Section 08 14 16 - Flush Wood Doors.

B. Section 28 10 00 - Access Control: Electronic access control devices.

### 1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. BHMA (CPD) - Certified Products Directory; Current Edition.

C. BHMA A156.16 - Auxiliary Hardware; 2023.

D. BHMA A156.20 - Standard for Strap and Tee Hinges, and Hasps; 2021.

E. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

F. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

G. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

H. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

J. ITS (DIR) - Directory of Listed Products; Current Edition.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

M. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.

O. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

P. UL (DIR) - Online Certifications Directory; Current Edition.

Q. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

R. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

### 1.04 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. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

### 1.05 SUBMITTALS

A. See Section 01 30 00 - 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. Provide complete description for each door listed.
   3. Provide manufacturer name, product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.

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.

### 1.06 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.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

### 1.07 DELIVERY, STORAGE, AND HANDLING

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

### 1.08 WARRANTY

A. See Section 01 78 00 - 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

### 2.01 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. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
5. 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.
6. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
    a. Air Leakage Rate: Tested in accordance with UL 1784, with air leakage rate not to exceed 3.0 cfm/sf of door opening at 0.10 inch of water for both ambient and elevated temperature tests.
7. Listed and certified compliant with specified standards by BHMA (CPD).
8. Auxiliary Hardware: BHMA A156.16.
9. Straps and Tee Hinges: BHMA A156.20.
10. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
11. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
12. 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.
    1. See Section 28 10 00 for additional access control system requirements.

E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule on Drawings.

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.

**2.02 FINISHES**

**PART 3 EXECUTION**

**3.01 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.

### 3.02 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. 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. Flush Wood Doors: See Section 08 14 16.
   4. 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.

F. 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.

### 3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.

B. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

### 3.04 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

### 3.05 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.

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

### 3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

**END OF SECTION**

# SECTION 09 97 23
# CONCRETE AND MASONRY COATINGS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Moisture resistant textured concrete and masonry coatings.

### 1.02 REFERENCE STANDARDS

A. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings; 2017 (Reapproved 2021).

B. ASTM D2243 - Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings; 2020.

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

### 1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating coating materials.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include cleaning procedures and repair and patching techniques.

### 1.04 QUALITY ASSURANCE

### 1.05 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Restrict traffic from area where coating is being applied or is curing.

### 1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

## PART 2 PRODUCTS

### 2.01 MATERIALS

A. Coatings - General: Provide complete systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated.

B. High Build, Water Based Textured Coating System for Masonry: Water based styrene-acrylic resin primer; acrylic terpolymer (elastomeric) top coat and graded sand aggregate.
   1. Stated by manufacturer as suitable for masonry and concrete surfaces cured 28 days, minimum; cement plaster, cement fiber board, and metal.
   2. Dry Film Thickness: 15 mils, minimum.
   3. Flexibility Test: Passing, when tested according to ASTM D522/D522M with a 1 inch mandrel.
   4. Freeze Thaw Resistance: Passing, when tested according to ASTM D2243 for 50 cycles.
   5. Water Vapor Transmission: 4.2 perms, maximum, when tested in accordance with ASTM E96/E96M.
   6. Color: To be selected by Architect from manufacturer's standard range.
   7. Texture: Fine.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

C. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 16 percent.

### 3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

### 3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete and Masonry: Prior to priming, patch holes and indentations and fill cracks with manufacturer's recommended crack repair material.

### 3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

### 3.05 CLEANING

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

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

### 3.06 PROTECTION

A. Protect finished work from damage.

**END OF SECTION**

**SECTION 11 40 00**
**FOODSERVICE EQUIPMENT**

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Documents, apply to the Work specified in this Section.

1.2 SCOPE

A. Include the Work specified, shown or reasonably inferable as part of Foodservice Equipment. Portions of this Work may be subcontracted to those qualified to do such work, as may be necessary because of jurisdictional trade agreements and restrictions.

NOTE:THIS ARTICLE DOES NOT INCLUDE OR INFER THAT THE FOODSERVICE EQUIPMENT CONTRACTOR IS RESPONSIBLE FOR THE HIRING OF SUB-TRADES OR CONSTRUCTION SERVICES TO INSTALL THE EQUIPMENT OTHER THAN AS DIRECTLY SPECIFIED AS BEING PART OF THE FOODSERVICE CONTRACTOR RESPONSIBILITY, I.E. PRE-PLUMBING OR PRE-WIRING OF FABRICATED EQUIPMENT; INTERCONNECTION OF HOODS (PLUMBING/ELECTRICAL) WHEN REQUIRED; PRE-WIRING JUNCTION BOXES AT TOP OF COLD STORAGE ASSEMBLIES FOR SINGLE POINT CONNECTION; INSTALLATION OF CONDENSATE DRAINS AND DRAIN LINE HEAT TAPE WITHIN THE COLD STORAGE ASSEMBLIES, ETC.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Corner guards: Division 09.

B. Soda System EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote foodservice equipment refrigeration systems: EMT Conduit provided by this section and installed by Division 22. GC to coordinate between these two trades.

C. Empty EMT conduit with pull-wire and wide-sweep bends for interconnect cables between LAN and POS terminals, change-makers, pre-check units, printers, CPU's, etc.: Division 27.

D. Supply and exhaust fans for foodservice equipment and exhaust hoods: Division 23.

E. Millwork fixtures (e.g., serving stations, coffee bars): Division 06.

1.4 EQUIPMENT FURNISHED/INSTALLED BY OTHERS

A. Obtain and coordinate utilities requirements of Owner-Furnished/Owner-Installed (OF/OI) equipment with the building utilities and roughing-in drawings/provisions.

B. Coordinate physical data of OF/OI appliances or equipment and incorporate information into Submittal Drawings. Vendor- or Purveyor-Furnished equipment (e.g., coffee/tea equipment): same as OF/OI.

1.5 WORK INSTALLED BUT FURNISHED BY OTHERS

A. Coordinate delivery/installation schedule of Owner-Furnished/Contractor-Installed (OF/CI) equipment with Owner not less than ninety (90) days before equipment requirement.

B. Obtain and coordinate utilities requirements of OF/CI equipment with the building utilities and roughing-in drawings/provisions.

C. Receive at job-site and fully incorporate into installation procedures as if furnished under this Section.

1.6 QUALITY ASSURANCE

A. In addition to complying with applicable laws, statutes, building codes and regulations of public authorities, comply with the following:
   1. National Sanitation Foundation (all equipment to bear label).
   2. National Electric Code.
   3. Underwriters' Laboratories, Inc.
   4. American Gas Association Laboratories.
   5. National Fire Protection Association.
   6. Americans with Disabilities Act
   7. Food and Drug Administration HAACP Guidelines.
   8. Clean Air Act Title 6.

B. Furnish certification of regularly-manufactured equipment listing or classification by Underwriters' Laboratories, Inc. or other recognized test facility with initial submittal.

1.7 SUBSTITUTIONS

A. Equipment items or components specified are intended to be the Basis of Bid. All other brands, including any additional names which may be listed as "Alternates" or "Approved Equal," must conform with the specifications, size, accessories, etc. of the first-named brand and be subject to Paragraph C-03 of this Article. All appliances within common group or category (e.g., refrigerators, kettles, ovens, etc.): same manufacturer.

B. Proposed Substitutions:
   1. Submitted no less than 14 calendar days prior to Bid Date.
   2. Submit proposed substitutions with catalog data and/or manufacturers shop details indicating all modifications required to conform with specified brand.

C. Substitutions with prior approval:
   1. Submitted on Bidder's letterhead attached to Proposal Form with individual additive/deductive amounts stipulated and the documentation required in Paragraph B-02.
   2. Owner reserves the right to accept or reject any or all substitution proposals before execution of Contract.
   3. Provide all design/engineering services required to make adjustments in space, systems, utilities, etc. and pay all additional costs of utilities, construction or professional services that may be incurred due to the acceptance of any substitution.

1.8 INTERPRETATION OF DOCUMENTS

A. During Bidding: contractors', suppliers' or vendors' questions and comments pertaining to Construction Documents' clarity or intent will be addressed by addendum.

B. Subsequent to Award:
   1. Confirmation of Construction Document requirements will be provided by Clarification Bulletin.
   2. Request For Information Bulletins submitted by Contractor: contain Contractor's proposed resolution.

1.9 WARRANTY

A. Provide a written warranty for a period of one year from the date of Substantial Completion, including extended four-year replacement warranty on compressor bodies.

B. Components of equipment subject to replacement prior to one-year's use (such as refrigerator door gaskets) and those items which may fail due to improper or inadequate periodic maintenance by the Owner/Operator (such as an uncleaned refrigeration system condenser) are not intended to be included within the scope of the Warranty.

C. Refrigeration Systems/Equipment: one year free service available within twenty-four hours of notification.

D. Furnish three copies of a list of all equipment and their respective local service agencies, indicating the address, telephone number and name of person to contact. Whenever possible, the service agencies selected shall be factory-authorized for the equipment assigned.

1.10 SUBMITTAL DATA

A. Special Requirements: the following are in addition to any general requirements given elsewhere in the Documents.

B. All drawings and other submittals: indicate Worrell Design Group, Inc. as foodservice consultant.

C. Brochure Format (for regularly-manufactured equipment and components):
1. Front and rear protective cover with labeled project name.
2. Brochure index: indicate functional Area/Room number, item number, quantity, description and manufacturer.
3. A separate fly sheet for each component or item of equipment, indicating: item number, name, quantity, manufacturer, optional equipment, modifications, special instructions and utility requirements. An item of equipment or assembly containing more than one buyout sub-assembly or component shall have the secondary item listed in parenthesis beside the primary item name. For example: Serving Counter (hot food well).
4. Catalog specification sheet and manufacturer's drawing.
5. Certification letter of equipment listing or classification by Underwriters' Laboratories, Inc. or other recognized testing facility.

D. Shop Drawings (Rough-In Drawings)
1. Separate drawing sheets: same size as Contract Drawings (Contract Drawings are not to be traced or reproduced).
2. ¼" scale drawing of fixed/movable Foodservice Equipment and pre-fabricated Cold Storage Assemblies with itemized schedules.
3. Special Conditions Drawings, sizing and locating the following conditions:
   a. Slab depressions, cores, sleeves or block-outs (cold storage assemblies, drain trenches, piping, etc.).
   b. Concrete or masonry platforms.
   c. Pipe sleeves or roof jacks.
   d. Wall-openings or block-outs for pass-through equipment, recessed control panels, in-wall fire-protection system components, etc.
   e. Above-ceiling hanger assemblies for support of exhaust hoods, utensil-racks, etc.
   f. Access panels in walls or ceiling for service of equipment.
   g. Ceiling pockets or recesses for unusually high equipment.
   h. In-wall carriers for wall-hung or cantilevered equipment.
4. Electrical rough-in drawing.
5. Plumbing/mechanical rough-in drawing.

6. Required information:
    a. All fixed and movable Foodservice Equipment shown on Contract Drawings.
    b. All prefabricated Cold Storage Assemblies and Conveyor/Dishtable Assemblies shown on Contract Drawings.
    c. All general-use and convenience utilities or services indicated on Contract Drawings, including those required by or connected to equipment or devices not in this Section.
    d. All rough-in drawings: fully dimensioned from engineering benchmark or finished-room surface to point of stub-up through floor and stub-out through wall or ceiling for all mechanical, electrical and plumbing services.
    e. Connection number/tag system and symbols: identical to Contract Drawings.

E. Shop Drawings (Manufacturer's and Fabricator's):
1. Sheet Size: identical to Contract Drawings, drawn or plotted at ¾" scale for plan view and elevations; 1½" scale for sections and construction details.
2. Included information: item number, name and quantity.
3. Construction details, sections and elevations to reflect requirements of the Specifications and Drawings.
4. Indicate adjacent walls, columns and equipment.
5. Indicate plumbing and electrical schematic drawings for equipment such as: conveyors, waste systems, self-cleaning exhaust hoods, exhaust hood fire protection systems and fabricated fixtures with single electrical or plumbing connection.
6. Mechanical or electrical operating components or products integrated into a fabricated fixture: ventilation and service access required or recommended by the manufacturer, including panel size and location to permit easy lubrication, adjustment or replacement of all moving parts.

F. Regular Submittal:
1. After the return of one copy of the preliminary submittal, resubmit for approval.
2. Follow routine procedures specified elsewhere or as directed.
3. All data and material: thoroughly reviewed for compliance by Contractor prior to submittal. Foodservice Consultant's repetitive reviewing time (more than twice) incurred due to the Contractor's failure to comply with the requirements of this Article may be invoiced to this Contractor at Consultant's standard hourly rates.

1.11 SERVICE MANUAL

A. Three copies bound in 1½" hardback, three-ring binders (as many volumes as required by scope of project) with same data as brochure at completion of installation (Refer to "Submittal Data").

B. Each Volume: section for maintenance of finish materials (e.g., stainless steel, plastic laminates, FRP, Plexiglas, etc.).

C. Catalog specification sheet and/or manufacturer's shop drawings.

D. Each Volume: index of items, manufacturer's operating/maintenance information, replacement parts data and price lists. Provide the name, title and address of personnel at each respective manufacturer to be contacted for spare/replacement parts after warranty period.

E. To the extent possible, provide two copies of manufacturers' video instructional cassettes for operating, maintenance and service of equipment.

1.12 VERIFICATION AND COORDINATION OF PROJECT/DATA

A. Utilities Rough-in Drawings and Field-Services within four weeks after receipt of notice-to-proceed, review Contract Drawings and Submittal Data for accuracy and completeness and notify Architect of conflicts and proposed adjustments. Coordinate work with other sub-contractors and field-check the installed utility capacities and locations.

B. Review critical systems/components for application, performance and capacity and submit calculation worksheets with initial submission of brochure/rough-in drawings, with all proposed adjustments noted, including:
   1. Exhaust hood removal/supply air volume, velocity, static pressure, duct collar sizes and locations.
   2. Refrigeration Systems (compressor, condenser and evaporator) capacities/sizes, quantities and refrigerant piping distances/sizes.
   3. Exhaust Hood Fire Suppression Systems (nozzle locations, air handler and fuel interlocks, piping/distance limitations).
   4. Locations of Vacuum Breakers.
   5. Waste Water Conservation Measures required by applicable guidelines/codes (e.g., use of disposers and transfer-piping from warewash machines).
   6. Solid Waste Removal/Recycling measures required by applicable guidelines/codes (e.g., separation of waste material and compaction).
   7. Conformance of Refrigerated Components/Equipment with HACCP Guidelines (e.g., salad/sandwich pans, upright/open refrigerator cabinets, walk-in refrigerators, salad bars) with HACCP Guidelines.
   8. Gas, water and steam/condensate and chilled water line sizes and manifold configurations.
   9. Diameter and length of flexible connector lines for fixed movable gas appliances.
   10. Fabricated Equipment load center panels (individual and total amperage calculations and circuit balance).
   11. ADA compliance of work stations, service positions, passageways, etc.

C. Ceiling mounted appliances/fixtures: verify and coordinate dimensions/location of support framing/hangers with General Contractor. All material and installation below 12'-0" aff.: Section 11 40 00.

D. Dimension Responsibility: obtain actual or guaranteed measurements for proper fit of equipment. All dimensions indicated in Contract Documents are approximate and are as accurate as can be determined at the time. Field-check all horizontal/vertical measurements and conditions at the building prior to fabrication or delivery of equipment and notify the Architect of all conflicts or deviation from the dimensions shown.

E. Scheduling to Fit Openings: should it become necessary to schedule construction of walls or partitions prior to delivery of fixed equipment, the equipment must be fabricated for passage through finished openings. Maintain close contact with the project and be cognizant of all conditions, including vertical handling limitations within the building (elevator cabs or openings, stairs, etc.) and possible hoisting requirements. Coordinate all procedures with General Contractor and Project Team.

F. Refrigerated and Dry Storage Areas: verify and coordinate dimensions to accommodate scheduled modular shelf sections. Notify Architect of variance between the Contract Documents and actual conditions.

G. Color/Pattern Selections: submit selection samples of solid polymer products, plastic laminate, paint or stain finishes and vinyl-coated surface material of equipment as selected by Architect.

H. Size/Weight Coordination: obtain dinnerware size/weight information for selection/coordination of self-leveling dispensing, warewashing and transport equipment.

I. Movable Equipment Interface: rolling stock (pan racks, carts, dollies, dish/tray/rack dispensers) required to fit through or into fixed equipment (roll-in refrigerators, counter bodies, etc.) is to be reviewed and coordinated for compatibility at time of initial shop drawing submittal. Indicate conflicts and proposed adjustments.

J. Relocation of Work: relocate or re-route work as required to coordinate related items free of charge if no extra work is involved.

**PART 2 - PRODUCTS**

2.1 FABRICATED FIXTURES MATERIAL/COMPONENTS

A. Stainless steel sheets or shapes: 18-8, Type 302, polished to 180 grit No. 4 finish.

B. Stainless steel joints and seams: heli-arc welded, free of pits and flaws, ground smooth and polished to No. 4 finish.
   1. The "grain" direction of horizontal stainless steel surfaces: longitudinal, including the splashback. The polishing procedure at right-angle corners of fixtures shall provide a mitered appearance.

C. Galvanized Iron Sheets: Armco copper bearing Zinc Grip or Zinc Grip/Paint Grip.
   1. Galvanized iron joints and seams: arc-welded, free of pits and flaws and ground smooth.
   2. Galvanized sheets or shapes: washed with mineral spirits and painted with Rustoleum gray semi-gloss enamel.

D. Sound Deadening: Schnee Butyl Sealant ¾” wide tacky tape positioned continuously between all frame-members or contact material and underside of stainless steel surface (sinks, table tops, food wells, overshelves and undershelves). Tighten stud-bolts for maximum compression of sealant and trim excess.

E. Plastic Laminates: color/pattern selected by Architect, in 1/16" thickness for flat surfaces: 1/32" thickness for radiused surfaces. Plastic laminates and adhesives must be N.S.F. approved (Standard No. 35).

F. Solid Polymer products: color/pattern/material as selected by Architect in thickness as specified. Solid Polymer and adhesives must be N.S.F. approved (Standard No. 51). In addition, no less than the following:
   1. Verify with particular specified solid polymer product manufacturer minimum countertop thickness for all counters and particularly at hot and cold food service applications.
   2. Conform to technical guidelines of specified solid polymer manufacturer for their product installation requirements.
   3. Provide adequate support directly below any external load as recommended by solid polymer product manufacturer.
   4. Radius all inside corners of cutouts a minimum of ¼" or larger.
   5. At hot/cold cutout locations, follow solid polymer product manufacturer guidelines (minimum distance from one cutout to the next; reinforcing support for weight of hot/cold unit; edge treatment of cutout at hot/cold unit; heat/cold isolation requirements; insulating tapes, etc.).
   6. At top penetrations such as for breath protector posts, fill faucets, electric service conduits, provide larger diameter hole (minimum 1/8" clear all around for item hole is cut for) or as recommended by solid polymer product manufacturer.
   7. Provide flexible expansion joints as recommended by solid polymer product manufacturer.

8. Support countertop seams as recommended by solid polymer product manufacturer.
9. Allow 1/8" or larger expansion/contraction gap at wall clearance and interior edges of dropped countertop edges and adjacent counter bodies.

G. Casters.
1. Fabricated fixtures with "Open Base" construction: Jarvis and Jarvis Model No. 5-405-113P-NSF swivel casters with grease seals on forks and wheels; Zerk fitting in swivel; two casters: Model No. E-75 Vertilock brakes. All casters: B-7" rolling bumpers with stainless steel top discs.

H. Cutting Boards: ¾" thick read "Polylite" or TEKNOR APEX "Plastic Tuff" cutting board, size as indicated.

I. Identification Plates, Labels, Tags:
1. Prohibited Information: names of foodservice equipment contractor/dealer, suppliers, fabricators and contractors.
2. Required Information: function or purpose of controls such as display light switches, food warmer controls, etc.
3. Plate Construction: engraved phenolic plastic, secured to equipment with epoxy cement or stainless steel screws. Furnish samples.

2.2 PLUMBING/MECHANICAL REQUIREMENTS

A. Plumbing Fittings and Components: furnished under this Section as follows:

**NOTE: FITTING AND COMPONENTS DESCRIBED IN ITEMS 01, 02, 03, AND 04 ARE FURNISHED LOOSE FOR INSTALLATION BY DIVISION 22/23.**

1. Control valves, appliance pressure regulators for water, gas and steam, and vacuum breakers: wherever required on Foodservice Equipment (chrome-plated where exposed).
2. Faucets and drains without connected overflows (unless otherwise indicated) for all sinks.
3. Specialty Foodservice water-fill faucets or hose assemblies indicated in drawings/specifications.
4. Extensions of indirect waste fittings to open-sight floor sink or floor drains from sinks, under bar equipment, and food holding components of serving counters (e.g. cold pans, hot food wells, refrigerator/freezer coils not equipped with condensate evaporators) furnished and installed by Division 22. Drains: painted with aluminum paint where exposed, type "K" copper where concealed.
5. Piping brackets and supports beneath/within fabricated equipment.
6. Closed Base Bodies: removable 18 gauge stainless steel closure panel at plumbing penetrations, under top.
7. Control valves on Open Base fixtures: mounted on 14 gauge stainless steel gusset-shaped panel with 3½" setback from counter top edge/rim to face of control handle.
8. Fill hose/faucet at support pedestals or Closed Base Body: installed in a 15" x 18" x 5" deep recessed mounting panel. Panel bottom: sloped on a $60^{o}$ angle, with 3/8" stainless steel rod hanger-bracket for hose.
9. In-line water filter system:
   a. Everpure System filters for coffee/tea brewers, ice makers, water chillers and beverage systems.
   b. Hako Model FS-2000 Water Conditioner for self-generating steam combi-ovens, convection steamers and kettles; Model 8PP for table top steamers.

B. Final Plumbing Connections Provisions.
1. Fabricated equipment containing components, fittings and/or devices indicated on Foodservice Connections Drawings to be connected to the building systems: each

component, fitting or group thereof pre-piped to a utility compartment for final connection by Division 22. Refer to drawings for capacities.

2. Field-assembled equipment (e.g., prefabricated walk-in refrigerator/freezers, exhaust hoods, warewash machines, convection ovens, etc.): plumbing components completely interconnected under this Section for final connection arrangements indicated on Utility Connection Drawings.
3. All plumbing final connection points of equipment shall be tagged, indicating:
   a. Item number.
   b. Name of devices or components.
   c. Type of utility (water, gas, steam, drain, chilled water).

C. Ducts and Vents.
1. All exhaust hoods not furred-in to ceiling: furnished with 18 gauge stainless steel seamless duct risers to 6" above finished ceiling for final connection. The duct: trimmed at ceiling with 16 gauge stainless steel angle flange with all corners welded.
2. Exhaust hoods which are furred-in to ceiling: 2" high duct collar for final connection to duct system.
3. Warewash machines equipped with integral vent cowls or extended hoods: furnished with 18 gauge stainless steel seamless duct risers to 6" above finish ceiling for final connection. The duct: trimmed at ceiling with 16 gauge stainless steel angle flange with all corners welded.

## 2.3 FOODSERVICE EQUIPMENT REFRIGERATION SYSTEMS

A. Install complete with all refrigerant, oil, dials, dehydrators, gauges, controls required for the proper operation of the system.

## 2.4 PLUMBING TRIM

A. Faucets: furnished for all sinks or equipment requiring open water supply.

B. Fill Faucets: furnished for appliances requiring open water supply. Unless otherwise noted in Part 4 - Equipment Schedule, provide a T & S Model No. B-0167 Fill Faucet Assembly with 68" hose length, No. EB-0107-35 valve and No. B-0103-01 Rose Spray.

C. Drain Fittings: furnished for all sinks or equipment requiring removal of liquids. Install specified chrome-plated or stainless steel fittings in die-stamped openings with washers and locknuts. Solder may be used as a sealer but shall not be applied to the top surface of the drain fittings.

## 2.5 ELECTRICAL REQUIREMENTS

A. All electrical systems, components and accessories within the work of this Section: certified to be in accordance with NEC 70.

B. Electrical Fittings and Components: furnished under this Section as follows. Coordinate foodservice equipment loads, voltage and phase with building system and confirm any existing or OF/OI equipment requirements.

C. Cord and Caps.
1. Coordinate all Foodservice Equipment cord/caps with related receptacles.
2. All 120 volt "plug-in" equipment shall have Type SO or SJO cord and plug with ground wire fastened to frame/body of item.
3. Cord lengths for fixed equipment: adjusted to eliminate loose-hanging excess.

D. Switches and Controls.

1. Each motor-driven appliance or electrically-heated unit: equipped with control switch or starter per Underwriters' Laboratories, Inc. with low-voltage and overload protection.
2. Disposer controls recess-mounted in wall: external fittings and accessories removed from enclosure and furnished with 16 gauge stainless steel perimeter angle flange with welded corners. Install control at 4'-0" aff to bottom of enclosure.
3. Disposer controls recess-mounted in counter-splash risers: external fittings and accessories removed from NEMA 4 enclosure and furnished with 16 gauge stainless steel perimeter angle flange with welded corners. Install control at 3'-0" aff to bottom of enclosure. Provide panel with 60" long coil of Seal-Tite electrical conduit, from bottom of control panel for final field connections under Division 26.
4. Equipment which is not provided with built-in circuit breakers or fused terminal block and is indicated on Utility Connections Drawings to be directly-connected to the building electrical system: a NEMA 4 stainless steel disconnect switch furnished and installed by Division 26.
5. All remote manual starters, disconnect switches, magnetic contactors or starters and push-button stations: NEMA Type 4 enclosure; NEMA Type 1 enclosure only when installed in a Closed Base Body.
6. All 208/240 volt and 460/480 volt equipment or devices: integral, pre-wired step-down transformer to provide 120 volt control circuit.

E. Motors.
1. 120 volt motors: manual tumbler type starter with thermal overload protection and interchangeable heating elements.
2. 208/240 volt and 460/480 volt motors: magnetic starter with low-voltage protection and one interchangeable overload relay per phase.

F. Heating Elements.
1. Electrically-heated equipment: thermostatic controls.
2. Water heating equipment: UL listed. Equipped with positive low-water shut-off.

G. Receptacles and Switches.
1. Receptacles installed in vertical panels of support pedestals or Closed Base Bodies: installed in 12" x 8½" x 3" deep recessed mounting panel sloped on 60$^{o}$ angle and turned up to top of opening.
2. Pre-wire receptacles in closed base fixtures to a junction box installed within 6" from bottom of utility or compressor compartments.
3. Receptacles mounted on Open Base fixtures: installed on 12" x 10½" x 4½" deep 14 gauge stainless steel panel with returned ends and sloping recess. Secure panel to underframe of fixture top.
4. Pre-wire receptacles on open base fixtures to a junction box secured to a leg or mounted on underside of lower shelf. Vertical runs of wiring: made in rigid conduit or within the tubular leg.
5. Receptacles installed in/on fabricated equipment: Hubbell, Inc. assemblies horizontally-mounted in a metal box with stainless steel cover plate.
6. Switches installed in/on fabricated equipment: Hubbell, Inc. with metal box and stainless steel cover plate. Switches: pre-wired to the controlled device and to a junction box installed within 6" from bottom of utility or compressor compartment. All refrigeration system switches: installed within the compressor compartment near the door opening.
7. Load centers installed in/on fabricated equipment to have all fixture components pre-wired to load center with balanced phase loading. Load center: ready for final connection by Division 26 and flush-mounted within utility compartment rear panel, set back 8" from access door. All breaker/device information: typewritten on circuit schedule in load center door (number corresponding breaker/device) with enclosed schematic wiring diagram of fixture components.

H. Light Fixtures.
1. Light fixtures with lamps installed in/on fabricated or field-assembled equipment: pre-wired to a junction box for final connection (continuous-run fixtures when indicated).
2. Fluorescent Display Light: install light fixtures full-length of Display Stand and Serving Shelf with stud bolts and pre-wire through support posts to an apron-mounted switch.
3. Heat Lamps: installed to underside of serving shelf assemblies. When multiple 24" heat lamps are specified, provide maximum length heat lamp chassis. Install all switches remote from lamps.
4. Cold Storage Light Fixtures: electrically connected through the hub fitting located on the top of the fixture. All horizontal conduit: above ceiling panels. Install plastic sleeve through ceiling panels for electrical conduit. Seal sleeved penetrations airtight at both sides of panel.

I. Final Electrical Connection Provisions.
1. Fabricated equipment containing electrically-operated components or fittings indicated on Utility Connections Drawings: direct-connected, with each component, fitting or group pre-wired to a junction box for final connection by Division 26. Refer to drawings for circuit loading.
2. Fabricated equipment containing electrically-operated components and/or devices indicated: circuit-breaker load center with each component or device pre-wired to a separate circuit breaker for balanced phase loading and single final connection by Division 26.
3. Field-assembled equipment (e.g., prefabricated cold storage assemblies, exhaust hoods, waste systems, etc.) shall have electrical components completely interconnected in this Section for final connection arrangements as indicated on Utility Connections Drawings by Division 26.
4. Pre-wire the following groups of cold storage assembly electrical devices to a top-mounted junction box for final connection by Division 26 per compartment grouping (unless otherwise indicated).
   a. Light fixtures and switches; heated pressure-relief vent.
   b. Door/jamb heaters.
   c. Evaporator fans, defrost elements and drain line heaters.
5. All electrical final connection points of equipment shall be tagged, indicating:
   a. Item number.
   b. Name of devices on circuit.
   c. Total electrical load.
   d. Voltage and phase.

J. Lamps: in all Foodservice Equipment containing light fixtures. Refrigerator or heated cabinets LED lights. All exposed fluorescent lamps above or within a food zone: Shat-R-Shield lamps or standard lamps, sleeved with end caps.

## 2.6 CUSTOM - FABRICATED/ASSEMBLED UNITS

A. All fixtures within this Section: constructed and installed by one manufacturer of uniform design and finish:

B. Mechanical or electrical operating components or products integrated into a fabricated fixture: ventilation and service access required or recommended by the manufacturer. The service access panel(s) size and placement is to permit easy lubrication, adjustment or replacement of all moving parts and is to be indicated on fabrication shop drawings.

## 2.7 COUNTER/TABLE TOPS

A. 14 gauge stainless steel; all free edges turned down 2" with ¾" tight hem at bottom. Free corners: rounded on ¾" radius.

B. Marine edges: turned up ½" on 45$^{O}$ angle and turned down 2" with ¾" tight hem at bottom.

C. Tops abutting high fixtures or walls: cove up specified height and slope back 1½" at top on 45$^{O}$ angle; 2½" slope where piping occurs. Turn down 1" at rear of splash and close ends to bottom of top turn-down. Secure splash turndown to wall with 4" long 14 gauge stainless steel "Z" clip anchored to wall, 36" o.c.

D. Freestanding tables and all serving counter splash-risers: turned back on 90$^{O}$ angle with 1" turndown at rear.

E. Brace tops with 1” x 4” x 1” x 14 gauge galvanized channel underbracing between each pair of legs and at center line of top. Tops greater than 30” deep two cross braces evenly spaced between each of legs.. Paint channel under bracing with Rustoleum gray semi-gloss enamel. Under bracing: secured to underside of top surfaces with ¼" studs welded 9" o.c. maximum with chrome-plated washer, lockwasher and capnut. Studs: such length that cap nuts can be made-up tight, bringing top down snugly on angle frame eliminating all vibrations or "oil-canning".

F. Tops: 1½" overhang at free sides of underframe or Closed Base Body.

G. Mockett Model No. SG5-26 chrome-plated/plastic grommet assembly * **OR** * integrally-welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops, ground and polished to match top.

H. All openings in tops: 3/16" high raised die-formed edges.

I. All top openings for pans or inserts: 20 gauge stainless steel, watertight liners, 8½" deep, secured to underside of counter top.

J. All "built-in" and "drop-in" counter equipment/appliances: with framing members at perimeter of opening.

2.8 SINKS

A. 14 gauge stainless steel; all interior corners (horizontal/vertical) coved on ¾" radius. 1½" wide double-walled partitions with flat tops between compartments.

B. Continuous exterior panels of multiple-compartment sinks: 18 gauge stainless steel apron, wrap 1 1/2" at sides and bottom.

C. Sinks with dimension larger than 20" x 20" (no overflow): score and slope sink bottom ½" to die-stamped opening fitted with Component Hardware Model No. D50-7200 rotary drain. 14 gauge stainless steel bracket: welded to sink bottom for drain stem with 1½" handle clearance.

D. Sinks with dimension of 20" x 20" or less (with overflow): score and slope sink bottom ½" to die-stamped opening fitted with Component Hardware Model No. D50-7215 rotary drain with connected overflow. 14 gauge stainless steel bracket: welded to sink bottom for drain stem with 1½" handle clearance.

E. Where sinks are installed in fixture with Closed Base Body, provide a Component Hardware Model No. D50-7215 rotary drain with connected overflow. (Sinks with dimension larger than 20" x 20" in Closed Base Body will not have overflow fitting.) 14 gauge stainless steel bracket: welded to sink bottom.

F. When single-hole deck-mounted faucets are specified, install overflow fitting in side wall of sink compartment and provide ell-fitting in connecting tubing.

G. Flush Covers: ¾" thick READ "Polylite" or TEKNOR APEX "Plastic-Tuff" cutting board with all corners and edges eased and two 1" finger holes. Support clips: ¼" stainless steel rod 2" long, formed at 45° with two ¾" leg ends (¼" long threaded ends). Insert rod-clips through tight-clearance holes in sink, seal watertight and secure with stainless steel acorn-nuts or tack-weld at exterior of sink wall. Set support clips ½" below top. Provide 14 gauge stainless steel channel or angle support frame to store covers when not in use. Cover holder: adjacent to sink compartment, below counter top or under drawer assembly.

2.9 UTENSIL - WASH COUNTERS

A. 14 gauge stainless steel; all free edges coved up 3" with 1½" diameter rolled rim and bullnosed corners.

B. Edges of utensil-wash counters next to high fixtures or walls: coved up 10" and sloped back 1½" on 45° angle; 2½" slope where piping occurs. Turn down 1" at rear of splash and secure back splash to wall with 4" long 14 gauge stainless steel "Z" clip anchored to wall @ 36" o.c. Vacuum breaker pockets: 6" long square turnback sections, aligned with slope breakline.

C. Exposed Rear Splash: 16 gauge stainless steel finished panel from top of splash to bottom edge of rolled rim with welded vertical joint at end of splash and ½" turnback at bottom of panel. Secure panel with concealed attachment and install bracing 24" o.c.

D. Cove all interior corners (horizontal/vertical) on ¾" radius and slope tables 1/8" per foot, maintaining level crown.

E. Brace utensil-wash counters with 1" x 4" 12 gauge stainless steel channels down centerline of top and between each pair of legs, with closed ends. Bracing: secured to underside of dishtable with ¼" studs welded 6" o.c. maximum, with chrome-plated washer, lockwasher and cap nut. Studs: such length that the cap nuts can be made up tight, bringing the dishtable down on the channel-members, eliminating all vibration and "oil-canning."

F. Integrally-welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops: ground and polished to match top.

G. Hose Bibb: T & S Model No. B-0674-BSTP; mounted on 12 gauge stainless steel flange or inverted gusset bracket with 3/8" stainless steel rod hose-hanger.

2.10 DOORS

A. 18 gauge x 1" stainless steel double pan-formed welded construction, insulated with 1" thick polyurethane boards. Seal perimeter joint of pans. Offset lower horizontal framing member of Closed Base Body to align flush access door with bottom of Body.

B. Channel-formed full-length horizontal recessed pull: ¾" turndown at front and ends with ½" tight hem. Front edge of pull: flush with face of door. Recess behind pull: sloped up on 60° angle and terminated 1" below bottom edge of pull.

C. Door Hardware:

D. Two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge location).

E. Component Hardware Model No. 35-2000 concealed Magnetic Catch.

F. Louvered opening: cut-out opening size as indicated, turn in 1" and weld. All corners: ground and polished.

G. Full-height 18 gauge stainless steel louver with 1" vanes at 45°, ½" spacing. Perimeter channel-formed frame: 1½" x 1". 45° x 1" x ½" x opening width plus ½" 18 gauge stainless steel louver.

H. Tack weld tab of louver flange to back panel of door.

2.11 CLOSED BASE BODIES

A. Frame: frameless construction utilizing formed front, end and intermediate panels of 16 gauge stainless steel. Upper, intermediate and lower horizontal framing members of 16 gauge stainless steel. Top opening to have front to back stiffeners at 24” o.c. maximum.

B. Vertical and horizontal channel members at shelf interior or drawer enclosures, such as corners and center mullions: closed and sealed

C. Closed Base Bodies not set on platform: Component Hardware Model No. A48-5048-C, 6" legs spaced 5'-0" o.c. maximum.

2.12 COMPRESSOR COMPARTMENTS

A. Same material as Closed Base Bodies with back and end partitions; omit bottoms only.

B. 10 gauge steel slide out support: channel frame on full extension slides with 125 lb. minimum capacity secured to fixture frame with anti-vibration mountings for maximum sound deadening. Closed Base Body on solid platform: front-to-back slide out support channels set 4" above bottom for air circulation.

C. Access Door: 18 gauge stainless steel double-pan type with channel formed horizontal recessed pull full length of top (similar profile as Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turndown at front and face of door. Recess behind pull slopes up on 60° angle, terminating 1" below bottom edge of pull. Offset lower horizontal framing member of Closed Base Body to align flush access door with bottom of body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and Component Hardware Model No. 35-2000 concealed magnetic catch.

2.13 UTILITY COMPARTMENTS

A. Closed Base Bodies or Pedestal Supports: fitted with utility compartments wherever piping or wiring is required in/on the fixture.

B. Same material as Closed Base Bodies with full-height back and end partitions. Omit bottoms except at hose-reel locations.

C. Access Doors: 18 gauge stainless steel double-pan type with channel formed horizontal recessed pull full-length of top (similar profile to Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turn down at front of door, recess behind pull slopes up on 60° angle, terminating 1" below bottom edge of pull. Offset the lower horizontal framing member of the Closed Base Fixture to permit flush alignment of door with face and bottom edge of body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and one Component Hardware Model No. 35-2000 concealed magnetic catch..

D. No shelves of Closed Base Fixtures are to be penetrated.

2.14 UTENSIL RACKS

A. Rack: ¼" x 2" 300 series stainless steel flat bar with No. 4 finish, fully welded and formed to match shape shown on drawings. Lowest band: 90" aff, unless otherwise indicated.

B. Table Mount Supports: 1-5/8" diameter 16 gauge stainless steel tubing extended thru counter top. Secure to closed base framing or crossrail/undershelf on open base fixture. Tubing penetrations of counter tops: integrally welded stainless steel inverted gusset.

C. Utensil Rack Hooks: Component Hardware Model No. J77-4401 stainless steel hooks spaced 8" o.c. maximum.

D. Electrical Receptacle: NEMA No. 5-20-R GFCI or as noted. Mount in fully welded 3½" x 5½" x 3" 14 gauge stainless steel enclosure with ½" radius corners. Stainless steel cover plate to fit specified receptacle. Pre-wire thru tubular support for final connection above ceiling by Division 26.

2.15 OPEN BASE STRUCTURES

A. 1-5/8" o.d. x 16 gauge seamless stainless steel tubing legs beveled at bottom. 1-5/8" o.d. crossrails fully-welded (360$^{O}$ smooth and polished) to legs at 10" aff, o.c.

B. Top of Leg: inserted in Component Hardware Model No. A20-0206-C gusset fully-welded to table frame or sink bottom.

C. Bullet Foot: Component Hardware Model No. A10-0851-C.

D. Freestanding fixtures requiring utility connections: Component Hardware Model No. A10-0854 flanged feet at the fixture corners, anchored to floor with non-corrosive bolts.

E. Table Bases: maximum leg spacing of 6'-0" o.c.; dishtable and utensil wash counter bases at 5'-0" o.c.

F. Open Base equipment specified to be supported by brackets at the rear side only (not completely cantilevered): tubular legs at front side only with Component Hardware Model No. A10-0854 flanged feet anchored to floor with non-corrosive bolts. Front-to-back crossrail: fitted into Component Hardware Model No. A20-0406-C circular gusset secured to wall with non-corrosive bolts.

2.16 UNDERSHELVES

A. Open Base Structures: 16 gauge stainless steel turned down 1½" with ¾" tight hem at bottom. Notch all corners to fit tubular legs and weld from underside to completely fill gap; grind and polish. Cove up 2" with ¾" tight hem at rear or ends adjacent to wall, columns, refrigerators, etc. The turn up at freestanding fixtures is to be hemmed tight to bottom of turndown. Brace undershelf with 1" x 4" x 1" 14 gauge stainless steel channel at longitudinal centerline and at each intermediate pair of legs.

B. Open Base Structure specified to be supported by brackets at rear side only (not completely cantilevered): 16 gauge stainless steel turned down 1 ½" at free sides with tight hem at bottom edge. Notch all corners to fit tubular legs as required and weld from underside to completely fill gap; grind and polish. Cove up 2" with ¾" tight hem at rear or ends, as indicated. Fill gap at front to back rail, grind and polish. Brace undershelf with 1" x 4" x 1" 14 gauge stainless steel channel at longitudinal centerline between front to back rails.

C. Closed Base Fixtures: 16 gauge stainless steel turned down 1½" at front. Front edge of bottom shelf: turned back and sealed to finished masonry platform or boxed for leg application. Center shelf has ¾" tight hem.

1. Shelves: turn up square at ends (coved up at rear only) to the shelf above or counter top flanged out for attachment with no open spaces at interior.
2. All shelf partitions at exposed ends of cabinet bodies or interiors: free of exposed framing members.
3. Reinforce shelves with full-length 1" x 4" x 14 gauge stainless steel closed hat channel.
4. Unless otherwise noted, all closed base undershelves are to be 22" deep, clear.
5. Fully weld smooth and polish, the vertical seam of shelf turndown/turn up with face of body partition.
6. Seal the vertical seam of square turn-in at exposed interior of open shelf sections.

2.17 ANCHOR PLATES/WOOD GROUNDS

A. Behind finish surface wherever building wall, partitions or ceiling construction will not accommodate direct attachment of equipment such as overshelves, wall cabinets, hose reels, utensil racks, exhaust hoods, display cases, etc. Material and installation by General Contractor. Location and coordination with trades by Section 114000.

B. Anchor Plates: not less than 12" x 12" x ¼" thick steel, secured to the structure above or behind the finished surface, positioned at attachment points.

C. Wood Grounds: length required by fixture, component or device, 24" wide x ¾" thick plywood secured to partition system prior to gypsum board installation.

D. Above ceiling supports: structural shapes (4" x 8.0 lb. channel) suspended from structure. Maximum height 15'-0" aff. size: width of equipment x length of equipment plus 6'-0". Crossbracing at 6'-0" on center maximum.

2.18 OVERSHELVES

A. 16 gauge stainless steel with free edges turned down 1" with ½" tight hem at bottom. ¾" radius at free corners.

B. Turn up 2" raw at walls or adjoining high fixtures with horizontal coved corner at rear. Round front corners of turn up on ¾" radius.

C. Where shelf width exceeds 12" width, reinforce with ½" x 4" x 14 gauge stainless steel closed hat channel full-length of shelf.

D. Wall-Mounted Shelves: 16 gauge stainless steel brackets 48" o.c. maximum, set in 6" from ends.

E. Freestanding Shelves: where splash is required at free overshelves, turn up square 2" at ends, cove up at rear and hem tight to lower edge of front turndown. Weld exposed corners.
1. Freestanding overshelves: 16 gauge stainless steel cantilevered brackets at rear of table; double-cantilevered brackets at center of table. Posts for cantilevered overshelves are 1-5/8" o.d. x 16 gauge stainless steel secured to underframe, 4'-0" o.c. Ends of shelves: secured to adjacent wall/fixture or mounted on 1¼" diameter stainless steel posts.
2. Freestanding overshelves not on cantilevered brackets: 1¼" o.d. x 16 gauge stainless steel posts, each pair at 4'-0" o.c., maximum.

2.19 DRAIN TRENCH LINER/GRATING

A. Liners: 14 gauge stainless steel in sizes as indicated.

B. Interior of liners: 6" deep with all interior corners (horizontal/vertical) coved on ¾" radius; sloped and scored 1" to integrally welded Component Hardware Model No. D34-Y011 basket

drain assemblies @ 48" o.c., fitted with 6" long welded tailpiece. 12” long stainless steel safety chain: connected to basket strainer, crumb cup assembly and top of liner wall.

C. Liners: 1" wide perimeter shoulder at the top, turned up flush with finished floor, tight-hemmed back down to the shoulder level and flanged out 2" for attachment to the slab.

D. Underside of sloping portion of liner: 2" long "Z" clips.

E. Grating: McNichols Grating - Type GCM-5-150 – Close mesh, press locked - aluminum grating.
1. 1½" x 3/16" bearing bars at 11/16” o.c..
2. 1½" x 3/16" cross bars at 4” o.c.
3. Full perimeter frame, section quantities and sizes indicated.
4. Maximum of 2'-0" sections.

2.20 WALL PANELS

A. Wall Panels: 18 gauge stainless steel, double pan-formed ½" thick with internal stiffener members. Fill with USDA approved thermal insulation, full height and width of panels, attach to interior with mastic. Maximum allowable temperature at rear side of panel: 120$^{O}$F.
1. Height of panels as required: top of tile base to underside of hood, top of tile base to top cap of stub wall or top of splash to underside of hood.
2. Level and square lower edge and sides.
3. Butt joint all panels.

2.21 EXHAUST HOOD FIRE EXTINGUISHING SYSTEM (FUSIBLE-LINK / LIQUID CHEMICAL)

A. System: installed in accordance with manufacturer's recommendations and applicable codes or standards. Submit Installation certification Form to Architect.

B. Automatic Chemical System: in each filtered exhaust hood/duct assembly and also surface protection above/in all equipment required by NFPA Bulletin No. 96 and local Fire Marshall's regulations. Refer to Contract Drawings for quantity of exhaust fan units serving single or multiple exhaust hoods and coordinate with hood/fan controls.

C. Install chemical cylinders as indicated on drawings and install piping to exhaust hoods in totally-concealed manner. Set cylinders and cabinets at underside of finished ceiling unless noted otherwise. Exposed piping/fittings within cylinder location and exhaust hood: chrome-plated or sleeved with stainless steel tubing. Exposed pipe threads in/above food zone not acceptable. Submit schematic diagram of installation and confirm critical distances from cylinders to nozzles.

D. System Components: Captive Aire Tank® system assemblies, in system increments required by dimensions and configuration of equipment and hoods.

E. Remote Manual Release: located in path of egress from protected exhaust hood area. Division 26 to provide 4" Octagon box in wall (at 48" aff) with EMT conduit stub to 6" above finished ceiling.

F. Each System: Captive Aire Tank® cylinder control assembly with electric switch.

G. Fusible links installed in duct collar of filtered hoods/ducts.

H. Fusible links located directly above each cooking device required by Code, in quantity required by length of protected appliance.

I. Ansul K-Guard series. fire extinguisher located at each exhaust hood. Install at 36” aff to bottom of extinguisher. Verify mounting location with Fire Marshall.

J. Required quantity and sizes of mechanically-operated gas valves.

2.22 HIGHLIGHTING

A. Polish the following vertical surfaces to a No. 8 finish:
1. Stainless steel table and counter top turndowns and backsplash returns.
2. Dishtable and utensil wash counter rolled rims (full radius).
3. Overshelf turndowns.
4. Door and drawer horizontal pulls.

2.23 SHOP/FIELD JOINTS

A. Field joints: least possible number, used only when equipment size must be limited for access into building or interior space.

B. Stainless steel tops (including edges and splashes): fully welded, ground and polished to match adjacent surface.

C. Vertical field joints of fixture backsplashes that are inaccessible from the back: terminate 1" above the horizontal coved corner. The remaining height of field joint: hairline butt joint with offset draw-angle behind. All horizontal/vertical draw-joints: located and noted on shop drawings.

D. Hairline butt joint: 1½" x 1½" x 1/8" steel angles welded to back/underside of countertop/shelf. Offset angle beyond joining metal edge ½" (min.) to provide flat backing surface for joint with angle of other joining metal edge, set for ½" space between vertical legs of angles. Bolt sections together with 5/16" machine bolts, lock washers, acorn head cap nuts, set 3" o.c.

E. Closed Base Bodies: draw-type with hairline seam fully field-welded.

F. Millwork: plastic laminated material joints shall be doweled, glued and draw-bolted with fasteners.

G. Solid Polymer: surfaces drawn tight, filled, sanded and finished to match adjacent surface.

2.24 PREFABRICATED COLD STORAGE ASSEMBLIES

A. Sectional Assemblies: size/shape indicated on drawings; 8'-6" aff unless otherwise specified. Door locations/size: exactly as shown.

B. Sandwich Panel Insulation: Class 1 Urethane with vapor barrier, 4" thickness with mature "U" factor of .030 or lower.

C. Panel Skin Material/Finish: stainless steel exposed exterior panel surfaces, .040" stucco-embossed aluminum interior with baked-on primer and finish application of white polyester enamel, 22-gauge galvanized concealed panel surfaces.

D. Interior Ceiling Panels: 20 gauge zinc coated steel with baked-on primer and finish application of white polyester enamel.

E. Wherever compartment dimension exceeds clear-span ability of ceiling panels, provide I-beam support on exterior of ceiling or spline-hangers. Install ½" diameter steel rods through beam/hangers and secure to structure above. Beams or posts within compartments are not acceptable.

F. Reinforce prefabricated wall panels to rigid-support the door assemblies. All door jambs: furnished with replaceable full-perimeter thermostatically-controlled heater cable. Install 2" x

4" 16 gauge stainless steel hat-channel full-width of jamb with 1/8" stainless steel removable flush sill, secured with stainless steel screws and sealed watertight to channel.

G. "Floorless" Assemblies:
1. 6 mil polyethylene sheets in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.
2. Level and square prefabricated perimeter and partition wall panels, anchored to slab recess. Protect exposed surface of panels.
3. Two layers of 2" thick rigid polyurethane board insulation with staggered joints, set in mastic.
4. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of finished floor base.
5. Provide New Age Model No. 9787-C cove base at perimeter of interior walls when finished floor surface is sealed concrete.

Note: CONCRETE FLOORING OVER INSULATION PROVIDED BY DIVISION 03/09 AS PER ARTICLE 1.04A THIS WORK IS NOT IN THE SCOPE OF EQUIPMENT SUPPLIER.

H. Each Compartment: 2 ½" diameter chrome-plated flush-mounted dial thermometer with re-calibration. All thermometers furnished with sufficient length of capillary tubing to extend from exterior front of the assembly to a mounting position of the sensor bulb and glycerin container within evaporator return air-stream with tubing clipped to panel at 36" o.c.

I. Each compartment: flush mounted audio/visual high/low temperature alarm panel. Secure alarm control sensor to wall panel in evaporator return air stream.

J. Refrigerant Loss Alarm System – provide per Uniform Mechanical Code 1997 – Section 1120. When required sensors provided in each compartment. Alarm requirements to be calculated by total charge and type of refrigerant for each compartment, figured on a cubic foot capacity.

K. Panic-alarm Switch: installed in each compartment at 72" aff. Interconnect Hubbell "Presswitch" to audio/visual alarm.

L. Kason Series 1810 LED surface-mounted light fixture.

M. Light Fixtures: wired to interior and exterior companion 3-way Hubbell Presswitch per compartment, mounted in "FS" boxes with Hypalon covers and pilot lights. Compartments with multiple entrances: 4-way switches.

N. Penetrations of Panels: sealed with Dow Corning 3-6548 silicone RTV foam, full-depth of panel. Trim excess flush.

O. 6” x 1” engraved phenolic-plastic compartment identification sign in Architect's selection of color with 1/2” letters, mounted below respective alarm and thermometer (multiple compartment assemblies).

P. Install closure panels and/or trim strips to building walls and ceiling with concealed attachment. Closure material: same as wall panels unless noted otherwise.

Q. Compartment Entrance Doors: 36" x 78" nominal clearance unless otherwise noted.
1. Mount hinged doors on three ball-bearing cam-lift hinges.
2. Swing doors as indicated on drawings.
3. Defrost heater: thermostatically controlled and replaceable at full-perimeter of all doors, except when using clear Lexan doors (in addition to door jambs). Defrost heaters to be wired for continuous service.
4. 30” high x full-length 16 gauge stainless steel kick plates at front and rear of all hinged doors.

5. 12" x 2" engraved phenolic plastic compartment identification sign in Architect's color selection with 1" letters, mounted above door window.
6. 14" x 22" three-panel glass view window with heater and molded non-metallic inner and outer frame. Heater to be wired for continuous service.
7. Padlock/key provisions in door latch with interior safety release.
8. Foot treadle door opener. * USE CAREFULLY, MAY RESTRICT SELECTION *
9. Refrigerator/Freezer Entrance Door Material/Finish: Stainless steel interior/exterior unless noted otherwise.
10. Freezer fan switch connected to solenoid (for compressor pump down cycle) at each freezer entrance door jamb, pre-wired thru-wall to top-mounted junction box and freezer evaporator fans with temperature activated override control.
11. Heated pressure relief ports in freezers to be wired for continuous service.
12. Full height x width of opening - strip curtain at all exterior doors.

2.25 COLD STORAGE REFRIGERATION SYSTEMS

A. Unit Coolers: specified quantity and model, ceiling-hung by ½" o.d. nylon bolts with stainless steel washers and nuts. Insert hanger bolts through plastic sleeve and seal penetration airtight.
   1. Unit cooler drain fittings: positioned as indicated on drawings. Installation of cast tee-fittings on drainpan outlet with union and cleanout plug and extension of 1" Type K copper drain line through wall panel to air-gap fitting or floor drain under this Section.
   2. Slope drain line ½" per foot, trap at exterior of assembly and turn down into drain. Manifold drain lines of adjacent compartments wherever possible.
   3. Install drain line plastic sleeve through compartment wall, seal around drain line and install stainless steel escutcheon with setscrews.
   4. Electric drain line heater cable: on all unit coolers operating below 36$^{O}$F., installed from coil drain line fitting to wall penetration under this Section. Heater cables: minimum rating of 30 watts/lineal foot, 208 volts, single phase. Wrap drain line with maximum 2" loop spacing and interwire to unit cooler for continuous operation.
   5. Mounted, pre-piped and pre-wired evaporator components:
      a. Sporlan thermostatic expansion valve with external equalizer.
      b. Shut-off valve at evaporator suction and liquid lines.
      c. Sporlan "Catch-All" refrigerant filter/dehydrator on liquid line.
      d. White Rogers 1609-101 adjustable thermostat with remote bulb positioned in return air-stream of evaporator.
      e. Manual-lift stem solenoid valve.
      f. Electrical disconnect switch in NEMA 4 enclosure.

B. Refrigerated Design Texas, air-cooled or water-cooled rack systems for indoor use located on floor storage assemblies installed as follows:
   1. Rack frame assembly installed on custom fabricated assembly with ss square tubing 12” AFF with foot inserts, refer to drawing for location
   2. Condenser assemblies isolated from frame with vibration absorbing pads.
   3. Provide flexible connectors at all electrical & piping connections.

C. Refrigerant System Installation.
   1. Refrigerant Lines; Type "L" hard copper tubing. Fittings: wrought copper or brass designed for use with high temperature solder. Piping joints: made with silver solder (Sil-Fos). Piping: properly suspended from and anchored to the structure with adjustable hangers 6' o.c. maximum. Suction lines: sized to have maximum pressure drop of two pounds in medium temperature systems; one pound in low temperature system. Liquid lines: sized to give maximum pressure to prevent trapping of oil. Insulation on all suction lines: Armaflex insulation by Armstrong. ¾" thick at medium temp 1" thick at low-temp. Refrigerant lines in PVC or EMT conduit: sealed at both ends with Dow Corning 3-6548 silicone RTV foam. Exterior Refrigerant Lines to be

wrapped by refrigeration system installer in self fastening jacket of Type 3003-H14 aluminum alloy 0.016-inch thick. Provide aluminum strapping and seals for applying aluminum jacket and covers according to manufacturer's recommendations to provide completely weather-tight covering.

D. Evacuation and Charging.
   1. After completion of the pressure test, the system shall be evacuated using an approved auxiliary vacuum pump. Connections for evacuation: in accordance with manufacturer's recommendations.
   2. Charging subsequent to the initial charge which is contained in the condensing unit (Provide appropriate Refrigerant per Federal Regulations): given through the charging valve in the high side passing all the liquid refrigerant through a charging dehydrator. All charging lines and gauges: purged of air prior to connection with system. Refrigerant: unused and shall be delivered in clean containers. After the system is fully charged: start and place in full operation.

2.26 SOURCE INFORMATION

The Ansul Company
One Stanton Street
Marinette, Wisconsin 54143
(715) 735-7411
FAX: (800) 543-9822

Chemgrate Corporation
5151 Beltline Rd., Ste. 1212
Dallas, Texas 75254
(800) 527-4043

The Chicago Faucet Company
2100 South Clearwater Drive
Des Plaines, Illinois 60018 + 5999
(847) 803-5000
FAX: (847) 803-5454

Component Hardware Group, Inc.
1890 Swarthmorth Avenue
Lakewood, New Jersey 08701
(732) 363-4700
FAX: (732) 364-8110

Dormont Manufacturing
6015 Enterprise Drive
Export, Pennsylvania 15632
(724) 735-4800
FAX: (724) 733-4808

Doug Mockett & Company
(Chrome Plated Grommets)
P.O. Box 3333
Manhattan Beach, California 90266
(310) 318-2491
FAX: (310) 376-7650

Jarvis Caster Co.
881 Lower Brownsville
Jackson, TN 38301
(800) 995-9876
FAX: (800) 259-7188

Kason Industries, Inc.
57 Amlajack Boulevard
Newman, Georgia 30265
(770) 304-3000
FAX: (770) 251-4854

Refrigeration Design Technologies
1808 FM Road 66, Box 622
Waxahachie, Texas 75168
(972) 937-3215
FAX: (972) 937-0970
Randall Dyess/Brent Dyess

Schnee Moorehead Chemical
Schnee Butyl Sealant
111 South Nursery Road
Irving, Texas 75060
(800) 878-7876
(972) 554-3939

T & S Brass & Bronze Works
2 Saddleback Cove, Box 1088
Travelers Rest, South Carolina 29690
(800) 476-4103
FAX: (800) 868-0084

**PART 3 - EXECUTION**

3.1 DELIVERY AND INSTALLATION

A. Supervision: provide a competent foreman or supervisor who shall remain on the job during the entire installation.

B. Delivery: coordinate with progress of construction and Owner's operation schedules. Unless otherwise instructed and documented by Owner or General Contractor, the following procedures apply:

C. Field-Assembled Fixed Equipment integrated into the structure (e.g., cold storage assemblies, exhaust hoods, drain trench/grate assemblies, conveyor systems, ceiling-mounted utensil racks, etc.) are to be sent to the job-site when directed by the General Contractor and installed/protected accordingly.
1. All other Fixed Equipment: delivered after completion of work on adjacent finished ceilings, lighting, finished floor and wall systems, including painting.
2. Major Movable Equipment: delivered when possible to inventory in secured area for interim job-site storage or, if secured area is not available, when fixed equipment installation/clean-up has been completed.
3. Minor appliances and loose items (e.g., pans, covers, flatware containers, etc.) delivered only when Owner is prepared to receive and inventory such items.

D. Protection of Work:
1. Fabricated fixtures: fiberboard or plywood taped to tops and exposed body panels/components.
2. Manufactured Equipment: fiberboard or plywood taped as required by equipment shape and installation-access requirements.
3. Prohibited use of equipment: tool and materials storage, workbench, scaffold, stacking area, etc.
4. Damaged Equipment: immediately documented and submitted to Owner with Contractor's recommendation of action for repair or replacement and it's impact on the Project Schedule and Contract Amount, if any.

3.2 CLEAN AND ADJUST

A. Clean up and remove from the job site, all debris resulting from this Work as the installation progresses.

B. Thoroughly clean and polish interior/exterior of all Foodservice Equipment, prior to demonstration and final observation, ready for Owner's use.

C. Lubricate and adjust drawer slides, hinges, casters.

D. Adjust pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, exhaust hood grilles, etc.

E. Clean or replace faucet aerators, line strainers.

F. Touch-up damage to painted finishes.

G. Start up and check operation of all refrigeration systems for at least 72 hours prior to acceptance.

3.3 EQUIPMENT START-UP/DEMONSTRATION

A. Carefully test, adjust and regulate all equipment in accordance with the manufacturer's instructions and certify in writing to the Owner that the installation, adjustments and performance are in full compliance.

B. Provide the Owner or Foodservice Operators with a thorough operational demonstration of all equipment and furnish instructions for general and specific care and maintenance. Coordinate and schedule selected items of equipment and attendees with Owner at least two weeks in advance of demonstration periods.

3.4 FINAL OBSERVATION

A. Final observation will be made when the Contractor will certify that he has completed his work, made a thorough review of the installation/operation of each item in the contract and found it to be in compliance with the Construction Documents.

B. Repetitive final observations (more than two) and all costs associated thereto which may be incurred due to the Contractor's failure to comply with the requirements of this Article will be invoiced to this Contractor on a time and expense basis.

**PART 4 - EQUIPMENT SCHEDULE**

4.1 REGULARLY-MANUFACTURED EQUIPMENT/COMPONENTS:

A. Standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.

4.2 FABRICATED AND FIELD-ASSEMBLED EQUIPMENT:

A. Arrangement and configuration as shown on Plans, Elevations and Detail Drawings.

4.3 REFER TO DRAWINGS:

A. For unit quantities and electrical or mechanical provisions required, including manufacturer's optional voltages, wattages, burner capacities, etc.

4.4 REFER TO PART 2 – PRODUCTS:

A. For accessories, fittings, requirements and procedures related to the listed buy-out and fabricated equipment.

4.5 FOODSERVICE EQUIPMENT

**ITEM 101 REFRIGERATION SYSTEM, WATER COOLED**
Manufacturer/Model: Model RDT, WATER COOLED model IRW1-02Z0CT3-AST
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model RDT, WATER COOLED
- Refrigerator: Condensing Unit: ZB08KAE ½ HP. Evaporator BEL0095.
- Freezer: Condensing Unit: ZF09K4E 3.0 HP, Evaporator BEL0080.
- Special instructions: install unit on floor with a custom fabricated ss 2” square tubing assembly, foot inserts and 12” tall structure. Anchor RDT assembly to this structure. This unit will be installed on the floor, refer to drawings for location.

- Confirm with Owner if refrigerator is to be installed to building network system, if so provide cat 5 cable for network connectivity. Provide 120Volts plug for it. Refer to RDT manufacturer installation instructions.

**ITEM 102 COLD STORAGE ASSEMBLY**
Manufacturer/Model: THERMOKOOL Cold Storage Assembly.
Utilities: Refer to drawings.
Unit Sizes: Size/configuration as shown on drawings x 8'-6" aff to top of compartment.
Equipment:
- Refer to drawings. and Part 2 - Products, "Prefabricated Cold Storage Assemblies".
- Refrigerator/Freezer Compartments:
- Three (3) Kason #1810 LED Light Fixtures (40 Watt, 48" Fixture).
- 1/8" Diamond Aluminum Tread Plate Wainscot @ 36" high at exposed exterior.
- Top closure panel as required, Refer to drawings and "Prefabricated Cold Storage Assemblies".

**ITEM 103 COLD STORAGE SHELVING, METROMAX Q**
Manufacturer/Model: Metro Metromax Q, Polymer Cold Storage Shelving.
Equipment:
- Shelf material/type: Metromax Q.
- Post material/size: Metromax Q/74".
- Complete shelf assemblies indicated 4 tiers high 24" deep by length indicated on plan.
- Configuration: 4 tiers, lower shelf adjusted to 8" aff; balance at 14" clear.

Special Instructions:
- Verify Shelving quantities and sizes with field dimensions to fit the room sizes. Refer to Drawings.

**ITEM 104 DRY STORAGE SHELVING, METROMAX Q**
Manufacturer/Model: METRO, METROMAX Q, Polymer Storage Shelving
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model METRO, METROMAX Q, 24"X48"X86" FOR DRY STORAGE Shelf Material/type: MetroMax Q Shelf, 24"deep, removable open grid polymer shelf mats on an epoxy coated steel frame with quick adjust corner release, (4) connectors, Microban antimicrobial product protect, 800 lb. capacity per shelf.
- Post: MX86P Polymer trilobal post, 86-3/16"H staionary post, adjustable leveling foot, grooved on 1" increments, corrosion proof all polymer construction with built in Microban antimicrobial product protect.
- Configuration: 5 tiers, lower shelf adjusted to 8" aff, 2nd shelf at 29" clear, balance at 14" clear.
- Special Instruction:
- Verify Shelving quantities and sizes with field dimensions to fit the room sizes.

**ITEM 105 PLANETARY MIXER / STAND**
Manufacturer/Model: Hobart Model HL200-1STD
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model HL200-1STD 100-120/50/60/1; Bench type mixer; with bowl, beater, whip & spiral dough arm, US/EXP configuration - Legacy Planetary Mixer, Bench, 20 quart, (3) fixed speeds plus stir speed, gear-driven transmission, 15-minute SmartTimer™, #12 taper hub, manual bowl lift, stainless steel bowl, aluminum "B" beater, stainless steel "D" wire whip, aluminum "ED" spiral dough arm, stainless steel bowl guard, 1/2 hp, cord with plug
- Mixer Stand:

**ITEM 106 FOOD SLICER, ELECTRIC**
Manufacturer/Model: Hobart Model HS9-1

Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model HS9-1 Heavy Duty Meat Slicer, automatic, 13" CleanCut™ removable knife with removal tool, anodized finish with (6) interlocks, (3) stroke lengths & (4) stroke speeds, removable meat grip assembly, removable ring guard cover, product fence, single action top mounted sharpener with Borazon™ stones, manual lift lever, 1/2 hp motor, 120v/60hz/1-ph NSF cETLus
- Slicer Cart:

**ITEM 107 REACH-IN REFRIGERATOR**
Manufacturer/Model: True Mfg. - General Foodservice Model STA1R-2HS-HC
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model STA1R-2HS-HC SPEC SERIES® Refrigerator, reach-in, one-section, (2) stainless steel half doors with locks, cam-lift hinges, digital temperature control, (3) chrome shelves, LED interior lights, stainless steel front & sides, aluminum interior sides & walls, stainless floor & ceiling, 5" castors, R290 Hydrocarbon refrigerant, 1/4 HP, 115v/60/1-ph, 3.8 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA, ENERGY STAR®
- Door hinged right standard
- Field reversible door
- (3) chrome shelves & shelf supports standard per section
- 5" castors (set of 4), standard

**ITEM 108 PREPARATION TABLE W/ SINK**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings x 2’-6” deep x 3’-0” high to counter top surface.
Construction:

- Refer to drawings and Part 2 - Products.
- Top: refer to “Counter/Table Tops Construction” with Marine Edge on all free sizes, 10” splash at balance.
- Base Construction: refer to “Open Base Structure”.
- One 24” x 26” x 12” deep sinks, refer to “Sinks”
- Splash Mount Preparation Sink Faucet: Two T&S Brass Faucet Model B-0231-CR swing faucets.
- Omit rear cross rail at sinks
- Omit front cross rail at roll-under equipment and trash bin.
- One Edlund Model No. 1 can opener anchored to counter top with non-cirrisuve bikts,
- Undershelf: refer to “Undershelves.”
- Overshelf: 12” deep single overshelf post mounted at 20” (and 32”) above counter top.
- Post mounted Utensil Rack: extend 1-5/8” o.d. stainless steel tubing from backsplash, through overshelf, turn forward 12” and weld full length x 2” x ¼” stainless steel bar at end. Provide Component Hardware No. J77-4401 Double Pointed Hooks at 8” o.c. Top of rack at 84” aff.

**ITEM 109 WORK TABLE**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings x 2’-6” deep x 3’-0” high to counter top surface.
Construction:

- Refer to drawings and Part 2 - Products.
- Top: refer to “Counter/Table Tops Construction” with Marine Edge on all free sizes, 10” splash at balance.
- Base Construction: refer to “Open Base Structure”.
- Omit front cross rail for roll-in equipment and trash bin.

- One Edlund Model No. 1 can opener anchored to counter top with non-corrosive screws
- Overshelf: 12” deep single overshelf post mounted at 20” above counter top.
- Post mounted Oval Shaped Utensil Rack over Items 109 & 110: extend 1-5/8” o.d. stainless steel tubing from backsplash, through overshelf, turn forward 12” and weld full length x 2” x ¼” stainless steel bar at end. Provide Component Hardware No. J77-4401 Double Pointed Hooks at 8” o.c. Top of rack at 84” aff.
- Two (2) Duplex Outlets mounted on back splash, prewired to JB – refer to Electrical Connections Drawing.
- One (1) Duplex Outlet mounted on back splash, prewired to JB – refer to Electrical Connections Drawing for Item 105 Mixer.

**ITEM 110 WORK TABLE**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings x 2’-6” deep x 3’-0” high to counter top surface.
Construction:
- Refer to drawings and Part 2 - Products.
- Top: refer to “Counter/Table Tops Construction” with Marine Edge on all free sizes, 10” splash at balance.
- Base Construction: refer to “Open Base Structure”.
- Omit front cross rail for roll-in equipment and trash bin.
- Overshelf: 12” deep single overshelf post mounted at 20” above counter top.
- Shared Post mounted Oval Shaped Utensil Rack. Refer to Item 109 Work Table.
- Two (2) Duplex Outlets mounted on back splash, prewired to JB – refer to Electrical Connections Drawing.
- One (1) Duplex Outlet mounted on back splash, prewired to JB – refer to Electrical Connections Drawing for Item 106 Slicer.

**ITEM 111 COFFEE GRINDER / BREWER <By Vendor>**
Manufacturer/Model: Custom Model VF/VI
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model VF/VI Vendor Furnished/Vendor Installed

**ITEM 112 TEA / COFFEE DISPENSER <By Vendor>**
Manufacturer/Model: Custom Model VF/VI
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model VF/VI Vendor Furnished/Vendor Installed

**ITEM 113 WORK TABLE**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings x 2’-6” deep x 3’-0” high to counter top surface.
Construction:
- Refer to drawings and Part 2 - Products.
- Top: refer to “Counter/Table Tops Construction” with square edge turndown at all free sides. 6” splash at balance.
- Base construction: refer to “Open Base Structure”.
- Omit front cross rail for roll-under equipment and trash bin.

**ITEM 114 HEATED BANQUET CART**
Manufacturer/Model: Carter-Hoffmann (Middleby) Model BB64

Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model BB64 Classic Carter™ Banquet Cabinet, mobile, insulated, single door for pre-plated food, (80) covered plates up to 10.5" diameter, thermostatically controlled bottom mounted heat unit, without plate carriers, 6" casters, stainless steel construction, cUL, UL EPH
- 120v/60/1-ph, 1650 watts, 13.7 amps, 10 ft. rubber cord with NEMA 5-15P, standard
- Standard package
- 6" polyurethane casters, set of 4, standard

**ITEM 115 MOBILE UTENSIL RACK, 48" STAINLESS STEEL**
Manufacturer/Model: Metro Model PR48ES
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model PR48ES Mobile Pot & Pan Rack, 48"W x 24"D x 68"H, (4) shelves solid embossed stainless steel (2) 5MP polyurethane swivel casters & (2) 5MPB polyurethane swivel casters with brake, NSF

**ITEM 116 POT WASH TABLE**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings x 2’-6” deep x 3’-0” high to counter top surface.
Construction:

- Top: “Utensil Wash Counters” with Rolled Rim at free sizes, 10” splash at balance. Refer to drawings and Part 2 - Products.
- Base Construction: refer to “Utensil Wash Counters”
- Open Base Construction.
- Omit rear cross rail at sink compartment.
- Omit front cross rail at roll-under equipment and trash receptacle.
- Three (3) 1'-6" x 2'-2" x 15" deep sink compartments.
- Two T & S Model No. B-0290-04 swing faucets for 3/4" hot & cold water connections.
- Post mounted Utensil Rack: extend 1-5/8” o.d. stainless steel tubing from backsplash, through overshelf, turn forward 12” and weld full length x 2” x ¼” stainless steel bar at end. Provide Component Hardware No. J77-4401 Double Pointed Hooks at 8” o.c. Top of rack at 84” AFF.
- Overshelf: 12” deep single overshelf post mounted at 20” above counter top with open shelves Refer to Drawings for length.
- 18 gauge stainless steel butt-joint wall panels from backsplash to underside of overshelf.
- Hose Bibb assembly: One T&S Brass Model B-0674-CR-BSTP Hose Bibb, mounted undercounter on stainless steel bracket and hose rack. Refer to Drawings.

Special Instructions:

- Secure wall mounted equipment/components to in-wall ground or anchor plates, refer to “Anchor Plates/Wood Grounds”.

**ITEM 117 BEVERAGE SYSTEM <By Vendor>**
Manufacturer/Model: Custom Model VF/VI
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model VF/VI Vendor Furnished/Vendor Installed.

**ITEM 117.1 SODA LINE**

- SECTION 11 40 00 TO PROVIDE EMPTY BEVERAGE CONDUIT FOR PLENUM INSTALLATION: 6" DIAMETER, 16 GA LEAK POOF ALUMINUM TUBE ABOVE CEILING AND STUB OUT FROM WALL AT 12" AFF TO AND BETWEEN THE BEVERAGE COUNTER FOR BEVERAGE LINES. EMPTY CONDUIT WITH WIDE SWEEP BENDS - 24" MIN. RADIUS AND PULL

WIRES FURNISHED AND INSTALLED BY DIVISION 22. PRODUCT REFERENCE: COLOMBO, BEVERAGE CHASE SYSTEM. WWW.BEVERAGECHASE.COM (800)547-2820. TO BE INSTALLED BY DIVISION 22.
- PROVIDE SS CHASE 18 GA. FROM CEILING TO TERMINATION BOX. REFER TO DRAWING DETAIL.

**ITEM 118 ICE MAKER, CUBE-STYLE**
Manufacturer/Model: Hoshizaki Model KM-1100MWJ
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model KM-1100MWJ Ice Maker, Cube-Style, 30"W, water-cooled, self-contained condenser, production capacity up to 1073 lb/24 hours at 70°/50° (1006 lb AHRI certified at 90°/70°), stainless steel finish, crescent cube style, R-404A refrigerant, 208-230v/60/1-ph, 9.6 amps, NSF, UL
- Model H9320-52 Water Filtration System, twin configuration, 19.11" H (manifold & cartridge)
- Install on Item 119 – Ice Bin.

**ITEM 119 ICE BIN FOR ICE MACHINES**
Manufacturer/Model: Hoshizaki Model B-700SF
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model B-700SF Ice Bin, 44"W, top-hinged front-opening door, 700-lb ice storage capacity, for top-mounted ice makers, stainless steel exterior, painted legs included, protected with H-GUARD Plus Antimicrobial Agent, ETL, ETL-Sanitation
- Model HS-5607 Scoop Holder Kit
- Cutout and installation kit for Item 118 – Ice Maker.

**ITEM 120 EXHAUST HOOD**
Manufacturer/Model: Econ-Air Model 6030 EX-2-PSP-F Exhaust Hood
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Refer to Shop Drawings on FS3 Series Drawings.

**ITEM 120.1 EXHAUST HOOD FIRE SUPPRESSION SYSTEM**
Manufacturer/Model: Econ-Air Model TANK System
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Refer to Shop Drawings on FS3 Series Drawings.
- Refer to drawings and Part 2 - Products, "Exhaust Hood Fire Extinguishing System".
- Remote fire pull as indicated on drawings.
- Wall mounted hand held extinguisher.

Special Insturctions:
- Provide hood/duct protection for Item 120 - Exhaust Hood.
- Provide surface protection for cooking equipment.

**ITEM 121 ELECTRIC FRYER, BATTERY**
Manufacturer/Model: Frymaster/Dean Model FPRE214
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model FPRE214 Frymaster® Fryer Battery, electric, hi-efficiency, (2) 50 lb. capacity each, built-in filtration, open frypot design, automatic melt cycle, boil out temperature control, temperature probe,

includes: rack-type basket support, basket hanger & twin baskets, stainless steel frypots, doors, & cabinets, (2) 14kW, cULus, NSF, ENERGY STAR®
- Model FWH-1 Frymaster®/Dean® Food Warmer & Holding Station, ceramic heating element with wire guard, radiant heat, includes; heat lamp, cord & plug, 12 x 20 x 2-1/2" stainless steel cafeteria-style pan & screen (additional cabinet required), NSF, cULus
- Note: Prices listed are for within the USA only. Please contact the factory for pricing if quoting outside of the USA
- 120v/60/1-ph, 6.3 amps, standard, for heat lamp
- 120v/60/1-ph, 6.3 amps, standard, for heat lamp
- Note: Prices listed are for within the USA only. Please contact the factory for pricing if quoting outside of the USA
- Electrical specs must be specified
- CM3.5 controller, standard
- Full frypots, standard
- Casters, 5" diameter (set of 4), standard

**ITEM 122 6 PLATES STOVE W/OVEN AND SALAMANDER ELECTRIC**
Manufacturer/Model: Vulcan Model EV36S-6FP480
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model EV36S-6FP480 Restaurant Range, electric, 36", (6) 2.0 kW French hotplates, infinite controls, standard oversized oven, includes (1) rack, stainless steel front, sides, single-deck high shelf & 6" legs, 480v
- 480v/50-60/3-ph, 17.0kW, 23.5 amps, direct wire, standard
- Single deck stainless steel high shelf, standard
- Model 36ESB-208 Salamander Broiler, Electric, 36" wide, dual temperature controls, six-position adjustable grid, removable drip pan, stainless steel top, front &, sides, 208v/3-ph (Field convertible to 1-ph)
- NOTE: A reinforced riser must be ordered with every Salamander in order to properly mount to range
- Model CASTERS-ADJRR4 Casters, 6", adjustable (set of 4) (2 with locks)

**ITEM 123 KETTLE, ELECTRIC, COUNTERTOP**
Manufacturer/Model: Groen Model TDB-20C
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model TDB-20C Kettle, electric, table top, 20 quart capacity, 2/3 jacket, IPX6 water rated electronic Classic controls, 304 stainless steel liner, hand tilt, faucet bracket, support console on right, stainless steel construction, cULus, NSF, Made in USA
- 208v/60/3-ph, 6.3kw, 18.0 amps
- Model 174980 (TS/10S-2) Stand, 29.5”W x 31.75”D x 17.5”H, with drain drawer, bullet feet, stainless steel, for TDB & TDBC (20, 24, 40, 48) (No drain cart required)
- Model 146354 Casters, set of (4), (2) locking, for all BPM & BPP models and all TS/10 & TS/10S stands

**ITEM 124 DRAIN TRENCH/ LINER**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings.
Construction:
- Refer to drawings and Part 2 - Products.

Special Instructions:
- Furnished by Section 114000 – Installed by Division 22.

**ITEM 125 TILTING SKILLET BRAISING PAN, ELECTRIC**
Manufacturer/Model: Groen Model BPP-30EA
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model BPP-30EA Braising Pan, electric, 30-gallon capacity, 10" deep pan, 38" pan height, IPX6 water rated electronic Advanced controls with digital display, 1 minute to 10 hour timer, 175° - 400°F preset temperatures along with manual setting capability, power tilt, standard etch marks, faucet bracket, vent cover, round tubular open leg base, stainless steel construction, bullet feet, 11.5kW, cUL, UL, NSF, Made in USA
- 208v/60/3-ph, 32.0 amps, std.
- Model 158386 Drain drawer for (30) gallon
- Model FL FOOTKIT 4 Flanged Feet, for all BPM & BPP models (set of 4)

**ITEM 125.1 FAUCET, KETTLE / POT FILLER**
Manufacturer/Model: T&S Brass Model B-0610
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model B-0610 Pot & Kettle Filler Faucet, wall mount mixing faucet with 8" adjustable centers, quarter-turn Eterna cartridges with spring checks, lever handles with color coded indexes, 3/8" NPT atmospheric vacuum breaker (B-0968), 68" flexible stainless steel hose with heat-resistant gray handle & hold down ring, hook nozzle with self-closing valve, finger hook, polished chrome-plated brass faucet body, 1/2" NPT female inlets, CSA
- Model B-0230-K Installation Kit, (2) 1/2" NPT nipples, lock nuts & washers, (2) short "Ell" 1/2" NPT female x male
- 12”x12”x2.5” Pan formed stainless steel cover and bracket to mount faucet on wall.

**ITEM 126 DOUBLE ELECTRIC CONVECTION OVEN**
Manufacturer/Model: Vulcan Model VC44ED
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model VC44ED Convection Oven, electric, double-deck, standard depth, solid state controls, temperature range 150° to 500°F, 60 minute timer with audible alarm per oven, oven cool switch for rapid cool down, independently operated stainless steel doors with double pane windows, porcelain enamel on steel oven interiors, (5) nickel plated racks per oven, stainless steel front, top, sides & 8"H legs, (2) 1/2 HP two speed oven blower-motors, 12 kW each section, NSF, cUL, UL, ENERGY STAR®
- (2) 480v/60/3-ph, 30 amps total, priced per oven

**ITEM 127 COMBI OVEN, ELECTRIC**
Manufacturer/Model: RATIONAL Model ICP 6-FULL ON 6-FULL E 480V 3 PH
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

Two (2) (CC1ERRA.0000219) iCombi Pro® 6-Full Size Combi Ovens, double stack, electric, (12) 18" x 26" sheet pan or (24) 12" x 20" steam pan or (12) 2/1 GN pan capacity, (6) stainless steel grids included, intelligent cooking system with (4) assistants; iDensityControl, iCookingSuite, iProductionManager, & iCareSystem, (6) operating modes, (5) cooking methods, (3) manual operating modes, 85° to 572°F temperature range, quick clean, care control, eco mode, 6-point core temperature probe, retractable hand shower, Ethernet interface, Wi-Fi enabled, 440/480v/60Hz/3-ph, 22.4 kW each, CE, IPX5, UL, cULus, NSF, ENERGY STAR® 1 kt Model 60.74.725 Combi-Duo Stacking Kit for iCombi 6-full size (electric or gas) on iCombi 6- or 10-full size (electric only) 1 ea Model 60.31.204 Stand I for Combi-Duo, mobile, 7-

3/4"H, all sides open, stainless steel construction, height adjustable casters, for iCombi 6-full size on 6-full size 1 ea NOTE: All discounts subject to approval by manufacturer 1 ea 2 years parts and labor, 5 years steam generator warranty 1 ea Model CAP Chef Assistance Program, a RATIONAL certified Chef conducts 4 hours/location specialized application training with personnel, no charge 1 ea Model 9999.2002 Pre-Installation Site Consultation, provides an installation consultation to ensure the site has proper space and connections for gas, electric, drain & water, one (1) Consultation is needed for every four (4) cooking systems, includes 100 miles (200 miles round trip). (see attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET) 2 ea Model 9999.2252 RCI RATIONAL Certified Installation, new certified installation for each table-top iCombi of a combi-duo, 100 miles (200 round-trip) included. (See attached installation flyer for details) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET) 1 ea Model 9999.2003 Second Installation Trip – only with RATIONAL Certified Installation when separate dates are required. Includes up to 4 cooking systems in one kitchen. Includes 100 miles (200 miles round-trip). THIS ITEM IN NON-DISCOUNTABLE, USA ONLY (NET) 2 ea Model 8720.1552US Installation Kit, for electric iCombi/SCC/CMP 61 (208/60Hz/3 & 240/60Hz/3); electric iCombi/SCC/CMP 101 (440/60Hz/3 & 480/60Hz/3); electric iCombi/SCC/CMP 62 (440/60Hz/3 & 480/60Hz/3) THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET) 1 ea Model 1900.1158US Water Filtration Double Cartridge System, for full-size Combi-Duos or Specifications 03/03/2025 Page 1 of

if used for more than (2) units, includes: (1) double head with pressure gauge, (2) R95-CLX filter & (1) filter installation kit (for each additional unit add (1) additional head & additional cartridge. Maximum (4) cartridges) 1 ea Model 9999.2271 RCI RATIONAL Certified Installation, additional installation cost for a RATIONAL Water Filter System is available when purchased with Certified Installation of RATIONAL unit THIS ITEM IS NON-DISCOUNTABLE, USA ONLY (NET) 1 ea Note: The RATIONAL Water Filtration Systems helps provide consistent high-quality water to your RATIONAL cooking systems. The patented carbon block technology reduces the effects of sediment, chloramines, and chlorine while delivering the required flow rates. 1 ea Model 56.01.535 Active Green Cleaner Tabs, for all iCombi Pro/Classic, 150 pieces/bucket (minimum order quantity- 2 ea, unless ordered with a unit) (NET) 1 ea Model 56.00.562 Care Tabs, bucket of 150 packets for all iCombi Pro/Classic models and SelfCooking Center® units from 10/2008, with CareControl - Serial SG, SH or SI series (minimum order quantity: 2pcs, unless ordered with a unit) (NET) 6 ea Model 6010.2101 Gastronorm Grid Shelf, 2/1 size, 25-5/8" x 20-7/8", stainless steel 12 ea Model 6019.1150 CombiFry Basket, 1/1 GN, 12-3/4" x 20-7/8" 2

**ITEM 128 BACK COUNTER WITH SINK**

Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings x 2’-6” deep x 3’-0” high to counter top surface.
Construction:

- Refer to drawings and Part 2 - Products.
- Top: refer to “Counter/Table Tops Construction” with Square turn down on all free sides. 4” splash at balance.
- Base Construction: refer to “Closed Base Bodies”
- One 20” x 20” x 12” deep sinks, refer to “Sinks”.
- Deck Mount Work Sink Faucet: One T&S Brass Model B-0227 Deck Mount Faucets with 8” swing nozzle.
- Utility Compartments, refer to “Utility Compartments”
- Storage Compartments: refer to Drawings.
- Front and Back Hinged Doors: refer to “Doors.”
- Pass thru Opening for under counter Trash can Item 236

**ITEM 129 BACK COUNTER**

Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings x 2’-6” deep x 3’-0” high to counter top surface.

Construction:
- Refer to drawings and Part 2 - Products.
- Top: refer to “Counter/Table Tops Construction” with Square turn down on all free sides. 4” splash at balance.
- Base Construction: refer to “Closed Base Bodies”
- Storage Compartments: refer to Drawings.
- Front and Back Hinged Doors: refer to “Doors.”
- Pass thru Opening for under counter Trash can Item 236

**ITEM 130 REACH-IN DUAL TEMP CABINET**
Manufacturer/Model: True Mfg. - General Foodservice Model STA1DT-2HS-HC
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model STA1DT-2HS-HC SPEC SERIES® Refrigerator/Freezer, reach-in, one-section, (2) stainless steel half doors, locks, cam-lift hinges, digital temperature control, (3) chrome shelves, LED interior lights, stainless steel front & sides, aluminum interior, 5" castors, R290 Hydrocarbon refrigerant, R 1/10HP, F 1/4HP, 115v/60/1-ph, 3.7 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA
- Door hinged right standard
- Spec Kit #4 - (3) chrome shelves & shelf supports (specify for left, center or right section)
- Additional (3) chrome shelves & shelf supports standard per section
- 5" castors (set of 4), standard

**ITEM 131 ELECTRIC FRYER, BATTERY**
Manufacturer/Model: Frymaster/Dean Model FPRE214
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model FPRE214 Frymaster® Fryer Battery, electric, hi-efficiency, (2) 50 lb. capacity each, built-in filtration, open frypot design, automatic melt cycle, boil out temperature control, temperature probe, includes: rack-type basket support, basket hanger & twin baskets, stainless steel frypots, doors, & cabinets, (2) 14kW, cULus, NSF, ENERGY STAR®
- Model FWH-1 Frymaster®/Dean® Food Warmer & Holding Station, ceramic heating element with wire guard, radiant heat, includes; heat lamp, cord & plug, 12 x 20 x 2-1/2" stainless steel cafeteria-style pan & screen (additional cabinet required), NSF, cULus
- Note: Prices listed are for within the USA only. Please contact the factory for pricing if quoting outside of the USA
- 120v/60/1-ph, 6.3 amps, standard, for heat lamp
- 120v/60/1-ph, 6.3 amps, standard, for heat lamp
- Note: Prices listed are for within the USA only. Please contact the factory for pricing if quoting outside of the USA
- Electrical specs must be specified
- CM3.5 controller, standard
- Full frypots, standard
- Casters, 5" diameter (set of 4), standard

**ITEM 132 GRIDDLE, ELECTRIC, COUNTERTOP**
Manufacturer/Model: Vulcan Model HEG48E
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model HEG48E Heavy Duty Griddle, electric, countertop, 48" W x 24" D cooking surface, 1/2" thick polished steel griddle plate, bottom mounted snap action thermostat every 12", low profile, stainless

steel front, sides, front top ledge with "Cool Bullnose", front grease trough, 4" back & tapered side splashes, 4" adjustable legs, cCSAus, NSF
- 480v/60/3-ph, 21.6 kW, 29.2 amps

**ITEM 133 CHEF BASE**
Manufacturer/Model: True Mfg. - General Foodservice Model TRCB-72-HC
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model TRCB-72-HC Refrigerated Chef Base, 72-3/8"W base, one-piece 300 series 18 gauge stainless steel top with V edge, (4) drawers (accommodates (2) 12" x 20" x 4" pans, NOT included), stainless steel front/sides, aluminum back, aluminum interior with stainless steel floor, 4" castors, R290 Hydrocarbon refrigerant, 1/3 HP, 115v/60/1-ph, 4.4 amps, NEMA 5-15P, cULus, UL EPH Classified, CE, Made in USA
- Self-contained refrigeration standard
- Standard marine edge top
- Stainless Steel Interior.
- 4" Castors, standard

**ITEM 134 CHARBROILER, ELECTRIC, COUNTERTOP**
Manufacturer/Model: Star (Middleby) Model 5124CF
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model 5124CF Star-Max® Heavy Duty Charbroiler, electric, countertop, 24"W x 26"D, heavy cast iron removable grids, swing-up 3300 watt elements every 12", chrome metal knobs, grease drawer, welded steel frame with stainless steel top, front and grease trough, aluminized steel sides, 4" legs, cULus, UL EPH Classified, Made in USA
- (5124CF-208V) 208v/50/60/3-ph, 6.6 kW, 21.8 amps, field wired

**ITEM 135 EXHAUST HOOD**
Manufacturer/Model: Econ-Air Model 6030 EX-2-PSP-F Exhaust Hood
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Refer to Shop Drawings on FS3 Series Drawings.

**ITEM 136 OIL TRANSPORT CADDY**
Manufacturer/Model: Frymaster/Dean Model PSDU100
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model PSDU100 Frymaster®/Dean® Shortening Disposal Unit, 100 lb. oil capacity, manual pump, 9-5/8" drain height, one-way check valve, 6" wheels
- Note: Prices listed are for within the USA only. Please contact the factory for pricing if quoting outside of the USA

**ITEM 138 TRASH TRUCK**
Manufacturer/Model: Rubbermaid Model No. FG101100BLA ) Trash Truck
Equipment:

**ITEM 201 ACTION/GRILL/SPECIALTY COUTER**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.

Unit Sizes: Refer to drawings x 2’-10” high to counter top surface.
Construction: Refer to drawings and Part 2 - Products.

- Top: Solid Surface, refer to Drawings and Architect’s finish schedule. Verify pattern / color with the Architects.
- Full length self-serve breath protector: refer to drawing details:
- Heat Lamps:
- Install two (2) Item 205 – Drop-in Hot Food Wells:
- Closed base body construction.
- Built-in appliances/components as indicated with framing members at perimeter of cut out in top.
- Undershelf – refer to – “Undershelves”.
- Utility compartment.
- Hinged doors – refer to “Doors”.
- Install two (2) Item 204.1 – Cold/Hot Food Well Unit. Mount Condensing Unit in Compressor Compartment with louvered doors.
- Install Item 204.2 – Cold/Hot Food Well Unit. Mount Condensing Unit in Compressor Compartment with louvered doors.
- Install Item 203 – Sandwich Refrigerator in lined counter recess.
- Install Item 208 – Induction Cook Top in lined counter recess.
- Install Item 238 – Refrigerated Equipment Stand in lined counter recess.
- Install Item 202 – Conveyor Toaster on counter top.
- Storage Compartments.
- Plate Shelf with controls, and light switches.
- Eight (8) NEMA 5-20R-GFCI, 120 volt, single phase general-purpose outlets mounted below countertop in Apron Control along with Hot Food Display Warmer Controls.
- Load Center: locate load center compartment with one Square "D" Model No. QO320L125G / QOC24UF circuit breaker load center with ground bar kit, Visi-Trip breakers and cover. (Rated to 125 amps; 208 volts, three phase; 4 wire.
- Prewire equipment to JB Rough-in location. Ready for final connection by Div.26. Refer to Part 2 – Products, Section 2.5 G – Receptacles and Switches.

**ITEM 202 CONVEYOR TOASTER**
Manufacturer/Model: Hatco Model TQ-400
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model TQ-400 Toast-Qwik® Conveyor Toaster, horizontal conveyor, countertop design, all bread types toaster, approximately 6 slice capacity/min, 2" opening height, rotary mechanical controls, ColorGuard sensing system, CE, cULus, UL EPH Classified, Made in USA
- NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- 120v/60/1-ph, 1790 watts, 14.9 amps, NEMA 5-15P (domestic voltage), standard

**ITEM 203 SANDWICH / SALAD PREPARATION REFRIGERATOR**
Manufacturer/Model: True Mfg. - General Foodservice Model TSSU-27-08-HC~SPEC3
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model TSSU-27-08-HC~SPEC3 SPEC SERIES® Sandwich/Salad Unit, (8) 1/6 size (4"D) poly pans, stainless steel insulated cover, 11-3/4"D cutting board, series stainless steel front, sides & back, (1) door with lock, (2) shelves, stainless steel interior liner & stainless steel floor with coved corners, gray PVC coated adjustable wire shelves, exterior digital temperature control and display, R290 Hydrocarbon refrigerant, 1/5 HP, 115v/60/1-ph, 3.5 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA

- Self-contained refrigeration standard
- Right Hand, Standard: Unit comes with field reversible hinges & is built with hinging on right side of unit.
- Castors, 3" (34" work surface height = ADA)

**ITEM 204.1 HOT / COLD FOOD WELL UNIT, DROP-IN, ELECTRIC**
Manufacturer/Model: Hatco Model HCWBIR-2DA
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model HCWBIR-2DA Drop-In Hot/Cold Well, accommodates (2) full-size pans, condensing unit, FR2 hydro-heater, TXV valve, remote mountable panel, 60" power supply whip, electronic temperature control, auto defrost, automatic water fill, condensing unit, comes with pan support bars, 3000 watts, 1/5 HP, cULus, Made in USA
- NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- 120/208v/60/3-ph, 8.4 amps
- Install on Item 201 – Action/Grill/Specialty Counter.

**ITEM 204.2 HOT / COLD FOOD WELL UNIT, DROP-IN, ELECTRIC**
Manufacturer/Model: Hatco Model HCWBIR-3DA
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model HCWBIR-3DA Drop-In Hot/Cold Well, accommodates (3) full-size pans, condensing unit, FR2 hydro-heater, TXV valve, remote mountable panel, 60" power supply whip, electronic temperature control, auto defrost, automatic water fill, condensing unit, comes with pan support bars, 3000 watts, 1/5 HP, cULus, Made in USA
- NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- 120/208v/60/3-ph, 8.4 amps
- Install on Item 201 – Action/Grill/Specialty Counter.

**ITEM 205 HOT FOOD WELL UNIT, DROP-IN, ELECTRIC**
Manufacturer/Model: Hatco Model DHWBI-1
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model DHWBI-1 Drop-In Modular Dry Heated Well, (1) full size pan capacity, insulated, top mounted, remote thermostat with separate power switch, stainless steel & aluminized construction, cULus, UL EPH Classified, Made in USA
- NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- Single remote control configuration
- 120v/60/1, 960w, 8.0 amps
- 23-5/8" bezel depth, standard

**ITEM 206 EXHAUST HOOD**
Manufacturer/Model: Econ-Air Model 6030 EX-2-WI-PSP-F Exhaust Hood
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Refer to Shop Drawings on FS3 Series Drawings.

**ITEM 206.1 EXHAUST HOOD FIRE SUPPRESSION SYSTEM**
Manufacturer/Model: Econ-Air Model TANK System
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Refer to Shop Drawings on FS3 Series Drawings.
- Refer to drawings and Part 2 - Products, "Exhaust Hood Fire Extinguishing System".
- Remote fire pull as indicated on drawings.
- Wall mounted hand held extinguisher.

Special Insturctions:
- Provide hood/duct protection for Item 135 and 206 - Exhaust Hood.
- Provide surface protection for cooking equipment.

**ITEM 208 INDUCTION RANGE, COUNTERTOP**
Manufacturer/Model: CookTek (Middleby) Model HTF-9500-SH35-1
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Install on Item 201 – Action/Grill/Specialty Counter.

**ITEM 209 DELI/PIZZA SERVING COUNTER**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings x 2’-10” high to counter top surface.
Construction: Refer to drawings and Part 2 - Products.
- Top: Solid Surface, refer to Drawings and Architect’s finish schedule. Verify pattern / color with the Architects.
- Full length self-serve breath protector: refer to drawing details:
- Heat Lamps:
- Closed base body construction.
- Built-in appliances/components as indicated with framing members at perimeter of cut out in top.
- Undershelf – refer to – “Undershelves”.
- Utility compartment.
- Hinged doors – refer to “Doors”.
- Install Item 210 – Heated Shelf Food Warmer Unit.
- Install Item 211 – Panini Grill on counter top.
- Install Item 212 – Sandwich Refrigerator in lined counter recess.
- Storage Compartments.
- Plate Shelf with controls, and light switches.
- Three (3) NEMA 5-20R-GFCI, 120 volt, single phase general-purpose outlets mounted below countertop in Apron Control along with Hot Food Display Warmer Controls.
- Load Center: locate load center compartment with one Square "D" Model No. QO320L125G / QOC24UF circuit breaker load center with ground bar kit, Visi-Trip breakers and cover. (Rated to 125 amps; 208 volts, three phase; 4 wire.
- Prewire equipment to JB Rough-in location. Ready for final connection by Div.26. Refer to Part 2 – Products, Section 2.5 G – Receptacles and Switches.

**ITEM 210 HEATED SHELF FOOD WARMER**
Manufacturer/Model: Hatco Model GRSBF-48-I
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model GRSBF-48-I Glo-Ray® Built In Heated Shelf with Flush Top, 49-1/2" x 21" surface area, hardcoat aluminum top, control thermostat, illuminated on/off switch & mounting bracket, 1000 watts, NSF, CE, cUL, UL, UL EPH Classified, CSA
- NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- 120v/60/1-ph, 1000 watts, 8.3 amps, NEMA 5-15P (domestic voltage), standard
- NOTE: Recommended for use in metallic countertop, verify that the material is suitable for temperatures up to 200 degree F
- Thermostat control with lighted rocker switch (available at time of purchase only), standard

**ITEM 211 PANINI GRILL**
Manufacturer/Model: Equipex LLC Model PANINI PREMIUM/1
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model PANINI PREMIUM/1 Roller Grill Panini Grill, cast iron grooved top & grooved bottom griddle plates, 14"W x 9-1/2"D grill area, self- balancing adjustable top plate with heavy duty handle, front grease drawer & selector switch for panini press or bottom plate only operation, electronic timer, grills with stainless steel construction, 570°F thermostatic controls, 120v/60/1-ph, 15.0 amps, 1.75kW, NEMA 5-15P, cULus, cULus Classified
- Grooved top & grooved bottom plates, standard

**ITEM 212 SANDWICH / SALAD PREPARATION REFRIGERATOR**
Manufacturer/Model: True Mfg. - General Foodservice Model TSSU-72-18-HC
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model TSSU-72-18-HC Sandwich/Salad Unit, (18) 1/6 size (4"D) poly pans, stainless steel insulated cover, 11-3/4"D cutting board, (3) full doors, (6) PVC coated adjustable wire shelves, stainless steel top/front/sides, GalFan coated steel back, aluminum interior with stainless steel floor, R290 Hydrocarbon refrigerant, 1/2 HP, 115v/60/1-ph, 7.2 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA
- Self-contained refrigeration standard
- Castors, 3" (34" work surface height = ADA)

**ITEM 213 REACH-IN REFRIGERATOR**
Manufacturer/Model: True Mfg. - General Foodservice Model STA1R-2HS-HC
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model STA1R-2HS-HC SPEC SERIES® Refrigerator, reach-in, one-section, (2) stainless steel half doors with locks, cam-lift hinges, digital temperature control, (3) chrome shelves, LED interior lights, stainless steel front & sides, aluminum interior sides & walls, stainless floor & ceiling, 5" castors, R290 Hydrocarbon refrigerant, 1/4 HP, 115v/60/1-ph, 3.8 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA, ENERGY STAR®
- Door hinged right standard
- (3) chrome shelves & shelf supports standard per section
- 5" castors (set of 4), standard

**ITEM 214 CONVEYOR OVEN, ELECTRIC**
Manufacturer/Model: Lincoln Foodservice Model 2500/1353
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model 2500/1353 Digital Countertop Impinger® (DCTI) Oven, electric, single stack, 20"W baking chamber, 31” conveyor (standard), adjustable conveyor speed from 30 seconds to 30 minutes, 200°F (93°C) to 600°F (316°C) temperature range, stainless steel exterior, 208/240/60/1-ph, 6.0kW, 27 amps, NEMA 6-50P, cULus, UL EPH Classified, CE

**ITEM 215 BACK COUNTER**
Manufacturer/Model: Custom Fabricated.
Utilities: Refer to drawings.
Unit Sizes: Refer to drawings x 2’-9” deep x 2’-10” high to counter top surface.
Construction:
- Refer to drawings and Part 2 - Products.
- Top: refer to “Counter/Table Tops Construction” with Square turn down on all free sides. 4” splash at balance.
- Base Construction: refer to “Closed Base Bodies”
- Storage Compartments: refer to Drawings.
- Hinged Doors: refer to “Doors.”
- Install Item 214 – Conveyor Oven.

**ITEM 216 PIZZA PREPARATION REFRIGERATOR**
Manufacturer/Model: True Mfg. - General Foodservice Model TPP-AT-44-HC
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model TPP-AT-44-HC Pizza Prep, 33 - 41°F pan rail, stainless steel cover, 19-1/2"D cutting board, (1) door, (2) PVC coated adjustable wire shelves, includes: (6) 1/3 size clear polycarbonate insert pans (top), stainless steel front, top & sides, aluminum interior with stainless steel floor, front breathing, R290 Hydrocarbon refrigerant, 1/4 HP, 115v/60/1-ph, 3.9 amps, NEMA 5-15P, UL EPH Classified, cULus, CE, Made in USA
- Self-contained refrigeration standard
- 5" Castors, standard

**ITEM 219 CONDIMENT/BREAD COUNTER, MILLWORK, NOT IN SECT.114000**
Manufacturer/Model: Millwork by Div.6

**ITEM 221 POP-UP TOASTER**
Manufacturer/Model: Hatco Model TPT-208
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model TPT-208 Pop-Up Toaster, (4) 1-1/4" wide self centering slots, individual toasting controls, selector switch for double or single sided toasting, removable crumb tray, stainless steel construction, cULus, UL EPH Classified
- NOTE: Sale of this product must comply with Hatco's Minimum Resale Price Policy; consult order acknowledgement for details
- NOTE: Includes 24/7 parts & service assistance, call 414-671-6350
- 208v/60/1-ph, 2600w, 12.5 amps, 6' cord with NEMA 6-15P

**ITEM 222 DISPLAY CASE, PASTRY, COUNTERTOP**
Manufacturer/Model: Custom Fabricated
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- 27"W x 20"D x 20"H, 3-tier, Front access with doors, countertop mount.
- ½” x 2” rectangular tubing high polish frame. Glass walls and removable shelves 3/8” thick tempered glass.

- LED lights strip on top, provide casing for led display ss 18 gage sheet metal, provide plug NEMA 5-15P. Used connection E03 to plug lights, must have cable with plug concealed with plug coming out of the case.

**ITEM 223 SERVING COUNTER**
Utilities: Refer to drawings.
Construction: Refer to drawings and Part 2 - Products.

- Top: Solid Surface, refer to Drawings and Architect's finish schedule. Verify pattern / color with the Architects.
- Full length self-serve breath protector: refer to drawing details:
- Install Item 224 – Drop-In Cold Food Well Unit.
- Install Item 225 – Drop-in Hot Food Unit.
- Closed base body construction.
- Built-in appliances/components as indicated with framing members at perimeter of cut out in top.
- Utility compartment.
- Hinged doors – refer to "Doors" and Drawing Section.
- Recessed Plate Shelf:
- Compressor Compartments with louvered doors.
- Storage Compartments.
- Four (4) NEMA 5-20R-GFCI, 120 volt, single phase general-purpose outlets mounted below countertop in Apron Control along with Hot Food Display Warmer Controls.
- Load Center: locate load center compartment with one Square "D" Model No. QO320L125G / QOC24UF circuit breaker load center with ground bar kit, Visi-Trip breakers and cover. (Rated to 125 amps; 208 volts, three phase; 4 wire.
- Prewire equipment to JB Rough-in location. Ready for final connection by Div.26. Refer to Part 2 – Products, Section 2.05 G – Receptacles and Switches.

**ITEM 224 COLD FOOD WELL UNIT, DROP-IN REFRIGERATED**
Manufacturer/Model: Delfield Model N8156BP
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model N8156BP Drop-In Mechanically Cooled Pan, 56-1/4" W x 26" D, 4-pan size, 1" dia. drain, insulated pan, stainless steel inner liner & top, galvanized steel outer liner, includes adapter bars, self-contained refrigeration, R290 Hydrocarbon refrigerant, 2/7 hp, (55-1/4" x 25" cutout required), cUL, UL, NSF

**ITEM 225 HOT FOOD WELL UNIT, DROP-IN, ELECTRIC**
Manufacturer/Model: Alto-Shaam Model 700-RW
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model 700-RW Halo Heat® Hot Food Round (Soup) Well, Drop-In, Electric, 7 quart capacity, adjustable thermostatic controls, stainless steel construction, EcoSmart®, cULus, UL EPH ANSI/NSF 4
- NOTE: Subject to Manufacturer's Terms & Conditions. See Documents Section
- 120v/50/60/1-ph, 3.8 amps, .45kW, 6' cord, NEMA 5-15P (90° plug), standard
- Cord located on back of control box, standard

**ITEM 226 DISPLAY CASE, REFRIGERATED, SELF-SERVE**
Manufacturer/Model: Structural Concepts Model B45R

Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model B45R Oasis® Refrigerated Self-Service Case, 47-5/8"W x 34-1/4"D x 61-3/4"H, Warmest average product temperature of 40°F or less, LED top light, (2) metal shelves, Breeze with self-contained refrigeration, condensate pan, magnetic air filter, non-locking casters with levelers, end panels with mirrored stainless interior, black exterior, R290 Hydrocarbon refrigerant, cETLus, ETL-Sanitation
- NOTE: If GFCI is required, a GFCI breaker MUST be used in lieu of a GFCI receptacle
- Exterior Color: Powder coated SCC Standard Silversan Black (FDA compliant)
- Interior Color: Stainless steel
- Lower Front Panel Color: Stainless steel (must choose stainless exterior)
- Rear Exterior Color: Stainless steel
- Base support: Casters (non-locking) w/ levelers
- End Panel Left: Full with stainless steel mirror interior, standard
- End panel profile: Square profile, standard
- End Panel Right: Full with stainless steel mirror interior, standard
- End panel profile: Square profile, standard
- Cover/Curtain: None
- Price Tag Molding: None
- Rear Doors: None (solid back panel), standard
- Shelving: Metal shelves (2), non-lighted, standard
- Top Light: LED 4000K, standard
- Electrical Connection: 6' Straight blade power cord, standard
- Clean Sweep: None, standard
- Refrigeration: Breeze-E (Type II) self-contained refrigeration, standard
- Refrigerant: Hydrocarbon refrigerant (R290)
- Thermometer: Spirit filled thermometer, standard
- Heat Treated Crating: None, standard

**ITEM 227 DISPOSABLE CUP DISPENSER**
Manufacturer/Model: Dispense-Rite Model SLR-R-4SS
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model SLR-R-4SS Cup Dispensing Cabinet, 32-1/2" H x 8-1/8"W x 23"D, interchangeable gaskets, (4) SLR-2, holds 8 to 44 oz., paper, plastic & foam cups, rim dia. 3"-4-1/2", silver satin bezel, stainless steel cabinet with ABS plastic cup dispensers

**ITEM 228 ICE MAKER, CUBE-STYLE**
Manufacturer/Model: Hoshizaki Model KMD-860MWJ
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Model KMD-860MWJ Ice Maker, Cube-Style, 30"W, water-cooled, self-contained condenser, production capacity up to 940 lb/24 hours at 70°/50° (862 lb AHRI certified at 90°/70°), stainless steel finish, crescent cube style, R-404A refrigerant, 208-230v/60/1-ph, 8.5 amps, NSF, UL
- Model H9320-52 Water Filtration System, twin configuration, 19.11" H (manifold & cartridge)
- Install Ice Maker on top of Item 229 – Soda Ice & Beverage Dispenser.

**ITEM 229 SODA ICE & BEVERAGE DISPENSER <By Vendor>**
Manufacturer/Model: Custom Model VF/VI
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.

Equipment:
- Model VF/VI Vendor Furnished/Vendor Installed

**ITEM 230 COFFEE TEA BREWER <By Vendor>**
Manufacturer/Model: Custom Model VF/VI
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model VF/VI Vendor Furnished/Vendor Installed

**ITEM 231 COFFEE BREWER FOR AIRPOT <By Vendor>**
Manufacturer/Model: Custom Model VF/VI
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model VF/VI Vendor Furnished/Vendor Installed

**ITEM 232 AIRPOT <By Vendor>**
Manufacturer/Model: Custom Model VF/VI
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model VF/VI Vendor Furnished/Vendor Installed

**ITEM 233 CONDIMENT CADDY**
Manufacturer/Model: Vollrath Model CFIFO-2X
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model CFIFO-2X First In First Out Gravity Condiment Holder, 8-1/4"W x 12"D x 16-15/16"H, (4) sections (2 over 2) 2"W x 2"D, flip up top lid, ABS & smoked acrylic, Made in USA (Refer to vollrathfoodservice.com for full warranty policy)

**ITEM 234 POS - SELF PAY - OF/OI <By Owner>**

**ITEM 235 MICROWAVE OVEN**
Manufacturer/Model: Panasonic Model NE-1064F
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:
- Model NE-1064F PRO Commercial Microwave Oven, 1000 Watts, 0.8 cu. ft. capacity, (6) power levels, 2- & 3-stage cooking, 20 program memory capacity, touch control pad with Braille, 99-minute timer, programmable and manual operation, program list/cycle counter, self diagnostics, tone control, bottom energy feed, interior light, see-through door with "grab & go" handle, stainless steel front, cabinet & cavity, 120v/60/1-ph, 13.4 amps, cord, NEMA 5-15P, cULus, NSF

**ITEM 236 TRASH RECEPTACLE**
Manufacturer/Model: Rubbermaid Model No. FG352660GRAY (GRUTE) Trash Receptacle
Equipment:
- Install in Item 237.1 and Item 237.2 – Millwork Counter.

**ITEM 237.1 CONDIMENT/BREAD COUNTER, MILLWORK, NOT IN SECT.114000**
Manufacturer/Model: Millwork by Div.6

**ITEM 237.2 CONDIMENT/BREAD COUNTER, MILLWORK, NOT IN SECT.114000**
Manufacturer/Model: Millwork by Div.6

**ITEM 238 CHEF BASE**
Manufacturer/Model: True Mfg. - General Foodservice Model TRCB-50-60-HC
Utilities: Refer to drawings.
Unit Sizes: Refer to Drawings.
Equipment:

- Self-contained refrigeration standard
- Standard marine edge top
- Stainless Steel Interior.
- 4" Castors, standard

# SECTION 13 34 19
# METAL BUILDING SYSTEMS

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Metal wall and roof panels including gutters and downspouts and roof mounted equipment curbs.

### 1.02 REFERENCE STANDARDS

A. AISC 360 - Specification for Structural Steel Buildings; 2022.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

D. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2022.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

F. MBMA (MBSM) - Metal Building Systems Manual; 2019.

### 1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on profiles, component dimensions, fasteners.

C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchors and methods of anchorage, and installation; framing anchor bolt settings, sizes, locations from datum, and foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

D. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.

E. Designer's Qualification Statement.

F. Erector's Qualification Statement.

### 1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this type of work.
   1. Design Engineer Qualifications: Licensed in the State in which the Project is located.
   2. Comply with Codes and Loads indicated on Structural Drawings for submission of design calculations as required for acquiring permits.
   3. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.

B. Perform work in accordance with AISC 360 and MBMA (MBSM).

C. Erector Qualifications: Company specializing in performing the work of this section approved by manufacturer.

### 1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Metal Buildings Systems:
   1. Nucor Building Systems: www.nucorbuildingsystems.com/#sle.
   2. Red Dot Buildings: www.reddotbuildings.com/#sle.
   3. VP Buildings: www.vp.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

### 2.02 ASSEMBLIES

A. Single span rigid frame.

B. Primary Framing: Rigid frame of rafter beams and columns, canopy beams, and wind bracing.

C. Secondary Framing: Purlins, and other items detailed.

D. Wall System: Preformed metal panels of horizontal profile, with sub-girt framing/anchorage assembly, and accessory components.

E. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, insulation, and liner panels, and accessory components.

### 2.03 PERFORMANCE REQUIREMENTS

A. Design structural members to withstand dead load, and design loads due to pressure and suction of wind calculated in accordance with applicable code.

B. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

C. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of ____ degrees F.

### 2.04 MATERIALS - WALLS AND ROOF

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Designation SS (structural steel), Grade 33 (230), with G90/Z275 coating.

B. Steel Sheet: ASTM A792/A792M aluminum-zinc alloy coated to AZ50/AZM150.

C. Sealant: Manufacturer's standard type.

D. Trim, Closure Pieces, Caps, Flashings, Gutters, Downspouts, Rain Water Diverter, Fascias, and Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

### 2.05 FABRICATION - FRAMING

A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.

B. Anchor Bolts: Formed with bent shank, assembled with template for casting into concrete.

C. Provide framing for ventilator openings.

D. Provide wall opening framing for doors, windows, and other accessory components.

### 2.06 FABRICATION - GUTTERS AND DOWNSPOUTS

A. Fabricate of same material and finish as roofing metal.

B. Form sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.

C. Fabricate support straps of same material and finish as roofing metal, color as selected.

### 2.07 FINISHES

A. Framing Members: Clean, prepare, and galvanize to ASTM A123/A123M. Do not prime surfaces to be field welded.

## PART 3 EXECUTION

### 3.01 ERECTION - FRAMING

A. Erect framing in accordance with AISC 360.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.

C. Set column base plates with non-shrink grout to achieve full plate bearing.

D. Do not field cut or alter structural members without approval.

E. After erection, prime welds, abrasions, and surfaces not shop primed.

### 3.02 ERECTION - WALL AND ROOF PANELS

A. Install in accordance with manufacturer's instructions.

B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

C. Fasten cladding system to structural supports, aligned level and plumb.

D. Locate end laps over supports. End laps minimum 2 inches. Place side laps over bearing.

E. Provide expansion joints where indicated.

F. Use concealed fasteners.

G. Install sealant and gaskets, providing weather tight installation.

### 3.03 ERECTION - GUTTERS AND DOWNSPOUTS

A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.

B. Apply bituminous paint on surfaces in contact with cementitious materials.

C. Install splash pans under each downspout.

### 3.04 TOLERANCES

A. Framing Members: 1/4 inch from level; 1/8 inch from plumb.

**END OF SECTION**

# SECTION 21 05 00 - BASIC FIRE SUPPRESSION REQUIREMENTS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Requirements applicable to all Division 21 Sections. Also refer to Division 01 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

### 1.02 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.

C. Separate contracts will be awarded for the following work:

D. Scope of Work:

1. Plumbing Work: Refer to Section 22 05 00 "Basic Plumbing Requirements".
2. Heating Work: Refer to Section 23 05 00 "Basic HVAC Requirements".
3. Fire Protection Work shall include, but is not necessarily limited to:

    a. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.
    b. Furnish and install all fire hydrants and associated piping, valves, and supports including connection to the water main.
    c. Furnish and install a complete dry pipe sprinkler system for areas noted on the drawings.
    d. Furnish and install all items listed on the Fire Protection Material List.
    e. Furnish all hydraulic calculations and working sprinkler drawings.
    f. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
    g. Complete all applicable tests, certifications, forms, and matrices.

4. Testing, Adjusting, and Balancing Work: Refer to Section 23 05 00 "Basic HVAC Requirements".

### 1.03 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours will be required.

B. Itemize all work and list associated hours and pay scale for each item.

## 1.04 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:

    a. Plumbing Contractor.
    b. Heating Contractor.
    c. Air Conditioning and Ventilating Contractor.
    d. Temperature Control Contractor.
    e. Fire Protection Contractor.
    f. Testing, Adjusting, and Balancing Contractor.

2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.

    a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

| Distribution/Nominal Voltage | Utilization Voltage |
|---|---|
| 120 | 115 |
| 208 | 200 |
| 240 | 230 |
| 277 | 265 |
| 480 | 460 |

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:

    a. Light fixtures.
    b. Gravity flow piping, including steam and condensate.
    c. Electrical busduct.
    d. Sheet metal.
    e. Electrical cable trays, including access space.
    f. Sprinkler piping and other piping.
    g. Electrical conduits and wireway.

C. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

## 1.05 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.

b. Potential layout changes shall be made to avoid additional access panels.
c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

**1.06 QUALITY ASSURANCE**

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Cameron, LA Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.

6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.
2. Comply with all utility company requirements.
3. Make application for and pay for fire protection water service connection.

F. Examination of Drawings:

1. The drawings for the fire protection work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in fire protection documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.

    a. Any item listed as furnished shall also be installed, unless otherwise noted.
    b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

## 1.07 WEB-BASED PROJECT SOFTWARE

A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.

B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.

C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.

D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

## 1.08 SUBMITTALS

A. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date

b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
b. Unstamped submittals will be rejected.
c. The Contractor's review shall include, but not be limited to, verification of the following:

1) Only approved manufacturers are used.
2) Addenda items have been incorporated.
3) Catalog numbers and options match those specified.
4) Performance data matches that specified.
5) Electrical characteristics and loads match those specified.
6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.

7) Dimensions and service clearances are suitable for the intended location.
8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
b. The Contractor shall clearly indicate the size, finish, material, etc.
c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions. or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

B. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 21 XX XX.description.YYYYMMDD
    b. Transmittal file name: 21 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

## 1.09 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 01.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:

    a. Material: Delivered cost of product with taxes paid.
    b. Labor: Labor cost, excluding overhead and profit.

3. Itemize the cost for each of the following:

    a. Overhead and profit.
    b. Bonds.
    c. Insurance.
    d. General Requirements: Itemize all requirements.

4. For each line item having an installed cost of more than $5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:

    a. Each piece of equipment requiring shop drawings (e.g., fire pump, double interlock pre-action system, backflow preventer, etc.) using the project nomenclature (FP-1, DIPS-1, BFP-1, etc.).

b. Each sprinkler zone. In addition, break down the material and labor based on geography (building, floor, wing and/or phase).
c. Each double interlock pre-action system.
d. Each clean agent fire suppression system.
e. Each wet agent fire suppression system.
f. Site utilities (5' beyond building)
g. Seismic design
h. Commissioning
i. Record drawings
j. Punchlist and closeout

D. Update Schedule of Values when:

1. Indicated by Architect/Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

**1.10 CHANGE ORDERS**

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

**1.11 EQUIPMENT SUPPLIERS' INSPECTION**

A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:

1. Fire Seal Systems

B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

**1.12 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE**

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:

1. Motor windings and ventilation openings.
2. Bearings.
3. Equipment Pipe and Accessories connection openings.
4. Starter and control cabinets.
5. Pump Seals.
6. Engine cooling, air intake, and exhaust openings.

C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.

D. Keep all bearings properly lubricated and all belts properly tensioned and aligned.

E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

## 1.13 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

## 1.14 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

### 1.15 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

### 1.16 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

## 3.02 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (https://call811.com/) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried utilities. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6"sand bedding or CA6 crushed stone. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope Around Utilities to 6" Above Utilities: Place sand or CA6 crushed stone to a height of 6" over utilities in 6" layers. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill From 6" Above Utilities to Earthen Grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep.

4. Backfill From 6" Above Utilities to Below Slabs or Paved Area: Where the sand or CA6 crushed stone fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials:

    a. Sand, CA6: Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    b. Native Soil: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Native soils shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    c. Flowable Fill: Cementitious, self-leveling, self-compacting slurry as defined by the ACI with compressive strength of 50-100psi at 28 days; consisting of a mixture of fine aggregate or filler, water and cementitious materials. Filler material consist of sand, fly ash, spent foundry sand, quarry fines, baghouse dust. Cementitious materials consist of Portland cement, pozzolanic materials, and self-cementing materials. Flowable fill may be placed in a pour instead of 6" layers noted above.

6. Water shall not be permitted to rise in unbackfilled trenches.
7. Dispose of excess excavated earth as directed.
8. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
9. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

**3.03 ARCHITECT/ENGINEER OBSERVATION OF WORK**

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

   a. Pipe wall penetrations are sealed.
   b. Pipe identification is installed.
   c. Branch piping in the location of sprinklers shall be dropped to the ceiling.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

**3.04 PROJECT CLOSEOUT**

A. The following paragraphs supplement the requirements of Division 01.

B. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Inspection report by the State Fire Marshal of the fire protection system.
5. Start-up reports on all equipment requiring a factory installation inspection or start-up.
6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; receipt by Architect/Engineer required prior to final payment approval.

## 3.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div21.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div21.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

**3.06 INSTRUCTING THE OWNER'S REPRESENTATIVES**

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

D. The instructions shall include:

1. Explanation of all system flow diagrams.
2. Maintenance of equipment.
3. Start-up procedures for all major equipment.
4. Explanation of seasonal system changes.
5. Description of emergency system operation.

E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.

F. Minimum hours of instruction for each item shall be:

1. Sprinkler System(s) - 1 hours.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the fire protection and control systems.
2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

**3.07 SYSTEM STARTING AND ADJUSTING**

A. The fire protection systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

**3.08 RECORD DOCUMENTS**

A. The following paragraphs supplement Division 01 requirements.

B. Maintain at the job site a separate and complete set of fire protection drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations of other control devices, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.

D. Before completion of the project, a set of reproducible fire protection drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.

E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

F. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

**3.09 PAINTING**

A. This Contractor shall paint the following items:

1. All piping in mechanical room
2. Piping exposed in kitchen

B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.

C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.

D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.

E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.

F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

G. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.

H. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter, paint all pipes and equipment with the following:

1. Bare Metal Surfaces: Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
2. Color of paint shall be as follows:

a. All piping in mechanical room:

1) Fire Protection: Red pipe/white letters

b. Piping exposed in kitchen:

1) All Piping: White

**3.10 ADJUST AND CLEAN**

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.

D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

## 3.11 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

## 3.12 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:

    a. Minimizing the amount of dust generated.
    b. Reducing solvent fumes and VOC emissions.
    c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.

2. Request that the Owner designate an IAQ representative.
3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
6. Request copies of and follow all of the Owner's IAQ and infection control policies.
7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. Fire protection system operational.
4. Pipes labeled.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

**END OF SECTION**

# SECTION 21 05 03
# THROUGH PENETRATION FIRESTOPPING

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Through-Penetration Firestopping.

### 1.02 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

### 1.03 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. 1997 Uniform Building Code

K. 2021 International Building Code

L. NFPA 5000 - Building Construction Safety Code

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

## 1.05 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

C. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

## 1.06 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.
2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

## 1.07 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

# PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

B. Manufacturers:

1. 3M; Fire Protection Products Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
5. Johns-Manville.
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Dow Corning Corp.
10. Fire Trak Corp.
11. International Protective Coating Corp.
12. HoldRite

## 2.02 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.

E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

a. F Rating = Wall/Floor Rating
b. L Rating = Penetrations in Smoke Barriers

| Penetrating Item | UL System No. |
|---|---|
| No Penetrating Item | CAJ 0000-0999* |
| Metallic Pipe or Conduit | CAJ 1000-1999 |
| Non-Metallic Pipe or Conduit | CAJ 2000-2999 |
| Electrical Cables | CAJ 3000-3999 |
| Cable Trays | CAJ 4000-4999 |
| Insulated Pipes | CAJ 5000-5999 |
| Bus Duct and Misc. Electrical | CAJ 6000-6999 |
| Duct without Damper and Misc. Mechanical | CAJ 7000-7999 |
| Multiple Penetrations | CAJ 8000-8999 |

*Alternate method of firestopping is patching opening to match

| Penetrating Item | UL System No. |
|---|---|

original rated construction.

H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

### 3.02 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

### 3.03 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

## 3.04 IDENTIFICATION

A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:

1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

## 3.05 INSPECTION

A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The Contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the Contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The Contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the Contractor's expense.

**END OF SECTION**

# SECTION 21 05 29
# FIRE SUPPRESSION SUPPORTS AND ANCHORS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.

B. Equipment Bases and Supports.

C. Sleeves and Seals.

D. Flashing and Sealing of Equipment and Pipe Stacks.

E. Cutting of Openings.

F. Escutcheon Plates and Trim.

### 1.02 QUALITY ASSURANCE

A. Support Sprinkler Piping in conformance with NFPA 13.

B. Support Standpipes in conformance with NFPA 14.

### 1.03 REFERENCES

A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

D. MSS SP-127 - Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application

E. NFPA 13 - Standard for the Installation of Sprinkler Systems.

F. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

### 1.04 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

## PART 2 - PRODUCTS

### 2.01 HANGER RODS

A. Hanger rods for single rod hangers supporting steel, copper, and CPVC piping shall conform to the following:

1. Hanger Rod Diameter:

a. 4" and smaller: 3/8"
b. 5", 6", and 8": 1/2"
c. 10" and 12": 5/8"

B. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

C. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication. This applies to the following areas:

### 2.02 PIPE HANGERS AND SUPPORTS

A. General:

1. All pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS-SP-58, 69, 89, and 127 (where applicable).

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, and more frequently when required by applicable codes, but never at intervals over 15 feet. Support vertical pipes with riser clamps installed below hubs, couplings or lugs. Provide sufficient flexibility to accommodate expansion and contraction without compromising fire barrier penetrations and other fixed takeoff locations.

a. Products:

1) Eaton Fig. B3373 Series
2) nVent 510 Series
3) Anvil Fig. 90

2. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs.
3. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

C. Hangers and Clamps:

1. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp.

2. Unless otherwise indicated, hangers shall be as follows:

    a. Clevis Type: Service: Bare Metal Pipe, Rigid Plastic Pipe

        1) Products: Bare Steel, Plastic or Insulated Pipe

            a) Anvil Fig. 260
            b) Eaton Fig. 3100
            c) nVent Model 400

        2) Products: Bare Copper Pipe Felt or PVC Coated

            a) Anvil Fig. CT65
            b) nVent Model 402

    b. Adjustable Swivel Ring Type: Service: Bare Metal Pipe - 4 inches and Smaller

        1) Products: Bare Steel Pipe

            a) Anvil Fig. 69
            b) Eaton Fig. B3170NF
            c) nVent Model 115

        2) Products: Bare Copper Pipe

            a) Eaton Fig. B3170CTC
            b) nVent 102A0 Series
            c) Anvil Fig. CT-69

3. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
4. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
5. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.
6. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

    a. Clamp Type: Service: Bare Metal Pipe, Rigid Plastic Pipe

        1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp.
        2) Pipes subject to expansion and contraction shall have clamps slightly oversized to allow limited pipe movement.
        3) Products: Bare Steel, Plastic or Insulated Pipe

            a) Unistrut Fig. P1100 or P2500
            b) Eaton Fig. B2000 or B2400
            c) Anvil AS1200
            d) nVent USC

4) Products: Bare Copper Pipe

a) Eaton Fig. BVT
b) nVent CADDY Cushion Clamp

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.)

1) Products:

a) Anvil Fig. 86
b) Eaton Fig. B3033/B3034
c) nVent Model 300 & 310

b. Scissor Type Beam Clamps (for use with bar-joists and wide flange):

1) Products:

a) Anvil Fig. 228, 292
b) Eaton Fig. B3054
c) nVent Model 360

c. Concentrically Loaded Open Web Joist Hangers (for use with bar joists):

1) Products:

a) MCL. M1, M2 or M3

d. Steel Structure Welding:
e. Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and for protecting walls and ceilings from being damaged by smoke.

## 2.03 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Concrete Bases (Housekeeping Pads):

1. Refer to Section 21 05 50 for additional requirements for concrete bases in seismic applications.

2. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base), except where pad extension would interfere with working space at equipment control panels and electrical panels.
3. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6" x 6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.
5. Equipment requiring bases is as follows:

    a. Air Compressor

C. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Architect-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

D. Grout:

1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

## 2.04 OPENINGS IN FLOORS, WALLS AND CEILINGS

A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.

B. Coordinate all openings with other Contractors.

C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.

D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.

E. Do not cut structural members without written approval of the Architect or Structural Engineer.

## 2.05 PIPE SLEEVES AND LINTELS

A. Each Contractor shall provide pipe sleeves and lintels for all openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.

B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.

C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.

D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.

E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Engineer's design.

F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.

G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.

H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.

I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

J. Wall Seals ("Link-Seals"):

1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve or thermoplastic with integral water seal and textured surface.
3. Sleeves shall be at least 2 pipe sizes larger than the pipes.
4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.
5. Sealing element shall be as follows:

| Model | Service | Element Material | Temperature Range |
|---|---|---|---|
| S | Standard (Stainless) | EPDM | -40ºF to 250ºF |
| T | Fire Seals (1 hour) | Silicone | -67ºF to 400ºF |
| FS | Fire Seals (3 hours) | Silicone | -67ºF to 400ºF |
| OS | Oil Resistant/Stainless | Nitrile | -40°F to 210°F |

6. Manufacturers:

    a. Thunderline Corporation "Link-Seals"
    b. O-Z/Gedney Company
    c. Calpico, Inc.
    d. Innerlynx
    e. Metraflex Company (cold service only).
    f. Polywater PHSD

**2.06 ESCUTCHEON PLATES AND TRIM**

A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.

B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.

C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes duct and pipe openings.

**2.07 PIPE PENETRATIONS**

A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

B. Seal fire rated wall and floor penetrations with fire seal system as specified.

**2.08 PIPE ANCHORS**

A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.

B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

**2.09 FINISH**

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

**PART 3 - EXECUTION**

**3.01 FIRE SUPPRESSION SUPPORTS AND ANCHORS**

A. General Installation Requirements:

1. Install all items per manufacturer's instructions.
2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
4. Supports shall extend directly to building structure. Do not support piping from duct hangers. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
2. Set all concrete inserts in place before pouring concrete.
3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

    a. The hanger is attached within 6" from a web/chord joint.
    b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

H. Spacing of hangers shall in no case exceed the following:

1. Steel (All steel pipe unless otherwise noted):

a. Maximum Spacing:

1) 1-1/4" & under: 12'-0"
2) 1-1/2" & larger: 15'-0"

2. Steel (Schedule 40 lightweight alternative):

a. Maximum Spacing:

1) 3" & under: 12'-0"
2) 3" & under: 12'-0"

I. Installation of hangers shall conform to MSS SP-58, 69, 89, and applicable NFPA standards.

**END OF SECTION**

# SECTION 21 05 00
# BASIC FIRE SUPPRESSION REQUIREMENTS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Requirements applicable to all Division 21 Sections. Also refer to Division 01 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

### 1.02 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.

C. Separate contracts will be awarded for the following work:

D. Scope of Work:

1. Plumbing Work: Refer to Section 22 05 00 "Basic Plumbing Requirements".
2. Heating Work: Refer to Section 23 05 00 "Basic HVAC Requirements".
3. Fire Protection Work shall include, but is not necessarily limited to:

    a. Furnish and install a new fire protection service to the building including backflow preventer as required by Code.
    b. Furnish and install all fire hydrants and associated piping, valves, and supports including connection to the water main.
    c. Furnish and install a complete dry pipe sprinkler system for areas noted on the drawings.
    d. Furnish and install all items listed on the Fire Protection Material List.
    e. Furnish all hydraulic calculations and working sprinkler drawings.
    f. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
    g. Complete all applicable tests, certifications, forms, and matrices.

4. Testing, Adjusting, and Balancing Work: Refer to Section 23 05 00 "Basic HVAC Requirements".

### 1.03 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours will be required.

B. Itemize all work and list associated hours and pay scale for each item.

## 1.04 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:

    a. Plumbing Contractor.
    b. Heating Contractor.
    c. Air Conditioning and Ventilating Contractor.
    d. Temperature Control Contractor.
    e. Fire Protection Contractor.
    f. Testing, Adjusting, and Balancing Contractor.

2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.

    a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

| Distribution/Nominal Voltage | Utilization Voltage |
|---|---|
| 120 | 115 |
| 208 | 200 |
| 240 | 230 |
| 277 | 265 |
| 480 | 460 |

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:

    a. Light fixtures.
    b. Gravity flow piping, including steam and condensate.
    c. Electrical busduct.
    d. Sheet metal.
    e. Electrical cable trays, including access space.
    f. Sprinkler piping and other piping.
    g. Electrical conduits and wireway.

C. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

## 1.05 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.

b. Potential layout changes shall be made to avoid additional access panels.
c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

**1.06 QUALITY ASSURANCE**

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Cameron, LA Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.

6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.
2. Comply with all utility company requirements.
3. Make application for and pay for fire protection water service connection.

F. Examination of Drawings:

1. The drawings for the fire protection work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in fire protection documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.

    a. Any item listed as furnished shall also be installed, unless otherwise noted.
    b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

## 1.07 WEB-BASED PROJECT SOFTWARE

A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.

B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.

C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.

D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

## 1.08 SUBMITTALS

A. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date

b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
b. Unstamped submittals will be rejected.
c. The Contractor's review shall include, but not be limited to, verification of the following:

1) Only approved manufacturers are used.
2) Addenda items have been incorporated.
3) Catalog numbers and options match those specified.
4) Performance data matches that specified.
5) Electrical characteristics and loads match those specified.
6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.

7) Dimensions and service clearances are suitable for the intended location.
8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
b. The Contractor shall clearly indicate the size, finish, material, etc.
c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions. or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

B. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 21 XX XX.description.YYYYMMDD
    b. Transmittal file name: 21 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

## 1.09 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 01.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:

    a. Material: Delivered cost of product with taxes paid.
    b. Labor: Labor cost, excluding overhead and profit.

3. Itemize the cost for each of the following:

    a. Overhead and profit.
    b. Bonds.
    c. Insurance.
    d. General Requirements: Itemize all requirements.

4. For each line item having an installed cost of more than $5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:

    a. Each piece of equipment requiring shop drawings (e.g., fire pump, double interlock pre-action system, backflow preventer, etc.) using the project nomenclature (FP-1, DIPS-1, BFP-1, etc.).

b. Each sprinkler zone. In addition, break down the material and labor based on geography (building, floor, wing and/or phase).
c. Each double interlock pre-action system.
d. Each clean agent fire suppression system.
e. Each wet agent fire suppression system.
f. Site utilities (5' beyond building)
g. Seismic design
h. Commissioning
i. Record drawings
j. Punchlist and closeout

D. Update Schedule of Values when:

1. Indicated by Architect/Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

**1.10 CHANGE ORDERS**

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

**1.11 EQUIPMENT SUPPLIERS' INSPECTION**

A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:

1. Fire Seal Systems

B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

**1.12 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE**

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:

1. Motor windings and ventilation openings.
2. Bearings.
3. Equipment Pipe and Accessories connection openings.
4. Starter and control cabinets.
5. Pump Seals.
6. Engine cooling, air intake, and exhaust openings.

C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.

D. Keep all bearings properly lubricated and all belts properly tensioned and aligned.

E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

## 1.13 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

## 1.14 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

### 1.15 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

### 1.16 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

## 3.02 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (https://call811.com/) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried utilities. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6"sand bedding or CA6 crushed stone. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope Around Utilities to 6" Above Utilities: Place sand or CA6 crushed stone to a height of 6" over utilities in 6" layers. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill From 6" Above Utilities to Earthen Grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep.

4. Backfill From 6" Above Utilities to Below Slabs or Paved Area: Where the sand or CA6 crushed stone fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials:

    a. Sand, CA6: Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    b. Native Soil: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Native soils shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    c. Flowable Fill: Cementitious, self-leveling, self-compacting slurry as defined by the ACI with compressive strength of 50-100psi at 28 days; consisting of a mixture of fine aggregate or filler, water and cementitious materials. Filler material consist of sand, fly ash, spent foundry sand, quarry fines, baghouse dust. Cementitious materials consist of Portland cement, pozzolanic materials, and self-cementing materials. Flowable fill may be placed in a pour instead of 6" layers noted above.

6. Water shall not be permitted to rise in unbackfilled trenches.
7. Dispose of excess excavated earth as directed.
8. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
9. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

**3.03 ARCHITECT/ENGINEER OBSERVATION OF WORK**

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

   a. Pipe wall penetrations are sealed.
   b. Pipe identification is installed.
   c. Branch piping in the location of sprinklers shall be dropped to the ceiling.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

**3.04 PROJECT CLOSEOUT**

A. The following paragraphs supplement the requirements of Division 01.

B. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Inspection report by the State Fire Marshal of the fire protection system.
5. Start-up reports on all equipment requiring a factory installation inspection or start-up.
6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; receipt by Architect/Engineer required prior to final payment approval.

## 3.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div21.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div21.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.

8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

**3.06 INSTRUCTING THE OWNER'S REPRESENTATIVES**

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

D. The instructions shall include:

1. Explanation of all system flow diagrams.
2. Maintenance of equipment.
3. Start-up procedures for all major equipment.
4. Explanation of seasonal system changes.
5. Description of emergency system operation.

E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.

F. Minimum hours of instruction for each item shall be:

1. Sprinkler System(s) - 1 hours.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the fire protection and control systems.
2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

**3.07 SYSTEM STARTING AND ADJUSTING**

A. The fire protection systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

**3.08 RECORD DOCUMENTS**

A. The following paragraphs supplement Division 01 requirements.

B. Maintain at the job site a separate and complete set of fire protection drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations of other control devices, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.

D. Before completion of the project, a set of reproducible fire protection drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.

E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

F. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

**3.09 PAINTING**

A. This Contractor shall paint the following items:

1. All piping in mechanical room
2. Piping exposed in kitchen

B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.

C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.

D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.

E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.

F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

G. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.

H. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter, paint all pipes and equipment with the following:

1. Bare Metal Surfaces: Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
2. Color of paint shall be as follows:

    a. All piping in mechanical room:

        1) Fire Protection: Red pipe/white letters

    b. Piping exposed in kitchen:

        1) All Piping: White

**3.10 ADJUST AND CLEAN**

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.

D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

## 3.11 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

## 3.12 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:

    a. Minimizing the amount of dust generated.
    b. Reducing solvent fumes and VOC emissions.
    c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.

2. Request that the Owner designate an IAQ representative.
3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
6. Request copies of and follow all of the Owner's IAQ and infection control policies.
7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. Fire protection system operational.
4. Pipes labeled.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

**END OF SECTION**

# SECTION 22 05 00
# BASIC PLUMBING REQUIREMENTS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

### 1.02 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.

C. Separate contracts will be awarded for the following work:

D. Scope of Work:

1. Plumbing Work shall include, but is not necessarily limited to:

    a. Furnish and install all items listed in the Plumbing Material List.
    b. Furnish and install a new domestic water service to the building.
    c. Furnish and install water meter and domestic water backflow preventer as required by Code.
    d. Furnish and install a complete domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
    e. Furnish and install water softener.
    f. Furnish and install water heaters.
    g. Furnish and install makeup water connection to hydronic heating and/or cooling systems including reduced pressure principle type backflow preventer.
    h. Furnish and install complete storm water drainage system.
    i. Furnish and install condensate drain piping from plumbing related equipment such as ice machines.
    j. Furnish and install site storm water piping, cleanouts, and manholes.
    k. Furnish and install complete sanitary sewer and vent system.
    l. Furnish and install sanitary sewage ejector basins and pumps.
    m. Furnish and install site sanitary sewer piping, cleanouts, and manholes.
    n. Furnish and install laboratory gas systems including all piping and valves.
    o. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 22 05 50.
    p. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
    q. Complete all applicable tests, certifications, forms, and matrices.

2. Heating Work: Refer to Section 23 05 00 "Basic HVAC Requirements".

3. Air Conditioning and Ventilating Work: Refer to Section 23 05 00 "Basic HVAC Requirements".
4. Temperature Control Work: Refer to Section 23 05 00 "Basic HVAC Requirements".
5. Testing, Adjusting, and Balancing Work: Refer to Section 23 05 00 "Basic HVAC Requirements".

**1.03 WORK SEQUENCE**

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours will be required.

B. Itemize all work and list associated hours and pay scale for each item.

**1.04 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS**

A. Definitions:

1. "Mechanical Contractors" refers to the following:

    a. Plumbing Contractor.
    b. Heating Contractor.
    c. Air Conditioning and Ventilating Contractor.
    d. Temperature Control Contractor.
    e. Fire Protection Contractor.
    f. Testing, Adjusting, and Balancing Contractor.

2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.

    a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.

7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

| Distribution/Nominal Voltage | Utilization Voltage |
|---|---|
| 120 | 115 |
| 208 | 200 |
| 240 | 230 |
| 277 | 265 |
| 480 | 460 |

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:

    a. Light fixtures.
    b. Gravity flow piping, including steam and condensate.
    c. Electrical busduct.
    d. Sheet metal.
    e. Electrical cable trays, including access space.
    f. Sprinkler piping and other piping.
    g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:

    a. Burners.
    b. Chillers.
    c. Computer Room Air Conditioning Units.
    d. Condensate Return Stations.
    e. Condensing Units.
    f. Makeup Air Units.

g. Electric Humidifiers.
h. Gas Trains.
i. Package Air Handling Units.
j. Packaged Rooftop Units.

2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. Temperature Control Contractor's Responsibility:

   a. Wiring of all devices needed to make the Temperature Control System functional.
   b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor.
   c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

## 1.05 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

   a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
   b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
d. Maintenance clearances and code-required dedicated space shall be included.
e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

   a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

   a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

   a. Scale of drawings:

      1) General plans: 1/4 Inch = 1 '-0" (minimum).
      2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
      3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
      4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).

5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

## 1.06 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Cameron Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.
4. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the plumbing work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.

    a. Any item listed as furnished shall also be installed, unless otherwise noted.
    b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

## 1.07 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

| Referenced Specification Section | Submittal Item |
|---|---|
| 22 05 00 | Owner Training Agenda |
| 22 05 03 | Fire Seal Systems |
| 22 05 13 | Motors |
| 22 05 15 | Variable Frequency Drives |
| 22 05 50 | Seismic Restraint Systems |
| 22 05 53 | Plumbing Identification |
| 22 07 16 | Plumbing Equipment Insulation |
| 22 07 19 | Plumbing Pipe Insulation |
| 22 09 00 | Instrumentation |
| 22 10 00 | Plumbing Piping Systems and Valves |
| 22 10 30 | Plumbing Specialties |
| 22 11 23 | Domestic Water Pumps |
| 22 14 29 | Sump Pumps |
| 22 30 00 | Plumbing Equipment |
| 22 40 00 | Plumbing Fixtures |

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date
b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

    a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
    b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
    c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.
    c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
    d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 22 XX XX.description.YYYYMMDD
    b. Transmittal file name: 22 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

## 1.08 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

## 1.09 EQUIPMENT SUPPLIERS' INSPECTION

A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:

1. Fire Seal Systems
2. Seismic Restraints and Equipment Bracing

B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

## 1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.

C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

## 1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

## 1.12 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

## 1.13 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

## 1.14 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the first manufacturer is the basis for job design and establishes the quality.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractor's part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

## 1.15 PROJECT COMMISSIONING

A. The Contractor shall work with the Commissioning Agent (CxA) and provide all services as described in the Commissioning Plan.

## PART 2 - EXECUTION

### 2.01 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

### 2.02 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (https://call811.com/) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope Around Utilities to 6" Above Utilities: Place sand to a height of 6" over utilities in 6" layers. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill From 6" Above Utilities to Earthen Grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep.
4. Backfill From 6" Above Utilities to Below Slabs or Paved Area: Where the sand fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials:

    a. Sand, CA6: Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    b. Native Soil: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Native soils shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    c. Flowable Fill: Cementitious, self-leveling, self-compacting slurry as defined by the ACI with compressive strength of 50-100psi at 28 days; consisting of a mixture of fine aggregate or filler, water and cementitious materials. Filler material consist of sand, fly ash, spent foundry sand, quarry fines, baghouse dust. Cementitious materials consist of Portland cement, pozzolanic materials, and self-cementing materials. Flowable fill may be placed in a pour instead of 6" layers noted above.

6. Water shall not be permitted to rise in unbackfilled trenches.
7. Dispose of excess excavated earth as directed.
8. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
9. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.

2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

**2.03 ARCHITECT/ENGINEER OBSERVATION OF WORK**

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

a. Pipe insulation is installed and fully sealed.
b. Pipe wall penetrations are sealed.
c. Pipe identification and valve tags are installed.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

**2.04 PROJECT CLOSEOUT**

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including reproducible drawings and specifications.

3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

## 2.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div22.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.

2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.
16. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

## 2.06 INSTRUCTING THE OWNER'S REPRESENTATIVES

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

D. The instructions shall include:

1. Explanation of all system flow diagrams.
2. Maintenance of equipment.
3. Start-up procedures for all major equipment.
4. Explanation of seasonal system changes.
5. Explanation of Owner’s Responsibilities to operate, maintain, and flush domestic water system (i.e., ASHRAE Standard 188).

E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.

F. Minimum hours of instruction for each item shall be:

1. Domestic Hot Water System - 2 hours
2. All Domestic Water Systems operation, maintenance and flushing of all fixtures and dead legs - 2 hours
3. Domestic Water Pressure Booster System - 1 hours.
4. Water Softener, Filtration and/or Purification System - 1 hours

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

## 2.07 SYSTEM STARTING AND ADJUSTING

A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.

D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

## 2.08 RECORD DOCUMENTS

A. The following paragraphs supplement Division 1 requirements.

B. Maintain at the job site a separate and complete set of plumbing drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.

D. Before completion of the project, a set of reproducible plumbing drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.

E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

F. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

**2.09 PAINTING**

A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.

B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.

C. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.

D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.

E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

F. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.

G. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.
3. Color of paint shall be as follows:

    a. All piping in mechanical room:

        1) Domestic Cold Water: Blue pipe/white letters
        2) Domestic Hot Water: Red pipe/white letters
        3) Sanitary Waste: Green pipe/black letters

## 2.10 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.

D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

## 2.11 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

## 2.12 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:

    a. Minimizing the amount of dust generated.
    b. Reducing solvent fumes and VOC emissions.
    c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
    d. Protect stored on-site and installed absorptive materials from moisture damage.

2. Request that the Owner designate an IAQ representative.
3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
6. Request copies of and follow all of the Owner's IAQ and infection control policies.
7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.

9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.
1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. All plumbing fixtures installed and caulked.
4. Pipe insulation complete, pipes labeled and valves tagged.
5. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

Accepted by:

Prime Contractor _____

By _____ Date _____
Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.
It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

**END OF SECTION**

# SECTION 22 05 03
# THROUGH PENETRATION FIRESTOPPING

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Through-Penetration Firestopping.

### 1.02 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

### 1.03 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. 1997 Uniform Building Code

K. 2021 International Building Code

L. NFPA 5000 - Building Construction Safety Code

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

## 1.05 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

## 1.06 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.
2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

## 1.07 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
5. Johns-Manville.
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Dow Corning Corp.
10. Fire Trak Corp.
11. International Protective Coating Corp.

### 2.02 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.

E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

   a. F Rating = Floor/Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

| Penetrating Item | UL System No. |
|---|---|
| No Penetrating Item | FC 0000-0999* |
| Metallic Pipe or Conduit | FC 1000-1999 |
| Non-Metallic Pipe or Conduit | FC 2000-2999 |
| Electrical Cables | FC 3000-3999 |
| Cable Trays | FC 4000-4999 |

| Penetrating Item | UL System No. |
|---|---|
| Insulated Pipes | FC 5000-5999 |
| Bus Duct and Misc. Electrical | FC 6000-6999 |
| Duct without Damper and Misc. Mechanical | FC 7000-7999 |
| Multiple Penetrations | FC 8000-8999 |

*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

   a. F Rating = Floor/Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

| Penetrating Item | UL System No. |
|---|---|
| No Penetrating Item | WL 0000-0999* |
| Metallic Pipe or Conduit | WL 1000-1999 |
| Non-Metallic Pipe or Conduit | WL 2000-2999 |
| Electrical Cables | WL 3000-3999 |
| Cable Trays | WL 4000-4999 |
| Insulated Pipes | WL 5000-5999 |
| Bus Duct and Misc. Electrical | WL 6000-6999 |
| Duct without Damper and Misc. Mechanical | WL 7000-7999 |
| Multiple Penetrations | WL 8000-8999 |

*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall/Floor Rating
   b. L Rating = Penetrations in Smoke Barriers

| Penetrating Item | UL System No. |
|---|---|
| No Penetrating Item | CAJ 0000-0999* |
| Metallic Pipe or Conduit | CAJ 1000-1999 |
| Non-Metallic Pipe or Conduit | CAJ 2000-2999 |
| Electrical Cables | CAJ 3000-3999 |
| Cable Trays | CAJ 4000-4999 |
| Insulated Pipes | CAJ 5000-5999 |
| Bus Duct and Misc. Electrical | CAJ 6000-6999 |
| Duct without Damper and Misc. Mechanical | CAJ 7000-7999 |
| Multiple Penetrations | CAJ 8000-8999 |

*Alternate method of firestopping is patching opening to match original rated construction.

H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

### 3.02 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

### 3.03 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### 3.04 IDENTIFICATION

A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:

1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."

2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

**3.05 INSPECTION**

A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the engineer and manufacturer's factory representative. The engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the engineer's discretion and the contractor's expense.

**END OF SECTION**

# SECTION 22 05 13
# MOTORS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Single Phase and Three Phase Electric Motors.

### 1.02 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.

E. ANSI/NEMA MG 1 - Motors and Generators.

F. ANSI/NFPA 70 - National Electrical Code.

G. Energy Independence and Act of 2007.

### 1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer's recommendations for equipment and motor.

### 1.04 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

### 1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacture of commercial and industrial motors and accessories, with a minimum of three years documented manufacturing experience.

## PART 2 - PRODUCTS

### 2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

| Distribution/Nominal Voltage | Utilization Voltage |
|---|---|
| 120 | 115 |
| 208 | 200 |
| 240 | 230 |
| 277 | 265 |
| 480 | 460 |

B. Design motors for continuous operation in 40ºC environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.

D. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

E. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.

F. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.

G. Each contractor shall set all motors furnished by him.

H. All motors shall have a minimum service factor of 1.15.

I. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.

J. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.

K. Aluminum end housings are not permitted on motors 15 HP or larger.

L. Motor Driven Equipment:

1. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.
2. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.

M. Provide all belted motors with a means of moving and securing the motor to tighten belts. Motors over 2 HP shall have screw type tension adjustment. Motors over 40 HP shall have dual screw adjusters. Slide bases shall conform to NEMA standards.

N. Motors for pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control.

## 2.02 ELECTRICALLY COMMUTATED MOTORS (ECM)

A. Motor shall be variable speed, constant torque, brushless DC motor for direct-drive applications. Electronics shall be encapsulated for moisture protection and shall integral surge protection. Motor shall be pre-wired for specific voltage and phase.

B. Motor frame shall be NEMA 48; UL recognized components shall be provided for the motor construction.

C. All EC motors shall be a minimum of 85% efficient at all speeds.

D. Motors shall be permanently lubricated; utilize ball bearings to match with the connected driven equipment.

E. Provide motor with onboard motor control module. Motor speed shall be limited to provide electronic over current protection. Starter shall provide soft start to reduce inrush current and shall be controllable from 20% to 100% of full rated speed.

F. Operational mode shall be as scheduled and shall be one of the following:

1. Constant Flow
2. Constant Temperature
3. Constant Pressure

## 2.03 PREMIUM EFFICIENCY MOTORS (INCLUDING MOST 3-PHASE GENERAL PURPOSE MOTORS)

A. All motors, unless exempted by EPAct legislation that became federal law on December 19, 2010, shall comply with the efficiencies listed in that standard, which are reprinted below. These match the 2010 NEMA premium efficiency ratings. All ratings listed are nominal full load efficiencies, verified in accordance with IEEE Standard 112, Test Method B. Average expected (not guaranteed minimum) power factors shall also be at least the following:

| | Full-Load Efficiencies % | | | | | |
|---|---|---|---|---|---|---|
| | Open Drip-Proof | | | Totally Enclosed Fan Cooled | | |
| HP | 1200 rpm | 1800 rpm | 3600 rpm | 1200 rpm | 1800 rpm | 3600 rpm |
| 1.0 | 82.5 | 85.5 | 77.0 | 82.5 | 85.5 | 77.0 |
| 1.5 | 86.5 | 86.5 | 84.0 | 87.5 | 86.5 | 84.0 |
| 2.0 | 87.5 | 86.5 | 85.5 | 88.5 | 86.5 | 85.5 |
| 3.0 | 88.5 | 89.5 | 85.5 | 89.5 | 89.5 | 86.5 |
| 5.0 | 89.5 | 89.5 | 86.5 | 89.5 | 89.5 | 88.5 |
| 7.5 | 90.2 | 91.0 | 88.5 | 91.0 | 91.7 | 89.5 |
| 10.0 | 91.7 | 91.7 | 89.5 | 91.0 | 91.7 | 90.2 |
| 15.0 | 91.7 | 93.0 | 90.2 | 91.7 | 92.4 | 91.0 |

| | Full-Load Efficiencies % | | | | | |
|---|---|---|---|---|---|---|
| | Open Drip-Proof | | | Totally Enclosed Fan Cooled | | |
| HP | 1200 rpm | 1800 rpm | 3600 rpm | 1200 rpm | 1800 rpm | 3600 rpm |
| 20.0 | 92.4 | 93.0 | 91.0 | 91.7 | 93.0 | 91.0 |
| 25.0 | 93.0 | 93.6 | 91.7 | 93.0 | 93.6 | 91.7 |
| 30.0 | 93.6 | 94.1 | 91.7 | 93.0 | 93.6 | 91.7 |
| 40.0 | 94.1 | 94.1 | 92.4 | 94.1 | 94.1 | 92.4 |
| 50.0 | 94.1 | 94.5 | 93.0 | 94.1 | 94.5 | 93.0 |
| 60.0 | 94.5 | 95.0 | 93.6 | 94.5 | 95.0 | 93.6 |
| 75.0 | 94.5 | 95.0 | 93.6 | 94.5 | 95.4 | 93.6 |
| 100.0 | 95.0 | 95.4 | 93.6 | 95.0 | 95.4 | 94.1 |
| 125.0 | 95.0 | 95.4 | 94.1 | 95.0 | 95.4 | 95.0 |
| 150.0 | 95.4 | 95.8 | 94.1 | 95.8 | 95.8 | 95.0 |
| 200.0 | 95.4 | 95.8 | 95.0 | 95.8 | 96.2 | 95.4 |
| 250.0 | 95.4 | 95.8 | 95.0 | 95.8 | 96.2 | 95.8 |
| 300.0 | 95.4 | 95.8 | 95.4 | 95.8 | 96.2 | 95.8 |
| 350.0 | 95.4 | 95.8 | 95.4 | 95.8 | 96.2 | 95.8 |
| 400.0 | 95.8 | 95.8 | 95.8 | 95.8 | 96.2 | 95.8 |
| 450.0 | 96.2 | 96.2 | 95.8 | 95.8 | 96.2 | 95.8 |
| 500.0 | 96.2 | 96.2 | 95.8 | 95.8 | 96.2 | 95.8 |

B. Motor nameplate shall be noted with the above ratings.

**2.04 MOTORS ON VARIABLE FREQUENCY DRIVES**

A. All motors driven by VFDs shall be premium efficiency type.

B. Motors shall be designed for use with VFDs in variable torque applications with 1.15 service factor. Motors shall not be equipped with auxiliary blowers.

C. Motors driven by VFDs shall have Class F or H insulation and be designated by the motor manufacturer to be suitable for inverter duty service in accordance with NEMA MG 1 Section IV, "Performance Standards Applying to All Machines," Part 31 "Definite-Purpose Inverter-Fed Polyphase Motors.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.

C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations. Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

**END OF SECTION**

# SECTION 22 05 29
# PLUMBING SUPPORTS AND ANCHORS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.

B. Equipment Bases and Supports.

C. Sleeves and Seals.

D. Flashing and Sealing of Equipment and Pipe Stacks.

E. Cutting of Openings.

F. Escutcheon Plates and Trim.

### 1.02 REFERENCES

A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices

D. MSS SP-127 - Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application.

### 1.03 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

## PART 2 - PRODUCTS

### 2.01 HANGER RODS

A. Hanger rods for single rod hangers shall conform to the following:

1. Steel, Cast Iron, and Glass Pipe:

a. Hanger Rod Diameter:

1) 2-1/2" and smaller: 3/8"
2) 3" through 3-5/8": 3/8"
3) 4" through 6": 1/2"
4) 8": 5/8"
5) 10": 3/4"
6) 12": 7/8"
7) 14" and 16": 1"

8) 18" and 24": 1-1/4")

2. Copper and Plastic Pipe:

a. Hanger Rod Diameter:

1) 2-1/2" and smaller: 3/8"
2) 3") through 3-5/8": 3/8"
3) 4") through 6": 1/2"
4) 8": 5/8"
5) 10": 3/4"
6) 12": 7/8"
7) 14" and 16": 1"
8) 18" and 24": 1-1/4"

B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.

C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

D. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication. This applies to the following areas:

## 2.02 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

3. Copper piping located in an exposed area, including indirect waste piping in janitor's closets, shall use split ring standoff hangers for copper tubing. Support shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.

a. Products:

1) nVent/M-Co Model #456
2) Eaton Fig. 3198HCT
3) Anvil Fig. CT138R

B. Vertical Supports:

1. Support and laterally brace vertical pipes at every floor level in multi-story structures, unless otherwise noted by applicable codes, but never at intervals over 15 feet Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

    a. Products:

        1) Eaton Fig B3373 Series
        2) nVent 510 Series
        3) Anvil Fig. 90

2. Cold Pipe: Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.

    a. Products:

        1) Mason RBA, RCA or RDA
        2) Mason BR

3. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.

C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp within their temperature limits of -65°F to +275°F.
3. Vertical cold pipe drops and rough-ins to fixtures shall be supported by insulated pipe clamps to prevent thermal bridging and condensation.
4. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
5. Ferrous hot piping 4 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.

    a. Products:

        1) Anvil Fig. 160, 161, 162, 163, 164, 165
        2) Eaton Fig. 3160, 3161, 3162, 3163, 3164, 3165
        3) nVent Model 630, 631, 632, 633, 634, 635

6. Unless otherwise indicated, hangers shall be as follows:

    a. Clevis Type: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches & Smaller

        1) Products: Bare Steel Plastic or Insulated Pipe:

            a) Anvil Fig. 260
            b) Eaton Fig. 3100
            c) nVent Model 400

        2) Products: Bare Copper Pipe Felt or PVC Coated:

            a) Eaton Fig. B3104F or B3100CTC
            b) Anvil Fig. CT65
            c) nVent Fig. 402

7. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.

    a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
    b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

8. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

    a. Clamp Type: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and smaller

        1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp.
        2) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.
        3) Products: Bare Steel, Plastic or Insulated Pipe:

            a) Unistrut Fig. P1100 or P2500
            b) Anvil Fig. AS1200

        4) Products: Bare Copper Pipe:

            a) Eaton Fig. BVT
            b) nVent CADDY Cushion Clamp

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar-joists.):

1) Products:

a) Anvil Fig. 86
b) Eaton Fig. B3033/B3034
c) nVent Model 300 & 310

b. Concrete: Concrete Inserts, Single Rod Galvanized:

1) Products:

a) Anvil Fig. 282
b) Eaton Fig. B3014

c. Concrete: Concrete Inserts, Continuous Strip Galvanized:

1) Products:

a) Unistrut Corp P3200 Series
b) Eaton Fig. B22
c) nVent CONB
d) Anvil AS249

d. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-20. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.

## 2.03 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Concrete Bases (Housekeeping Pads):

1. Refer to Section 22 05 50 for additional requirements for concrete bases in seismic applications.
2. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base), except where pad extension would interfere with working space at equipment control panels and electrical panels.
3. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".

4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.
5. Equipment requiring bases is as follows:

    a. Expansion Tank
    b. Pump
    c. Tank
    d. Water Heater
    e. Water Softener

C. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

D. Grout:

1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

## 2.04 OPENINGS IN FLOORS, WALLS AND CEILINGS

A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.

B. Coordinate all openings with other Contractors.

C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.

D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.

E. Do not cut structural members without written approval of the Architect or Structural Engineer.

F. Exposed Housing Penetrations: Seal pipes with surface temperature below 150°F, penetrating housings with conical stepped, white silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite.

## 2.05 ROOF PENETRATIONS

A. Roof Curb Enclosure: Provide weatherproof roof curb and enclosure for pipe penetrations. Refer to drawings for details.

B. Conical Pipe Boot: Seal pipes with surface temperature below 150°F penetrating single-ply roofs with conical stepped, UV-resistant silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite. Color: Black shall match roofing membrane.

C. Break insulation only at the clamp for pipes between 60°F and 150°F. Seal outdoor insulation edges watertight.

**2.06 SLEEVES AND LINTELS**

A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.

B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.

C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.

D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.

E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer's design.

F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.

G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.

H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.

I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

J. Wall Seals ("Link-Seals"):

1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve. If piping carries only fluids below 120°F, sleeves may be thermoplastic with integral water seal and textured surface.
3. Sleeves shall be at least 2 pipe sizes larger than the pipes.
4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.

5. Sealing element shall be as follows:

| | | Element | |
|---|---|---|---|
| Model | Service | Material | Temperature Range |
| S | Standard (Stainless) | EPDM | -40°F to 250°F |
| T | High/Low Temperature (Steam) | Silicone | -67°F to 400°F |
| T | Fire Seals (1 hour) | Silicone | -67°F to 400°F |
| FS | Fire Seals (3 hours) | Silicone | -67°F to 400°F |
| OS | Oil Resistant/Stainless | Nitrile | -40°F to 210°F |

6. Manufacturers:

   a. Thunderline Corporation "Link-Seals"
   b. Innerlynx
   c. Metraflex Company (cold service only)

**2.07 ESCUTCHEON PLATES AND TRIM**

A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.

B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.

C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

**2.08 PIPE PENETRATIONS**

A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

B. Seal fire rated wall and floor penetrations with fire seal system as specified.

**2.09 PIPE ANCHORS**

A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.

B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

**2.10 FINISH**

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

**PART 3 - EXECUTION**

**3.01 PLUMBING SUPPORTS AND ANCHORS**

A. General Installation Requirements:

1. Install all items per manufacturer's instructions.

2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with sheet metal contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
2. Set all concrete inserts in place before pouring concrete.
3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

    a. The hanger is attached within 6" from a web/chord joint.
    b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.

4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

H. Steel/Concrete Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

1. Steel and Fiberglass (Std. Weight or Heavier - Liquid Service):

a. Maximum Spacing:

1) 1-1/4" & under: 7'-0"
2) 1-1/2": 9'-0"
3) 2": 10'-0"
4) 2-1/2": 11'-0"
5) 3": 12'-0"
6) 4" & larger: 12'-0"

2. Steel (Std. Weight or Heavier - Vapor Service):

a. Maximum Spacing:

1) 1-1/4" and under: 9'-0"
2) 1-1/2": 12'-0"
3) 2" & larger: 12'-0"

3. Hard Drawn Copper & Brass (Liquid Service):

a. Maximum Spacing:

1) 3/4" and under: 5'-0"
2) 1": 6'-0"
3) 1-1/4": 7'-0"
4) 1-1/2" 8'-0"
5) 2": 8'-0"
6) 2-1/2": 9'-0"
7) 3": 10'-0"
8) 4": 12'-0"
9) 6": 12'-0"

4. Hard Drawn Copper & Brass (Vapor Service):

    a. Maximum Spacing:

        1) 3/4" & under: 7'-0"
        2) 1": 8'-0"
        3) 1-1/4": 9'-0"
        4) 1-1/2": 10'-0"
        5) 2": 11'-0"
        6) 2-1/2" & larger: 12'-0"

5. Plastic Pipe:

    a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.

6. Ultra-Flexible Pipe, and Flexible Hose, and Soft Copper Tubing:

    a. Continuous channel with hangers maximum 8'-0" OC.

I. Installation of hangers shall conform to MSS SP-58, 69, 89 and the applicable Plumbing Code.

**END OF SECTION**

# SECTION 22 05 53
# PLUMBING IDENTIFICATION

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Identification of products installed under Division 22.

### 1.02 REFERENCES

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

B. ASTM B-1, B-3, and B-8 for copper conductors.

C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 “ 2kV Cables.

D. CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders for Medical Use.

E. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

### 1.03 SUBMITTALS

A. Submit shop drawings under provisions of Section 22 05 00. Include list of items identified, wording, letter sizes, and color coding.

B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

1. 3M
2. Bunting
3. Calpico

### 2.02 MATERIALS

A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

| OD of Pipe or Insulation | Marker Length | Size of Letters |
|---|---|---|
| Up to and including 1-1/4" | 8" | 1/2" |
| 1-1/2" to 2" | 8" | 3/4" |
| 2-1/2" to 6" | 12" | 1-1/4" |
| 8" to 10" | 24" | 2-1/2" |
| Over 10" | 32" | 3-1/2" |

Plastic tags may be used for outside diameters under 3/4"

B. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.

C. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.

D. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.

E. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

F. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.

G. Tracer Wire:

1. Single copper conductors shall be solid or stranded annealed or hard uncoated copper per UL83 and ASTM requirements. Tracer tape or copper-coated steel wire is not acceptable.
2. Conductor shall be insulated with HMWPE as specified and applied in a concentric manner. The minimum at any point shall not be less than 90% of the specified average thickness in compliance with UL 83.
3. Tracer wire shall be continuously spark tested at 7500 Volts DC. Other electrical and mechanical tests shall be in accordance with UL 1581.

H. Ceiling Markers:

1. Label Style:

a. The intent is for the ceiling labels to be inconspicuous but easy to find and read while standing underneath. The labels shall be located on the grid T-bar nearest the ceiling tile that can be removed to provide the best access to the serviceable side of equipment or to valves. An arrow can be used to point to the tile needing removal.
b. The label tape shall be approximately 1/2" wide with all capitalized letters approximately 3/16" tall.
c. Ceiling grid labels shall be made with a label maker with durable adhesive labels having a clear background and black letters.
d. Equipment labels shall be as designated on the drawings (e.g., WHA, TP, etc.).
e. Valve labels shall be designated by the size, service, and the valve tag number (e.g., 1-1/4" CW #123, 2" HWS #234, etc.). A single longer label can be used to identify multiple valves using spaces between the descriptors if the valves are located close together and have the same service (e.g., CW, HW, and HWC lines serving the same restroom, etc.).

2. "Dot" Style:

a. The intent is for the ceiling labels to be inconspicuous but easy to find and read while standing underneath. The labels shall be located on the grid T-bar nearest the ceiling tile that can be removed to provide the best access to the serviceable side of equipment or to valves.
b. The marker shall be a self-adhesive color dot approximately 1/2" in diameter.
c. The equipment and accessories to be marked and dot color shall be coordinated with the Architect/Engineer and Owner.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Install all products per manufacturer's recommendations.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Valves:

1. All valves (except shutoff valves at equipment) shall have numbered tags.
2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
6. Number all tags and show the service of the pipe.
7. Provide one Plexiglas framed valve directory listing all valves, with respective tag numbers, uses and locations. Mount directory in location chosen by the Architect/Engineer.

D. Pipe Markers:

1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.

3. Apply markers and arrows in the following locations where clearly visible:

    a. At each valve.
    b. On both sides of walls that pipes penetrate.
    c. At least every 20 feet along all pipes.
    d. On each riser and each leg of each "T" joint.
    e. At least once in every room and each story traversed.

4. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Provide engraved plastic tags at all hydronic or steam system makeup water meters.
3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

F. Tracer Wire:

1. Tracer wire shall be installed on top of all non-metallic buried utilities.
2. Tracer wire shall be taped directly to plastic water or drain pipe.
3. Tracer wire when attached shall be secured to the pipe a minimum of every 10 feet and at all changes of direction.
4. Tape shall be Polyken "930-35", Protecto-Wrap "310", or approved equal.
5. Tracer wire shall be continuous between boxes and shall be tested for continuity.
6. Splices in tracer wire shall be made with a water proof splice kit to prevent corrosion. Wire nuts shall not be used.
7. The tracer wire shall daylight to grade through a 2" PVC conduit, at the point of the utility entrance to building. PVC conduit shall be capped and labeled as future contact point to locate the utility.

## 3.02 SCHEDULE

A. Pipes to be marked shall be labeled with text as follows, regardless of which method or material is used:

1. CONDENSATE DRAIN: White lettering; green background
2. DOMESTIC COLD WATER: White lettering; green background
3. DOMESTIC HOT WATER - 140°F: White lettering; green background
4. DOMESTIC HOT WATER CIRCULATING - 140°F: White lettering; green background
5. SANITARY SEWER: Black lettering; yellow background
6. VENT: Black lettering; yellow background
7. STORM SEWER (PRIMARY AND SECONDARY): White lettering; green background
8. TEMPERED WATER: White lettering; green background
9. All Underground Pipes: Varies
10. Tracer Wire - All other buried types: White lettering; green background

B. Ceiling Markers:

1. CLEAN OUT Condensate, San, Etc.
2. WATER HAMMER ARRESTOR
3. CONTROL VALVE
4. HWC BALANCING/CONTROL VALVE

**END OF SECTION**

# SECTION 22 05 93
# PLUMBING TESTING, ADJUSTING, AND BALANCING

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Testing, adjusting, and balancing of plumbing systems.

### 1.02 QUALITY ASSURANCE

A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, SMARTA Certified Air and Hydronic Balancer, or TABB Certified Supervisor.

B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

### 1.03 REFERENCES

A. AABC - National Standards for Total System Balance, 2002.

B. ASHRAE - 2003 HVAC Applications Handbook; Chapter 37, Testing, Adjusting and Balancing.

C. TABB - International Standards for Environmental Systems Balance.

### 1.04 REPORT FORMS

A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.

B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.

C. Refer to PART 4 for required reports.

### 1.05 WARRANTY/GUARANTEE

A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.

B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

### 1.06 SCHEDULING

A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.

B. Project will be constructed in phases. Provide balancing report after each phase is complete.

## PART 2 - EXECUTION

### 2.01 GENERAL REQUIREMENTS

A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.

B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g., submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.

C. Recorded data shall represent actual measured or observed conditions.

D. Cut insulation, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.

E. Permanently mark setting of valves and other adjustment devices allowing for settings to be restored. Set and lock memory stops.

F. Leave systems in proper working order, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.

G. Installations with systems consisting of multiple components shall be balanced with all system components operating.

### 2.02 EXAMINATION

A. Before beginning work, verify that systems are complete and operable. Ensure the following:

1. General Equipment Requirements:

    a. Equipment is safe to operate and in normal condition.
    b. Equipment with moving parts is properly lubricated.
    c. Temperature control systems are complete and operable.
    d. Proper thermal overload protection is in place for electrical equipment.
    e. Direction of rotation of all pumps is correct.
    f. Access doors are closed and end caps are in place.

2. Pipe System Requirements:

    a. Hydronic systems have been cleaned, filled, and vented.
    b. Strainer screens are clean and in place.

c. Shutoff, throttling and balancing valves are open.

B. Report any defects or deficiencies to Architect/Engineer.

C. Promptly report items that are abnormal or prevent proper balancing.

D. If, for design reasons, system cannot be properly balanced, report as soon as observed.

E. Beginning of work means acceptance of existing conditions.

**2.03 PREPARATION**

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.

B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

**2.04 INSTALLATION TOLERANCES**

A. ± 10% of scheduled values:

1. Adjust piping systems to ±10% of design values.

**2.05 ADJUSTING**

A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.

B. Once balancing of systems is complete, at least one valve must be 100% open.

C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.

D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.

E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

**2.06 SUBMISSION OF REPORTS**

A. Fill in test results on appropriate forms.

**PART 3 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED**

**3.01 GENERAL REQUIREMENTS**

A. Title Page:

1. Project name.
2. Project location.
3. Project Architect.

4. Project Engineer (IMEG Corp.).
5. Project General Contractor.
6. TAB Company name, address, phone number.
7. TAB Supervisor's name and certification number.
8. TAB Supervisor's signature and date.
9. Report date.

B. Report Index

C. General Information:

1. Test conditions.
2. Nomenclature used throughout report.
3. Notable system characteristics/discrepancies from design.
4. Test standards followed.
5. Any deficiencies noted.
6. Quality assurance statement.

D. Instrument List:

1. Instrument.
2. Manufacturer, model, and serial number.
3. Range.
4. Calibration date.

**3.02 PLUMBING SYSTEMS**

A. Pump Data:

1. Drawing symbol.
2. Service.
3. Manufacturer, size, and model.
4. Impeller size: specified, actual, and final (if trimmed).
5. Flow Rate (gpm): specified and actual.
6. Pump Head: specified, operating and shutoff.
7. Suction Pressure: operating and shutoff.
8. Discharge Pressure: operating and shutoff.

B. Electric Motors:

1. Drawing symbol of equipment served.
2. Manufacturer, model, frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps for each phase.

C. Balancing Valve:

1. Drawing symbol.
2. Service.
3. Location.
4. Size.
5. Manufacturer and model.
6. Flow rate (gpm): specified and actual.
7. Pressure drop: specified and actual.

**END OF SECTION**

# SECTION 22 07 16
# PLUMBING EQUIPMENT INSULATION

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Equipment Insulation.

B. Equipment Insulation Finishes.

### 1.02 QUALITY ASSURANCE

A. Applicator: Company specializing in insulation application with five years minimum experience.

B. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255, or UL 723 (where required).

### 1.03 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ANSI/ASTM B209 - Aluminum and Aluminum Alloy Sheet and Plate

C. ANSI/ASTM C534 - Elastomeric Foam Insulation

D. ANSI/ASTM C921 - Properties of Jacketing Materials for Thermal Insulation

E. ANSI/ASTM D1668 - Glass Fabric for Waterproofing

F. ASTM E84 - Surface Burning Characteristics of Building Materials.

G. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

H. NFPA 255 - Surface Burning Characteristics of Building Materials.

I. UL 723 - Surface Burning Characteristics of Building Materials.

## PART 2 - PRODUCTS

### 2.01 INSULATION

A. Type A: Glass Fiber Blanket; ANSI/ASTM C612; 0.40 maximum 'K' value at 300°F; 3.0 lb./cu ft.; suitable to 850°F, 25/50 flame spread/smoke developed.

B. Type B: Glass Fiber Board; ANSI/ASTM C612; 0.28 maximum 'K' value at 200°F; 6.0 lb./cu ft; suitable to 850°F, 25/50 flame spread/smoke developed.

C. Type C: Flexible elastomeric foam insulation; closed-cell, sponge or expanded rubber (polyethylene type is not permitted); ANSI/ASTM C534, Grade 1 Type I for tubular materials; flexible plastic; 0.25 maximum 'K' value at 75°F, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Maximum 1" thick per layer where thicker values are specified.

### 2.02 INSULATION FINISHES

A. Type 1: Glass Fabric; ASTM D1668, woven glass fabric with two coats of mastic approved for insulation type. Use vapor barrier mastic on system requiring a vapor barrier.

B. Type 2: All Service Jacket; ASTM C921; Factory or Field Applied; all-purpose polymer or polypropylene service jacket; Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Seal all joints with manufacturer approved tape and adhesive to maintain vapor barrier. Indoor use only, if used outdoors add type 4 finish.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Install all materials per manufacturer's instructions, codes and industry standards.

B. Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation.

C. Do not insulate factory insulated equipment.

D. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation. Secure to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier mastic.

F. Do not insulate over nameplates or ASME stamps. Bevel and seal insulation around such, unless omitting insulation would cause condensation problem. When such is the case, appropriate tagging shall be provided to identify the presence of these items.

G. When equipment with insulation requires periodic opening for maintenance, repair, or cleaning; install specially fabricated removable insulation sections. Covers shall have mechanical fasteners and be reusable.

H. Install 26 gauge galvanized sheet metal corner protection angles where insulation extends to the floor. Minimum 2" coverage of insulation.

I. Insulate all equipment surfaces that are not factory insulated and are intended to operate below 60°F and/or above 100°F. Verify insulation type and thickness with equipment manufacturer and Architect/Engineer.

J. Insulate all supports on equipment operating below ambient temperature.

## 3.02 INSULATION

A. Type A and B:

1. Apply with edges tightly butted and joints staggered.
2. Secure with welded pins and washers, 4" from each edge and 16" on center, or 1/2" x 0.015" galvanized steel bands, 12" on center.

B. Type C:

1. Apply with edges tightly butted and joints staggered. Install multiple layers if required thickness is greater than 1" thick.
2. Secure with manufacturer approved adhesive. Seal all joints with manufacturer approved adhesive.

## 3.03 SCHEDULE

A. Domestic Hot Water Storage Tank (up to 250°F): 2" thick Type B; Finish 1 or 2.

B. Water Softener Tank:

1. 1" thick Type B, Finish 1 or 2
2. 1" thick Type C, Finish 3.

**END OF SECTION**

# SECTION 22 07 19
# PLUMBING PIPING INSULATION

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Piping Insulation.

B. Insulation Jackets.

### 1.02 QUALITY ASSURANCE

A. Applicator: Company specializing in piping insulation application with five years minimum experience.

B. Materials: Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. 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.

### 1.03 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ANSI/ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.

C. ANSI/ASTM C534 - Elastomeric Foam Insulation.

D. ASTM C591 - Unfaced Preformed Rigid Cellular Polyisocyanurate Insulation.

E. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.

F. ASTM C1729 - Standard Specification for Aluminum Jacketing for Insulation.

G. ASTM C1767 - Standard Specification for Stainless Steel Jacketing for Insulation.

H. ASTM E84 - Surface Burning Characteristics of Building Materials.

I. NFPA 255 - Surface Burning Characteristics of Building Materials.

J. UL 723 - Surface Burning Characteristics of Building Materials.

K. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

## PART 2 - PRODUCTS

### 2.01 INSULATION

A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All-purpose polymer or polypropylene service jacket, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.

B. Type B: Flexible elastomeric foam insulation; closed-cell, sponge or expanded rubber (polyethylene type is not permitted); ANSI/ASTM C534 Grade 1 Type I for tubular materials; flexible plastic; 0.25 maximum 'K' value at 75°F, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Maximum 1" thick per layer where multiple layers are specified.

C. Type C: Molded rigid cellular glass; ANSI/ASTM C-552; 0.29 maximum 'K' value at 75°F; density 7.3lb/ft; minimum compressive strength 90 psi parallel to rise; moisture resistant, non-combustible; suitable for -100°F to +900°F. For below grade installations, use asphaltic mastic paper vapor barrier jacket. Use self-seal all-purpose polymer or polypropylene service jacket for above grade installations.

D. Type D: Hydrous Calcium Silicate; ASTM C533; rigid molded pipe insulation; asbestos free; 0.40 'K' value at 300°F; 1200°F maximum service temperature; 16 gauge stainless steel tie wires on maximum 12" centers.

E. Type E: Preformed rigid cellular polyisocyanurate insulation; ANSI/ASTM C591; maximum 'K' value of 0.19 at 75°F; density 4.0lb/ft; minimum compressive strength 95 psi parallel to rise; moisture resistant; listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code; suitable for -297°F to +300°F.

F. Type F: Phenolic insulation; ASTM C1126; maximum 'K' value of 0.22 at 75°F; density 3.75lb/ft; minimum compressive strength 50 psi parallel to rise; moisture resistant; listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code; suitable for -290°F to +250°F.

### 2.02 VAPOR BARRIER JACKETS

A. All-purpose polymer or polypropylene service jacket vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

B. Polyvinylidene Chloride (PVDC or Saran) film and tape: Durable and highly moisture and moisture vapor resistant. Please refer to manufacturer's recommended installation guidelines.

### 2.03 JACKET COVERINGS

A. Aluminum Jackets: ASTM C1729; 0.016" thick (thicker where required by ASTM C1729); stucco embossed finish with Z edge seams and aluminum bands for outdoor use. Where colored jacket covers are called for, provide factory-applied hard film acrylic paint in color selected by Architect.

B. Plastic Jackets and Fitting Covers: High impact, glossy white, 0.030" thick, self-extinguishing plastic. Suitable for use indoors or outdoors with ultraviolet inhibitors. Suitable for -40°F to 150°F. Listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.

## PART 3 - EXECUTION

### 3.01 PREPARATION

A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

### 3.02 INSTALLATION

A. General Installation Requirements:

1. Install materials per manufacturer's instructions, building codes and industry standards.
2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.

B. Insulated Piping Operating Below 60°F:

1. Insulate fittings, valves, unions, flanges, strainers, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.
2. On piping operating below 60°F in locations that are not mechanically cooled (e.g., penthouses, mechanical rooms, tunnels, chases at exterior walls, etc.), Type B insulation shall be used.
3. All balance valves with fluid operating below 60°F shall be insulated with a removable plug wrapped with vapor barrier tape to allow reading and adjusting of the valve.

C. Insulated Piping Operating Between 60°F and 140°F:

1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.

D. Insulated Piping Operating Above 140°F:

1. Insulate fittings, valves, flanges, and strainers.
2. All balance valves with fluid operating above 140°F shall be insulated and an opening shall be left in the insulation to allow for reading and adjusting the valve.

E. Exposed Piping:

1. Locate and cover seams in least visible locations.
2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.
3. On exposed piping serving kitchen equipment or plumbing fixtures, the piping shall be insulated unless local code allows it to be uninsulated. In no instance should the uninsulated portion of the piping be more than 4ft in developed length.

### 3.03 SUPPORT PROTECTION

A. Provide a shield on all insulated piping at each support between the insulation jacket and the support.

B. On all insulated piping greater than 1-1/2", provide shield with insulation insert of same thickness and contour as adjoining insulation at each support, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Inserts shall be as follows:

1. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a minimum 180° cylindrical segment the same length as metal shields. Inserts shall be:

   a. Molded hydrous calcium silicate (only use for pipes with operating temperatures above 90°F, with a minimum compressive strength of 100 psi is acceptable for pipe sizes 14" and below. For pipe sizes larger than 14", provide rolled steel plate in addition to the shield.
   b. As an alternative to separate pipe insulation insert and saddle, properly sized manufactured integral rigid insulation insert and shield assemblies may be used.

      1) Products:

         a) Buckaroo CoolDry
         b) Cooper/B-Line Fig. B3380 through B3384
         c) Pipe Shields A1000, A2000

   c. Insulation Couplings:

      1) Molded thermoplastic slip coupling, -65°F to 275°F, sizes up to 4-1/8" OD, and receive insulation thickness up to 1". Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60°F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.
      2) Horizontal Strut Mounted Insulated Pipe Manufacturers:

         a) Klo-Shure or equal

      3) Vertical:

         a) Manufacturers: Klo-Shure Titan or equal

   d. Rectangular blocks, plugs, or wood material are not acceptable.
   e. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.

C. Neatly finish insulation at supports, protrusions, and interruptions.

D. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.

E. Shields shall be at least the following lengths and gauges:

| Pipe Size | Shield Size |
|---|---|
| 1/2" to 3-1/2" | 12" long x 18 gauge |
| 4" | 12" long x 16 gauge |
| 5” to 6" | 18" long x 16 gauge |
| 8” to 14" | 24" long x 14 gauge |
| 16” to 24" | 24" long x 12 gauge |

F. Ferrous hot piping 4 inches and larger, provide steel saddle at rollers as described in Section 22 05 29 "Plumbing Supports and Anchors".

G. Minimum 1/4" rolled galvanized steel plates shall be provided in addition to the sleeves as reinforcement on large pipes to reduce point loading on roller, trapeze hanger and strut support locations depending on insulation compressive strength. Refer to section above for exact locations.

**3.04 INSULATION**

A. Type A Insulation:

1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.
2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
3. Apply insulation with laps on top of pipe.
4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60°F seal fitting covers with vapor retarder mastic in addition to tape.

B. Type B Insulation:

1. Install per manufacturer's instructions or ASTM C1710.
2. Elastomeric Cellular Foam: Where possible, slip insulation over the open end of pipe without slitting. Seal all butt ends, longitudinal seams, and fittings with adhesive. At elbows and tees, use mitered connections. Do not compress or crush insulation at cemented joints. Joints shall be sealed completely and not pucker or wrinkle. Paint the outside of outdoor insulation with two coats of latex enamel paint recommended by the manufacturer.
3. Insulation Installation on Straight Pipes and Tubes:

    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 must be installed in compression to allow for expansion and contraction. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.

4. Insulation Installation on Valves and Pipe Specialties:

    a. Install preformed sections of same material as straight segments of pipe insulation when available.
    b. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
    c. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

C. Type C Insulation:

1. Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner.
2. Insulate fittings with prefabricated fittings.

D. Type D Insulation:

1. Use pre-molded half sections. Butt longitudinal and circumferential joints tightly. Wire in place with 16 gauge stainless steel wire on maximum 12" centers.
2. Apply in two layers. Stagger all joints between layers. Wire each layer individually.

E. Type E Insulation:

1. Indoors, above grade or below grade, Polyvinylidene chloride (PVDC or Saran) vapor retarder film and tape: Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner. Refer to manufacturer's recommendations for installation guidelines.
2. Insulate pipe fittings with prefabricated insulation fittings.

F. Type F Insulation:

1. Seal all longitudinal joints with manufacturer approved adhesive or mastic. Secure butt joint strips in a similar manner.
2. Indoors, above grade or below grade, polyvinylidene chloride (PVDC or Saran) vapor retarder film and tape: Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner. Refer to manufacturer's recommendations for installation guidelines.
3. Insulate pipe fittings with prefabricated insulation fittings.

## 3.05 JACKET COVER INSTALLATION

A. Metal Covering:

1. Provide vapor barrier as specified for insulation type. Cover with aluminum jacket covering with seams located on the bottom of horizontal piping. Include fittings, joints and valves.
2. Seal all interior and exterior butt joints with metal draw bands and sealant. Seal all exterior joints watertight.
3. Interior joints do not need to be sealed.
4. Use metal covering on the following pipes:

    a. All exposed piping in finished spaces unless noted otherwise on the drawings.
    b. All exposed piping in locker rooms.
    c. All exposed piping adjacent to cloud ceilings.
    d. All exposed piping in mechanical or equipment rooms below 8'-0" above floor.

e. All exposed piping in mechanical rooms that is subject to damage from normal operations. (Example: Piping that must be stepped over routinely.)

5. Use colored aluminum jacket covers on the following pipes:

a. All exterior piping.

B. Plastic Covering:

1. Provide vapor barrier as specified for insulation type. Cover with plastic jacket covering. Position seams to shed water.
2. Solvent weld all joints with manufacturer recommended cement.
3. Overlap all laps and butt joints 1-1/2" minimum. Repair any loose ends that do not seal securely. Solvent weld all fitting covers in the same manner. Final installation shall be watertight.
4. All joints in areas noted shall meet USDA standards for Totally Sealed Systems, including overlaps of 1" on circumferential and 1.5" to 2" on longitudinal seams.
5. Use plastic insulation covering on all exposed pipes including, but not limited to:

a. All exposed piping in finished spaces unless noted otherwise on the drawings.
b. All exposed piping in locker rooms.
c. All exposed piping adjacent to cloud ceilings.
d. All exposed piping in unfinished areas as noted on drawings (e.g., storage rooms, janitor's closets, utility rooms, etc.).
e. All exposed piping in mechanical or equipment rooms below 8'-0" above floor.
f. All exposed piping in mechanical rooms that is subject to damage from normal operations. (Example: Piping that must be stepped over routinely.)
g. All exposed piping in tunnels designated as passageways, equipment access, or egress.

6. Use colored plastic covering on the following pipes:

a. All exterior piping.

## 3.06 SCHEDULE

A. Refer to drawings for insulation schedule.

**END OF SECTION**

# SECTION 22 10 00
# PLUMBING PIPING

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Pipe and Pipe Fittings.

B. Valves.

C. Check Valves.

### 1.02 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.

B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.

D. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

### 1.03 REFERENCES

A. ANSI/ASME A112.3.1 - Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above and Below Ground.

B. ASME A112.6.9 - Siphonic Drain Test; The American Society of Mechanical Engineers.

C. ANSI/ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.

D. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.

E. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

F. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.

G. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.

H. ANSI/ASME B16.9 - Factory-Made Wrought Steel Butt Welding Fittings.

I. ANSI/ASME B31.3 - Chemical Plant and Petroleum Refinery Piping.

J. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.

K. ANSI/ASTM B32 - Solder Metal.

L. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

M. ANSI/ASTM D2466 - PVC Plastic Pipe Fittings, Schedule 40.

N. ANSI/AWS D1.1 - Structural Welding Code.

O. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings 3" through 48", for Water and Other Liquids.

P. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.

Q. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

R. ANSI/AWWA C153 - Compact Ductile Iron Fittings 3" through 48", for Water and Other Liquids.

S. ASME - Boiler and Pressure Vessel Code.

T. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.

U. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

V. ASTM A74 - Hub and Spigot Cast Iron Soil Pipe and Fittings.

W. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

X. ASTM A312 - Standard for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

Y. ASTM A554 - Standard for Welded Stainless Steel Mechanical Tubing.

Z. ASTM A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.

AA. ASTM A888 - Hubless Cast Iron Soil Pipe and Fittings.

BB. ASTM B88 - Seamless Copper Water Tube.

CC. ASTM B306 - Copper Drainage Tube (DWV).

DD. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

EE. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

FF. ASTM C1540 - Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

GG. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

HH. ASTM D1785 - Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.

II. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

JJ. ASTM D2661 - ABS DWV Pipe & Fittings.

KK. ASTM D2665 - PVC DWV Pipe & Fittings.

LL. ASTM D2846 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems

MM. ASTM D3033 - Type PSP (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.

NN. ASTM D3034 - Type PSM (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.

OO. ASTM F402 - Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.

PP. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

QQ. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

RR. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipes.

SS. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

TT. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

UU. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

VV. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

WW. AWS A5.8 - Brazed Filler Metal.

XX. AWWA C651 - Disinfecting Water Mains.

YY. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

ZZ. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

AAA. FM 1680 - Couplings Used in Hubless Cast Iron Systems.

BBB. NFPA 24 - Private Fire Service Mains and Their Appurtenances.

CCC. NSF - National Sanitation Foundation

**1.04 DELIVERY, STORAGE, AND HANDLING**

A. Deliver and store valves in shipping containers with labeling in place.

### 1.05 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 22 05 00 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

## PART 2 - PRODUCTS

### 2.01 CAST IRON PIPE

A. Cast Iron; Standard Weight; Hub and Spigot Joints:
1. Pipe: Standard weight hub and spigot cast iron soil pipe, bituminous corrosion protective coating inside and outside, CISPI 301 or ASTM A74.
2. Design Pressure: Gravity Maximum Design Temperature: 180°F
3. Joints: Compression gasket, ASTM C564.
4. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 301. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
5. Adapters: Heavy duty no-hub transition for joining cast iron and PVC pipe. Adapters shall be tested and certified to ASTM C 1460 and be constructed with Type 304 stainless steel shield, thickness 0.015" shield, gasket material to meet ASTM C564, 1-1/2" to 4" will be 3" wide with four 304 stainless steel bands, and 6" to 10" will be 4" wide with six 304 stainless steel bands and 3/8" 305 stainless steel hex head screws torqued to 80 inch pounds.

B. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets:

1. Pipe: Standard weight no-hub cast iron soil pipe, bituminous corrosion protective coating inside and outside, CISPI 301 or ASTM A888.
2. Design Pressure: Gravity Maximum Design Temperature: 180°F
3. Joints: ASTM C1540, FM 1680, and ASTM C-564.

a. Super Duty, Shielded Stainless Steel Couplings: Neoprene sleeve gasket, 0.015" thick 304 stainless steel shield , stainless steel 3/8" screw type clamps, minimum of four clamps for 1-1/2" to 4" and six clamps for 5" and larger pipe sizes. Clamps shall be tightened to minimum 80 inch pounds or as manufacturer requires. Husky SD-4000 or equal.

### 2.02 COPPER PIPE

A. Copper Pipe; Type L; Solder Joints:

1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
2. Design Pressure: 175 psi; Maximum Design Temperature: 200°°F.
3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
4. Fittings: Wrought copper solder joint, ANSI B16.22.

B. Copper Pipe; Type L; Mechanical Press Connection:

1. Pipe: Type L hard drawn seamless copper tube, ASTM B88.
2. Design Pressure: 175 psi; Maximum Design Temperature: 200°°F.
3. Joints: Mechanical press connection.
4. Fittings: Copper, ANSI B-16.22, with embedded EPDM O-ring, NSF-61.

5. Fitting Identification: Press ends shall provide the ability to identify an unpressed fitting from the floor prior to testing. The function of this feature is to provide the installer quick and easy identification of connections that have not been pressed prior to putting the system into operation.
6. Special Requirements: Mechanical press fitting manufacturer shall provide Contractor training prior to installation.
7. Manufacturers:

    a. Viega ProPress
    b. Elkhart Xpress
    c. Nibco Press System Fittings and Valves
    d. Merit Brass
    e. Mueller Streamline PRS

C. Copper Pipe; Type K; Solder Joints:

1. Pipe: Type K annealed copper tube, ASTM B88.
2. Design Pressure: 150 psi. Maximum Design Temperature: 200°°F.
3. Joints: Solder with 100% lead-free solder and flux ASTM B32.
4. Fittings: Wrought copper solder joint, ANSI B16.22.

D. Copper Pipe; Type K; Mechanical Press Connection:

1. Pipe: Type K annealed copper tube, ASTM B88.
2. Design Pressure: 150 psi. Maximum Design Temperature: 200°°F.
3. Joints: Mechanical press connection.
4. Fittings: Copper, ANSI B-16.22, with embedded EPDM O-ring, NSF-61.
5. Fitting Identification: Press ends shall provide the ability to identify an unpressed fitting from the floor prior to testing. The function of this feature is to provide the installer quick and easy identification of connections that have not been pressed prior to putting the system into operation.
6. Special Requirements: Mechanical press fitting manufacturer shall provide contractor training prior to installation.
7. Manufacturers:

    a. Viega ProPress
    b. Elkhart Xpress
    c. Nibco Press System Fittings and Valves
    d. Merit Brass
    e. Mueller Streamline PRS.

E. Copper Pipe: Type DWV; Solder Joints:

1. Pipe: Type DWV hard temper seamless copper drainage tube, ASTM B306.
2. Design Pressure: Gravity Maximum Design Temperature: 180°°F
3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.
4. Fittings: Cast brass solder joint drainage type, ANSI B16.23 or wrought copper solder joint drainage type, ANSI B16.29.

F. Copper Pipe: Type M; Solder Joints:

1. Pipe: Type M hard temper seamless copper drainage tube, ASTM B306.
2. Design Pressure: Gravity Maximum Design Temperature: 180°°F
3. Joints: Solder with 100% lead-free solder and flux, ASTM B32.

4. Fittings: Cast brass solder joint drainage type, ANSI B16.23 or wrought copper solder joint drainage type, ANSI B16.29.

**2.03 DUCTILE IRON PIPE**

A. Ductile Iron Pipe; Pressure Water Pipe; Push-On Joints - Pressure Pipe:

1. Pipe: Ductile iron pressure water pipe, ANSI/AWWA C151/A21.51, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4.
2. Design Pressure: 200 psi. Maximum Design Temperature: 150°°F.
3. Fittings: Ductile iron, ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4, push-on joints.
4. Joint: Push-on joint with rubber gasket, ANSI/AWWA C111/A21.11.

B. Ductile Iron Pipe; Pressure Water Pipe; Mechanical Joints:

1. Pipe: Ductile iron pressure water pipe, ANSI/AWWA C151/A21.51, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4.
2. Design Pressure: 200 psi. Maximum Design Temperature: 150°°F.
3. Fittings: Ductile iron, ANSI/AWWA C110/A21.10, or ANSI/AWWA C153/A21.53, 200 psi pressure class, cement-mortar lined per ANSI/AWWA C104/A21.4, mechanical joints.
4. Joint: Mechanical joint with glands and gaskets and steel bolts. ANSI/AWWAC111/A21.11.

**2.04 PLASTIC PIPE**

A. Cross-Linked Polyethylene (PEX); Cold Expansion Joint:

1. Tubing: Cross-linked polyethylene (PEX-b), SDR-9, ASTM F876, NSF Certified
2. Design Pressure/Temperature: 100 psig at 180°°F.
3. Joints: Bending the tubing greater than eight (8) times the outside diameter shall be permitted. Bends less than eight (8) times the outside diameter shall be barbed insertion fittings provided by the manufacturer.
4. Fittings: Cold expansion joint compatible with engineered polymerlead-free brass construction. System shall conform to ASTM F1960.
5. Limitations: Shall not be used in a return air plenum unless specifically listed to ASTM E84/UL723.
6. Virgin Rigid Chlorinated Polyvinyl Chloride (CPVC); SDR-11; Solvent Weld Joints:
7. Tubing: Virgin rigid chlorinated polyvinyl chloride (CPVC). Copper tube size (CTS) manufactured to standard dimensional ratio (SDR) 11, ASTM D1784: ASTM D2846, NSF Certified.
8. Joints: Solvent cement, ASTM F493
9. Fittings: Same as tubing. Fittings and tubing shall be a system provided by the same manufacturer. Threaded adapters for threaded valves shall be metal threaded adapter with solvent socket.
10. Limitations: Shall not be used in a return air plenum unless specifically listed to ASTM E84/UL723.
11. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 22 05 16 for expansion joint requirements.

B. Virgin Rigid Chlorinated Polyvinyl Chloride (CPVC) ;Schedule 80; Solvent Weld Joints:

1. Tubing: Virgin rigid chlorinated polyvinyl chloride (CPVC). Iron Pipe Size (IPS) Schedule 80 with a cell class of 23447-B, ASTM D1784, NSF Certified.

2. Design Pressure/Temperature: 100 psig at 180°°F for 2-1/2" pipe, 185 psig at 140°°F for 3" pipe, 160 psig at 140°°F for 4" pipe, 140 psig at 140°°F for 6" pipe, 125 psig at 140°°F for 8" pipe.
3. Joints: Solvent cement, ASTM F493.
4. Fittings: Same as tubing. Fittings and tubing shall be a system provided by the same manufacturer.
5. Limitations: Shall not be used in a return air plenum unless specifically listed to ASTM E84/UL723.
6. Special Requirements: Provide expansion loop(s) and/or Schedule 80 expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 22 05 16 for expansion joint requirements.

C. Virgin Rigid Chlorinated Polyvinyl Chloride (CPVC), Type 1 D1784; Grooved Mechanical Joint

1. Pipe: Virgin rigid chlorinated polyvinyl chloride (CPVC). Iron Pipe Size (IPS) Schedule 80 with a cell class of 23447-B, ASTM D1784, NSF Certified. Cut grooved with single pass, pipe mounted cut groover in accordance with coupling manufacturer¢¢s standards.
2. Design Pressure/Temperature: 100 psig (690 kPa gauge) at 180°F (82°C) for 2-1/2" pipe, 185 psig at 140°F for 3" pipe, 160 psig at 140°F for 4" pipe, 140 psig at 140°F for 6" pipe, 125 psig at 140°F for 8" pipe.
3. Couplings for CPVC / PVC Pipe: Consisting of two orange enamel coated ductile iron housings conforming to ASTM A 536, Grade 65-45-12 cast with housing keys to join cut grooved components, zinc-electroplated steel bolts and nuts conforming to ASTM A449 and ASTM A563/A563M, with Grade P fluoroelastomer center-leg gasket, NSF-61 for potable water services. Installation ready coupling for direct stab installation without field disassembly. Design Basis: Victaulic Style 357 and Style 356 transition coupling.
4. Fittings: CPVC/PVC fittings meet the requirements of ASTM F439, modified for grooved ends. Fittings are supplied either directly molded to size with integral groove profile or are fabricated from socket fittings with factory solvent cemented grooved tangents. Classified in accordance with NSF-PW SE for potable water service.

D. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints:

1. Pipe: Schedule 40 rigid, PVC-DWV, or ABS-DWV, normal impact Type I, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.
2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
3. Fittings: PVC-DWV, or ABS-DWV, normal impact Type I, with solvent-weld socket type ends for Schedule 40 pipe.
4. Limits: Schedule 40 PVC-DWV, or ABS-DWV pipe must not be threaded. Do not use where exposed or in return air plenums.
5. Use: Use PVC or ABS only where allowed by local jurisdiction. Comply with all special requirements or limitations.
6. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 22 05 16 for expansion joint requirements.

E. Polypropylene (fire retardant); Schedule 40 Drainage; Electrically Fused Joints:

1. Pipe: Fire retardant polypropylene Schedule 40 drainage pipe.
2. Joints:

    a. Join pipe and fittings with electrically fused joints. Make fittings between dissimilar materials with adapters furnished by the polypropylene pipe manufacturer.
    b. Above Floor Only: Mechanical joint with gasket, stainless steel outer sleeve and corrosion resistant nuts and bolts or threaded fittings with gasket and compression nuts.

3. Fittings: Fire retardant polypropylene DWV pattern with socket ends for electrically fused joints. Pipe and fittings shall be a system provided by the same manufacturer.
4. Limitations: For use in non-return air plenums.
5. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 22 05 16 for expansion joint requirements.

F. Polypropylene (non-fire retardant); Schedule 40 Drainage; Electrically Fused Joints:

1. Pipe: Non-fire retardant polypropylene Schedule 40 drainage pipe.
2. Joints: Join pipe and fittings with electrically fused joints. Make fittings between dissimilar materials with adapters furnished by the polypropylene pipe manufacturer.
3. Fittings: Non-fire retardant polypropylene DWV pattern with socket ends for electrically fused joints. Pipe and fittings shall be a system provided by the same manufacturer.
4. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 22 05 16 for expansion joint requirements.

G. Polyvinylidene Fluoride (PVDF); Schedule 40 Drainage; Electrically Fused Joints:

1. Pipe: Polyvinylidene fluoride (PVDF) Schedule 40 drainage pipe, ASTM E-84, UL 723.
2. Joints:

    a. Join pipe and fittings with electrically fused joints. Make fittings between dissimilar materials with adapters furnished by the polypropylene pipe manufacturer.
    b. Above Floor Only: Mechanical joint with gasket, stainless steel outer sleeve and corrosion resistant nuts and bolts or threaded fittings with gasket and compression nuts.

3. Fittings: Polyvinylidene fluoride (PVDF) DWV pattern with socket ends for electrically fused joints. Pipe and fittings shall be a system provided by the same manufacturer.
4. Limitations: Allowed for use in return air plenums.
5. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 22 05 16 for expansion joint requirements.

H. Chlorinated Polyvinyl Chloride (CPVC); Schedule 40 Drainage; Solvent Weld Joints:

1. Pipe: Chlorinated polyvinyl chloride (CPVC) Schedule 40 drainage pipe, ASTM F1412, NSF Listed.
2. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer, ASTM F493.
3. Fittings: Chlorinated polyvinyl chloride (CPVC) DWV pattern with socket ends for Schedule 40 pipe.
4. Limitations: CPVC shall not be used in a return air plenum unless it is specifically listed to ASTM E84 and/or UL723. CAN ULC S102.2 listing is not acceptable.
5. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 22 05 16 for expansion joint requirements.

I. Polypropylene Piping:

1. Design Pressure 150 psi at 180°°F

2. Polypropylene; SDR 7.3; Socket or Electrofusion:

    a. Pipe: Multilayer extruded PP-RCT polypropylene with fiberglass layer; SDR 7.3. ASTM F2389.7.3. Shall comply with NSF/ANSI 14, CSA B137.11 and NSF/ANSI 61 for transport of drinking water.
    b. Joints: Polypropylene socket fused or electrofusion.
    c. Fittings: Polypropylene PP-RCT; PP-RCT/brass (for connection to brass or bronze valves).
    d. Limitations: Shall not be used in a plenum unless listed ä? 25/50 per ASTM E84/UL723.

3. Manufacturers:

    a. Niron FG Clima
    b. Aquatherm MF

J. Polypropylene; SDR 11 Pressure; Fusion Weld:

1. Pipe: Polypropylene SDR 11 (150 psig) SDR 17.6 (90 psig) SDR 32.5 (45 psig), ASTM D4101
2. Design Pressure/Temperature: 45 psig 90 psig 150 psig at 68°°F
3. Joints:

    a. Pressure fittings 1/2" through 4" shall be socket fusion type.
    b. Drainage pattern fittings, and pressure fittings 2" and larger shall be butt fusion welded per ASTM D2657.
    c. Pipe and fittings shall be a system provided by the same manufacturer.

4. Limitations: Not for use in return air plenums.
5. Special Requirements: Provide expansion loop(s) and/or expansion joints in the piping system per the manufacturer's guidelines and as shown on the drawings. Refer to Section 22 05 16 for expansion joint requirements.
6. Manufacturer:

    a. Simtech
    b. Approved equal

K. Polyvinylidene Fluoride (PVDF); SDR 7.4; Fusion Weld:

1. Pipe: Polyvinylidene fluoride (PVDF) SDR 7.4 (232 psig) SDR 11 (150 psig), ASTM D3222.
2. Design Pressure/Temperature - 150 psig 232 psig at 73°°F
3. Joints:

    a. Pressure fittings 3/8" through 1-1/2" shall be socket fusion type.
    b. Drainage pattern fittings, and pressure fittings 2" and larger shall be butt fusion welded per ASTM D2657-87.
    c. Pipe and fittings shall be a system provided by the same manufacturer.

4. Limitations: Not for use in return air plenums.
5. Manufacturer:

    a. Simtech
    b. Approved equal

## 2.05 VALVES

A. Shutoff Valves:

1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
2. Butterfly Valves:

a. BF-1:

1) 2-1/2" thru 6", 175 psi CWP, elastomers rated for 20°°F to 250°°F at 125 psig, fully lugged end, ductile or cast iron body (not in contact with fluid); bronze, aluminum-bronze or stainless steel disc; EPDM seat, stainless steel stem, extended neck, 175 psi bubble-tight, bi-directional dead-end shutoff without backing flange or nuts and with cap screws extending to centerline of valve body (for pipe extension without draining system), 10 position locking operator up to 6" size. Cv of at least 1580 in 6" size. Center Line Series 200, Keystone #222, Watts #DBF-03-121-1P, Stockham LD712-B&3-E, Nibco LD2000N Series, Milwaukee CL series, Hammond 5200 series.

3. Ball Valves:

a. BA-1: 3" and under, 150 psi saturated steam, 600 psi CWP, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals. Apollo #77C-140, Stockham #S-255-FB-P-UL, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB.

1) Provide solid extended shaft for all insulated piping.
2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°°F, heating water piping over 120°°F, steam, condensate, boiler feed water piping, and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

b. BA-1A: 2-1/2" and 3", 150 psi saturated steam, 275 psi CWP ANSI Class, 150 psi standard port, carbon steel body stainless steel ball and trim, Teflon seats and seals. Apollo #88A-100, Stockham #3951-CS-R-66-LL, Nibco #F510-CS/66, Milwaukee #F90.

1) Provide extended shaft for all valves in insulated piping.
2) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°°F, heating water piping over 120°°F, steam, condensate, boiler feed water piping, and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim.

B. Throttling Valves

1. Globe Valves:

a. GL-1: 2" and under, 150# saturated steam, 300# CWP, screwed, bronze. Crane #7TF, Stockham #B22T, Walworth #3095, Milwaukee #590, Hammond #IB413T, Watts #B-4010-T, Nibco T-235Y.

b. GL-2: 2-1/2" thru 10", 125# steam @ 353°°F, 200# CWP @ 150°°F, flanged, iron body, bronze mounted. Crane #351, Hammond #IR116, Stockham #G-512, Walworth #8906F, Milwaukee #F2981, Watts #F-501, Nibco F-718B.

2. Plug Valves:

a. PL-1: 2" and under, 125# steam @ 450°°F, 175# CWP @ 180°°F, cast iron body, screwed, full port. Walworth #1700, DeZurik #425, S-RS49.
b. PL-2: 2-1/2" thru 4", 125# steam @ 450°°F, 175# CWP @ 180°°F, flanged, cast iron body, full port. Walworth #1700F, DeZurik #425, F-RS49.

**2.06 STRAINERS**

A. For pipe systems where mechanical press connections are allowed, strainers with mechanical press connections are acceptable subject to the requirements in the paragraphs below.

B. ST-1: Bronze body, screwed ends, screwed cover, 150 psi S @ 350°°F, 200 psi CWP @ 150°°F. Armstrong #F4SC, Metraflex #TS, Mueller Steam Specialty Co. #351, Sarco #BT, Watts #777.

**2.07 CHECK VALVES**

A. For pipe systems where mechanical press connections are allowed, check valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.

B. CK-1: 2" and under, 125# steam @ 406°°F, 200# CWP @ 150°°F, screwed, bronze, horizontal swing. Crane #37, Hammond #IB904, Stockham #B319-Y, Walworth #3406, Milwaukee #509, Watts #G-5000, Nibco T-413B.

C. CK-6: 2-1/2" thru 12", 125# steam @ 450°°F, 200# CWP @ 150°°F, flanged, all iron, horizontal swing. Crane #373-1/2, Hammond #IR1126, Stockham #G933, Walworth #8928-1/2F, Milwaukee #F-2971, Watts #F-511-R, Nibco F-918N.

D. CK-13: 2-1/2" thru 12", 200# CWP, double disc wafer type, iron body, bronze or aluminum-bronze discs, 316SS shaft and spring, Viton, EPDM or BUNA-N, Cv of at least 700 in 6" size. Mueller Steam Specialty Co. #71-AHB-6-H, Stockham #WG-961 EPDM or #WG-970 BUNA, NIBCO W-920-W, Crane.

**2.08 LOCK OUT TRIM**

A. Provide lock out trim for all quarter turn shutoff valves opening to atmosphere and installed in domestic water piping over 120°°F and as indicated on the drawings.

**2.09 VALVE OPERATORS**

A. Provide handwheels for gate valves and gear operators for butterfly valves.

**2.10 VALVE CONNECTIONS**

A. Provide all connections to match pipe joints. Valves shall be same size as pipe unless noted otherwise.

## 2.11 CONNECTIONS BETWEEN DISSIMILAR METALS

A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.

B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.

C. Aluminum, iron, steel, brass, copper, bronze, galvanized steel and stainless steel are commonly used and require isolation from each other with the following exceptions:

1. Iron and steel connected to each other.
2. Brass, copper, and bronze connected to each other.
3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.

D. Dielectric protection is required at connections to equipment of a material different than the piping.

E. Screwed and/or Grooved Joints (acceptable up to 4" size):

1. Dielectric waterway rated for 300 psi CWP and 225°F.
2. Optional: Copper-silicon casting conforming to UNS C87850 with grooved and/or threaded ends.
3. UL classified in accordance with ANSI / NSF-61 for potable water service.
4. Manufacturers:

    a. Elster Group ClearFlow fittings
    b. Victaulic Series 647
    c. Matco-Norca

# PART 3 - EXECUTION

## 3.01 PREPARATION

A. Install all products per manufacturer's recommendations.

B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

C. Remove scale and dirt, on inside and outside, before assembly.

D. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.

E. Connect to equipment with flanges or unions. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

F. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.

G. Roof Penetration (Vent) Flashing:

1. Built-up Roofing: Flash vents with 3# seamless sheet lead of sufficient size to extend 15" into roofing felts for built-up roofs.

**3.02 SYSTEM, PIPING AND VALVE SCHEDULE**

A. Cold Water, Hot Water, Tempered Water - Potable and Non-Potable (Above Ground):

1. Copper Pipe; Type L; Solder Joints: All Sizes
2. Copper Pipe; Type L; Mechanical Press Connection: 4" and Under
3. Shutoff Valves: BF-1, BA-1
4. Throttling Valves: GL-1, GL-2
5. Check Valves: CK-1
6. Strainers: ST-1

B. Cold Water, Hot Water, Tempered Water - Potable and Non-Potable (Underground):

1. Cross-Linked Polyethylene (PEX); Cold Expansion Joint: 3" and Under

C. Sanitary Waste and Vent, Gravity (Above Ground):

1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
3. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes

D. Sanitary Indirect Drainage (Above Ground):

1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
3. Copper Pipe: Type DWV; Solder Joints: 1-1/4" to 4"
4. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes

E. Storm Drainage, Gravity (Above Ground):

1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
3. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes

F. Sanitary Waste and Vent, Gravity (Underground - Inside Building):

1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"

G. Storm Drainage, Gravity (Underground - Inside Building):

1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"

H. Sanitary Waste and Vent, Gravity (Underground - Outside Building):

1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"

I. Storm Drainage, Gravity (Underground - Outside Building):

1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"

J. Sanitary Waste - Pumped (Underground - Outside Building)

1. Ductile Iron Pipe; Pressure Water Pipe; Push-On Joints - Pressure Pipe: All Sizes
2. Ductile Iron Pipe; Pressure Water Pipe; Mechanical Joints: All Sizes

K. Sanitary Waste - Pumped (Above Ground - Inside Building):

1. Copper Pipe; Type K; Solder Joints: All Sizes
2. Shutoff Valves:, BA-1A
3. Check Valves:, CK-13

L. Condensate/Equipment Drainage:

1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
3. Copper Pipe: Type DWV; Solder Joints: 1-1/4" to 4"
4. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes

**3.03 TESTING PIPING**

A. Sanitary Drainage, Sanitary Vent, Storm Drainage:

1. Test all piping with water to prove tight.
2. Test piping before insulation is applied.
3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
5. A smoke/air test at the same pressure may be used in lieu of the hydrostatic water test. Exception: Smoke/air test shall not be performed on plastic piping.
6. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
7. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.

B. Hot Water - Potable and Non-Potable, Cold Water - Potable and Non-Potable, Tempered Water - Potable and Non-Potable, Service Water:

1. Test pipes underground or in chases and walls before piping is concealed.
2. Test all pipes before the insulation is applied. If insulation is applied before the pipe is tested and a leak develops which ruins the insulation, replace damaged insulation.
3. Test the pipe with 100 psig water pressure or equal inert gas such as nitrogen. Exception: Inert gas test shall not be used to test plastic piping.
4. Hold test pressure for at least 2 hours.
5. Test to be witnessed by the Architect/Engineer's representative, if requested by the Architect/Engineer.

C. All Other Piping:

1. Test piping at 150% of normal operating pressure.
2. Piping shall hold this pressure for one hour with no drop in pressure.
3. Test piping using water, nitrogen, or air as compatible with the final service of the pipe. Do not use combustible fluids.
4. Drain and clean all piping after testing is complete.

**3.04 CLEANING PIPING**

A. Assembly:

1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.

B. Air Blow:

1. Blow out pipe and components with clean compressed air. Instrument air, argon, nitrogen and sulfuric acid lines shall be blown out with dry, oil free air or nitrogen gas. "Oil Free" is defined as air compressed in a centrifugal, Teflon ring, carbon ring or water pumped air compressor. Where air supply is judged to be inadequate to continually attain cleaning velocity, alternate pressurization and sudden relief procedure may be used until discharge at all blow out points is clean. Use 80-90 psig pressure unless otherwise indicated.
2. Air blow applies to the following systems:

    a. Acetylene
    b. Carbon Dioxide
    c. Nitrogen (use oil free air or nitrogen gas)
    d. Argon (use oil free air or nitrogen gas)
    e. Instrument Air (use oil free air or nitrogen gas)
    f. Distilled Water (use maximum of 50 psig pressure)
    g. Chemical Feed
    h. Air Compressor Intakes
    i. Sulfuric Acid (use oil free air or nitrogen gas)

C. All Water Piping:

1. Flush all piping using faucets, flush valves, etc. until the flow is clean.
2. After flushing, thoroughly clean all inlet strainers, aerators, and other such devices.
3. If necessary, remove valves to clean out all foreign material.

## 3.05 INSTALLATION

A. General Installation Requirements:

1. Provide dielectric connections between dissimilar metals.
2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
3. Group piping whenever practical at common elevations.
4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
5. Slope water piping and arrange to drain at low points.
6. Install bell and spigot piping with bells upstream.
7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
8. Seal pipes passing through exterior walls with a wall seal per Section 22 05 29. Provide Schedule 40 galvanized sleeve at least 2 pipe sizes larger than the pipe.
9. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.
10. All vertical pipe drops to sinks or other equipment installed below the ceiling shall be routed within a wall cavity, unless specifically noted otherwise to be surface mounted. For renovation projects, this Contractor is responsible for opening and patching existing walls for installation of piping. Wall patching shall match existing condition.

B. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

C. Valves/Fittings and Accessories:

1. Install shutoff valves that permit the isolation of equipment/fixtures in each room without isolating any other room or portion of the building. Individual fixture angle stops do not meet this requirement. Exception: Back-to-back rooms in no more than two adjacent rooms.
2. Provide clearance for installation of insulation and access to valves and fittings.
3. Provide access doors for concealed valves and fittings.
4. Install valve stems upright or horizontal, not inverted.
5. Provide one plug valve wrench for every ten plug valves 2" and smaller, minimum of one. Provide each plug valve 2-1/2" and larger with a wrench with set screw.
6. Install corrugated, stainless steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

D. Underground Piping:

1. Install buried water piping outside the building with at least 5 feet of cover. Refer to Section 22 05 00 for Excavation, Fill, Backfill and Compaction requirements
2. Direct buried, uninsulated steel pipe shall have a factory applied external protective coating consisting of two coats with an intermediate layer of 18 mil fibrous glass mat. Coating thickness shall total not less than 3/32". The outer coating shall be further protected by a wrapping of heavy Kraft paper. This external protection shall extend and be exposed for a minimum of 1 foot beyond the buried or concealed portion of the pipe.

    a. Manufacturers:

        1) Pipe Line Service Co., Franklin Park, Illinois

2) Lithcote Corp., Melrose Park, Illinois

3. As an option, the Contractor may provide factory applied protective coatings consisting of a polyethylene plastic film bonded to the pipe surface by a hot applied thermo-plastic adhesive.

a. Manufacturers:

1) Republic Steel Corp. "X-Tru-Coat"

4. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.
5. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
6. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.
7. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.

E. Sanitary and Storm Piping:

1. Install all sanitary and storm piping inside the building with a slope as shown on the drawings.
2. Install horizontal offset at all connections to roof drains to allow for pipe expansion.
3. Slope sanitary and storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 2 feet per second.
4. Sway Bracing: Where horizontal sanitary and/or storm pipes 4 inches and larger change flow direction greater than 45°, rigid bracing or thrust restraints shall be installed to resist movement of the upstream pipe in the direction of pipe flow. The rigid bracing or thrust restraint shall be connected to structure. A change of flow direction from horizontal into a vertical pipe does not require the upstream pipe to be braced.
5. All sanitary and storm piping shall have at least 42" of cover when leaving the building.
6. Starter fittings with internal baffles are not permitted.

## 3.06 PIPE ERECTION AND LAYING

A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.

B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.

C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.

D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.

E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.

F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.

G. Provide flanges or unions at all final connections to equipment, traps and valves.

H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.

I. Use full and double lengths of pipe wherever possible.

J. Unless otherwise indicated, install all piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or equipment.

K. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.

L. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Refer to Section 22 05 00 for Excavation, Fill, Backfill and Compaction requirements.

M. Unless otherwise indicated, branch take-offs shall be from top of mains or headers at either a 45° or 90° angle from the horizontal plane for air lines, and from top, bottom or side for liquids.

## 3.07 DRAINING AND VENTING

A. Unless otherwise indicated on the drawings, all horizontal water lines, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate and venting.

B. Maintain accurate grade where pipes pitch or slope for venting and drainage. No pipes shall have pockets due to changes in elevation.

C. Provide drain valves at all low points of water piping systems for complete or sectionalized draining.

D. Use eccentric reducing fittings on horizontal runs when changing size of pipes for proper drainage and venting. Install gravity drain pipes with bottom of pipe and eccentric reducers in a continuous line; all other liquid lines with top of pipe and eccentric reducers in a continuous line.

E. Provide air vents at high points and wherever else required to eliminate air in all water piping systems.

F. Install air vents in accessible locations. If necessary to trap and vent air in a remote location, install an 1/8" pipe from the tapping location to an accessible location and terminate with a venting device.

G. All vent and drain piping shall be of same materials and construction for the service involved.

## 3.08 PLUMBING VENTS

A. Vent as shown on the drawings and in accordance with all codes having jurisdiction.

B. Extend the high side of the soil and waste stacks at least 12" above roof.

C. In no case shall the vent through the roof be less than 4" in diameter.

D. Vent pipes through the roof shall be located a minimum of 15 feet from any air intake opening on the roof.

**3.09 BRANCH CONNECTIONS**

A. For domestic water and vent systems only, make branch connections with standard tee or cross fittings of the type required for the service.

B. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.

C. Do not use double wye or double combination wye and eighth bend DWV fittings in horizontal piping.

D. Branch connections from the headers and mains may be mechanically formed using an extraction device. The branch piping connection shall be brazed connection for the following services only:

1. Domestic water piping above ground.

E. Further limit use of mechanically formed fittings as follows:

1. Must have at least same pressure rating as the main.
2. Main must be Type K or L copper tubing.
3. Permanent marking shall indicate insertion depth and orientation.
4. Branch pipe shall conform to the inner curve of the piping main.
5. Main must be 1" or larger.
6. Branch must be 3/4" or larger.

F. Forged weld-on fittings are limited as follows:

1. Must have at least same pressure rating as the main.
2. Main must be 2-1/2" or larger.
3. Branch line is at least two pipe sizes under main size.

**3.10 JOINING OF PIPE**

A. Solder Joints (Copper Pipe):

1. Make up joints with 100% lead-free solder, ASTM B32. Cut tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to soldering. Apply flux evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly so solder will flow to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.
2. Flux shall be non-acid type.
3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°°F melting point solder. Remove discs and seals during soldering if they are not suitable for 470°°F.

B. Brazed Joints (Copper Pipe):

1. Make up joints with silver alloy brazing filler metal conforming to ASTM B260 "Brazing Filler Metal" BAg-1 or BAg-2. Cut copper tubing so ends are perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt and grease just prior to brazing. Apply non-corrosive flux of the type recommended by filler alloy manufacturer, evenly, but sparingly, over all surfaces to be joined. Heat joints uniformly using oxygen-acetylene torch with tip size recommended by fitting manufacturer. Wipe and brush joint clean after alloy has set.
2. Remove discs from solder end valves during brazing.

C. Mechanical Press Connection (Copper and Stainless Steel Pipe):

1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
2. Fully insert tubing into the fitting and mark tubing.
3. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
4. Joint shall be pressed with a tool approved by the manufacturer.
5. Installers shall be trained by manufacturer personnel or representative. Provide documentation upon request.

D. Hub and Spigot Joints - Sanitary Pipe and Storm Pipe (Cast Iron and Stainless Steel Pipe):

1. Lead and Oakum Joints: Pack joint with oakum made of vegetable fiber, cotton, or hemp. Pour joint with molten lead up to top of hub. Ensure leak-free joints by working joint with inside and outside caulking irons.
2. Compression Gasket Joints: Joint shall be one-piece double seal compression type gasket made specifically for joining cast iron soil pipe. Gasket shall be neoprene, permitting joint to flex as much as 5 degrees without loss of seal. Gasket shall be extra heavy weight class, conforming to ASTM C-564.

E. Solvent Weld Joints (PVC):

1. Make joints with a two-step process. Use primer conforming to ASTM F656 and solvent cement conforming to ASTM D2564.

F. Solvent Weld Joints (CPVC):

1. Make joints with a one-step process. Use CPVC cement conforming to ASTM F493. A primer is not required.
2. If a primer is required by the Authority Having Jurisdiction, then a primer conforming to ASTM F656 shall be used.

G. Cold Expansion Joint (PEX):

1. Cold expansion joints shall be made in accordance with manufacturer's installation instructions.
2. All installers shall undergo training provided by the manufacturer or manufacturer's representative.

H. No-Hub Sleeve Gaskets (No-Hub) (Cast Iron Pipe):

1. Gasket shall be heavy weight class, conforming to ASTM C564.
2. The gasket shall have an internal center stop.

3. The gasket shall be covered by a stainless steel band secured with a minimum of four stainless steel bands per fitting/joint.
4. Sleeve gaskets shall be installed in accordance with the manufacturer's installation instructions.

## 3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfection of the domestic water piping shall be completed within three (3) weeks prior to building occupancy. Contractor is responsible for disinfecting water piping if used by workers during construction; disinfection during construction does not eliminate the requirement for final disinfection prior to occupancy. Flushing of piping shall be completed within two (2) weeks prior to building occupancy.

B. Provide necessary connections at the start of individual sections of mains for adding chlorine.

C. Before starting work, verify system is complete, flushed and clean.

D. Follow the disinfection of potable water procedure outlined in this project's applicable plumbing code. For example: IPC 610.1, UPC 609.10, CPC 609.9, and Illinois 890.1180. Where local codes do not outline a disinfection procedure, follow the International Plumbing Code procedure 610.1.

E. Bleed water from all outlets to ensure chlorine distribution throughout the entire domestic water system.

F. Take water samples, no sooner than 24 hours after flushing, from 2% of outlets and from water entry. Obtain, analyze, and test samples in accordance with AWWA C651, Section 5 - Verification.

## 3.12 SERVICE CONNECTIONS

A. Provide new sanitary and/or storm sewer services. Before commencing work check invert elevations needed for sewer connections, confirm inverts and verify these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service with water meter with bypass valves. Provide sleeve in wall for service main per Section 22 05 29.

**END OF SECTION**

# SECTION 22 30 00
# PLUMBING EQUIPMENT

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Water Heaters.

### 1.02 QUALITY ASSURANCE

A. Products and installation of specified products shall conform to recommendations and requirements of the following organizations:

1. National Sanitation Foundation (NSF).
2. American Society of Mechanical Engineers (ASME).
3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
4. National Electrical Manufacturers' Association (NEMA).
5. Underwriters' Laboratories (UL).

B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR, ANSI Z21.10.1 and ANSI Z21.10.3.

C. Conform to ASME Section VIII for construction of water heaters and heat exchangers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

### 1.03 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ANSI/ASME Section 8D - Pressure Vessels.

C. ANSI/NFPA 70 - National Electrical Code.

D. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.

E. ASSE 1005 - Water Heater Drain Valves, 3/4" Iron Pipe Size.

F. UL 174 - Household Electric Storage Tank Water Heaters.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

### 1.05 REGULATORY REQUIREMENTS

A. Water heaters shall conform to AGA, ANSI/NFPA 54, ANSI/NFPA 70, ANSI/UL 1453 as applicable.

B. Conform to ANSI/ASME Section 8 Division 1 for fabrication of steel pressure vessels.

C. Conform to ANSI/ASME Section 10 for manufacture of fiber-reinforced plastic pressure vessels.

## PART 2 - PRODUCTS

### 2.01 WATER HEATERS

A. All water heaters shall be as scheduled on the drawings.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Install all items in accordance with manufacturer's instructions.

### 3.02 WATER HEATER INSTALLATION

A. Install water heaters level and plumb, according to drawings, manufacturer's instructions, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

B. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend drain piping full size from relief valve and discharge by positive air gap onto closest floor drain. Discharge pipe material shall be same as domestic water piping.

**END OF SECTION**

# SECTION 23 05 00
# BASIC HVAC REQUIREMENTS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Requirements applicable to all Division 23 Sections. Also refer to Division 01 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

### 1.02 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.

C. Scope of Work:

1. Plumbing Work: Refer to Section 22 05 00 "Basic Plumbing Requirements".
2. Heating Work shall include, but is not necessarily limited to:

    a. Furnish and install complete heating water system including pumps, piping, insulation, air control equipment, terminal heating equipment, and specialties. Make final connections to all coils, including those furnished by others.
    b. Furnish and install complete chilled water system including pumps, piping, insulation, air control equipment, terminal cooling equipment, and specialties. Make final connections to all coils, including those furnished by others.
    c. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
    d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
    e. Complete all applicable tests, certifications, forms, and matrices.

3. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:

    a. Furnish and install built-up air handling units complete with louvers, dampers, filters, coils, fans, motors, housing, and vibration isolation.
    b. Furnish and install rooftop air handling units complete with curbs.
    c. Furnish and install air-cooled condensing units and curbs.
    d. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
    e. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
    f. Furnish and install all terminal air boxes and reheat coils.
    g. Furnish and install combustion air louver, damper, and ductwork.
    h. Furnish and install complete fume hood exhaust systems including fans, ductwork, and fittings.

i. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
j. Furnish and install mechanical room ventilation systems including louvers, ductwork, insulation, and fans.
k. Furnish and install all temperature control systems.
l. Furnish and install all fire dampers.
m. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
n. Complete all applicable tests, certifications, forms, and matrices.

4. Temperature Control Work shall include, but is not necessarily limited to:

a. Furnish and install a complete temperature control system as specified in Section 23 09 00.
b. Temperature control system shall consist of a full Direct Digital Control (DDC) system including all accessories, sensors, and programming.
c. Furnish automatic control valves and dampers for installation by others.
d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.

5. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:

a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, hydronic systems, plumbing systems, and verification of control systems.
b. Complete all applicable tests, certifications, forms, and matrices

**1.03 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS**

A. Definitions:

1. "Mechanical Contractors" refers to the following:

a. Plumbing Contractor.
b. Heating Contractor.
c. Air Conditioning and Ventilating Contractor.
d. Temperature Control Contractor.
e. Fire Protection Contractor.
f. Testing, Adjusting, and Balancing Contractor.

2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.

5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.

    a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

| Distribution/Nominal Voltage | Utilization Voltage |
|---|---|
| 120 | 115 |
| 208 | 200 |
| 240 | 230 |
| 277 | 265 |
| 480 | 460 |

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:

    a. Light fixtures.
    b. Gravity flow piping, including steam and condensate.
    c. Electrical busduct.
    d. Sheet metal.
    e. Electrical cable trays, including access space.
    f. Sprinkler piping and other piping.

g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:

   a. Chillers.
   b. Computer Room Air Conditioning Units.
   c. Condensing Units.
   d. Makeup Air Units.
   e. Package Air Handling Units.

2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. Temperature Control Contractor's Responsibility:

   a. Wiring of all devices needed to make the Temperature Control System functional.
   b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor.
   c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

## 1.04 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" (40 mm) and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" (40 mm) and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1'-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.

b. Potential layout changes shall be made to avoid additional access panels.
c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

**1.05 QUALITY ASSURANCE**

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the Local and state Codes, Laws, Ordinances and other regulations having jurisdiction.
2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
3. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
4. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.

6. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the mechanical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.

    a. Any item listed as furnished shall also be installed, unless otherwise noted.
    b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.

2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

## 1.06 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

| Referenced Specification Section | Submittal Item |
|---|---|
| 23 05 00 | Owner Training Agenda |
| 23 05 13 | Motors |
| 23 05 29 | Hangers and Supports |
| 23 05 29 | Prefabricated Curbs |
| 23 05 48 | Vibration Isolation Equipment |
| 23 05 53 | HVAC Identification |
| 23 05 93 | Testing, Adjusting, and Balancing |
| 23 07 13 | Duct Insulation |
| 23 07 16 | HVAC Equipment Insulation |
| 23 07 19 | HVAC Pipe Insulation |
| 23 09 00 | Controls |
| 23 21 00 | Hydronic Piping Systems and Valves |
| 23 21 23 | HVAC Pumps |
| 23 23 00 | Refrigeration Piping and Specialties |
| 23 25 00 | Chemical Treatment Systems |
| 23 31 00 | Ductwork |
| 23 31 00 | Ductwork Layout Drawings |
| 23 31 00 | Duct Specialties (such as Turning Vanes) |
| 23 33 00 | Fire Dampers |
| 23 34 13.13 | Mixed Flow Laboratory Exhaust Fans |
| 23 34 23 | Power Ventilators |
| 23 34 23 | Prefabricated Curbs |
| 23 36 00 | Terminal Air Boxes |
| 23 37 00 | Grilles, Registers, and Diffusers |
| 23 37 00 | Louvers |
| 23 40 00 | Filters and Filter Systems |
| 23 51 00 | Prefabricated Stacks |

| | |
|---|---|
| 23 62 13 | Air Cooled Condensing Units |
| 23 63 13 | Condensers |
| 23 64 26.13 | Air Cooled Rotary-Screw Water Chillers |
| 23 73 13 | Non-ERV Indoor and Outdoor Climate Changer |
| 23 73 13.20 | Large AHU, DOAS, ERV Climate Change AHU-4, DOAS-1 to ERV-1 |
| 23 81 21 | Computer Room Units |
| 23 81 26 | Split System Air Conditioning Units |
| 23 82 16 | Coils |

B. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

1. Transmittal: Each transmittal shall include the following:

   a. Date
   b. Project title and number
   c. Contractor's name and address
   d. Division of work (e.g., plumbing, heating, ventilating, etc.)
   e. Description of items submitted and relevant specification number
   f. Notations of deviations from the contract documents
   g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

   a. Date
   b. Project title and number
   c. Architect/Engineer
   d. Contractor and subcontractors' names and addresses
   e. Supplier and manufacturer's names and addresses
   f. Division of work (e.g., plumbing, heating, ventilating, etc.)
   g. Description of item submitted (using project nomenclature) and relevant specification number
   h. Notations of deviations from the contract documents
   i. Other pertinent data
   j. Provide space for Contractor's review stamps

3. Composition:

   a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
   b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
   c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.
    c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
    d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.

12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions. or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 23 XX XX.description.YYYYMMDD
    b. Transmittal file name: 23 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

**1.07 EQUIPMENT SUPPLIERS' INSPECTION**

A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:

1. Air Cooled Condensers
2. Base Mounted Pumps
3. Chillers
4. Computer Room Units
5. Condensing Units
6. Air Rotation Units
7. DOAS units.

8. Air handling units.

B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

**1.08 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE**

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Keep all bearings properly lubricated and all belts properly tensioned and aligned.

C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

**1.09 NETWORK / INTERNET CONNECTED EQUIPMENT**

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

**1.10 WARRANTY**

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

### 1.11 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

### 1.12 PROJECT COMMISSIONING

A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section and provide all services as described in the Commissioning Plan.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

## 3.02 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (https://call811.com/) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6"sand bedding. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope Around Utilities to 6" Above Utilities: Place sand to a height of 6" over utilities in 6" layers. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill From 6" Above Utilities to Earthen Grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep.

4. Backfill From 6" Above Utilities to Below Slabs or Paved Area: Where the sand fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials:

    a. Sand, CA6: Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    b. Native Soil: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Native soils shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    c. Flowable Fill: Cementitious, self-leveling, self-compacting slurry as defined by the ACI with compressive strength of 50-100psi at 28 days; consisting of a mixture of fine aggregate or filler, water and cementitious materials. Filler material consist of sand, fly ash, spent foundry sand, quarry fines, baghouse dust. Cementitious materials consist of Portland cement, pozzolanic materials, and self-cementing materials. Flowable fill may be placed in a pour instead of 6" layers noted above.

6. Water shall not be permitted to rise in unbackfilled trenches.
7. Dispose of excess excavated earth as directed.
8. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
9. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

**3.03 ARCHITECT/ENGINEER OBSERVATION OF WORK**

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

    a. Pipe insulation is installed and fully sealed.
    b. Pipe and duct wall penetrations are sealed.
    c. Pipe identification and valve tags are installed.
    d. Main, branch and flexible ducts are installed.
    e. Diffusers, registers and grilles are installed and connected to ductwork.
    f. Terminal air box reheat coil piping or wiring is complete.
    g. Terminal air box control wiring is complete and all control boxes are closed.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

**3.04 PROJECT CLOSEOUT**

A. The following paragraphs supplement the requirements of Division 01.

B. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

## 3.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div23.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Refer to Section 23 09 00 for additional requirements for Temperature Control submittals.
5. Copy of final approved test and balance reports.
6. Copies of all factory inspections and/or equipment startup reports.
7. Copies of warranties.

8. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
9. Dimensional drawings of equipment.
10. Capacities and utility consumption of equipment.
11. Detailed parts lists with lists of suppliers.
12. Operating procedures for each system.
13. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
14. Repair procedures for major components.
15. List of lubricants in all equipment and recommended frequency of lubrication.
16. Instruction books, cards, and manuals furnished with the equipment.

**3.06 INSTRUCTING THE OWNER'S REPRESENTATIVES**

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

D. The instructions shall include:

1. Explanation of all system flow diagrams.
2. Explanation of all air handling systems.
3. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
4. Maintenance of equipment.
5. Start-up procedures for all major equipment.

E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.

F. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of four weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

## 3.07 PAINTING

A. This Contractor shall paint the following items:

1. All piping in mechanical room

B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.

C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.

D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.

E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.

F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

G. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.
3. Color of paint shall be as follows:

a. All piping in mechanical room:

1) Chilled Water: Blue pipe/black letters

## 3.08 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed bare metal ductwork, piping, hangers, and accessories.

D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

## 3.09 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

**READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION**

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All air handling units operating and balanced.
3. All fans shall be operating and balanced.
4. All pumps, boilers and chillers operating and balanced.
5. All miscellaneous mechanical systems (unit heaters, fan coil units, cabinet heaters, etc.) operating.
6. All temperature control systems operating, programmed and calibrated.
7. Pipe insulation complete, pipes labeled and valves tagged.
8. Fire damper and fire/smoke damper access doors labeled in accordance with specifications.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

**END OF SECTION**

# SECTION 23 05 03
# THROUGH PENETRATION FIRESTOPPING

## PART 1 - GENERAL

### 1.01 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. 1997 Uniform Building Code

K. 2021 International Building Code

L. NFPA 5000 - Building Construction Safety Code

### 1.02 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

### 1.03 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

C. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

### 1.04 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the , General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.
2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

### 1.05 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
5. Johns-Manville.

### 2.02 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.

E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

| Penetrating Item | UL System No. |
|---|---|
| No Penetrating Item | WL 0000-0999* |
| Metallic Pipe or Conduit | WL 1000-1999 |
| Non-Metallic Pipe or Conduit | WL 2000-2999 |
| Electrical Cables | WL 3000-3999 |
| Cable Trays | WL 4000-4999 |
| Insulated Pipes | WL 5000-5999 |
| Bus Duct and Misc. Electrical | WL 6000-6999 |
| Duct without Damper and Misc. Mechanical | WL 7000-7999 |
| Multiple Penetrations | WL 8000-8999 |

*Alternate method of firestopping is patching opening to match original rated construction.

2. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall/Floor Rating
   b. L Rating = Penetrations in Smoke Barriers

| Penetrating Item | UL System No. |
|---|---|
| No Penetrating Item | CAJ 0000-0999* |
| Metallic Pipe or Conduit | CAJ 1000-1999 |
| Non-Metallic Pipe or Conduit | CAJ 2000-2999 |
| Electrical Cables | CAJ 3000-3999 |
| Cable Trays | CAJ 4000-4999 |
| Insulated Pipes | CAJ 5000-5999 |
| Bus Duct and Misc. Electrical | CAJ 6000-6999 |
| Duct without Damper and Misc. Mechanical | CAJ 7000-7999 |
| Multiple Penetrations | CAJ 8000-8999 |

*Alternate method of firestopping is patching opening to match original rated construction.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

### 3.02 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

### 3.03 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### 3.04 INSPECTION

A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

**END OF SECTION**

# SECTION 23 05 13
# MOTORS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Single Phase and Three Phase Electric Motors.

### 1.02 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.

E. ANSI/NEMA MG 1 - Motors and Generators.

F. ANSI/NFPA 70 - National Electrical Code.

G. Energy Independence and Security Act of 2007.

### 1.03 SUBMITTALS

A. Submit shop drawings under provisions of Section 23 05 00. Include nominal efficiency and power factor for all premium efficiency motors. Efficiencies must meet or exceed the nominal energy efficiency levels presented below.

B. Submit shop drawings for all three phase motors.

C. Submit motor data with equipment when motor is installed by the manufacturer at the factory.

D. Submit shaft grounding rings or brushes or ceramic bearings for all motors as required.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer's recommendations for equipment and motor.

### 1.05 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

### 1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacture of commercial and industrial motors and accessories, with a minimum of three years documented manufacturing experience.

## PART 2 - PRODUCTS

### 2.01 MOTORS - GENERAL CONSTRUCTION AND REQUIREMENTS

A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

| Distribution/Nominal Voltage | Utilization Voltage |
|---|---|
| 120 | 115 |
| 208 | 200 |
| 240 | 230 |
| 277 | 265 |
| 480 | 460 |

B. Design motors for continuous operation in 40ºC environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.

D. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

E. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.

F. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.

G. Each contractor shall set all motors furnished by him.

H. All motors shall have a minimum service factor of 1.15.

I. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.

J. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.

K. Aluminum end housings are not permitted on motors 15 HP or larger.

L. Motor Driven Equipment:

1. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.
2. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.

M. Provide all belted motors with a means of moving and securing the motor to tighten belts. Motors over 2 HP shall have screw type tension adjustment. Motors over 40 HP shall have dual screw adjusters. Slide bases shall conform to NEMA standards.

## 2.02 ELECTRICALLY COMMUTATED MOTORS (ECM)

A. Motor shall be variable speed, constant torque, brushless DC motor for direct-drive applications. Electronics shall be encapsulated for moisture protection and shall integral surge protection. Motor shall be pre-wired for specific voltage and phase.

B. Motor frame shall be NEMA 48; UL recognized components shall be provided for the motor construction.

C. All EC motors shall be a minimum of 85% efficient at all speeds.

D. Motors shall be permanently lubricated; utilize ball bearings to match with the connected driven equipment.

E. Provide motor with on-board motor control module. Motor speed shall be limited to provide electronic over current protection. Starter shall provide soft start to reduce inrush current and shall be controllable from 20% to 100% of full rated speed.

F. Operational mode shall be as scheduled and shall be one of the following:

1. Constant Flow
2. Constant Temperature
3. Constant Pressure

## 2.03 PREMIUM EFFICIENCY MOTORS (INCLUDING MOST 3-PHASE GENERAL PURPOSE MOTORS)

A. All motors, unless exempted by EPAct legislation that became federal law on December 19, 2010, shall comply with the efficiencies listed in that standard, which are reprinted below. These match the 2010 NEMA premium efficiency ratings. All ratings listed are nominal full load efficiencies, verified in accordance with IEEE Standard 112, Test Method B. Average expected (not guaranteed minimum) power factors shall also be at least the following:

| | Full-Load Efficiencies % | | | | | |
|---|---|---|---|---|---|---|
| | Open Drip-Proof | | | Totally Enclosed Fan Cooled | | |
| HP | 1200 rpm | 1800 rpm | 3600 rpm | 1200 rpm | 1800 rpm | 3600 rpm |
| 1.0 | 82.5 | 85.5 | 77.0 | 82.5 | 85.5 | 77.0 |
| 1.5 | 86.5 | 86.5 | 84.0 | 87.5 | 86.5 | 84.0 |
| 2.0 | 87.5 | 86.5 | 85.5 | 88.5 | 86.5 | 85.5 |
| 3.0 | 88.5 | 89.5 | 85.5 | 89.5 | 89.5 | 86.5 |
| 5.0 | 89.5 | 89.5 | 86.5 | 89.5 | 89.5 | 88.5 |
| 7.5 | 90.2 | 91.0 | 88.5 | 91.0 | 91.7 | 89.5 |
| 10.0 | 91.7 | 91.7 | 89.5 | 91.0 | 91.7 | 90.2 |
| 15.0 | 91.7 | 93.0 | 90.2 | 91.7 | 92.4 | 91.0 |
| 20.0 | 92.4 | 93.0 | 91.0 | 91.7 | 93.0 | 91.0 |
| 25.0 | 93.0 | 93.6 | 91.7 | 93.0 | 93.6 | 91.7 |
| 30.0 | 93.6 | 94.1 | 91.7 | 93.0 | 93.6 | 91.7 |
| 40.0 | 94.1 | 94.1 | 92.4 | 94.1 | 94.1 | 92.4 |
| 50.0 | 94.1 | 94.5 | 93.0 | 94.1 | 94.5 | 93.0 |
| 60.0 | 94.5 | 95.0 | 93.6 | 94.5 | 95.0 | 93.6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 75.0 | 94.5 | 95.0 | 93.6 | 94.5 | 95.4 | 93.6 |
| 100.0 | 95.0 | 95.4 | 93.6 | 95.0 | 95.4 | 94.1 |
| 125.0 | 95.0 | 95.4 | 94.1 | 95.0 | 95.4 | 95.0 |
| 150.0 | 95.4 | 95.8 | 94.1 | 95.8 | 95.8 | 95.0 |
| 200.0 | 95.4 | 95.8 | 95.0 | 95.8 | 96.2 | 95.4 |
| 250.0 | 95.4 | 95.8 | 95.0 | 95.8 | 96.2 | 95.8 |
| 300.0 | 95.4 | 95.8 | 95.4 | 95.8 | 96.2 | 95.8 |
| 350.0 | 95.4 | 95.8 | 95.4 | 95.8 | 96.2 | 95.8 |
| 400.0 | 95.8 | 95.8 | 95.8 | 95.8 | 96.2 | 95.8 |
| 450.0 | 96.2 | 96.2 | 95.8 | 95.8 | 96.2 | 95.8 |
| 500.0 | 96.2 | 96.2 | 95.8 | 95.8 | 96.2 | 95.8 |

B. Motor nameplate shall be noted with the above ratings.

## 2.04 MOTORS ON VARIABLE FREQUENCY DRIVES

A. All motors driven by VFDs shall be premium efficiency type.

B. Motors shall be designed for use with VFDs in variable torque applications with 1.15 service factor. Motors shall not be equipped with auxiliary blowers.

C. Motors driven by VFDs shall have Class F or H insulation and be designated by the motor manufacturer to be suitable for inverter duty service in accordance with NEMA MG 1 Section IV, "Performance Standards Applying to All Machines," Part 31 "Definite-Purpose Inverter-Fed Polyphase Motors.

D. All 480 volt motors driven by VFDs shall be provided with shaft grounding rings or grounding brushes or ceramic bearings as a means to protect bearings from adverse shaft currents.

1. Providing grounding rings internal to the motor housing is an acceptable solution, provided the motor is affixed with a label clearly indicating the presence of a grounding assembly. The grounding ring shall be listed for 40,000 hours of motor service and shall be accessible via the drive endplate.
2. Motor shafts 2" and larger require shaft grounding on the drive end and the non-drive end. This Contractor shall ensure (via field observation and measurement) that the shaft is effectively grounded upon startup.

## 2.05 SHEAVES

A. All sheaves shall conform to NEMA Standard MG1-14.42, which lists minimum diameters and maximum overhangs. Locate motors to minimize overhang.

B. When replacing sheaves, use sheaves of at least the originally supplied sizes.

C. Contractor responsible for motor shall also be responsible for replacement sheaves. Coordinate with testing and balancing of the equipment.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.

C. For belt drive motors, mount sheaves on the appropriate shafts per manufacturer's instructions. Use a straight edge to check alignment of the sheaves. Reposition sheaves as necessary so the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so the belt(s) can be added, and tighten the base so the belt tension is in accordance with the drive manufacturer's recommendations. Frequently check belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

**END OF SECTION**

# SECTION 23 34 23
# POWER VENTILATORS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Roof Exhaust Fan.

B. Rooftop Fan Curbs.

### 1.02 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300.

C. Fabrication: Conform to AMCA 99.

D. Fan Energy Index (FEI): Fans shall meet or exceed the minimum FEI scheduled at the specified airflow, pressure, and air density (duty point). In no case shall the FEI at the specified duty point fall below 1.1.

### 1.03 REFERENCES

A. AMCA 99 - Standards Handbook.

B. AMCA 208 - Calculation of the Fan Energy Index (FEI).

C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

D. AMCA 230 - AMCA 230 - Laboratory Methods of Testing Air Circulating Fans for Rating and Certification.

E. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

F. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

G. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

H. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

I. SMACNA - HVAC Duct Construction Standards (latest edition).

### 1.04 SUBMITTALS

A. Submit shop drawings per Section 23 05 00. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point (ceiling and HVLS fans are exempt from FEI submittal requirements).

B. Submit manufacturer's installation instructions.

C. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

## PART 2 - PRODUCTS

### 2.01 ROOFTOP EXHAUST FAN - DIRECT DRIVEN

A. Fan Wheel: Centrifugal type, aluminum or composite with backward inclined or airfoil blades, statically and dynamically balanced.

B. Housing: Removable, spun aluminum dome or rectangular top, with square, one piece, aluminum base and curb cap with Venturi inlet cone.

C. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.

D. Any steel parts shall be galvanized or epoxy coated. Non-corrosive fasteners.

E. Direct drive, motor mounted outside of airstream and ventilated with outside air.

F. Aluminum or brass bird screen. Plastic mesh will not be allowed.

G. Mill aluminum finish.

H. Dampers: Furnish normally closed, electric motorized damper. Provide step-down transformer if required. Install and wire damper to open when fan runs. Dampers shall be aluminum with brass bushings, blade seals and blade tie rods. Leakage shall not exceed 4 cfm/sq.ft @1" SP (or shall be AMCA Class 1 certified).

I. Motor (as scheduled on drawings):

1. Electronically Commutated Motor (ECM): Motor shall be variable speed, constant torque, brushless DC motor for direct-drive applications. Electronics shall be encapsulated for moisture protection and shall include integral surge protection. Motor shall be pre-wired for specific voltage and phase. Motor frame shall be NEMA 48; All EC motors shall be a minimum of 85% efficient at all speeds. Provide motor with onboard motor control module. Motor speed shall be limited to provide electronic overcurrent protection. Provide non-fused, with thermal overload protection, factory mounted and wired disconnect switch mounted inside fan housing. Starter shall provide soft start to reduce inrush current and shall be controllable from 20% to 100% of full rated speed. Operational mode shall be as follows:

    a. ECM set for constant CFM.
    b.

J. Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

K. Manufacturers:

1. Cook"
2. Greenheck

## 2.02 ROOFTOP FAN CURBS

A. Furnish and install prefabricated roof curbs for all rooftop fans.

B. Size curb to match the curb cap of fan.

C. Roof Mounting Curb: Minimum 24", minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.

D. Construction: Unitized construction, continuous arc welded corner seams. Insulated with 1-1/2" thick, 3 lb. density rigid fiberglass board. Damper support angle. Pressure treated wood nailer. Curb with cant.

1. 18-gauge galvanized steel.

E. Manufacturers:

1. Same manufacturer as the fan
2. Pate

# PART 3 - EXECUTION

## 3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated lag screws to roof curb.

C. If manufacturer has no recommendations, secure roof exhaust fans to curbs with 1/4" lag bolts on 8" maximum centers.

D. MC shall install and wire factory provided damper to open when the fan runs if the manufacturer does not provide an option to pre-wire the damper.

**END OF SECTION**

# SECTION 26 05 00
# BASIC ELECTRICAL REQUIREMENTS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Interior Communications Pathways Section 27 05 28. This section is also applicable to Fire Alarm and Detection Systems Section 28 31 00.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

### 1.02 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

### 1.03 SCOPE OF WORK

A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.

B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

D. Description of Systems shall be as follows:

1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
2. Electrical power service system from the Utility Company to and including service entrance equipment, distribution and metering.
3. Grounding system.
4. Fire alarm system.
5. Wiring system for temperature control system as shown on the drawings.
6. Lightning protection system.
7. Wiring of equipment furnished by others.
8. Removal work and/or relocation and reuse of existing systems and equipment.
9. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.

E. Work Not Included:

1. Telecommunications cabling will be by others, in raceways and conduits furnished and installed as part of the Electrical work.
2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

## 1.04 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.

B. Itemize all work and list associated hours and pay scale for each item.

## 1.05 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, and CONTROL CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements.
4. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:

    a. Luminaires.
    b. Gravity flow piping, including steam and condensate.
    c. Electrical bus duct.
    d. Sheet metal.
    e. Cable trays, including access space.
    f. Other piping.
    g. Conduits and wireway.

D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor's or Subcontractor's Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

## 1.06 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

## 1.07 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.

2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Cameron Codes, Laws, Ordinances and other regulations having jurisdiction.
2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
3. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
6. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
8. Pay all telephone company charges related to the service or change in service.

E. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.

6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

F. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

## 1.08 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

| Referenced Specification Section | Submittal Item |
|---|---|
| 26 05 03 | Through Penetration Firestopping |
| 26 05 13 | Wire and Cable |
| 26 05 15 | Medium Voltage Cable and Accessories |
| 26 05 17 | Electric Heat Trace and Snow Melt |
| 26 05 23 | Manufactured Wiring Assemblies |
| 26 05 26 | Grounding and Bonding |

| Referenced Specification Section | Submittal Item |
|---|---|
| 26 05 29 | Undercarpet Cable Systems |
| 26 05 33 | Conduit and Boxes |
| 26 05 35 | Surface Raceways |
| 26 05 36 | Cable Trays |
| 26 05 37 | Manholes |
| 26 05 38 | Underfloor Ducts and Layout Plan |
| 26 05 48 | Seismic Requirements for Equipment and Supports |
| 26 05 53 | Electrical Identification |
| 26 05 73 | Power System Study |
| 26 09 13 | Energy Metering and Management System |
| 26 09 23 | DALI Lighting Control Systems |
| 26 09 33 | Lighting Control System |
| 26 11 00 | Secondary Unit Substation |
| 26 12 00 | Dry-Type Distribution and Power Transformers |
| 26 12 13 | Liquid-Filled Substation Distribution Transformers |
| 26 12 19 | Pad-Mounted, Liquid-Filled Transformers |
| 26 12 21 | Pole-Mounted Overhead Distribution Transformers |
| 26 13 13 | Medium Voltage Metal-Clad Vacuum Circuit Breaker Switchgear |
| 26 13 14 | Pad Mounted Medium Voltage Switchgear |
| 26 13 15 | Pad-Mounted Medium Voltage SF6 Switchgear |
| 26 13 34 | Medium Voltage Metal-Enclosed Load Interrupter Switchgear |
| 26 13 35 | Paralleling and Distribution Switchgear Medium Voltage |
| 26 18 39 | Medium Voltage Motor Controllers |
| 26 18 39.02 | Medium Voltage AC Drive Motor Controllers |
| 26 19 00 | Overhead Power Distribution |
| 26 20 00 | Service Entrance |
| 26 22 00 | Dry Type Transformers |
| 26 23 00 | Low-Voltage Switchgear |
| 26 24 13 | Switchboards |
| 26 24 14 | Paralleling and Distribution Switchboard |
| 26 24 16 | Panelboards |
| 26 24 19 | Motor Control |
| 26 24 21 | Hospital Isolated Power Systems |
| 26 24 22 | Integrated Power Center |
| 26 24 23 | Packaged Power Center |
| 26 25 00 | Busway and Layout Plan |
| 26 25 05 | Cable Bus |
| 26 26 00 | Power Distribution Unit |
| 26 27 16 | Cabinets and Enclosures |
| 26 27 23 | Indoor Service Poles |

| Referenced Specification Section | Submittal Item |
|---|---|
| 26 27 26 | Wiring Devices |
| 26 27 29 | Electric Vehicle Charging Station |
| 26 28 13 | Fuses |
| 26 28 16 | Disconnect Switches |
| 26 28 21 | Contactors |
| 26 29 23 | Variable Frequency Drives |
| 26 31 00 | Solar Photovoltaic Systems |
| 26 32 13 | Packaged Engine Generator Systems |
| 26 33 53 | Static Uninterruptible Power Supply (UPS) |
| 26 35 00 | Power Conditioners |
| 26 35 33 | Power Factor Correction Equipment |
| 26 36 00 | Transfer Switch |
| 26 41 00 | Lightning Protection Equipment |
| 26 43 00 | Surge Protection Devices |
| 26 51 00 | Lighting |
| 26 51 19 | LED Lighting |
| 26 52 15 | Emergency Lighting Inverter |
| 26 56 68 | Sports Lighting |
| 28 31 00 | Fire Alarm and Detection Systems |
| 28 31 50 | Air Sampling Smoke Detection System |
| Drawings | Clock System |
| Drawings | Photocells, Timeclocks, Relays |

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

    a. Date
    b. Project title and number
    c. Contractor's name and address
    d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
    e. Description of items submitted and relevant specification number
    f. Notations of deviations from the contract documents
    g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

    a. Date
    b. Project title and number
    c. Architect/Engineer
    d. Contractor and subcontractors' names and addresses
    e. Supplier and manufacturer's names and addresses
    f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
    g. Description of item submitted (using project nomenclature) and relevant specification number
    h. Notations of deviations from the contract documents
    i. Other pertinent data
    j. Provide space for Contractor's review stamps

3. Composition:

    a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
    b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
    c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.

c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect™™s/Engineer's review and processing of each submittal, excluding mailing.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer™™s opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 26 XX XX.description.YYYYMMDD
    b. Transmittal file name: 26 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

## 1.09 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

B. Keep all materials clean, dry and free from damaging environments.

C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

## 1.10 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

B. The following network connected equipment shall be equipped with restricted access protocols:

1. Adjustable trip overcurrent protection devices
2. Power monitoring and control
3. Electrical controls
4. Lighting control system
5. Variable frequency drives
6. Package engine generator and remote annunciator
7. Transfer switch and remote annunciator
8. Static uninterruptible power supply (UPS)
9. Fire alarm and automatic detection

## 1.11 WARRANTY

A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

### 1.12 INSURANCE

A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

### 1.13 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.

E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

### 1.14 PROJECT COMMISSIONING

A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and provide all services as described in the Commissioning Plan.

## PART 2 - PRODUCTS

### 2.01 GENERAL

A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

## PART 3 - EXECUTION

### 3.01 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

### 3.02 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.
9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.

12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.

C. Dewatering:

1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand and/or CA6 for backfilling.
3. Native soil materials may be used as backfill if approved by the Geotechnical Engineer.
4. Dispose of the excess excavated earth as directed.
5. Backfill materials (native soil material, sand, and/or CA6) shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
6. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
7. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
8. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
9. Conduits that are concrete encased or in a ductbank, conduit spacers, and cradles shall be installed on a bed of compacted CA-6 gravel. Refer to conduit section for backfilling and ductbank requirements.
10. Backfill with native soil material (if approved) or sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
11. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.
12. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
13. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Architect/Engineer.

## 3.03 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation:

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

   a. All junction boxes are closed and identified in accordance with Section 26 05 53 Electrical Identification.
   b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
   c. Luminaire whips are supported above the ceiling.
   d. Conduit identification is installed in accordance with Section 26 05 53 Electrical Identification.
   e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
   f. All wall penetrations have been sealed.

2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

## 3.04 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.

2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.

C. The following must be submitted before Architect/Engineer recommends final payment:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including marked-up or reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed and submit receipt to Architect/Engineer.
5. Inspection and testing report by the fire alarm system manufacturer.
6. Start-up reports on all equipment requiring a factory installation or start-up.

## 3.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div26.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

## 3.06 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

D. The instructions shall include:

1. Maintenance of equipment.

2. Start-up procedures for all major equipment.
3. Description of emergency system operation.

E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.

F. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

**3.07 RECORD DOCUMENTS**

A. The following paragraphs supplement Division 1 requirements.

B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

F. Record actual routing of conduits exceeding 2 inches.

**3.08 PAINTING**

A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.

B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.

C. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.

D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect the color preference before ordering.

E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, and storage rooms. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

F. All electrical conduit and equipment, fittings, hangers, structural supports, etc., in unfinished areas, such as equipment and storage room area, shall be painted two (2) coats of oil paint of colors selected by the Architect.

G. Do NOT paint electric conduits in crawl spaces, tunnels, or spaces above suspended ceilings except that where conduit is in a damp location give exposed threads at joints two coats of sealer after joint is made up.

H. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.

**3.09 ADJUST AND CLEAN**

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

**3.10 SPECIAL REQUIREMENTS**

A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.

B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.

D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.

1. Elevator machine rooms and hoistways.

2. Exit enclosures.
3. Other areas restricted by code.
4. Technology, data, server rooms.
5. Fire pump and sprinkler rooms.
6. Normal power in emergency power equipment rooms: Limited to feeders and branch circuits serving the emergency power equipment located in the room.
7. Emergency power in normal power equipment rooms: Limited to feeders and branch circuits serving the normal power equipment located in the room.

## 3.11 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Within the Limits of Construction:

1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.

B. Outside the Limits of Construction:

1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.
3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.

C. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. General Contractor shall erect and maintain dust barriers throughout the construction work. These barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.
2. The Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01" w.g. minimum relative to all adjacent areas of the building.

    a. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed specifically for this purpose. All filtration for air recirculated back into the building shall be HEPA (99.97% DOP efficiency) for work adjacent to healthcare or elderly facilities. If no work is adjacent to these areas, 95% filtration is acceptable. Filtering air discharged to outdoors shall be accomplished with 30% filters.
    b. If air is discharged outdoors, maintain all required distances to doors, windows, air intakes, etc.
    c. If high levels of Volatile Organic Compounds (VOC's) or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.

d. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Owner and the authority having jurisdiction.
e. Seal return, exhaust, and supply air openings in or near the construction zone that serve existing air handling systems, and rebalance the systems for proper operation. If this is impractical, add filters at the intakes of sufficient cross sectional area to minimize the pressure drop and avoid the need for rebalancing.
f. Maintain pressure control one hour before and after all construction periods, and 24 hours per day in healthcare or elderly facilities.

3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:

a. Minimizing the amount of dust generated.
b. Reducing solvent fumes and VOC emissions.
c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.

4. Request that the Owner designate an IAQ representative.
5. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
7. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
8. Request copies of and follow all Owner's IAQ and infection control policies.
9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
11. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings under Construction".

## 3.12 SYSTEM STARTING AND ADJUSTING

A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

## 3.13 FIELD QUALITY CONTROL

A. General:

1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

B. Ground Resistance:

1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Architect/Engineer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)
2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain.
3. If the ground resistance value obtained is more than the value set forth in Section 26 05 26, the following shall be done to obtain the value given:

    a. Verify that all connections in the service ground system are secure.
    b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
    c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
    d. Review results with the Architect/Engineer.

4. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:

    a. Date of test.
    b. Number of hours since the last rain.
    c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
    d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
    e. Make, model, and calibration date of test equipment.
    f. Tabulation of measurements taken and calculations made.

C. Ground-Fault Equipment Performance Testing:

1. Test: Perform ground-fault performance testing when system is installed. The test process shall use primary current injection per manufacturer instruction and procedures. Perform test for the following:

    a. Service disconnects
    b. Solid state molded case circuit breakers and solid-state insulated case circuit breakers equipped with ground fault protection.
    c. Fusible switches with ground fault relay protection.
    d. Outside branch circuits and feeders.
    e. Code required.

2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.

D. Arc Energy Reduction Equipment Performance Testing:

1. Test: Perform arc energy protection performance testing when system is installed. The test process shall use primary current injection or approved method per manufacturer instructions and procedures. Perform test for the following:

    a. All arc energy reduction systems installed.

2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.

E. Other Equipment:

1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.

F. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.

G. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Architect/Engineer to have an Owner/Architect/Engineer representative present during testing.

H. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.

I. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

## 3.14 UTILITY REBATE

A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.

B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

**READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION**

**To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.**

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Smoke and fire/smoke dampers are wired and have been tested.
4. Per Section 26 05 00, cable insulation test results have been submitted.
5. Per Section 26 05 00, medium voltage testing report has been submitted.
6. Per Section 26 05 00, ground resistance test results have been submitted.
7. Operation and Maintenance manuals have been submitted as per Section 26 05 00.
8. Bound copies of approved shop drawings have been submitted as per Section 26 05 00.
9. Report of instruction of Owner's representative has been submitted as per Section 26 05 00.
10. Fire alarm inspection and testing report has been submitted as per Sections 26 05 00 and 28 31 00.
11. Start-up reports from factory representative have been submitted as per Section 26 05 00.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

**END OF SECTION**

# SECTION 26 05 03
# THROUGH PENETRATION FIRESTOPPING

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Through-Penetration Firestopping.

### 1.02 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

### 1.03 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. 1997 Uniform Building Code

K. Wisconsin Administrative Code

L. 2021 International Building Code

M. NFPA 5000 - Building Construction Safety Code

### 1.04 SUBMITTALS

A. Submit under provisions of Section 26 05 00.

B. Submit Firestopping Installers Certification for all installers on the project.

C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Interek / Warnock Hersey Assembly number.

D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
4. F ratings for each firestop system.

E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

## 1.06 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°°F.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

### 1.07 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.
2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

### 1.08 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk
4. Tremco; Sealant/Weatherproofing Division
5. Johns-Manville
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Wiremold/Legrand: FlameStopper
10. Dow Corning Corp.
11. Fire Trak Corp.
12. International Protective Coating Corp.
13. HoldRite

### 2.02 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

E. Provide firestopping systems allowing continuous insulation for all insulated pipes.

F. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

   a. F Rating = Floor/Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

| Penetrating Item | UL System No. |
|---|---|
| No Penetrating Item | FC 0000-0999* |
| Metallic Pipe or Conduit | FC 1000-1999 |
| Non-Metallic Pipe or Conduit | FC 2000-2999 |
| Electrical Cables | FC 3000-3999 |
| Cable Trays | FC 4000-4999 |
| Insulated Pipes | FC 5000-5999 |
| Bus Duct and Misc. Electrical | FC 6000-6999 |
| Duct without Damper and Misc. Mechanical | FC 7000-7999 |
| Multiple Penetrations | FC 8000-8999 |

*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

| Penetrating Item | UL System No. |
|---|---|
| No Penetrating Item | WL 0000-0999* |
| Metallic Pipe or Conduit | WL 1000-1999 |
| Non-Metallic Pipe or Conduit | WL 2000-2999 |
| Electrical Cables | WL 3000-3999 |
| Cable Trays | WL 4000-4999 |
| Insulated Pipes | WL 5000-5999 |
| Bus Duct and Misc. Electrical | WL 6000-6999 |
| Duct without Damper and Misc. Mechanical | WL 7000-7999 |
| Multiple Penetrations | WL 8000-8999 |

*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall/Floor Rating

b. L Rating = Penetrations in Smoke Barriers

| Penetrating Item | UL System No. |
|---|---|
| No Penetrating Item | CAJ 0000-0999* |
| Metallic Pipe or Conduit | CAJ 1000-1999 |
| Non-Metallic Pipe or Conduit | CAJ 2000-2999 |
| Electrical Cables | CAJ 3000-3999 |
| Cable Trays | CAJ 4000-4999 |
| Insulated Pipes | CAJ 5000-5999 |
| Bus Duct and Misc. Electrical | CAJ 6000-6999 |
| Duct without Damper and Misc. Mechanical | CAJ 7000-7999 |
| Multiple Penetrations | CAJ 8000-8999 |

*Alternate method of firestopping is patching opening to match original rated construction.

G. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

H. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

### 3.02 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

**3.03 CLEANING AND PROTECTING**

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

**3.04 INSPECTION**

A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

**END OF SECTION**

# SECTION 26 05 13
# WIRE AND CABLE

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Building wire

B. Cabling for remote control, signal, and power limited circuits

C. Fire rated and circuit integrity (CI) cable and assemblies

D. Metal-clad cable (MC)

### 1.02 RELATED WORK

A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

### 1.03 REFERENCES

A. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy

B. NFPA 70 - National Electrical Code (NEC)

C. UL 44 - Thermoset-Insulated Wires and Cables

D. UL 83 - Thermoplastic-Insulated Wires and Cables

E. UL 854 - Service-Entrance Cables

F. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords

G. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables

### 1.04 SUBMITTALS

A. Submit shop drawings and product data under the provisions of Section 26 05 00.

B. Submit manufacturer's installation instructions.

## PART 2 - PRODUCTS

### 2.01 BUILDING WIRE

A. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.

B. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or XHHW-2.

C. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings.

D. Motor Feeder from Variable Frequency Drives: Copper conductor, 600-volt XHHW-2 insulation, stranded conductor, unless otherwise noted on the drawings. Three conductor stranded copper, 600-volt XHHW-2 insulation, with copper ground and overall helical copper tape shield. Shield shall be terminated at both ends of cable with an approved termination.

E. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.

F. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

## 2.02 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS

A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.

1. Fire alarm
2. Low voltage switching and lighting control
3. Electronic control
4. Other specialized cabling, signal, and power limited cabling. Refer to the appropriate Division 23, 27, or 28 requirements; including, but not limited, to the following:

    a. Building Automation Systems and Controls, Division 23.
    b. Information Technology Backbone and Horizontal Cabling, Division 27.
    c. Television Distribution Systems CATV, Division 27.
    d. Sound Masking Paging Systems, Professional Audio/Video, Division 27.
    e.
    f. Electronic Access Control, Intrusion Detection Systems, Video Surveillance, Division 28.

B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket.

C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.

D. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

## 2.03 FIRE-RATED AND CIRCUIT INTEGRITY (CI) CABLE AND ASSEMBLIES

A. Properties and requirements of fire rated cables and assemblies:

1. 2HR fire rated for horizontal and vertical installations.

B. Acceptable fire-rated cables and listed assemblies:

1. Feeder assembly located outside the structure (example: below finished grade), rated metal stud and drywall enclosure, or encased in concrete; minimum 2 inches of concrete).
2. Exothermal Mat Material: Raceway / Cable protected with exothermic mat material, UL listed.

    a. Install per manufacturer guidelines and requirements. Apply appropriate quantity of wrapped layers of material as required to achieve rating.
    b. Contractor shall upsize cable / wiring / raceway sizes as required for derating.
    c. Provide cable / wire ampacity derating calculations for each application, reference manufacturer for additional information, document and submit derated calculations as a shop drawing submittal for approval prior to installation. Minimum cable / wire derating shall be:

        1) Individual conduit raceways (less than or equal to 4" trade size): 10%.
        2) Parallel conduit raceways associated with the same feeder and protected by a common installation assembly: 15%.
        3) Cable tray raceway: 50%.

    d. Manufacturer:

        1) 3M Interam Endothermic Mat
        2) Or submitted for engineer review prior to bid.

3. Mineral Insulated Cables: Copper conductor, 600-volt insulation, rated 90°C, Type MI.

    a. Manufacturer:

        1) Raychem Pyrotenax MI

4. MC Cable: Copper conductor, 600V thermoset, low smoke zero halogen silicone rubber insulation, continuously welded corrugated copper armor for equipment grounding conductor, rated 90°C, UL listed 2196. MC fire rated cable shall not be used for branch circuits that required redundant equipment ground paths per code.

    a. Manufacturers:

        1) VITALink MC
        2) Draka Lifeline MC Series

5. Fire rated cable in EMT or IMC raceway: Copper conductor, 300-volt or ethernet power-limited circuit cables low smoke zero halogen (LSZH), rated 105°C. Assembly including raceway shall be UL listed 2196 and UL circuit integrity (FHIT).

    a. Manufacturers:

        1) VITALINK CI/CIC or ethernet series
        2) Draka RHW-2 EMT Series

6. Fire rated cable in phenolic RTRC conduit: Copper conductor, 600-volt RHW-2 or RW90 low smoke zero halogen (LSZH) insulation, rated 90°C. Assembly shall be UL listed 2196 and UL circuit integrity (FHIT).

    a. Manufacturer:

        1) Draka Lifeline RHW-2

### 2.04 METAL-CLAD CABLE (MC)

A. Conductors shall be copper, 600-volt insulation, THHN. Metal clad cable shall be constructed in strict accordance with Underwriters Laboratories, Inc. Standard for Metal-Clad Cables, UL 15694, exterior of metal interlocked armor.

B. Minimum conductor size for branch circuit wiring shall be 12 AWG, with larger wires used where specified.

## PART 3 - EXECUTION

### 3.01 WIRE AND CABLE INSTALLATION SCHEDULE

A. Above Accessible Ceilings:

1. Building wire shall be installed in raceway.
2. Metal clad cable, Type MC, 1/2" size with minimum #12 conductors and ground, shall be allowed for flexible whips to individual luminaires on non-essential circuits. The flexible whips shall be between 18" to 72" in length per Electrical Code.

B. All Other Locations: Building wire in raceway.

C. Above Grade: All conductors installed above grade shall be type "THHN".

D. Underground or In Slab: All conductors shall be type "THWN".

E. Low Voltage Cable (less than 100 volts): Low voltage cables in ducts, plenums, and other air handling spaces shall be plenum listed. Low voltage cables in non-accessible areas shall be installed in conduit. Low voltage cable may be installed without conduit in accessible areas using the following types of cable supports. Cable support types/systems shall comply with the warranty requirements of the low voltage cable manufacturer.

    1. J-hooks

F. Fire-Rated 2-Hour Feeders and Circuit Requiring Continuous Operation (CI): Refer to Part 2 of this section for acceptable products and assemblies. Installation shall meet UL 2196.

### 3.02 CONTRACTOR CHANGES

A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)). Service entrance conductors are based on copper conductor installed in underground electrical ducts, NEC Table B.2(7) (2011 - 2017 edition Table B310.15(B)(2)(7); 2008 or later edition B.301.7) or calculated in accordance with Annex B Application Information for Ampacity Calculation.

B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.

C. Underground electrical duct ampacity rating shall be in accordance with NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)) or calculated in accordance with Annex B Application Information for Ampacity Calculation. The calculations and a sketch of the proposed installation shall be submitted prior to any conduit being installed.

D. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.

E. Record drawing shall include the calculations and sketches.

**3.03 GENERAL WIRING METHODS**

A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.

B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.

C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.

D. Use no wire smaller than 8 AWG for outdoor lighting circuits.

E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.

F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.

G. Splice only in junction or outlet boxes.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

I. Make conductor lengths for parallel circuits equal.

J. All conductors shall be continuous in conduit from last outlet to their termination.

K. Terminate all spare conductors on terminal blocks, and label the spare conductors.

L. Cables or wires shall not be laid out on the ground before pulling.

M. Cables or wires shall not be dragged over earth or paving.

N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.

O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.

P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

**3.04 WIRING INSTALLATION IN RACEWAYS**

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.

D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.

E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.

F. Only nylon rope shall be permitted to pull cables into conduit and ducts.

G. Completely and thoroughly swab raceway system before installing conductors.

H. Conductor Supports in Vertical Raceways:

1. Support conductors in vertical raceways in accordance with the Electrical Code Spacing of Conductors Supports.
2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

**3.05 CABLE INSTALLATION**

A. Provide protection for exposed cables where subject to damage.

B. Use suitable cable fittings and connectors.

C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.

D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.

E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.

F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.

G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

**3.06 FIRE-RATED CABLE AND ASSEMBLY INSTRUCTIONS**

A. Terminations of the fire-rated cable must be outside of the fire zone.

B. Fire-rated cable shall be installed according to the manufacturer's instructions, recommendations, and UL listing.

C. Route fire-rated cable and assemblies separate from other feeders and distribution. Install cable and assemblies in locations protected from physical damage.

D. Refer to Electrical Identification Section 26 05 53 for specific identification requirements.

**3.07 WIRING CONNECTIONS AND TERMINATIONS**

A. Splice and tap only in accessible junction boxes.

B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.

C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.

D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Cold shrink connector insulator with 1kV rating shall be used in damp and wet locations.

F. Thoroughly clean wires before installing lugs and connectors.

G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.

I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:

1. Facing the front and operating side of the equipment, the phase identification shall be:

a. Left to Right - A-B-C
b. Top to Bottom - A-B-C

J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.

K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

**3.08 MC CABLE INSTALLATION**

A. Cable shall be supported by an approved means every 4.5' and within 12" of outlet boxes, junction boxes, cabinets, or fittings.

B. Cable may be unsupported in the following conditions:

1. Cable is no longer than 2' in length at terminals where flexibility is necessary.
2. Cable is not more than 4.5' from the last point of support for connections within an accessible ceiling to light fixtures or equipment.

C. Conductor ampacity shall be derated as required by the Electrical Code where more than three current carrying conductors are used.

D. Each 120 and 277-volt circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for cable derating.

E. Cables shall be cut using a rotary cutter as recommended by the manufacturer to eliminate nicking and cutting of the conductors.

F. Bending radius shall comply with the requirements listed in the Electrical Code for the type and size of cable being installed, but shall not be less than 5-times the diameter of the cable in any case.

G. At cable terminations, a fitting shall be provided to protect wires from abrasion, unless the design of the outlet boxes or fittings is such as to afford equivalent protection, and, in addition, an insulating bushing or its equivalent protection shall be provided between the conductors and the armor.

**3.09 FIELD QUALITY CONTROL**

A. Field inspection and testing will be performed under provisions of Division 1.

B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.

C. MI cable shall have the insulation resistance of each cable tested with a 500-volt dc megohmeter prior to energizing the cables. Tabulate resistance values and submit to Architect/Engineer for acceptance.

D. Inspect wire and cable for physical damage and proper connection.

E. Torque test conductor connections and terminations to manufacturer's recommended values.

F. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

G. Protection of wire and cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

H. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

**END OF SECTION**

# SECTION 26 05 26
# GROUNDING AND BONDING

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Equipment grounding system

B. Bonding system

C. Grounding electrode system

### 1.02 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

B. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with UL 467 Grounding and Bonding Equipment.

E. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

F. Comply with Electrical Code; for overhead-line construction and medium-voltage underground construction, comply with IEEE/ANSI C2 National Electrical Safety Code (NESC).

### 1.03 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

### 1.04 SUBMITTALS

A. Submit shop drawings under provisions of Section 26 05 00.

B. Product Data: For the following:

1. Ground rods.
2. Chemical electrodes.

C. Product Data: For each type of product indicated.

D. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.
2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Indicate layout of ground field, location of system grounding electrode connections, and routing of grounding electrode conductor and ground ring.

**1.05 SUMMARY**

A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

**PART 2 - PRODUCTS**

**2.01 GROUNDING CONDUCTORS**

A. For insulated conductors, comply with Division 26 Section 26 05 13 "Wire and Cable".

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated. Refer to Section 26 05 53 for insulation color.

D. Isolated Ground Conductors: Insulated. Refer to Section 26 05 53 for insulation color.

E. Grounding Electrode Conductors: Stranded cable.

F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

G. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

H. GB; Grounding Bar:

1. Bare, annealed copper bars of rectangular cross section, with insulators. 1/4" x 2", length of technology or applicable room.

I. IBT; Intersystem Bonding Termination:

1. Copper bar, 1/4" x 2" x 24". Provide with wall mounting brackets, insulators and pre-tapped holes.
2. Manufacturers:

    a. Harger GBI Series.
    b. Erico EGB Series.

## 2.02 CONNECTOR PRODUCTS

A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

C. Bolted Connectors: Bolted-pressure-type connectors.

D. Substation connectors shall comply with IEEE 837 listed for use for specific types, sizes, and combinations of conductors and connected items.

## 2.03 GROUNDING ELECTRODES

A. Ground Rods Copper-clad steel.

B. Ground Rods: Sectional type; copper-clad steel.

1. Size: 3/4" in diameter by 120 inches per section.

C. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.

D. Test Wells: Provide handholes as shown on drawings or as specified in Division 2 Section "Underground Ducts and Utility Structures."

E. Concrete-Encased Grounding Electrode (Ufer): Fabricate according to Electrical Code, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG or 20 feet of 1/2"steel reinforcing bar.

# PART 3 - EXECUTION

## 3.01 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

D. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

E. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

F. Structural Steel Connection: Exothermic-welded connections to structural steel. Coordinate with structure to provide physical protection.

G. Underground Connections: Use for underground connections, except those at test wells.

H. Connections at Test Wells: Use compression-type connectors on conductors and make two bolted- and clamped-type connections between conductors and ground rods.

I. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity. The connection to the non-metallic boxes shall be made to any metallic fitting or device requiring grounding.

J. Tighten screws and bolts for grounding and bonding 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.

K. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

## 3.02 INSTALLATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.

C. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.

D. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then use a bolted clamp. Bond straps directly to the basic structure, taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

E. In raceways, use insulated equipment grounding conductors.

F. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

G. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, below access floors, and elsewhere as indicated, with bolted connections to form a continuous ground path.

**3.03 EQUIPMENT GROUNDING SYSTEM**

A. Comply with Electrical Code, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by Electrical Code are indicated.

B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by Electrical Code:

1. Lighting and receptacle circuits. Terminate each end on a grounding lug or bus.
2. Single-phase and three-phase motor and appliance branch circuits.
3. Flexible raceway runs, including FMC and LFMC.
4. Armored and metal-clad cable runs.

D. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

E. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

F. Isolated Grounding Circuits: Install an insulated equipment grounding conductor connected to the receptacle or equipment grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at isolated equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

G. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

**3.04 BONDING SYSTEM**

A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.

B. Isolated Equipment Enclosure: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment bonding conductor.

C. Exterior Metallic Pull and Junction Box Covers, Metallic Hand Rails: Bond to grounding system using flexible grounding conductors.

D. Equipment Circuits: Install a bonding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, dampers, and heaters. Bond conductor to each unit and to air duct. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps or copper conductor sized equal to the equipment grounding conductor.

E. Bond metal ducts of dust collectors, particulate conveying, fume hoods, and other hazardous materials to the equipment grounding conductors of associated pumps, fans, or blowers. Use braided-type bonding straps. Provide braided bare copper bonding conductor in nonmetallic dust collector ductwork to each equipment inlet location, and bond to equipment.

F. Water Heater, Heat-Tracing, Metal Well Casing, and Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, well casing, connected equipment, and components.

G. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.

H. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated bonding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Leave 10 feet of slack conductor at terminal board.

I. Telecom Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bar.

J. Industrial Control Panels, Terminal Cabinets, and Similar Installation: Terminate bonding conductor on cabinet grounding terminal. Provide an equipment grounding conductor and bond adjacent and associated control panels together.

K. Equipment Ground Conductor Continuity: All spliced equipment grounding conductors in junction boxes, cabinets, and distribution equipment shall be connected together and bonded to the metal enclosure.

L. Remote control, signaling, and fire alarm circuits shall be bonded in accordance with the most recent version of the National Electric Code.

M. Metal Poles Supporting Outdoor Lighting Fixtures > 15 feet: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

N. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

## 3.05 GROUNDING ELECTRODE SYSTEM

A. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.

B. Provide bonding at Utility Company's metering equipment and pad mounted transformer.

C. Ground Rods: Install at least two rods spaced at least 20 feet from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 12 inches below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters, filtering devices, and similar equipment. Connect to pipe with grounding clamp connectors.

F. Natural Gas Service Piping: Bond to natural gas main service with grounding clamp connectors. Bonding conductor shall be connected to the main service ground bar. Provide grounding jumpers around all breaks in metallic continuity.

G. Natural Gas Equipment Piping: Bond each aboveground portion of natural gas metallic piping system at each equipment location with grounding clamp connectors. Bonding shall be performed after any flexible attachment nearest the equipment. The equipment grounding conductors may serve as the bonding means.

## 3.06 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.
2. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
3. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
4. Testing: Perform the following field quality-control testing:

    a. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

b. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

c. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

   1) Equipment Rated 500 kVA and Less: 10 ohms.
   2) Equipment Rated 500 to 1000 kVA: 5 ohms.
   3) Equipment Rated More Than 1000 kVA: 3 ohms.
   4) Substations and Pad-Mounted Switching Equipment: 5 ohms.
   5) Manhole Grounds: 10 ohms.

d. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect/Engineer promptly and include recommendations to reduce ground resistance.

## 3.07 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2. Maintain restored surfaces. Restore disturbed paving.

**END OF SECTION**

# SECTION 26 05 27
# SUPPORTING DEVICES

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Conduit and Equipment Supports

B. Fastening Hardware

C. Concrete Housekeeping Pads

### 1.02 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

### 1.03 COORDINATION

A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

A. Allied Support Systems

B. Cooper B-Line

C. Erico, Inc.

D. Hilti

E. Power Fasteners

F. Orbit Industries

### 2.02 MATERIAL

A. Support Channel: Hot-dip galvanized; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.

B. Hardware: Corrosion resistant.

C. Anchorage and Structural Attachment Components:

1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.

    a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
3. Welding Lugs: Comply with MSS-SP-69, Type 57.
4. Beam clamps for Steel Beams and Joists: Double sided or concentric open web joist hangars. Single-sided type is not acceptable.
5. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.
7. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
8. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

D. Conduit Sleeves and Lintels:

1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor's work in masonry walls and conduit sleeves for floors, unless specifically shown as being by others.
2. Refer to Structural General Notes for lintel requirements in masonry construction.
3. Refer to Structural plans and specifications for lintel requirements and sizes.
4. Lintels:

    a. Lintels in non-bearing masonry wall openings can be sized in accordance with the note below. Lintels that occur in existing bearing walls are to be sized according to similar conditions and spans in the new construction and lintel schedule. Bottom plate size shall be a minimum of 3/8" thick. The width of the plate shall be 3/4" less than the field verified wall thickness. The plate shall be the full length of the lintel member. Lintels are not required over openings that are 12" wide or less and at least 1 course below the top of the wall.
    b. All lintels shall have a minimum of 8" end bearing.
    c. All lintels in exterior wall construction shall be hot-dip galvanized.
    d. For all openings not otherwise detailed or scheduled, minimum lintels shall be for each 4 inch of masonry width:

        1) 0 to 2'-0" span: 5/16" plate (3/4" less than wall width)
        2) 2'-0" to 4'-0" span: L 3 1/2 x 3 1/2 x 1/4
        3) 4'-0" to 6'-0" span: L4 x 3 1/2 x 5/16 (llv)
        4) 6'-0" to 8'-0" span: L5 x 3 1/2 x 5/16 (llv)

    e. All angles that are back to back shall be welded top and bottom 3" at 12" minimum.

5. Fabricate all lintels from structural steel shapes or as indicated on the drawings. All lintels and grouped wall openings shall be approved by the Architect or Structural Engineer.
6. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.
7. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
8. Sleeves shall not penetrate structural members without approval from the Structural Engineer.
9. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.
10. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
11. Where conduits rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
12. Size sleeves large enough to allow expansion and contraction movement.

E. Concrete Housekeeping Pads:

1. Concrete bases for all floor mounted equipment and wall mounted equipment which is surface mounted and extends to within 6" of the finished floor, unless shown otherwise on the drawings, shall be 3-1/2" thick concrete.
2. Bases shall extend 3" on all sides of the equipment (6" larger than factory base).
3. Where the base is less than 12" from a wall, the base shall be carried to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6" x 6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at twenty-eight days.

F. Rooftop Support System:

1. Provide pre-fabricated roof supports for all conduit and equipment installed above the roof. Support all conduit and equipment a minimum of 4" above roof.
2. Support system shall be compatible with single ply, bituminous, metal, and spray foam roof systems. The base shall be rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
3. All metal components shall be hot dipped galvanized. Mounting hardware shall be stainless steel or hot dipped galvanized. Support shall be UV, corrosion, and freeze/thaw resistant. Support shall include orange paint, reflective safety orange accents, or similar markings for increased visibility.
4. Products:

    a. Anvil International HBS-Base Series
    b. Cooper B-Line Dura-Blok
    c. Erico Caddy Pyramid 50, 150, 300, or 600 (to match load).

G. Truss and Joist Support System: Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

    a. The hanger is attached within 6" from a web/chord joint.
    b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.

B. Trapeze support installation: Cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

D. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.

E. Do not use powder-actuated anchors without specific permission.

F. Do not drill structural steel members.

G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

H. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.

I. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting.

J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

K. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

L. Refer to Section 26 05 33 for special conduit supporting requirements.

**3.02 FINISH**

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.

B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

**END OF SECTION**

# SECTION 26 05 33
# CONDUIT AND BOXES

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Rigid metallic conduit and fittings (RMC)

B. Stainless steel conduit (316SS) and fittings

C. Intermediate metallic conduit and fittings (IMC)

D. Electrical metallic tubing and fittings (EMT)

E. Flexible metallic conduit and fittings (FMC)

F. Liquidtight flexible metallic conduit and fittings (LFMC)

G. Rigid polyvinyl chloride conduit and fittings (PVC)

H. High density polyethylene conduit and fittings (HDPE)

I. Reinforced thermosetting resin conduit (RTRC)

J. Phenolic reinforced thermosetting resin conduit (Phenolic RTRC)

K. Wall and ceiling outlet boxes

L. Electrical connection

M. Pull and junction boxes

N. Rough-ins

O. Handholes

P. Foundation - Underground Sleeves and Seals

Q. Raceway Seals and Sealant

R. Accessories

### 1.02 RELATED WORK

A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

### 1.03 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated

2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated
5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports

B. Federal Specifications (FS):

1. A-A-50553A - Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
2. A-A-55810 - Specification for Flexible Metal Conduit

C. NECA "Standards of Installation"

D. National Electrical Manufacturers Association (NEMA):

1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
2. RN 1 - Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit
3. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
4. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation

E. NFPA 70 - National Electrical Code (NEC)

F. Underwriters Laboratories (UL): Applicable Listings

1. UL 1 - Flexible Metal Conduit
2. UL 6 - Rigid Metal Conduit
3. UL 360 - Liquid Tight Flexible Steel Conduit
4. UL514-B - Conduit Tubing and Cable Fittings
5. UL651-A - Type EB and a PVC Conduit and HDPE Conduit
6. UL651-B - Continuous Length HDPE Conduit
7. UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
8. UL797 - Electrical Metal Tubing
9. UL1242 - Intermediate Metal Conduit

G. American Standard of Testing and Materials (ASTM):

1. ASTM D 570 - Standard Test Method for Water Absorption of Plastics
2. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics
3. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
4. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
5. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
6. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material

H. Definitions:

1. Fittings: Conduit connection or coupling.
2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.

3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

### 1.04 SUBMITTALS

A. Include fittings and conduits 1.5" and larger in coordination files. Include all in--floor and underfloor conduit in coordination files. Refer to Section 26 05 00 for coordination drawing requirements.

## PART 2 - PRODUCTS

### 2.01 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

A. Manufacturers:

1. Allied
2. LTV
3. Steelduct
4. Calbond Calpipe
5. Wheatland Tube Co
6. O-Z Gedney
7. or approved equal.

B. Manufacturers of RMC Conduit Fittings:

1. Appleton Electric
2. O-Z/Gedney Co.
3. Electroline
4. Raco
5. Bridgeport
6. Midwest
7. Regal
8. Thomas & Betts
9. Crouse-Hinds
10. Killark
11. Orbit Industries
12. or approved equal.

C. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

D. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

E. PVC Externally Coated Conduit: Compliant with UL 6, ANSI C80.1 and NEMA RN 1; rigid galvanized steel conduit with external 40 mil PVC coating and internal 2 mil urethane coating surface. All fittings and conduit bodies shall be complete with coating. Threads shall be hot galvanized and coated with a clear coat of urethane. The PVC coated system shall include necessary PVC coated fittings, boxes and covers to form a complete encapsulated system.

1. Acceptable Manufacturers:

a. Calbond Calpipe
b. Robroy
c. T&B Ocal
d. or approved equal.

**2.02 INTERMEDIATE METALLIC CONDUIT (IMC) AND FITTINGS**

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

B. Manufacturers:

1. Allied
2. LTV
3. Steelduct
4. Wheatland Tube Co
5. O-Z Gedney
6. or approved equal.

C. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.

5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

## 2.03 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.

B. Manufacturers of EMT Conduit:

1. Allied
2. Calbond Calpipe
3. LTV
4. Steelduct
5. Wheatland Tube Co
6. or approved equal.

C. Fittings and Conduit Bodies:

1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.
2. 1/2" and 3/4" Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.
3. Larger than 2": Compression type of steel designed for their specific application.
4. Manufacturers of EMT Conduit Fittings:

    a. Appleton Electric
    b. O-Z/Gedney Co.
    c. Electroline
    d. Raco
    e. Bridgeport
    f. Midwest
    g. Regal
    h. Thomas & Betts
    i. Orbit Industries
    j. or approved equal.

## 2.04 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.

B. Manufacturers:

1. American Flex
2. Alflex
3. Electri-Flex Co
4. or approved equal.

C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.

D. Fittings and Conduit Bodies:

1. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron or screw-in type, die-cast zinc.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Manufacturers:

a. O-Z/Gedney Co.
b. Thomas & Betts
c. Appleton Electric
d. Electroline
e. Bridgeport
f. Midwest
g. Regal
h. Orbit Industries
i. or approved equal.

## 2.05 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

A. Manufacturers:

1. Anaconda Type UA
2. Electri-Flex Type LA
3. Alflex
4. Carlon (Lamson & Sessions)
5. or approved equal.

B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.

C. Fittings and Conduit Bodies:

1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Manufacturers:

a. Appleton Electric
b. O-Z/Gedney Co.
c. Electroline
d. Bridgeport
e. Thomas & Betts
f. Midwest
g. Regal
h. Carlon (Lamson & Sessions)
i. Orbit Industries
j. or approved equal.

## 2.06 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.

B. Acceptable Manufacturers:

1. Carlon (Lamson & Sessions) Type 40
2. Cantex, J.M. Mfg.
3. or approved equal.

C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.

D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.

E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

## 2.07 HIGH DENSITY POLYETHYLENE (HDPE)

A. Minimum Size: 2 inch, unless noted otherwise.

B. Acceptable Manufacturers:

1. Carlon
2. Chevron Phillips Chemical Company
3. or approved equal.

C. Materials used for the manufacture of polyethylene pipe and fittings shall be extra high molecular weight, high-density polyethylene resin. The material shall be listed by PPI (Plastic Pipe Institute) and shall meet the following resin properties:

| ASTM Test | Description | Values HDPE |
|---|---|---|
| D-1505 | Density g/CM 3 | less than 0.941 |
| D-1238 | Melt Index, g/10 min Condition E | greater than 0.55 grams/10 min. |
| D-638 | Tensile Strength at yield (psi) | 3000 min. |
| D-1693 | Environmental Stress Crack Resistance Condition B, F 20 | 96 hrs. |
| D-790 | Flexural Modulus, MPa (psi) | less than 80,000 |
| D-746 | Brittleness Temperature | -75°C Max |

D. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw material, including both the base resin and coextruded resin. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.

E. Fitting and Conduit Bodies:

1. Directional Bore and Plow Type Installation: Electrofusion or Universal Aluminum threaded couplings. Tensile strength of coupled pipe must be greater than 2,000 lbs.
2. For all other type of installation: Coupler must provide a water tight connection. The tensile strength of coupled pipe must be greater than 1,000 lbs.
3. E-loc type couplings are not acceptable in any situations.
4. Acceptable Manufacturers:

    a. ARCON
    b. Carlon

c. or approved equal.

## 2.08 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC) AND FITTINGS

A. Minimum Size: 1 inch.

B. Acceptable Manufacturers:

1. Champion Fiberglass
2. Atkore - FRE Composites
3. or approved equal.

C. Conduit shall be fiberglass reinforced epoxy using a filament winding process. Conduit, elbows and fittings shall be manufactured from the same resin/hardener/glass system and the same filament wound system. Resin systems shall be epoxy with no fillers. Glass used shall be E-type.

D. Fitting and Conduit Bodies:

1. Expansion fittings for RTRC shall be provided in accordance with Electrical Code.
2. Joints in wet locations and underground locations shall be watertight.

## 2.09 PHENOLIC REINFORCED THERMOSETTING RESIN CONDUIT AND FITTINGS (PHENOLIC RTRC)

A. Minimum Size: 1 inch.

B. Manufacturers:

1. Champion Fiberglass Flameshield XW
2. Atkore - FRE Composites BreathSaver
3. or approved equal.

C. Conduit shall be low smoke, no flame, low toxicity. Conduit shall be fiberglass reinforced phenolic using a filament winding process. Conduit, elbows, conduit bodies, and fittings shall be manufactured from the same resin/hardener/glass system and the same filament wound system. Resin systems shall be phenol with no fillers. Fiberglass used shall be E-type.

D. Fitting and Conduit Bodies:

1. Expansion fittings shall be provided in accordance with Electrical Code.
2. Joints in wet locations and underground locations shall be watertight.

## 2.10 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, 16 gauge (approximately 0.0625 inches), with 1/2-inch male fixture studs where required.

B. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.

C. Cast Boxes: Nema FB1, Type FD, Aluminum, cast feralloy, or stainless steel deep type, gasketed cover, threaded hubs.

D. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.

E. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.

F. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.

G. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

## 2.11 ECONN; ELECTRICAL CONNECTION

A. Electrical connection to equipment and motors, sized per Electrical Code. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

## 2.12 JB; PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.

B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.

C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.

E. Flanged type boxes shall be used where installed flush in wall.

## 2.13 FOUNDATION - UNDERGROUND SLEEVES AND SEALS

A. Wall Seals ("Link-Seals"):

1. Where shown on the drawings, raceways passing through foundation walls to an underground condition shall have their annual space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing element consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve.

3. Sleeves shall be at least 2 trade sizes larger than the penetrating raceway.
4. Pressure shall be maintained by stainless steel bolts and accessories. Pressure plates may be of composite materials for Models S and OS.
5. Sealing Elements shall be as follows:

| Model | Service | Element Material | Temperature Range |
|---|---|---|---|
| S | Standard (Stainless) | EPDM | -40°F to 250°F |
| T | Fire Seals (1 hour) | Silicone | -67°F to 400°F |
| FS | Fire Seals (3 hours) | Silicone | -67°F to 400°F |
| OS | Oil Resistant / Stainless | Nitrile | -40°F to 210°F |

6. Approved Manufacturers:

    a. Thunderline Corporation "Link-Seals"
    b. O-Z/Gedney Company
    c. Calpico, Inc
    d. Innerlynx
    e. Polywater PGKD Series

## 2.14 RACEWAY SEALS AND SEALANT

A. Duct Sealant: Field applied expandable duct sealant, closed cell field cured, water tight, air tight. Identified for use with electrical cables, conductors, and raceways. Minimum liquid withstanding of 10-feet head of water (5 PSI). Compatible with conductors and raceways, UL94 Flammability Certified.

1. NOT ALLOWED. Duct seal putty, all-purpose construction sealant.
2. Manufacturers:

    a. Polywater FST / AFT Series
    b. Approved equal

B. Duct Seal Bushing: Custom mechanical seal, liquid tight, gas tight, stainless steel hardware. Minimum liquid withstanding of 10-feet head of water (5 PSI). Coordinate product with raceway size, cable quantities, and cable sizes.

1. Manufacturers:

    a. Polywater PHRD / PHSD Series Varia /PHSI Module Series
    b. Jackmoon Commscope DuctPlug Series
    c. CalAm Manufacturing WedgeSeal Series

C. Duct Seal Bushing Alternative Option: Inflatable duct seal system. Capable of withstanding a 10-foot head of water (5 PSI).

1. Manufacturers:

    a. Raychem Rayflate Duct Sealing Systems RDSS
    b. Approved equal

D. Wall Sleeve Duct Seal System: Cast-in-place or Core-Drill two piece push-in- place construction, gasketed seal to prevent entry of water and gases.

1. Cable: Duct Seal Bushing, provide interior sleeve duct seal bushing for each duct entry. Provide duct seal bushings with individual seals for each applicable cable.
2. Manufacturers:

a. Polywater Varia PHSI Series
b. Approved equal

**2.15 ACCESSORIES**

A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control - IsoBacker Pad, SpecSeal - SSP Putty and Pads, 3M #MPP-4S or equal.

B. Sound Barrier Insulation Pads: Mastic, non-hardening, sheet material, minimum 1/8" thickness applied to all five sides of back boxes. Kinetics Noise Control - SealTight Backer Pad, L.H. DOTTIE Co., #68 or equal.

**PART 3 - EXECUTION**

**3.01 INSTALLATION TRAINING**

A. PVC coated rigid metal conduit, phenolic reinforced thermosetting resin conduit (phenolic RTRC), and reinforced thermosetting resin conduit (RTRC) manufacturers shall provide Contractor installation training for field cutting, joint preparation, joint assembly, field bending, and field cut sealing.

**3.02 CONDUIT INSTALLATION SCHEDULE AND SIZING**

A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.

B. Installation Schedule: Refer to drawings.

C. Fire Rated Assemblies:

1. Listed Fire Rated Assemblies: Phenolic RTRC

D. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.

E. Minimum Conduit Size (Unless Noted Otherwise):

1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
2. Below Grade 5' or less from Building Foundation: 1 inch.
3. Below Grade More than 5' from Building Foundation: 1 inch.
4. Telecommunication Conduit: 1 inch.
5. Controls Conduit: 1/2 inch.

F. Conduit Embedded in Slabs above Grade:

1. Embedded installation NOT allowed in elevated slabs with metal composite decks nor structural pour in place slabs less than 6 inches in depth unless specifically noted or shown on drawings otherwise.
2. Maximum size 1-1/4 inch for conduits crossing each other.

G. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

**3.03 CONDUIT ARRANGEMENT**

A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.

B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.

C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):

1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.
2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.

D. Conduit shall not share the same cell as structural reinforcement in masonry walls.

E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.

F. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.

G. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

**3.04 CONDUIT SUPPORT**

A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.

1. Support wire used to independently support raceway and wiring systems above suspending ceilings shall be supported on both ends, minimum 12 gauge suspended ceiling support wire, and distinguishable from ceiling support systems by color (field paint), tagging, or equivalent means.

B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.

C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.

D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1-1/2" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.

F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.

G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.

J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.

K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the Electrical Code requirements.

L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.

M. Finish:

1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

## 3.05 CONDUIT INSTALLATION

A. Conduit Connections:

1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.

C. Conduit Bends:

1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.

    a. A third bend is acceptable if:

        1) The total run is not longer than (33) feet.
        2) The conduit size is increased to the next trade size.

5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
6. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
7. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
8. Use conduit bodies to make sharp changes in direction (i.e. around beams).

D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. Seal penetrations with intumescent caulk, putty, or sheet installed per manufacturer's recommendations. All materials used to seal penetrations of firewalls and floors shall be tested and certified as a system per ASTM E814 Standard for fire tests or through-penetration fire stops as manufactured by 3M or approved equal.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.
8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system.
9. Horizontal conduit routing through slabs above grade

    a. Conduits, if run in concrete structure, shall be in middle one-third of slab thickness, and leave at least 3" min. concrete cover. Conduits shall run parallel to each other and spaced at least 8" apart centerline to centerline. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Maximum conduit outside diameter 1".
    b. No conduits are allowed in concrete on metal deck unless expressly approved in writing by the Structural Engineer.
    c. No conduits are allowed to be routed horizontally through slabs above grade.

10. Do not route conduits across each other in slabs on grade.

11. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
12. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
13. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
14. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
15. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

**3.06 CONDUIT TERMINATIONS**

A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.

B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.

C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.

D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.

E. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

**3.07 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) OVERHEAD CONDUIT INSTALLATION**

A. Conduit shall be installed away from high temperature piping and equipment.

B. Conduit shall be installed to prevent exposure to ultraviolet radiation.

C. Proper allowances shall be made for expansion and/or contraction of the conduit during installation.

D. Expansion fittings shall be installed in any 100' continuous run of conduit and at each 100' thereafter.

E. Supports shall be made from non-corroding materials and spacing shall not be greater than the listing in the Electrical Code, but also shall not exceed the manufacturer's recommendations depending on the expected surface temperature.

**3.08 UNDERGROUND CONDUIT INSTALLATION**

A. Conduit Connections:

1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.

B. Conduit Bends (Lateral):

1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.

C. Conduit Elbows (vertical):

1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.

D. Expansion Fittings at Finished Grade: Provide underground raceways with an expansion fitting after emerging from finished grade and exterior equipment pads. Field locate the expansion fitting above and within 24 inches of finished grade. Raceways extending less than 12 inches above finished grade, transitioning to LFMC within 12 inches of finished grade, and interior concrete building slabs do not require an expansion fitting unless required by code.

E. Conduit Placement:

1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum f'c = 2500 and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
8. All non-metallic conduit installed underground outside of a slab shall be rigid.

F. Horizontal Directional Drilling:

1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.
2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.

G. Raceway Seal (Exterior to Raceway):

1. All power, telecommunication, electrical conduits and innerducts shall be sealed between the raceway and the building foundation. The raceway penetration shall be sealed liquid-tight, water-tight, non-corrosive.

2. Below Grade Installation Options:

   a. Cast-in-place concrete installation.
   b. Hydraulic cement, hydraulic group, hydraulic epoxy.
   c. Foundation - Underground Sleeves and Seals; refer to Part 2-Products for product information.

3. Above Grade Installation Options:

   a. Masonry grout for masonry applications.
   b. Caulk Sealant, interior/exterior rated, color per architect. Refer to architectural specifications for additional requirements.

H. Raceway Seal (Interior to Raceway, with Cables or Empty):

1. All power, telecommunication, electrical conduits and innerducts, including those with cables, shall be sealed at the building and vault entry. The seal shall prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceways shall also be sealed.

2. Installation Schedule, nominal size:

   a. 2" or less: Duct Seal Bushing or Duct Sealnt
   b. 2-1/2" through 4": Duct Seal Bushing
   c. 5" and 6": Wall Sleeve Duct Seal System

## 3.09 BOX INSTALLATION SCHEDULE

A. Galvanized steel boxes may be used in:

1. Concealed interior locations above ceilings and in hollow studded partitions.
2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
3. Direct contact with concrete except slab on grade.

B. Cast boxes shall be used in:

1. Exterior locations.
2. Direct contact with earth.
3. Direct contact with concrete in slab on grade.
4. Wet locations.
5. Kitchens and laundries when exposed on wall surface.

## 3.10 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.

D. Locate and install to maintain headroom and to present a neat appearance.

E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

**3.11 OUTLET BOX INSTALLATION**

A. Do not install boxes back-to-back in walls.

1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.

B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)

D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.

E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

F. Provide knockout closures for unused openings.

G. Support boxes independently of conduit.

H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

I. Install boxes in walls without damaging wall insulation.

J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.

K. Position outlets to locate luminaires as shown on reflected ceiling drawings.

L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

N. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

## 3.12 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.

B. Support pull and junction boxes independent of conduit.

C. Do not install boxes back-to-back in walls.

1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.

D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

## 3.13 EXPOSED BOX INSTALLATION

A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.

B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.

C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.

D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.

E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)

F. Wood, plastic, or fiber plugs shall not be used for fastenings.

G. Explosive devices shall not be used unless specifically allowed.

**END OF SECTION**

# SECTION 26 05 53
# ELECTRICAL IDENTIFICATION

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Adhesive Markings and Field Labels

B. Nameplates and Signs

C. Product Colors

### 1.02 REFERENCES

A. NFPA 70E - National Electrical Safety Code

B. NFPA 70 - National Electrical Code (NEC)

C. ANSI A13.1 - Standard for Pipe Identification

D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

### 1.03 QUALITY ASSURANCE

A. Electrical identification products shall be suitable for the environment installed. Identification labels damaged by the environment due to ultraviolet light fading, damp or wet conditions, physical damage, corrosion, or other conditions shall be replaced with labels suitable for the environment.

## PART 2 - PRODUCTS

### 2.01 ADHESIVE MARKINGS AND FIELD LABELS

A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).

1. Label Size as follows:

a. Raceways: Kroy or Brother labels 1-inch high by 12-inches long (minimum).

2. Color: As specified for various systems.

B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.

C. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.

D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

E. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application. Provide ties in specified colors when used for color coding. Cable ties shall be listed and identified for the application, securement, and support.

F. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.

G. Aluminum, Wraparound Marker Bands: 1-inch width, 0.014 (5mm) inch thick aluminum bands with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

H. Brass or Aluminum Tags: 2" (50mm) by 2" (50mm) by .05-inch metal tags with stamped legend, punched for fastener.

I. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.

J. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Font: Normal 721 Swiss Bold
b. Adhesive Labels: 3/16 inch minimum text height
c. Vinyl / Plastic Laminate Labels: 3/4" inch minimum text height

**2.02 NAMEPLATES AND SIGNS**

A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.

B. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Text Height: 3/8 inch minimum

C. Baked-Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting ¼" grommets in corners.

D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.

E. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

F. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

## 2.03 PRODUCT COLORS

A. Adhesive Markings and Field Labels:

1. All Labels: Black letters on white face
2. Normal Power and General Labels: Black letters on white face
3. Control Labels: Black letters on white face
4. Fire Alarm: Red letters on white face
5. Emergency: Red letters on white face

B. Nameplates and Signs:

1. NORMAL POWER: Black letters on white face
2. Control Labels: Black letters on white face
3. EMERGENCY: White letters on red face
4. GROUNDING: White letters on green face.
5. CAUTION or UPS: Black letters on yellow face

C. Raceways and Conduit:

1. Provide color coded conduit as indicated below. Conduit shall be colored by the manufacturer:

    a. Normal Power and General Distribution: Silver
    b. Emergency Power Distribution System:

        1) All Emergency: Orange
        2) Legally Required Standby: Yellow
        3) Optional Standby: Orange
        4) Life Safety and Critical Branch: Yellow
        5) Equipment Branch: Orange

    c. Fire Alarm System: Red
    d. Temperature Controls: Refer to mechanical cover sheet for color
    e. Ground: Green
    f. Low Voltage and Telephone: Purple
    g. Clock, Sound, Security System, and Intercom: Black
    h. Nurse Call: White

D. Box Covers:

1. Box covers shall be painted to correspond with system type as follows:

    a. Normal Power and General: Silver
    b. Emergency Power and Distribution:

        1) All Emergency: Orange
        2) Legally Required Standby: Yellow
        3) Optional Standby: Orange
        4) Life Safety and Critical Branch: Yellow
        5) Equipment Branch: Orange

    c. Fire Alarm System: Red
    d. Temperature Controls: Refer to mechanical cover sheet for color
    e. Ground: Green
    f. Low Voltage and Telephone: Purple

g. Clock, Sound, Security System, and Intercom: Black
h. Nurse Call: White

2. Box cover colors shall match conduit colors listed above.

E. Conductor Color Identification: Refer to Part 3 for additional information.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

B. Exposed Ceilings and Finished Spaces: The project includes exposed ceilings in finished spaces. The installation of colored raceways and labeling may not be aesthetically desirable in finished spaces. The contractor shall coordinate identification requirements in exposed ceilings of finished spaces with the Architect/Engineer prior to installation and ordering of materials.

C. Electrical System Color Chart: This Contractor shall furnish and install framed 8" x 12" charts of the color-coded identification scheme used for the electrical system in all electrical rooms and next to the main fire alarm panel.

D. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.

E. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.

F. Circuit Identification: Tag or label conductors as follows:

1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

G. Apply Danger, Warning, Caution and instruction signs as follows:

1. Install Danger, Warning, Caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

2. 'Danger' indicates a hazardous situation which, if not avoided, will result in death or serious injury. ANSI standard red background, white letters.
3. 'Warning' indicates a hazardous situation which, if not avoided, could result in death or serious injury. ANSI standard orange background, black letters.
4. 'Caution' indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. ANSI standard yellow background, black letters.
5. Emergency Operating Signs: Install, where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

H. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.

I. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

J. Install ARC FLASH WARNING signs on all power distribution equipment per Section 26 05 73.

K. Install ARC FLASH WARNING signs on all switchboards, switchgear, distribution panels, branch panelboards, industrial control panels, and motor control centers.

1. Sample Label:

   ! WARNING
   ARC FLASH AND SHOCK HAZARD
   APPROPRIATE PPE REQUIRED
   FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY
   REFER TO NFPA 70E

L. Circuits with more than 600V: Identify raceway and cable with "DANGER-HIGH VOLTAGE" in black letters 2 (50mm) inches high on orange background at 10'-0 foot intervals.

1. Entire floor area directly above conduits running beneath and within 12 inches of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to conduits concealed within wall.
3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.

M. Selective Coordination Label: Install caution signs on all switchboards, distribution panels, panelboards, disconnects, and other equipment with selectively coordinated overcurrent protection devices. Sign at a minimum shall contain:

1. CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED. EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED.

N. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches; provide a second plastic line marker to mark each edge of the trench when 16 inches of width is exceeded. Limit line markers to direct-buried cables.

## 3.02 FEEDER AND BRANCH CIRCUIT DIRECTORIES

A. Product:

1. Adhesive labels and field markings
2. Nameplates and signs

B. Feeder Directories Branch: Provide each feeder, branch circuit, feeder modification, and branch circuit modification with a typed circuit directory label. Refer to technical equipment specification sections for additional requirements. Include the following with each label:

1. Load Description: Lighting, receptacles, specific equipment, spare, space, or similar description.
2. Location: Room name, number, location.

C. Provide a factory or custom clear plastic sleeve for each branch panel directory and secure to inside panel cover.

## 3.03 LIGHTING CONTROL AND RECEPTACLE COVER PLATES

A. Product:

1. Adhesive labels and field markings
2. Nameplates and signs

B. Identification material to be engraved plastic-laminated labels, 1/16-inch minimum thickness with white letters on a red face. Letter and number size to 1/8-inch high.

C. Provide identification on all switch and receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. "C1A #24"). Identification for switch cover plates shall be installed on the inside cover.

## 3.04 CONDUIT AND EXPOSED CABLE LABELING

A. Product:

1. Adhesive labels and field markings

B. Conduit Identification: Pre-printed, flexible, self-adhesive vinyl labels with legend at 20 foot (6 meter) intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors. Labels for multiple conduits shall be aligned. Refer to color requirements in Part 2 when applicable in addition to the following:

1. 1000 Volt or less Normal/Emergency Power: Indicate feeder identification and voltage.
2. Fire Alarm: Indicate "FIRE ALARM".
3. Grounding: Indicate "GROUND" and equipment and designation.
4. Security System: Indicate "Security".
5. Telephone System: Indicate "Telephone".

C. Blank conduit ends or outlet boxes for future extension of system shall have permanent identification marker indicating purpose of conduit or box and where the raceway originated.

## 3.05 BOX LABELING

A. Products:

1. Adhesive labels and field markings

B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch Kroy tape OR Brother self-laminating vinyl label, letters/numbers color coded same as conduits. In rooms that are painted out, provide labeling on inside of cover.

C. All junction, pull, and connection boxes shall be identified as follows:

1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").
2. For other wiring, indicate system type and description of wiring ("FIRE ALARM NAC #1").

## 3.06 CONDUCTOR COLOR CODING

A. Products:

1. All wire and cables shall be color coded by the manufacturer.

B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.

C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches from the termination and spaced at 3- inches centers. Tighten to a snug fit, and cut off excess length.

D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.

E. Conductors shall be color coded as follows:

1. 208Y/120 Volt, 4-Wire:

a. A-Phase - Black
b. B-Phase - Red
c. C-Phase - Blue
d. Neutral - White
e. Ground Bond - Green

2. 480Y/277 Volt, 4-Wire:

a. A-Phase - Brown
b. B-Phase - Orange
c. C-Phase - Yellow
d. Neutral - Gray
e. Ground Bond - Green

3. Grounding Conductors:

    a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
    b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.

4. Cabling for Remote Control, Signal, and Power Limited Circuits:

    a. Fire Alarm: Red.
    b. Low Voltage Switching: Per manufacturer recommendations and code requirements.
    c. Building Automation Systems and Control: Refer to the Temperature Control Contactor notes located on the mechanical cover sheet.
    d. Electronic Control: Per manufacturer recommendations and code requirements.
    e. Audio/Visual Systems: Refer to Division 27.
    f. Structured Cabling: Refer to Division 27.

## 3.07 CONTROL EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all control equipment such as combination starters, starters, VFDs, contactors, motor control centers, etc.

C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.

D. Labeling shall include:

1. Equipment type and contract documents designation of equipment being served.
2. Location of equipment being served if it is not located within sight.
3. Voltage and phase of circuit(s).
4. Panel and circuit number(s) serving the equipment.
5. Method of automatic control, if included ("AUTO CONTROL BY FMCS").
6. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
7. Date of fault current study, refer to one-line diagram
8. Sample Label:

    EXHAUST FAN EF-1 ("LOCATED ON ROOF")
    480V, 3-PHASE
    FED FROM "1HA1-1"
    AUTO CONTROL BY FMCS
    22,000 AMPS AVAILABLE FAULT CURRENT
    DATE OF STUDY: 1 JAN 2017

## 3.08 EQUIPMENT CONNECTION IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.

C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner. The following list of equipment is specifically being listed to receive an equipment connection label; this list does not limit the equipment that shall receive a label:

1. Mechanical heating, ventilation, and air conditioning equipment; chillers, boilers, pumps, air handing ventilation units, condensing units, unit heaters, and similar equipment
2. Plumbing equipment
3. Fire protection equipment including fire pumps
4. Elevator
5. Industrial machinery

D. Labeling shall include:

1. Equipment type and contract documents designation of equipment being served
2. Location of equipment being served if it is not located within sight.
3. Voltage and rating of the equipment.
4. Panel and circuit numbers(s) serving the equipment
5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
6. Date of fault current study; refer to one-line diagram
7. Sample Label:

UNIT HEATER UH-1 ("LOCATED IN STORAGE ROOM 200")
480V: 3-PHASE
FED FROM "1HA1-1"
22,000 AMPS AVAILABLE FAULT CURRENT
DATE OF STUDY: 1 JAN 2017

## 3.09 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.

1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
2. Exterior Equipment: The identification material shall be engraved vinyl labels.
3. Labeling shall include:

a. Equipment type and contract documents designation of equipment.
b. Voltage of the equipment.
c. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
d. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").

e. Sample Label:

DISTRIBUTION PANEL DP-H1
480Y/277V
FED FROM SWITCHBOARD "SB-1" (LOCATED IN MAIN ELEC ROOM)

4. Provide the following on a separate label, installed below the label above:

a. Available fault current; refer to one-line diagram or panel schedules
b. Date of fault current study; refer to one-line diagram
c. Sample Label:

22,000 AMPS AVAILABLE FAULT CURRENT
DATE OF STUDY: 1 JAN 2017

C. Service Equipment Label: A separate nameplate for the service entrance equipment and include:

1. Nominal system voltage, service wire size, quantity, material, distance
2. Maximum available fault current; refer to one-line diagram for values
3. Clearing time of overcurrent protection devices based on available fault current. Refer to calculations and report from Section 26 05 73 for value.
4. Date of fault current study; refer to one-line diagram
5. Date of label
6. Sample Label:

480Y/277V, 6 SETS 4#750KCM CU, 75FT
39,800 AMPS AVAILABLE FAULT CURRENT
0.07 SECOND CLEARING TIME
DATE OF STUDY: 1 JAN 2017
DATE OF LABEL: 4 JUL 2017

D. Arc Energy Reduction Label:

1. Provide a separate engraved plastic laminate label centered at the top of each vertical section of the electrical gear indicating the following when applicable.

a. Label: "This equipment is designed with a system listed below".
b. Applicable Systems:

1) Zone-selective interlocking system for selective coordination and arc energy reduction
2) Differential relaying system for selective coordination and arc energy reduction
3) Arc energy reducing maintenance switch
4) Energy reducing active arc flash mitigation system

E. Adjustable-Trip Over Current Protection Label:

1. Provide a separate engraved plastic laminate label adjacent to each overcurrent projection device with adjustable trip settings. Provide label separate from load identification label.

a. Label:

1) Long-time delay:

2) Long-time pickup:
3) Short-time delay:
4) Short-time pickup:
5) Instantaneous:
6) Ground fault delay:
7) Ground fault:

b. Sample Label:

Long-time delay: 10.0
Long-time pickup: 1.0
Short-time delay: 0.15
Short-time pickup: 5.0
Instantaneous: 2.0
Ground fault delay: 0.25
Ground fault: 50.0

F. Nominal System Voltage Label:

1. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used in the panelboard or equipment shall be permanently posted on the interior of the door or cover.

G. Distribution panelboards and switchboards shall have each overcurrent protection device identified with name and location of the load being served ("AHU-1 LOCATED IN PENTHOUSE 1"). Provide a separate engraved plastic laminate label adjacent to each overcurrent projection device with feeder wire size, feeder wire quantity, conductor material and distance in feet. Provide label separate from load identification label and adjustable trip settings label.

1. Sample Labels for Feeders:

4#3/0 CU & 1#6 CU GND, 125FT
4#250KCM AL & 1#6 GND CU, 125FT
2 SETS 4#400KCM CU & 1#1 GND CU, 125FT

H. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 26 05 00 for other requirements.

## 3.10 TRANSFORMER EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all transformers. The identification nameplate shall be an engraved plastic-laminated label.

C. Labeling shall include:

1. Equipment type and contract documents designation of equipment
2. Name of the upstream equipment.
3. Voltage and rating of the equipment.
4. Location of the upstream equipment if it is not located within sight.

5. Sample Label:

   TRANSFORMER TR-15
   480V: 208Y/120V 15KVA
   FED FROM SWITCHBOARD "SB-1" (LOCATED IN ELEC 123)

**END OF SECTION**

# SECTION 26 09 33
# LIGHTING CONTROL SYSTEMS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Line and low voltage standalone lighting controls

B. Distributed lighting control

### 1.02 RELATED SECTIONS

A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:

1. 26 51 19 LED Lighting
2. 26 52 15 Emergency Lighting Inverter
3. Electrical Drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

### 1.03 RELATED WORK

A. Section 01 91 00 - Commissioning

B. Section 23 09 00 - Facility Management Control System (FMCS)

C. Section 26 51 00 - Lighting

### 1.04 QUALITY ASSURANCE

A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. All components and assemblies are to be factory pre-tested prior to delivery and installation.

C. Comply with Electrical Code as applicable to electrical wiring work.

D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

E. Panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Panels and accessories used for control of life safety and critical branch circuits shall be listed under UL 924 Emergency Lighting and Power Equipment.

F. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

## 1.05 REFERENCES

A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference

B. FS W S 896 Switch, Toggle

C. International Energy Conservation Code (IECC)

D. NEMA WD 1 - General Color Requirements for Wiring Devices

E. NEMA WD 7 - Occupancy Motion Sensors

F. NFPA 70 - National Electrical Code (NEC)

G. UL Standard 916 Energy Management Equipment

H. UL 924 - Emergency Lighting and Power Equipment

I. UL 1472 - Solid-State Dimming Controls

## 1.06 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, warranty, system software requirements, and roles and responsibilities of all persons and groups involved in installation, execution, and commissioning.

C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.

D. Submit a list of devices and equipment that will be installed for each sequence of operation.

E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations, and communication interfaces and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.

## 1.07 EXTRA STOCK

A. Provide extra stock under provisions of Section 26 05 00.

B. Sensors, Controls, Power Supplies, and Relays: Five (5) percent of quantity installed. Minimum of two (2) of each configuration and type.

C. Relays and Dimmer Modules: Five (5) percent of quantity installed. Minimum of two (2) of each size and type.

D. Control Stations: One (1) of each configuration and type, except for LCD touch screens requiring factory setup prior to installation.

## 1.08 PROJECT RECORD DOCUMENTS

A. Submit project record documents under provisions of Section 26 05 00.

B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

## 1.09 OPERATION AND MAINTENANCE DATA

A. Submit emergency, operation, and maintenance data under provisions of Section 26 05 00. Data shall also include the following:

1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
3. Replacement part numbers for all system components.

B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.

C. Submit software operating and maintenance manuals, program software backup on compact disc or compatible media with data files, device address list, and a printout of software application and graphic screens, where applicable.

## 1.10 SYSTEM DESCRIPTION

A. Performance Statement: This specification section and the accompanying lighting design documents describe the minimum material quality, required features, and operational requirements of the lighting control system (LCS). These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the performance required of the system, as presented in these documents, the Contractor and system manufacturer/vendor are solely responsible for determining all equipment, wiring, and programming required for a complete and operational system.

B. Provide an integrated lighting controls system consisting of panels, power supplies, controllers, sensors, relays, switches, devices, wiring, etc. necessary to perform the Lighting Control Sequence of Operation as defined on the plans and specifications. Contractor is responsible for confirming that all components and luminaires interoperate as a single system.

1. Sequence of Operation: Describes the required operation and performance for lighting control in each space. Sequences of operation are indicated on the drawings.
2. Drawings: The drawings include sequences of operation, locations of control interface devices, sensors, and control zones. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted with the shop drawings.

C. The following control types and features are acceptable. Acceptable control locations are shown on the drawings.

1. Line Voltage Control: Control equipment consists of traditional line voltage wiring devices and equipment such as switches, dimmers and combination occupancy/vacancy sensor switches, etc.
2. Distributed Control: Control equipment is in the space/zone being controlled; not reliant on centralized controllers.

    a. All locations shall have the ability to be networked for remote control and monitoring, but network connections are not required.

3. Centralized Control: Control equipment is in a central location serving multiple spaces/zones and provides time-based schedule and remote control.

    a. The lighting control system (LCS) shall be networked with BACnet IP capabilities.
    b. The lighting control system (LCS) shall have DMX512 capabilities.

4. Digital Addressable Lighting Interface (DALI): DALI provides digital communications to each addressable ballast / driver or group. Lamp and device faults are sent to DALI server.
5. Wireless Control: Equipment that uses radio frequency to transmit lighting control signals.

## 1.11 MOCKUP

A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires and controls in mockup may be reused as part of complete work if in original condition.

## 1.12 COMMISSIONING

A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative and the Commissioning Agent. Project closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Division 1 for detailed commissioning requirements.

B. The Contractor shall provide all services necessary for compliance with the IECC Section C408 Commissioning. The commissioning shall include, but not be limited to, a commissioning plan, preliminary commissioning report, construction documents, manuals, final commissioning report, and lighting system functional testing.

C. This project will have selected building systems commissioned. The Contractor is responsible to execute commissioning. The commissioning process, equipment, and systems to be commissioned are defined in Division 1. A third-party Commissioning Agent will direct the commissioning process.

D. The Contractor shall notify the Commissioning Agent, Architect/Engineer and Owner's Representative ten (10) working days prior to scheduled commissioning date.

E. The commissioning process requires meeting attendance. Refer to Division 1 for meeting requirements.

F. The system shall be functionally tested by a factory-authorized engineer and comply with the Sequence of Operation. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system.

### 1.13 WARRANTY

A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.

B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.01 LIGHTING CONTROLS

A. All items of material having a similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications. Lighting control switches, systems, and components shall be listed.

B. Color of lighting controls and sensors shall match the receptacle wiring devices specified in the space.

C. The functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish the functions described for the space.

### 2.02 LIGHTING CONTROL STATION

A. SW; The lighting control station shall contain the controls required by the lighting sequence of operation in a common coverplate. The controls may consist of switches, dimmers, occupancy sensors, pushbuttons, etc.

1. In spaces where the wall control station is shown in multiple locations, the sequence of operation shall be the same at all locations, unless noted otherwise.
2. The controls supplier shall prepare control station shop drawings showing arrangement of controls, dimensioned elevations, wiring diagram, and recommended backboxes. The shop drawing submittal should be identified with the lighting sequence that the station provides. Submit data sheets on the switches, dimmers, sensors, buttons, etc. contained in the control station.

### 2.03 DEVICE COLOR

A. All switch, lighting controls, and coverplate colors shall be the same as wiring devices, unless indicated otherwise.

### 2.04 COVERPLATES

A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space.

B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.

C. Install nameplate identification as indicated in Section 26 05 53.

D. Plate-securing screws shall be metal with head color matching the wall plate finish.

## 2.05 WALL SWITCHES

A. Refer to Electrical Symbols List for device type.

B. SW-1P; Single Pole Switch:

1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
2. Manufacturers:

    a. Hubbell HBL1221
    b. Leviton 1221-2
    c. Pass & Seymour PS20AC1
    d. Cooper AH1221

## 2.06 WALL DIMMERS

A. UL listed with integral air-gap switch for on/off control.

B. Integral EMI/RFI suppression.

C. Non-viewable heat sink.

D. Dimmer compatibility and wiring with the load being controlled shall be verified by Contractor prior to purchase and installation.

E. Dimmer to match device color.

F. SW-D-LED; LED Electronic Driver Dimmer:

1. 120 277-volt, decora style linear slider operator with positive off. Color to match adjacent devices. Luminaire manufacturer shall list compatible dimmer manufacturers and models. 0-10V dimmers shall comply with IEC 60629 Annex E.
2. Manufacturers:

    a. Compatible with provided LED driver.

G. SW-OD; Wall 0-10V Dimmer / Occupancy sensor:

1. Wall switch with manual on/auto off. 120VAC load rating of 0-800 W for electronic ballast, LED. 277VAC load rating of 0-1,800 W for electronic ballast, LED. adjustable OFF delay. 0-10V dimming with up to 30ma sink. Automatic ON/OFF, manual ON/automatic OFF, or occupancy on to predetermined dimming level go to last dimming setting upon occupancy.
2. Manufacturers:

    a. Sensor Switch WSX D Series

## 2.07 LOCAL DAYLIGHTING CONTROLS

A. Standalone Interior Photo Sensors:

1. SW-LS; Daylight Level Sensor - On/Off Control - One Zone:

    a. On/Off control. Range of 10-200 FC. Adjustable deadband prevents cycling. Adjustable time delay. 120/277 volt.
    b. Manufacturers:

        1) Watt Stopper LS-102
        2) Sensor Switch CM-PC
        3) Hubbell Automation DLCPC Series
        4) Greengate PPS-4

2. SW-LS-3Z; Daylight Level Sensor and Controller - On/Off Control - Three Zones:

    a. On/off control of up to three 10-amp zones. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. 120/277 volt.
    b. Manufacturers:

        1) Watt Stopper LCO-203/LS-290C
        2) Hubbell Automation LUXSTATOCM/LUXSTATLS
        3) LC&D Micro GR/2404 iDH/Pcell
        4) Sensor Switch N-CMPC

3. SW-LS-D: Daylight Level Sensor and Controller - 0-10V Dimming - One Zone:

    a. Dimming control of one 0-10V zone. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. Coordinated with dimming ballast prior to submittal.
    b. Manufacturers:

        1) Watt Stopper LS-301
        2) Hubble Automation DLC7
        3) Sensor Switch N-CMADC

4. Sensor shall detect changes in ambient light level and provide triggering of lighting groups in area based on sequence of operation.
5. Sensor shall be configurable via DIP switches at device or via handheld wireless remote programming unit. Settings shall include:

    a. Ambient sensitivity range between 1 and 1,000 foot-candles.
    b. Time delay of 5 to 300 seconds.
    c. Trigger setpoints with deadband adjustment.

6. Sensor shall provide on/off setpoints in quantity as specified on drawings and as shown in the sequence of operation.
7. Sensor shall be ceiling- or wall-mounted for range and viewing angle meeting application requirements as outlined in the sequence of operation.
8. Output signal from sensor shall be linear with light level.

B. SW-LS-PC; Standalone Exterior Photo Sensors:

1. Sensor shall be within a weatherproof enclosure, with design operation in temperatures of -30°F to +130°F. Sensor shall have threaded stem for box mounting, with knuckle to permit aiming of receptor after installation. Sensor shall be mounted facing north.
2. Sensor shall contain an integral switching contactor rated for 277-volt operation, with loads of up to 1,800 VA. Contacts shall be configured for zero-crossing closure to provide 100,000 cycle minimum operation.
3. Sensor shall detect changes in daylight levels to provide triggering of exterior lighting equipment based on the sequence of operation.
4. Sensor shall be field configurable at the device or via handheld wireless remote controller. Configurable settings shall include:

    a. Ambient sensitivity range of 5 to 1,500 foot-candles.
    b. Adjustable setpoint.
    c. Deadband adjustment by percentage of setpoint.
    d. Time delay of up to five minutes.

5. Sensor shall be equipped with a lens cover that can be applied for system testing during daylight conditions.
6. Manufacturers:

    a. Paragon
    b. Tork
    c. Intermatic

## 2.08 INDOOR OCCUPANCY AND VACANCY SENSORS

A. General Description: Wall- or ceiling-mounting, solid-state units with a separate power supply/relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied, with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes. Vacancy sensors require a manual switch operation to turn lights on and off, with a time delay for turning lights off when unoccupied.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20 A ballast load at 120 and 277 VAC, for 13-amp tungsten at 120 VAC, and for 1 hp at 120 VAC. Power supply to sensor shall be 24 V dc, 150-mA, Class 2 power source as defined by Electrical Code.
4. Mounting:

    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure. Mount relay above accessible ceiling near entry door to room or area.
    c. Time Delay and Sensitivity Adjustments: Recessed and concealed.

5. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Power Supply and Child Packs: Provide as required for sensor quantity and switching scheme. Mount to standard 1/2" knockout on electrical box above accessible ceiling near entry door to room or area. Sensor power shall be from emergency circuit if emergency lighting is in the area.

8. Detection Coverage (Room): Detect occupancy anywhere in an area based on hand motion.
9. Detection Coverage (Corridor): Detect occupancy based on a half-step motion.
10. Warranty: Five (5) year warranty.

B. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic or acoustic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.

1. SW-VS-D or SW-OC-D; 360 Degree Coverage Pattern:

   a. Frequency greater than 40 KHz. Dual sensing verifications (requires both technologies to activate), either technology maintains on status. Integrated ambient light level sensor (2 to 200 FC range), adjustable sensitivity and time delay, integrated isolated relay contact. Sensor shall control all circuits in area, unless noted otherwise. Initial settings: ambient sensor 40 FC.
   b. Manufacturers:

      1) Watt Stopper DT 300 Series
      2) Hubbell OMNI-DT2000 or ATD2000C
      3) Greengate OAC-DT
      4) Leviton OSC##-MOW
      5) Sensor Switch CM PDT 10

2. SW-VS-D-W or SW-OC-D-W; Wall Mounted on Adjustable Swivel Mount:

   a. Wall or ceiling sensor with adjustable settings to allow manual on/auto off or auto on/auto off. Integrated ambient light level sensor (2 to 100 FC range).
   b. Manufacturers:

      1) Watt Stopper DT-200 Series
      2) Hubbell LODTRP
      3) Leviton OSM12--M series
      4) Sensor Switch WvPDT 16 Series

3. SW-O; Wall Switch:

   a. Wall switch with manual on/auto off. 120/277 VAC load rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
   b. Manufacturers:

      1) Watt Stopper DW-100 Series
      2) Hubbell LHMTS, Leviton OSSMT series
      3) Sensor Switch WSX-PDT SA Series

4. SW-O2; Wall Switch:

   a. Multi-relay wall switch with manual on/auto off for two separate loads. 120/277 VAC load relay rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
   b. Manufacturers:

      1) Watt Stopper DW-200 Series

2) Hubbell LHMTD
3) Leviton OSSMD series
4) Sensor Switch WSX-PDT 2P Series

5. Sensitivity Adjustment: Separate for each sensing technology.
6. Detection Coverage:

a. Task Areas: Detect occupancy anywhere in an area based on hand motion.
b. Circulation Areas: Detect occupancy anywhere in an area based upon half-step walking motion.

C. Mask sensors where necessary to prevent nuisance switching from adjacent areas.

D. PIR Type: Detect occupancy by sensing a combination of heat and movement in area of coverage.

1. SW-OC-P-HA; High Bay - Aisle Coverage Pattern:

a. 20' to 40' mounting height. Minimum 1.3:1 walking motion coverage pattern to height ratio. Adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all luminaires in area. Initial settings: Time delay 10 minutes.
b. Manufacturers:

1) Watt Stopper HB-300 Series
2) Hubbell FHB 140 or HMHB series
3) Leviton OSFHU
4) Greengate OEF-P

2. SW-OC-P-HB; High Bay - 360 Degree Coverage Pattern:

a. 20' to 40' mounting height. Minimum 1.3:1 walking motion coverage pattern to height ratio. Adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all luminaires in area.
b. Manufacturers:

1) Watt Stopper HB-300 Series
2) Hubbell FHB 140 or HMHB series
3) Leviton OSFHU
4) Greengate OEF-P

3. SW-O; Wall Switch Occupancy Sensor:

a. Passive infrared, zero crossing circuitry, integrated ambient light sensor (10 to 150 FC range), adjustable sensitivity and time delay, no minimum load requirements, manual or auto on operation, Initial settings: 10 minutes, ambient sensor 40 FC. Manual ON for vacancy sensing.
b. Manufacturers:

1) Watt Stopper PW-100 Series
2) Sensor Switch WSX
3) Hubbell LHIRS1 or AP1277
4) Leviton ODS15
5) Greengate OSW-P-0451

4. SW-O2; Dual Wall Switch Occupancy Sensor:

    a. Passive infrared, zero crossing circuitry. Switches control two separate circuits or relays. Integrated ambient light sensor (10 to 150 FC range), adjustable sensitivity and time delay, no minimum load requirements, manual or auto on operation, Initial settings: 10 minutes, ambient sensor 40 FC. Manual ON for vacancy sensing.
    b. Manufacturers:

        1) Watt Stopper PW-200 Series
        2) Sensor Switch WSX-2
        3) Hubbell LHIRD2 or AP127712
        4) Leviton ODS
        5) Greengate OSW-P-0451

5. SW-OC-P-P; Ceiling Mounted - 360 Degree Coverage Pattern:

    a. Passive infrared, zero crossing circuitry, integrated ambient light sensor (4 to 190 FC Range), adjustable sensitivity and time delay, integral isolated relay contact. Sensor shall control all circuits in the area unless noted otherwise. Initial settings: ambient sensor 40 FC.
    b. Manufacturers:

        1) Watt Stopper CI Series
        2) Sensor Switch CM-9
        3) Hubbell Automation Omni-IR
        4) Leviton OSC Series
        5) Greengate OMR-P Series

6. With daylight filter and lens to afford coverage applicable to space to be controlled.

## 2.09 DISTRIBUTED LIGHTING CONTROL

A. Manufacturers: as listed below meet the qualifications as outlined in this specification. Contractor is responsible for verifying that selected manufacturer is capable of furnishing the complete system as specified herein.

1. Acuity Controls nLight Series
2. Legrand Watt Stopper DLM Series
3. Hubbell Automation NX Series

B. System Description: The lighting control system shall be a network of remote modules System includes all associated wiring, relay modules, photocells, switches, dimmers, time clock, occupancy sensors. System shall utilize distributed relays modules, allowing these relay modules to be located above accessible ceilings in or adjacent to rooms they are controlling.

C. Control Devices: All occupancy sensors (ultrasonic, IR and dual technology type), photocells, switches, and timers shall be provided with system and designed to operate on system network. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission.

D. Relay Modules: Mounted in NEMA enclosure with physically separate 120/277-volt wiring compartment from low voltage control wiring. Provide low voltage digital communication to control devices as shown on drawings and schedules. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission. Dimmable relay modules shall be provided where indicated. Relay modules shall contain up to four (4) relays. Relay modules shall be labeled with room number that relays control lighting within.

E. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20 A, 125-volt AC for tungsten filaments and 20 A, 277-volt AC for electronic ballasts, 50,000 cycles at rated capacity.

F. System shall include server / central station with operating software, data network, and BACnet IP communication with other systems as described. System communication protocol shall be compatible with the building automation system.

G. System server / central station shall provide programmable operation of lights connected via system relays and controlled with system devices. System software shall provide control of relays and control devices, time and sequence scheduling, timed out and blink light operation, and monitoring and reporting of system events and components. Initial programming shall be as shown on plans and schedules.

H. Server / Central Control Station: Lighting control system manufacturer shall be responsible to assure coordination between relay modules, network hubs, and control system server/ central station such that system performs as described. Server shall be provided with monitor, keyboard, and mouse, and plugged into a receptacle connected to an equipment emergency circuit as a minimum.

I. Network Hub: Network Hub shall contain processor and astronomic time clock for control and monitoring of lighting. Network hub shall be fed from an equipment emergency circuit at a minimum.

## PART 3 - EXECUTION

### 3.01 PRE-CONSTRUCTION MEETING

A. Schedule a pre-construction meeting with the controls representative, installing contractor, Architect/Engineer, and Owner to explain the proposed lighting control centralized, wireless, and distributed systems.

### 3.02 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means installer accepts existing conditions.

## 3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

B. All wiring shall be installed in conduit. Class II low voltage control wiring may be open wiring and shall maintain 150 mm (6 inch) spacing from electronic ballast and other RFI/EMI sources.

C. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

## 3.04 SUPPORT SERVICES

A. System Startup:

1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.

B. Testing:

1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming, However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:

    a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.
    b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
    c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.

3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.

    a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
    b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.

C. Training:

1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
2. Training duration shall be no less than three (3) days, with one (1) day being scheduled at least two (2) weeks after initial training.

D. Documentation:

1. Manufacturer shall provide system documentation including:

a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or BMS/BAS interface unit.
b. Drawings for each panel showing hardware configuration and numbering.
c. Panel wiring schedules.
d. Typical diagrams for each component.

## 3.05 SYSTEM COMMISSIONING

A. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 01 09 00, General Commissioning, for further details.

B. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01 09 00, General Commissioning, for system verification tests and commissioning requirements.

C. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01 09 00, General Commissioning, for Contractor training requirements.

**END OF SECTION**

# SECTION 26 22 00
# DRY TYPE TRANSFORMERS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Dry type two winding transformers

### 1.02 REFERENCES

A. NEMA - ST 1 - Specialty Transformers

B. NEMA ST 20 - Dry Type Transformers for General Applications

C. ANSI/IEEE C57.12.01 - General Requirements for Dry Type Distribution and Power Transformers

D. ANSI/IEEE C57.12.91 - Test Code for Dry Type Distribution and Power Transformers

E. Department of Energy 10 CFR Part 431 - Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule.

F. NEMA TP 2 - Standard Test Method for Measuring the Energy Consumption of Distribution Transformers

G. NEMA TP 3 - Standard for the Labeling of Distribution Transformer Efficiency

### 1.03 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, loss data, efficiency at 35, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

### 1.04 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products under provisions of Section 26 05 00.

B. Store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.

C. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

## PART 2 - PRODUCTS

### 2.01 DRY TYPE TWO WINDING TRANSFORMERS

A. Acceptable Manufacturers:

1. Square D 7400 EX##T / SK300##KB Series
2. Eaton V48M / H48M / B48M Series
3. ABB 9T Series
4. Hammond SG / SMK Series
5. Siemens 3F3 Series

B. Dry Type Transformers: NEMA ST 20, factory-assembled, air-cooled dry type transformers; ratings as shown on the drawings. Transformers supplied under this project shall meet the US Department of Energy (DOE) 2016 Efficiency requirements or the most current DOE CFR in effect.

C. Insulation system and average winding temperature rise for rated KVA as follows:

| Ratings | Class | Rise (degree C) |
|---|---|---|
| Less than 15 | 185 | 115 |
| or higher | 220 | 115 |

D. Case temperature shall not exceed 40°C rise above ambient at its warmest point.

E. Winding Taps, Transformers Less than 15 KVA: Two 5 percent below rated voltage, full capacity taps on primary winding.

F. Winding Taps, Transformers 15 KVA and Larger: Two (2) 2-1/2% below and two (2) 2-1/2% above rated voltage, full capacity taps on primary winding.

G. Sound Levels: Average audible sound level shall not exceed the values given below when tested to NEMA ST 20 standards:

| | Average Sound Level, Decibels | | | |
|---|---|---|---|---|
| | Self-Cooled Ventilated | | | Self-Cooled Sealed |
| Equivalent Winding kVA Range | K-Factor = 1<br>K-Factor = 4<br>K-Factor = 9 | K-Factor = 13<br>K-Factor = 20 | Forced Air w/ Fans Running | |
| 0-9 | 40 | 40 | 67 | 45 |
| 9.01-30.00 | 45 | 45 | 67 | 50 |
| 30.01-50.00 | 45 | 48 | 67 | 50 |
| 50.01-150.00 | 50 | 53 | 67 | 55 |
| 150.01-300.00 | 55 | 58 | 67 | 57 |
| 300.01-500.00 | 60 | 63 | 67 | 59 |
| 500.01-700.00 | 62 | 65 | 67 | 61 |
| 700.00-1000.00 | 64 | 67 | 67 | 63 |

H. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

I. Mounting: Transformers 75 KVA and less shall be suitable for wall, floor, or trapeze mounting; transformers larger than 75 KVA shall be suitable for floor or trapeze mounting.

J. Coil Conductors: Continuous windings with terminations brazed or welded.

K. Enclosure: NEMA ST 20; Type 1. Provide lifting eyes or brackets.

L. Isolate core and coil from enclosure using vibration-absorbing mounts.

M. Nameplate: NEMA TP 3; Include transformer connection data and overload capacity based on rated allowable temperature rise.

**2.02 ACCESSORIES**

A. Provide REQUIRED accessories as described below. Provide SCHEDULED accessories when listed with plan schedules. Refer to plan schedules for additional requirements.

B. Electronic Isolation Shield:

1. Provide electrostatic winding shield with separate insulated grounding connection as shown on the drawings. REQUIRED

C. Barriers: Provide finger safe barriers for lineside uninsulated and ungrounded terminations and components which remain energized when the main disconnecting device is 'open'. REQUIRED

D. Barriers (Service Equipment): Provide solid barriers for lineside uninsulated and ungrounded terminations and components which remain energized when the main disconnecting device is 'open'. REQUIRED

E. Transformer Disconnect Lockable Hasp: Provide circuit breakers, fused switches, and disconnects serving transformers with a lockable padlock hasp capable of being locked in the open/closed position. REQUIRED

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

A. Set transformer plumb and level.

B. Use flexible conduit, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Mount transformers on four 3”x3”x1/2” thick, 50 durometer rubber vibration isolating pads suitable for isolating the transformer noise from the building structure.

D. Ventilated transformers: Provide factory label on horizontal surface to prohibit storage on top, front, or adjacent to transformer.

E. Install primary, secondary, and grounding electrode conductors using factory or field fabricated enclosure entries. Conductors shall not be routed through ventilated openings.

## 3.02 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments. Adjustments shall be made at completion of project and at approximately 6 months following project acceptance when requested by the Owner.

**END OF SECTION**

# SECTION 26 24 16
# PANELBOARDS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Service and distribution panelboards: DP-#, DP-#

B. Lighting and appliance branch circuit panelboards: Panel '###'

### 1.02 RELATED SECTIONS AND WORK

A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

B. Section 26 09 13 - Energy Metering and Management System

### 1.03 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers

B. NEMA FU 1 - Low voltage cartridge fuses

C. NEMA KS 1 - Enclosed Switches

D. NEMA PB 1 - Panelboards

E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

F. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment

G. UL 248 - Low-Voltage Fuses

H. UL 67 - Panelboards

### 1.04 SUBMITTALS

A. Submit shop drawings for equipment and component devices under provisions of Section 26 05 00.

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Selective Coordination Study: Submit study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.

D. Arc Energy Reduction Documentation: Submit documentation to demonstrate the arc energy reduction system is set to operate at a value below the available arcing current.

E. Refurbished branch panel enclosure documentation for new branch panelboards installed in existing enclosures.

F. Submit manufacturer's instructions under provisions of Section 26 05 00.

**1.05 SPARE PARTS**

A. Keys: Furnish four (4) each to the Owner.

B. Fuses: Furnish 10% or a minimum of three (3) spare fuses of each type and rating installed to the Owner.

C. Fuse Pullers: Furnish one (1) fuse puller to the Owner.

**PART 2 - PRODUCTS**

**2.01 RATINGS**

A. Definitions:

1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. See Section 26 05 53 for additional requirements.
2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.

B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

**2.02 MAIN AND DISTRIBUTION PANELBOARDS**

A. General

1. Manufacturers:

a. Square D QMB, I-Line
b. ABB ReliaGear neXT
c. Siemens F2, P4
d. Eaton PRL4, PRL5

B. Panelboards: NEMA PB 1; type as shown on the drawings.

C. Enclosure: NEMA PB 1; Type 1.

D. Provide cabinet front with concealed trim clamps and hinged trim on door to allow access to wiring gutters without removal of trim and flush lock. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

F. All spaces shown on the one-line diagram shall be fully prepared spaces for future breakers.

G. Minimum Integrated Short Circuit Rating: 100,000 amperes rms symmetrical for 240-volt panelboards; 50,000 amperes rms symmetrical for 480-volt panelboards, or as shown on the drawings.

H. Fusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

I. Fuse Clips (Switches 600 Amperes and Smaller): Provide with Class 'R' rejection clips. Fuse Clips (601 Amperes and Larger): Designed to accommodate Class 'L' fuses.

J. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

K. Arc Energy Reduction:

1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch at the entrance to the electrical room.

## 2.03 BRANCH CIRCUIT PANELBOARDS

A. General

1. Manufacturers:

a. Square D NQ, NF
b. ABB ReliaGear Series
c. Siemens P1
d. Eaton PRL1, PRL2

B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.

C. Enclosure: NEMA PB 1; Type 1.

D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.

G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.

H. Minimum Integrated Short Circuit Rating: As shown on the drawings.

I. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.

J. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

K. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

L. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

**2.04 ACCESSORIES**

A. Provide REQUIRED accessories as described below. Provide SCHEDULED accessories when listed with plan schedules. Refer to plan schedules for additional requirements.

B. Barriers: Provide finger safe barriers for lineside uninsulated and ungrounded terminations and components which remain energized when the main disconnecting device is 'open'. REQUIRED

C. Barriers (Service Equipment): Provide solid barriers for lineside uninsulated and ungrounded terminations and components which remain energized when the main disconnecting device is 'open'. REQUIRED

D. Transformer Disconnect Lockable Hasp: Provide circuit breakers, fused switches, and disconnects serving transformers with a lockable padlock hasp capable of being locked in the open/closed position. REQUIRED

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.

B. Height: 6 feet to handle of highest device.

C. Provide filler plates for unused spaces in panelboards.

D. Provide custom typed circuit directory for each branch circuit panelboard. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

E. Stub five (5) empty one-inch conduits to accessible location above ceiling out of each recessed panelboard.

## 3.02 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

**END OF SECTION**

# SECTION 26 27 26
# WIRING DEVICES

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Device plates and box covers

B. Receptacles (REC-#)

C. Floor boxes and floor box with service fitting (FB-#)

D. Poke-through fittings (PT-#)

E. Cord and plug sets

### 1.02 RELATED SECTIONS

A. Section 26 05 38 - Underfloor Ducts.

### 1.03 QUALITY ASSURANCE

A. Provide similar devices from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Electrical Code, by a testing agency to Authorities Having Jurisdiction and marked for intended use.

C. Comply with the Electrical Code.

### 1.04 REFERENCES

A. DSCC W-C-896F - General Specification for Electrical Power Connector

B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet

C. NEMA WD 1 - General Color Requirements for Wiring Devices

D. NEMA WD 6 - Wiring Devices - Dimensional Requirements

E. NFPA 70 - National Electrical Code (NEC)

F. UL 498 - Standard for Attachment Plugs and Receptacles

G. UL 943 - Standard for Ground Fault Circuit Interrupters

### 1.05 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

### 1.06 COORDINATION

A. Receptacles for Owner Furnished Equipment: Match plug configurations.

B. Cord and Plug Sets: Match equipment requirements.

## PART 2 - PRODUCTS

### 2.01 DEVICE COLOR

A. All switch, receptacle, and outlet colors shall be ivory verified with Architect, unless indicated otherwise.

### 2.02 COVERPLATES

A. All switches, receptacles, and outlets shall be complete with the following:

1. #302 stainless steel coverplates in finished spaces where walls are finished.
2. #302 stainless steel coverplates in unfinished spaces for flush boxes.
3. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.

B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.

C. Install nameplate identification as indicated in Section 26 05 53.

D. Plate securing screws shall be metal with head color matching the wall plate finish.

### 2.03 RECEPTACLES

A. Refer to Electrical Symbols List for device type.

B. REC-DUP: NEMA 5-20R Duplex Receptacle:

1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and steel back strap.

a. Manufacturers:

1) Hubbell 5352A
2) Leviton, 5362-S
3) Pass & Seymour 5362
4) Cooper 5352

C. REC-DUP-GFI: NEMA 5-20R Ground Fault Duplex Receptacle:

1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, listed.

a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
b. Manufacturers:

1) Hubbell GF20L
2) Leviton GFNT2

3) Pass & Seymour 2097
4) Cooper SGF20

D. REC-DUP-WP: NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use cast aluminum cover.
2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.

a. Manufacturers:

1) Hubbell:

a) GFTWRST20 with aluminum housing WP826

2) Leviton GFWT2 with aluminum housing M5979
3) Pass & Seymour 2097TRWR with aluminum housing WIUCAST1
4) Cooper WRSGF20 with aluminum housing WIUMV-1

E. REC-DUP-O: NEMA 5-20R 2121 Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and brass back strap. Bottom half of duplex shall be split circuit wired and controlled by remote relay. Controlled receptacle shall have permanent NEMA approved and Electrical Code compliant marking on face of device.

a. Manufacturers:

1) Hubbell BR20C1
2) Leviton 5362-1P
3) Pass & Seymour 5362SCCH*
4) Eaton 5362CH

F. REC-DUP-XP: NEMA 5-20R Explosion Proof Duplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type, Class 1, Division 1 rated. Spring-loaded cover with gasket. Mount in cast box with threaded openings.

a. Manufacturers:

1) Appleton EFSC175
2) Crouse-Hinds ENRC21201
3) Killark UGR5-20231

G. REC-USB: NEMA 5-20R Receptacle with USB Charger:

1. Standard Grade Type C USB: 125-volt, 20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face.

a. One Type A USB charging rated at 5VDC 3.0A minimum and one Type C USB charging rated at 5VDC 5.0A. Mounted in double gang backbox.
b. Two Type C USB charging rated at 5VDC 5.0A. Mounted in double gang backbox.

c. Manufacturers:

1) Hubbell USB USB20C5

H. REC-SIM-520R: NEMA 5-20R Simplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.

a. Manufacturers:

1) Hubbell HBL5361
2) Leviton 5361
3) Pass & Seymour 5361
4) Cooper 5361

I. REC-SIM-530R: NEMA 5-30R Simplex Receptacle:

1. 125-volt, 30 amp, 3-wire grounding type, phenolic face.

a. Manufacturers:

1) Hubbell HBL9308
2) Leviton 5371
3) Pass & Seymour 3802
4) Cooper 5716N

J. REC-SIM-550R: NEMA 5-50R Simplex Receptacle:

1. 125-volt, 50 amp, 3-wire grounding type, phenolic face.

a. Manufacturers:

1) Hubbell HBL9360
2) Cooper 1253

K. REC-SIM-620R: NEMA 6-20R Simplex Receptacle:

1. 250-volt, 20 amp, 2-pole, 3-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL5461
2) Leviton 5461
3) Pass & Seymour 5871
4) Cooper 5461

L. REC-SIM-630R: NEMA 6-30R Simplex Receptacle:

1. 250-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL9330
2) Leviton 5372
3) Pass & Seymour 3801

4) Cooper 5700N

M. REC-SIM-650R: NEMA 6-50R Simplex Receptacle:

1. 250-volt, 50 amp, 2-pole, 3-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL9367
2) Leviton 5374
3) Pass & Seymour 3804
4) Cooper 5709N

N. REC-SIM-720R: NEMA 7-20R Simplex Receptacle:

1. 277-volt, 20 amp, 2-pole, 3-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell
2) Leviton
3) Pass & Seymour 7621

O. REC-SIM-730R: NEMA 7-30R Simplex Receptacle:

1. 277-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL9315
2) Leviton 9730-A
3) Pass & Seymour
4) Cooper 5795N

P. REC-SIM-750R: NEMA 7-50R Simplex Receptacle:

1. 277-volt, 50 amp, 2-pole, 3-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL9365
2) Leviton 9750-A
3) Pass & Seymour
4) Cooper

Q. REC-SIM-1420R: NEMA 14-20R Simplex Receptacle:

1. 125/250-volt, 20 amp, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL8410
2) Pass & Seymour 3820
3) Cooper 5759

R. REC-SIM-1430R: NEMA 14-30R Simplex Receptacle:

1. 125/250-volt, 30 amp, 3-pole, 4-wire grounding type with thermoplastic face. Flush mounted at +24 AFF.

a. Manufacturers:

1) Hubbell HBL9430A
2) Leviton 278
3) Pass & Seymour 3864
4) Cooper 5744N

S. REC-SIM-1450R: NEMA 14-50R Simplex Receptacle:

1. 125/250-volt, 50 amp, 3-pole, 4-wire grounding type with thermoplastic face. Flush mounted at +4" AFF.

a. Manufacturers:

1) Hubbell HBL9450A
2) Leviton 279
3) Pass & Seymour 3894
4) Cooper 5754N

T. REC-SIM-1460R: NEMA 14-60R Simplex Receptacle:

1. 125/250-volt, 60 amp, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL9460A
2) Leviton 9460
3) Pass & Seymour
4) Cooper 9460N

U. REC-SIM-1520R: NEMA 15-20R Simplex Receptacle:

1. 250-volt, 20 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL8420
2) Leviton
3) Pass & Seymour
4) Cooper

V. REC-SIM-1530R: NEMA 15-30R Simplex Receptacle:

1. 250-volt, 30 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL8430A
2) Leviton 8430
3) Pass & Seymour 5740

4) Cooper 8430N

W. REC-SIM-1550R: NEMA 15-50R Simplex Receptacle:

1. 250-volt, 50 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL8450A
2) Leviton 8450
3) Pass & Seymour 5750
4) Cooper 8450N

X. REC-SIM-1560R: NEMA 15-60R Simplex Receptacle:

1. 250-volt, 60 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL9460A
2) Pass & Seymour 5760
3) Cooper 8460N

Y. REC-SIM-L520R: NEMA L5-20R Simplex Receptacle, Locking Type:

1. 125-volt, 20 amp, 2-pole, 3-wire grounding type with impact resistant thermoplastic face.

a. Manufacturers:

1) Hubbell
2) Leviton
3) Pass & Seymour L520
4) Cooper CWL520R

Z. REC-SIM-L530R: NEMA L5-30R Simplex Receptacle Locking Type:

1. 125-volt, 30 amp, 2-pole, 3-wire grounding type with impact resistant thermoplastic face.

a. Manufacturers:

1) Hubbell
2) Leviton
3) Pass & Seymour L530
4) Cooper CWL530R

AA. REC-SIM-L620R: NEMA L6-20R Locking Type Simplex Receptacle:

1. 250-volt, 20 amp, 2-pole, 3-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL2320
2) Leviton 2320
3) Pass & Seymour L620R
4) Cooper CWL620R

BB. REC-SIM-L630R: NEMA L6-30R Locking Type Simplex Receptacle:

1. 250-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL2620
2) Leviton 2620
3) Pass & Seymour L630R
4) Cooper CWL630R

CC. REC-SIM-L720R: NEMA L7-20R Locking Type Simplex Receptacle:

1. 277-volt, 20 amp, 2-pole, 3-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL2330
2) Leviton 2330
3) Pass & Seymour L720R
4) Cooper CWL720R.

DD. REC-SIM-L730R: NEMA L7-30R Locking Type Simplex Receptacle:

1. 277-volt, 30 amp, 2-pole, 3-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL2630
2) Leviton 2630
3) Pass & Seymour L730R
4) Cooper CWL730R

EE. REC-SIM-L1420R: NEMA L14-20R Locking Type Simplex Receptacle:

1. 125/250-volt, 20 amp, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL 2410
2) Pass & Seymour L1420
3) Cooper CWL1420R

FF. REC-SIM-L1430R: NEMA L14-30R Locking Type Simplex Receptacle:

1. 125/250-volt, 30 amp, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL 2710
2) Leviton 2710
3) Pass & Seymour L1430R
4) Cooper CWL1430R

GG. REC-SIM-L1520R: NEMA L15-20R Locking Type Simplex Receptacle:

1. 250-volt, 20 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL2420
2) Leviton 2420
3) Pass & Seymour L1520R
4) Cooper CWL1520R

HH. REC-SIM-L1530R: NEMA L15-30R Locking Type Simplex Receptacle:

1. 250-volt, 30 amp, 3-phase, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL2720
2) Leviton 2720
3) Pass & Seymour L1530R
4) Cooper CWL1530R

II. REC-SIM-L1620R: NEMA L16-20R Locking Type Simplex Receptacle:

1. 480-volt, 20 amp, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL2431
2) Pass & Seymour L1620R
3) Cooper CWL1620R

JJ. REC-SIM-L1630R: NEMA L16-30R Locking Type Simplex Receptacle:

1. 480-volt, 30 amp, 3-pole, 4-wire grounding type with thermoplastic face.

a. Manufacturers:

1) Hubbell HBL2730
2) Leviton 2730
3) Pass & Seymour L1630R
4) Cooper CWL1630R

KK. REC-SIM-L2120R: NEMA L21-20R Locking Type Simplex Receptacle:

1. 120/208Y 3 phase 20-amp 5 wire grounding type.

a. Manufacturers:

1) Hubbell HBL2510
2) Cooper CWL2120R
3) Pass & Seymour L2120R

LL. REC-SIM-L2130R: NEMA L21-30R Locking Type Simplex Receptacle:

1. 120/208Y 3 phase 30-amp 5 wire grounding type.

a. Manufacturers:

1) Hubbell HBL2750
2) Cooper CWL2130R
3) Pass & Seymour L2130R

MM. REC-QUAD: NEMA 5-20R Double Duplex Receptacle:

1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to Duplex Receptacle above.

NN. REC-QUAD-GFI: NEMA 5-20R Double Duplex GFI Receptacle:

1. Consists of two duplex GFI receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to Duplex GFI Receptacle above.

OO. REC-QUAD-USB: NEMA 5-20R Double Duplex USB Receptacle:

1. Consists of two duplex USB receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to USB Receptacle above.

PP. REC-QUAD-WP: NEMA 5-20R Weatherproof Ground Fault Quad Receptacle:

1. Consists of two duplex, GFCI receptacles. Double gang box. Provide extra-duty NEMA 3R rated while-in-use cast aluminum cover.

a. Manufacturers:

1) Receptacle: Refer to GFCI Receptacle above.
2) Cover:

a) Intermatic WP1030MXD
b) Pass & Seymour WIUCAST2
c) Thomas & Betts Red Dot 2CKU

QQ. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.

RR. Side wired devices shall have four binding screws that are undercut for positive wire retention.

SS. Ground fault circuit interrupter (GFCI) receptacles shall be listed and comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.

TT. Hazardous (Classified) location receptacles shall comply with NEMA FB 11.

**2.04 FLOOR BOXES**

A. Cover Color and Style: Verify with Architect from manufacturer standard options.

B. Refer to Technology drawings for voice/data, Audio/Video outlet, and coordination requirements.

C. Floor Boxes Housing Material Based on Cast-in-Place Floor Type:

1. Slab on Grade: Cast Iron; corrosion resistant.
2. Elevated Slab: Cast Iron,
3. Raised Access Floor, Cast-in-Place, or Access Floor Panels: Stamped steel.
4. Wood Floor, not Cast-in-Place: Stamped steel and rated for wood floor application.

D. FB-#: Square or Rectangular (Standard):

1. Floor Box, square or rectangular, square/rectangular flush-mounted hinged cover with flange, provide complete with appropriate outlet cover plates and hardware, for use with concrete pour floors, fully adjustable.
2. Gang / Outlet Descriptions:

a. 125 Volt, 20 amp, NEMA 5-20R duplex receptacle with 3/4-inch conduit.
b. Voice/Data outlet with 1-1/4-inch conduit.
c. Audio/Visual outlet with 1-1/4-inch conduit.
d. Power furniture/equipment feed with flexible whip and 1-inch conduit.
e. Voice/Data furniture/equipment feed with flexible whip and 1-inch conduit.
f. Audio/Visual furniture/equipment feed with flexible whip and 1-inch conduit.
g. Spare with 1- inch conduit.
h. Refer to Technology drawings for additional information related to voice/data and audio/visual outlet requirements.

3. Manufacturers:

a. Cast:

1) Hubbell B### Series
2) Legrand Wiremold 880 Series
3) ABB Steel City 640 / 840 Series

b. Stamped Steel:

1) Hubbell 242# Series
2) Legrand Wiremold 880 Series
3) ABB Steel City 740 Series

c. Non-Metallic PVC:

1) Hubbell

2) Legrand Wiremold 880 Series
3) ABB Steel City 640 Series

4. Installation: Group route raceway conduits under slab on grade or in elevated slab to nearest wall. Route conduits to nearest wall or as shown on drawings. Provide hub reducers when applicable.

**2.05 POKE-THROUGH FITTINGS**

A. Cover Color and Style: Verify with Architect from manufacturer standard options.

B. Refer to Technology drawings for voice/data, Audio/Video outlet, and coordination requirements.

C. UL listed as fire-rated poke-through device for 1, 2, 4-hour rated floors: include fire stops and smoke barriers in through-floor component. UL514A listed for scrub locations.

D. Terminate in 4-inch square by 2-1/2-inch deep junction box.

E. Suitable for installation with a floor thickness of 2-1/4 to 7 inches.

F. PT-#: 4" Fire Rated Poke-Through:

1. Semi-flush mounted, hinged covers, for use with 4-inch core holes, provide complete with appropriate outlet coverplates and hardware. UL 514 scrub rated listed.
2. Gang / Outlet Descriptions, route conduit in ceiling space of lower level. Provide provisions to core drill floor to route power circuits to panel on same floor as poke through. Route low voltage raceways to scheduled technology room:

a. 125 Volt, 20 amp, NEMA 5-20R duplex receptacle.
b. Voice/Data outlet.
c. Audio/Visual outlet.
d. Power furniture/equipment feed with flexible whip.
e. Voice/Data furniture/equipment feed with flexible whip.
f. Audio/Visual furniture/equipment feed with flexible whip.
g. Spare.
h. Conduit Raceway (in ceiling space below floor):

1) Power: 3/4-inch conduit.
2) Voice/Data: 1-1/4-inch conduit.
3) Audio/Visual: 1-1/4-inch conduit.

i. Refer to Technology drawings for additional information related to voice/data and audio/visual outlet requirements.

3. Manufacturers:

a. Hubbell SystemOne Series
b. Legrand Wiremold 4RF/RC Series
c. ABB Steel City FPT4 Series

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.

B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.

C. Ground Fault Protection: Provide ground fault protection for all branch circuit breakers serving 120/208 receptacles and electrical outlets rated 50 amps or less single-phase and 100 amps or less three-phase in the following locations, as shown on drawings, or required by adopted code:

1. Bathrooms, locker rooms, shower rooms
2. Kitchens' all 120-volt through 250-volt receptacles
3. Buffet, serving, food preparation areas; all 120-volt through 250-volt receptacles
4. Rooftops
5. Interior/Exterior locations subject to damp/wet conditions
6. When located within 6 feet of sinks, bathtubs, and shower stalls
7. Plug-and-cord receptacles when the utilization appliance is located within 6 feet of a sink edge.
8. Aquariums and bait wells
9. Garages, accessory buildings, service bays
10. Accessory dwelling buildings
11. Exterior dwelling outlets (disconnects, equipment connections, etc.) when required by code.
12. Boathouses
13. Specific Appliances: Auto vacuum machines, water drink/bottle fill coolers, pressure staying machines, tire inflation machines, vending machines, sump pumps, dishwashers, electric ranges, ovens, clothes dryers, microwave ovens
14. Horticultural luminaire branch circuits
15. Future Provisions: Provide a conduit raceway and backbox for the future addition of countertop pop-receptacle when receptacles are not installed in kitchen islands and peninsulas.

D. Arc-Fault Protection: Provide arc-fault protection for all branch circuit breakers serving the following spaces, or required by adopted code.

1. Dwelling unit living and occupied areas including but not limited to kitchens, family, dining, living, parlors, libraries, dens, bedrooms, sunrooms, recreation, closets, hallways, laundry, and similar spaces.
2. Dormitory bedrooms, living rooms, hallways, closets, bathrooms, and similar rooms
3. Guest rooms and guest suites
4. Sleeping rooms for nursing homes, limited care, and similar non-dwelling living quarters dedicated to sleeping

E. Tamper Resistant Protection: Provide tamper resistant protection for all 15 / 20-amp 120/208 straight blade wiring devices in the following locations, as shown on the drawings, or required by adopted code.

1. Dwelling units and accessory dwelling unit structures

2. Boathouses
3. Dormitory units
4. Guest rooms, guest suites, and common public areas
5. Childcare, preschool, elementary, middle, high school, educational facilities
6. Medical Business Office: Offices, corridors, waiting rooms, common areas
7. Public Buildings: Corridors, waiting rooms, common areas
8. Public Spaces involving: Transportation waiting, gymnasiums, fitness centers, auditoriums, public use venue common areas
9. Nursing homes, assisted living, psychiatric spaces, substance abuse, foster care facilities
10. Agricultural buildings common areas accessible to the public

F. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This may include X-ray or similar non-destructive means.

G. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.

I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

J. Install devices and wall plates flush and level.

K. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 05 53 - Electrical Identification.

L. Test receptacles and modular wiring connectors for proper polarity, ground continuity and compliance with requirements.

M. Floor Box Installation:

1. Set boxes level and flush with finish flooring material.
2. Use cast iron floor boxes for installations in slab on grade. Trim shall match floor covering to be used.
3. Provide a minimum horizontal offset of 24 inches between boxes.
4. Provide saw-cutting and patching of existing concrete floors as necessary for floor box installations within existing floors.

**END OF SECTION**

# SECTION 26 28 13
# FUSES

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Fuses

B. Spare Fuse Cabinet

### 1.02 REFERENCES

A. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Types

B. UL 198E - Class R Fuses

C. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses)

D. NEMA FU 1 - Low Voltage Cartridge Fuses

E. NFPA 70 - National Electrical Code (NEC)

### 1.03 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

### 1.04 EXTRA MATERIALS

A. Provide two fuse pullers.

B. Provide three of each size and type of fuse installed.

### 1.05 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS - FUSES

A. Bussman, Division of Eaton

B. Edison Fuse, Division of Cooper Industries

C. Mersen

D. Littelfuse Inc

## 2.02 FUSES

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

C. Fuses with ratings larger than 600 amperes: Class L (time delay), unless otherwise noted on the drawings.

D. Fuses with ratings larger than 200 amperes but equal to or less than 600 amperes: Class RK-1 (time delay), unless otherwise noted on the drawings.

E. Fuses with ratings less than or equal to 200 amperes (not including control transformer fuses): Class RK-5, unless otherwise noted on the drawings.

F. Control transformer fuses: Class CC (time delay).

G. Fuses for packaged equipment: Size and type as recommended by equipment manufacturer.

## 2.03 SPARE FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
4. Fuse Pullers: For each size of fuse.

# PART 3 - EXECUTION

## 3.01 INSTALLATION

A. Install fuses where indicated on the drawings and specifications.

B. Install fuses in accordance with manufacturer's instruction.

C. Install fuses in packaged equipment as required by equipment manufacturer.

D. Install fuse with label oriented such that manufacturer, type, and size are easily read.

E. Install spare fuse cabinet in the Main Electrical Room.

**END OF SECTION**

# SECTION 26 28 16
# DISCONNECT SWITCHES

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Fusible switches

B. Non-fusible switches

C. Elevator Service Disconnect Switch

### 1.02 RELATED SECTIONS AND WORK

A. Refer to the Disconnect and Starter Schedule for rating and configuration.

### 1.03 REFERENCES

A. NEMA KS 1 - Enclosed Switches

### 1.04 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Product Data: For each type of enclosed switch, circuit breakers, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.

C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

### 1.05 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## PART 2 - PRODUCTS

### 2.01 FUSIBLE AND NON-FUSIBLE SWITCHES

A. Acceptable Manufacturers:

1. Square D 3110 Series
2. Eaton DH Series
3. ABB TH Series
4. Siemens HNF / HF Series

B. Fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on the drawings.

C. Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position.

D. Enclosures: Type as indicated on the disconnect schedule.

E. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.

1. Lockable
2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

## 2.02 ELEVATOR SERVICE DISCONNECT SWITCH

A. Acceptable Manufacturers:

1. Eaton Bussmann PS Series
2. Mersen ES Series
3. Littlefuse LPS Series

B. Elevator Service Fused Disconnect Switch: Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool, with lockable handle, ratings per drawing schedule, 120 volt shut trip, two field convertible mechanically interlocked form C auxiliary contacts, shunt trip voltage monitor relay, integral control transformer, Pilot Light "on", neutral bar/lug, NEMA 1 enclosure, minimum 100K SCCR, UL Listed.

C. Provide with fire alarm interface relays for:

1. Elevator Recall
2. Elevator Alternative Floor Recall
3. Elevator Shut Down Sequence
4. Fire Fighter's Cab Visual Alarm
5. Elevator Hoistway Damper

D. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.

1. Lockable
2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

# PART 3 - EXECUTION

## 3.01 INSTALLATION

A. Install disconnect switches where indicated on the drawings.

B. Install fuses in fusible disconnect switches.

C. Field coordinate installation with other contractors and equipment to maintain code required working space requirements.

D. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

**3.02 ELEVATOR SERVICE DISCONNECT SWITCH**

A. Coordinate installation with elevator requirements and contractor.

B. Coordinate installation with fire alarm contractor.

**3.03 ADJUSTING**

A. Set field-adjustable circuit breaker trip ranges.

**END OF SECTION**

# SECTION 26 36 00
# TRANSFER SWITCH

## PART 1 - GENERAL

### 1.01 RELATED SECTIONS AND WORK

A. Refer to the Transfer Switch Schedule for rating and configuration.

### 1.02 REFERENCES

A. NEMA ICS 1 - General Standards for Industrial Control and Systems

B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies

C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems

D. NEMA ICS 10 - Guide to Application of Low-Voltage Automatic Transfer Switch Equipment

E. UL 1008 - Standard for Automatic Transfer Switches

F. NFPA 99 - Health Care Code

G. NFPA 110 - Standard for Emergency and Standby Power Systems

### 1.03 REGULATORY REQUIREMENTS

A. Conform to applicable code for emergency and standby electrical systems.

## PART 2 - PRODUCTS

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field measurements are as instructed by the manufacturer.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means acceptance of existing conditions.

### 3.02 CONTROL AND SIGNAL CABLING

A. Provide control and signal cabling per manufacturer recommendations for the following systems components:

1. Remote annunciator.
2. Elevator controller. Provide wiring to elevator controller for emergency source mode and emergency to normal pre-signal.

3. Generator start signal. The generator start signal cabling for the following transfer switches shall be fire protected for a minimum of 2 hours using an approved method:

    a. Fire pump transfer switch
    b. [**Emergency, legally required, optional standby transfer switches**]
    c. [**Life safety, critical, equipment branch transfer switches**]
    d. Approved Methods:

        1) Raceway or cable encased in a minimum of 2 inches of concrete cover.
        2) Listed fire resistive raceway / cable system.
        3) Raceway / cable is protected by a listed electrical circuit protective system.

## 3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

**END OF SECTION**

# SECTION 26 41 00
# LIGHTNING PROTECTION SYSTEMS

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Air terminals and interconnecting conductors

B. Grounding and bonding for lightning protection

### 1.02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Section 26 05 26 - Grounding and Bonding

B. Section 26 43 00 - Surge Protection Devices

### 1.03 REFERENCES

A. ANSI/NFPA 780 - Lightning Protection Code

B. ANSI/UL 96 - Lightning Protection Components

C. UL 96A - Installation Requirements for Lightning Protection Systems

### 1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 05 00.

B. Shop drawings shall indicate layout of air terminals, grounding electrodes, and bonding connections to structure, ground grid, and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details. Include indications for use of raceway and type, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.

C. Product data shall show dimensions and materials of each component, and include indication of listing in accordance with ANSI/UL 96 or a nationally recognized testing laboratory.

D. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by an NRTL or LPI.

E. Submit manufacturer's installation instructions under provisions of Section 26 05 00.

F. Certification, signed by Contractor, that roof adhesive for air terminals is approved by manufacturers of both the terminal assembly and the single-ply membrane roofing material.

G. Field inspection reports indicating compliance with specified requirements.

## 1.05 SYSTEM DESCRIPTION

A. Lightning Protection System: System protecting building, consisting of air terminals on roofs, roof-mounted mechanical equipment, chimneys and stacks, parapets, bonding of structure and other metal objects; grounding electrodes; and interconnecting conductors. Class I materials shall be used for systems on structures not exceeding 75 feet in height. Class II materials shall be used for systems on structures exceeding 75 feet in height above grade.

B. Performance Statement: This specification and the accompanying roof plans describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every air terminal, conductor, and connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all equipment and wiring required for a complete and operational system.

## 1.06 PROJECT RECORD DOCUMENTS

A. Submit project record documents under provisions of Section 26 05 00.

B. Accurately record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

C. Listing and Labeling: As defined in NFPA 780, "Definitions" Article.

## 1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in lightning protection equipment with minimum three (3) years documented experience and a member of the Lightning Protection Institute or who is listed by a nationally recognized testing laboratory.

B. Installer: Authorized installer of manufacturer with minimum three (3) years documented experience and certified by the Lightning Protection Institute.

C. Listing and Labeling: As defined in NFPA 780, "Definitions" Article.

## 1.08 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference one week prior to commencing work of this Section.

## 1.09 SEQUENCING AND SCHEDULING

A. Coordinate work under provisions of Section 26 05 00.

B. Coordinate the work of this Section with exterior and interior finish installations. Coordinate painting of exposed conduits to match building finish with Architect.

C. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.

D. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

A. Heary Brothers Lightning Protection Co., Inc

B. Thompson Lightning Protection

C. Harger Lightning Protection

D. Robbins Lightning, Inc

E. Erico International Corporation

F. Burndy Thermoweld

G. VFC Lightning Protection

### 2.02 MATERIALS

A. All materials shall be copper and/or copper-bronze. In locations where the system components are mounted on aluminum surfaces, aluminum materials shall be used to avoid electrolytic corrosion of dissimilar metals.

B. Components: In accordance with ANSI/UL 96 or nationally recognized testing laboratory.

C. Air Terminals: Solid, unless otherwise indicated. Provide air terminals with safety 3/4" sphere tip. Provide swivel adapters to plumb air terminals when mounting on sloping surfaces.

D. Air Terminal for Chimney: Lead-coated copper.

E. Grounding Rods: Copper clad steel.

F. Ground Plate: 18"x18"x0.032" Copper ground plate.

G. Connectors and Splicers: Bronze, unless otherwise indicated.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify that field measurements are as shown on the shop drawings.

C. Beginning of installation means installer accepts existing conditions.

### 3.02 PROTECTION OF SURROUNDING ELEMENTS

A. Protect elements surrounding work of this Section from damage or disfiguration.

### 3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with ANSI/NFPA 780, UL 96A, and LPI-175.

C. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.

D. Conceal the following conductors:

1. System conductors.
2. Down conductors.
3. Interior conductors.
4. Conductors within normal view from exterior locations at grade within 200 feet of building.
5. Notify Architect/Engineer at least 48 hours in advance of inspection before concealing lightning protection components.

E. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.

F. Bond extremities of metal bodies exceeding 60 feet in vertical length to structural steel members.

G. Provide a ground ring electrode that meets or exceeds minimum requirements in NFPA 780.

1. Bond ground terminals to ground ring electrode.
2. Bond grounded metal bodies on building within 12 feet of ground to ground ring electrode.
3. Bond grounded metal bodies on building within 12 feet of roof to interconnecting loop at eave level or above.

H. Structures exceeding 60 feet in height: Bond lightning protection components with intermediate-level interconnection loop conductors to down conductors and other grounded media at maximum 60-foot intervals.

## 3.04 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

C. Bi-metal transition fittings shall be used when changing between aluminum and copper conductors.

## 3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 00.

B. Obtain the services of Underwriters' Laboratories, Inc. to provide inspection and certification of the lightning protection system under provisions of UL 96A to obtain a UL Master Label for system.

C. Install UL Master Label and attach to building at location directed by the Owner.

D. Provide an inspection by an inspector certified by LPI to obtain an LPI certification.

**END OF SECTION**

# SECTION 26 43 00
# SURGE PROTECTION DEVICES

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. This section describes materials and installation requirements for factory and field wired low voltage surge protection devices (SPD) for the protection of all AC electrical circuits. SPD equipment to be installed at designated service entrance equipment, distribution panels, electronic equipment, elevators, and receptacle devices.

### 1.02 QUALITY ASSURANCE

A. The specified unit shall be designed, manufactured, tested and installed in compliance with the above references. The unit shall be "Listed by Underwriters Laboratories" to UL 1449.

B. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacturer of such products for a minimum of five years.

### 1.03 REFERENCES

A. ANSI/IEEE C62.33 - IEEE Guide on Testing of MOV components

B. ANSI/IEEE C62.35 - IEEE Guide on Testing of SAD components

C. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits

D. ANSI/IEEE C62.45 - IEEE Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits

E. ANSI/UL 1449 Latest Edition - UL Standard for Safety for Surge Protective Devices

F. CBEMA - Computer Business Equipment Manufacturers Association

G. IEC 664 - International Engineering Consortium, Standard for Clamping Voltage

H. NFPA 70 - National Electrical Code (NEC)

I. CEC California Electrical Code

J. UL 67 - Listed for Internal Panelboard Transient Voltage Surge Suppressors

K. UL 96A - Devices listed as approved for secondary surge arrestors (VZCA)

L. UL 248-1 - Fusing

M. UL 1283 - Electromagnetic Interference Filters, Fifth Edition

## 1.04 SUBMITTALS

A. Shop Drawings: Should include device dimensions, mounting requirements including wire size and over-current protection device rating, nameplate nomenclature, electrical ratings, short circuit current rating, and test results as indicated below under "Testing, Warranty and Life Expectancy" as provided by an independent test lab or a UL certified test lab for the category(ies) of suppression device(s) specified using the appropriate IEEE test wave. Product data sheets with installation instructions for each size and type of device are required. Shop drawings submitted without the testing data as required by section this section will be rejected.

B. Fuse information: Provide fuse information if required for operation. Include size, manufacturer, time-current chart responses to UL 1449 testing requirements, maximum surge protection capability per mode and phase as limited by the fuse, and verification of repetitive surge protection device operation without system degeneration greater than 10%.

## 1.05 SPARE PARTS

A. Surge Protection Modules: Furnish 1 replacement module for each type installed.

B. Fuses: Furnish to the Owner 3 spare fuses of each type and rating installed.

## 1.06 TESTING, WARRANTY AND LIFE EXPECTANCY

A. Manufacturer must provide independent testing on repetitive capability and maximum surge current rating of service entrance suppressor units. This shall be performed at a nationally recognized lab not affiliated with the manufacturer.

1. Single pulse surge current capacity: Single pulse surge current tested in a mode at rated surge currents.
2. Single pulse surge current capacity test: An initial UL 1449 defined 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage (VPR).
3. A single 8 x 20µs waveform pulse of maximum rated surge current per mode shall then be applied. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.

B. Minimum Repetitive Surge Current Capacity:

1. Service entrance suppressor units should be tested repetitively at an independent lab to verify repetitive capacity.
2. Minimum Repetitive Surge Current Capacity Test:

    a. An initial UL 1449 surge defined as 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage.
    b. A repetitive number of ANSI/IEEE C62.41.2-2002 (Category C3) surges, defined as a 1.2 x 50µs 10kV or 20kV open circuit voltage waveform and an 8 x 20µs 10,000A short circuit current waveform, shall then be applied at one-minute intervals.
    c. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival.

3. Survival is achieved if the suppression voltage (VPR) does not vary by more than 10%.
4. Proof of such testing shall be the test log generated by the surge generator.

C. Provide UL 1449 classification white sheet pages indicating the VPR (voltage protection rating) for each SPD unit submitted for this product using the 6kV/3kA combination wave surge.

D. Warranty: Ten (10) years. Includes workmanship, installation and programming.

E. No scheduled parts replacement or preventative maintenance shall be required.

## PART 2 - PRODUCTS

### 2.01 DESCRIPTION

A. General: The unit shall provide transient voltage suppression, surge current diversion and high-frequency noise attenuation, when connected in parallel to the facilities distribution system. The unit MCOV shall not be less than 115% of the nominal system voltage. Operating frequency shall be for a 60 Hz system. The unit shall provide protection in all normal modes for "wye" and "delta" systems.

B. Short Circuit Current Rating: Provide factory label for SCCR rating. The short circuit current rating shall be the larger of the listed value on the drawings or as required by the equipment protected.

### 2.02 RATINGS

A. Service Entrance Suppressors - Hybrid:

1. For 277/480 120/208-volt, 3 phase, 4 wire, type 2, category C3 unit.

    a. Surge current capacity: 120,000/240,000 amps per protection mode/phase
    b. Nominal Discharge Current (IN): 20 kA.
    c. Mounting: Refer to the drawings.
    d. Voltage Protection Rating: Refer to requirements below.
    e. Components: Minimum component size of modular 20mm thermally protected metal oxide varistors (MOV). Modular hybrid combination of 20mm MOV may be combined with silicon avalanche diodes (SAD) or selenium cells.]

2. Manufacturers:

    a. Current Technology SL3 Series
    b. ASCO Power Technologies 570 Series
    c. LEA International DS Series

B. Secondary Distribution Suppressors:

1. For 277/480 120/208-volt, 3 phase, 4 wire, type 2, category B3/C1 unit.

    a. Surge current capacity: 60,000/120,000 amps per protection mode/phase
    b. Nominal Discharge Current (IN): 20 kA.
    c. Mounting: Refer to the drawings.
    d. Voltage Protection Rating: Refer to requirements below.
    e. Components: Minimum component size of 20mm metal thermally protected oxide varistors (MOV).

2. Manufacturers:
    a. Square D Surgelogic EMA Series

b. Siemens TPS3 Series
c. Eaton SPD Series
d. Current Technology Current Guard Plus
e. ASCO Power Technologies 400 Series
f. LEA International CFS Series

C. Voltage Protection Rating:

1. Protection modes and UL 1449 voltage protection rating for surge suppression units per each mode (L-N, L-L, L-G, and N-G as appropriate).

a. 277/480 Volt, 3 phase, 4 wire.1200 Volt L-N, L-G, N-G and 1800 Volt L-L
b. 480 Volt, 3 phase, 3 wire. 2000 Volt L-G, L-L
c. 120/208 Volt, 3 phase, 4 wire. 700 Volt L-N, N-G, 800 Volt L-G and 1200 Volt L-L
d. 240 Volt, 3 phase, 3 wire. 1200 Volt L-G, L-L
e. 120/240 Volt, 3 phase, 4 wire. 700 Volt L-N, N-G, 800 Volt L-G and 1200 Volt L-L

D. EMI/RFI Noise Rejection or Filtering:

1. Each unit shall include a UL1283 first order, high-frequency filter for noise filtering between 10 KHz and 100 MHz.

E. Indication:

1. Each unit shall include solid-state indicators with externally mounted LED visual status indicators that indicate on-line status of each protection mode of the unit.
2. Each unit shall include a visual indicator that indicates the unit is functioning properly and providing protection.
3. Each unit shall include an audible alarm with silencing switch to indicate when protection has failed.
4. Provide each service entrance secondary distribution type unit(s) with a transient counter.
5. Each unit shall contain form "C" contacts for remote indication of an alarm status.

## PART 3 - EXECUTION

### 3.01 INSPECTION

A. Examine equipment for size and type of surge protection device to be used to ensure physical compatibility.

B. Inspect surge protection device for any signs of physical damage due to shipping or handling before installing surge protection device.

### 3.02 INSTALLATION

A. Mounting Location:

1. The unit shall be installed as close as practical to the panel secondary lugs in accordance with applicable national/Local Electrical Codes and the manufacturer's recommended installation instructions. Connect the unit to the switchboard or panel using a conduit nipple. Flush mount the unit in the front of the switchboard. Mount unit directly across from the breaker or disconnect serving it.
2. Integral surge protection devices mount between the main and branch circuit breakers.

3. If internal surge protection device is specified, device shall be installed in a barrier compartment isolated from other components.

B. Connections:

1. Conductors from the protected bus to the unit shall not be any longer than necessary avoiding unnecessary bends. The conductor leads shall be twisted together and as short as possible. Connection shall be with mechanical lugs for each phase, neutral, and ground if applicable. Contractor shall provide wire and circuit breakers sized per the approved manufacturer's requirements. Maximum lead length from protected bus to surge protection device shall be per manufacturer's requirements, but no greater than 5'-0".
2. The surge protection unit shall be isolatable from the electrical distribution system via 3 pole circuit breaker mounted in the switchboard/panelboard. Single phase 120-volt units shall be hardwired without a disconnecting means.
3. Neutral and ground shall not be bonded together at secondary panelboard locations.

C. General:

1. Check unit for proper operation of protection and indication under start-up.
2. Check unit to ensure all MOVs for each mode of protection are operational. Verify integral fuse links are operational and have not melted.
3. Surge suppression devices shall not be installed ahead of the main service disconnect(s).
4. Install fuses in all fuse holders and fused disconnects internal to the surge protection unit. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit. External fusing of the surge protection device is not allowed.
5. Coordinate location of surge protection device to allow adequate clearances for maintenance.
6. Manufacturer service phone number shall be posted on the front of the surge protection device.

**END OF SECTION**

# SECTION 26 51 19
# LED LIGHTING

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Interior luminaires and accessories

B. Light-emitting diode (LED) luminaire systems

C. Emergency exit signs

### 1.02 RELATED SECTIONS

A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:

1. 26 09 33 Lighting Control Systems
2. 26 52 15 Emergency Lighting Inverter
3. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

### 1.03 REFERENCES

A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products

B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement

C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment

D. NFPA 70E - National Electrical Safety Code

E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System

F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products

G. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED

I. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)

J. UL 924 - Standard for Emergency Lighting and Power Equipment

K. UL676 Standard for Underwater Luminaires and Submersible Junction Box

## 1.04 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Basic Requirements of Submittal:

1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's, LED light engine, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
3. Include outline drawings, support points, weights, and accessory information for each luminaire.
4. Submit manufacturer origin of LED chipset and driver.

C. LED Lighting - Performance Testing Submittal (when requested by Architect/Engineer):

1. IESNA LM-79: Include photometric report for the latest generation system being furnished. Provide name of independent testing laboratory, report number, date of test, luminaire series/model number, input wattage, and light source specifications.
2. IESNA LM-80: Measuring Lumen Maintenance of LED Light Sources.

D. LED Lighting - Control Compatibility Submittal:

1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.

E. Submit Design Lights Consortium (DLC) information for each luminaire type.

F. Submit utility rebate forms where offered at project location. Submit completed rebate forms within 30 days of Substantial Completion.

## 1.05 EXTRA STOCK

A. Provide extra stock under provisions of Section 26 05 00.

B. LED Light Engines or Modules: 3 percent of quantity installed, minimum one (1) of each size and type of field replaceable light engine or module. Provide field replacement installation instructions.

C. Lenses: Three (3) percent of quantity installed, minimum one (1) of each size and type.

D. LED Drivers: 3 percent of quantity installed, minimum one (1) of each size and type.

E. Exit Signs: Provide 5 additional exit sign luminaires complete with labor, conduit, and wire. Additional exit luminaires shall be located per the Architect/Engineer or provided as attic stock when a location is not defined prior to Owner occupancy. When multiple exit signs are scheduled, the quantity listed above shall represent each type listed.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site. Store and protect under provisions of Section 26 05 00.

B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.

C. Handle site lighting poles carefully to prevent breakage and damage to finish.

### 1.07 MOCKUP

A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires in mockup may be reused as part of complete work if in original condition.

### 1.08 WARRANTY

A. The warranty period begins at the date of Substantial Completion.

B. LED Light Engines and Drivers:
1. LED Drivers and Dimming Drivers: Five (5) years
2. Light Emitting Diode (LED) Light Engines: Five (5) years

C. Emergency Lighting Units and Exit Signs:

1. Emergency Lighting Units: Three (3) year, non-prorated
2. Exit Signs: Three (3) year, non-prorated
3. Emergency Unit and Exit Sign Battery: Sealed lead acid or lead calcium cell, requiring no maintenance or replacement for ten (10) years under normal conditions.

D. Emergency Drivers:

1. Emergency LED Driver: Three (3) years

E. Emergency Inverter for LED Light Engines:

1. Emergency Inverter and Battery: Sealed nickel cadmium five (5) year, non-prorated.

### 1.09 REGULATORY REQUIREMENTS

A. Conform to NFPA 101 for installation requirements.

## PART 2 - PRODUCTS

### 2.01 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.

B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.

C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction.

D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.

E. Painted reflector surfaces shall have a minimum reflectance of 90%.

F. All painted components shall be painted after fabrication.

**2.02 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS**

A. Refer to the luminaire schedule for color temperature and minimum color rendering index CRI requirements. Provide light source color consistency by utilizing a binning tolerance within a maximum 3-step McAdam ellipse unless noted otherwise.

B. LED chip arrays specified as color changing shall have chip colors as noted on the luminaire schedule.

C. Rated life shall be minimum of 50,000 hours at L70.

D. LED chips shall be wired so that failure of one chip does not prohibit operation of the remainder of the chip array.

E. Luminaire delivered lumens is defined as the absolute lumens per the manufacturers LM-79-08 test report.

F. LED luminaires shall be designed for ease of component replacement including modular replaceable boards or Zhaga sockets. Luminaires that are factory sealed and do not have field replaceable parts shall provide a 10-year warranty.

G. LED light engine shall have a maximum LLD of 0.85 at 50,000 hours at 25°C ambient.

H. LED Driver:

1. Solid state driver with integral heat sink. Driver shall have over-heat, short-circuit and overload protection, power factor 0.90 or above and maximum total harmonic distortion of 10%. Driver shall have a voltage fluctuation tolerance of +/- 10%.
2. Drivers shall have dimming capabilities as outlined in the luminaire schedule for each luminaire type. Dimming shall control light output in a continuous curve from 100% to 10% unless noted otherwise.
3. Driver shall have a minimum of 50,000 hours rated life.
4. Driver shall be tested to ANSI C82-16 for input current inrush, total harmonic distortion (THD), and power factor. Driver start time shall be less than 0.5 seconds to 98% of initial light output. Flicker should be less than 30% throughout the operating range.
5. Driver shall be field replaceable without removal of the luminaire.
6. Class A sound rating; inaudible in a 27 dBA ambient.
7. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.

## 2.03 EMERGENCY EXIT SIGNS

A. Self-Powered Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings. One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, test switch, AC ON pilot light, automatic charger, and electronic circuitry. Power failure relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

B. Directional Indicators: The directional indicator for exit signage shall be of a chevron type meeting all requirements of NFPA 101.

C. Self-Diagnostics and Testing:

1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five minute discharge/diagnostic test at any time.

# PART 3 - EXECUTION

## 3.01 INSTALLATION

A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications.

1. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Provide independent support as follows:

a. Luminaires less than 56 lbs: Provide a minimum of two (2) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires.
b. Luminaires 56 lbs or greater: Provide a minimum of four (4) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires. Support luminaire independent of the ceiling system.
c. Luminaires larger than eight square feet (8 ft2): Support luminaire independent of the ceiling system.

B. Do not fasten luminaire supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted. Support wires shall be tightly wrapped (minimum of three turns within 3 inches of the connection) and sharply bend to prevent vertical movement.

C. Support suspended or pendant mounted luminaires independent of ceiling grid with adjustable stainless steel aircraft cables or per luminaire schedule mounting requirements. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.

D. Support wire used to independently support luminaires, raceways, and wiring systems shall be distinguishable from ceiling support systems by color (field paint), tagging or equivalent means.

E. Provide seismic bracing of luminaires per IBC Chapter 16. Design pendant luminaires on a component seismic coefficient (Cc) of 0.67. Design vertical supports with a factor of safety of 4.0. Contractor shall verify the Seismic Hazard Exposure Group and Performance Criteria Factor.

F. Install lamps in lamp holders of luminaires.

G. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.

H. Industrial Pendant Luminaires: Use power hook hangers rated 500 pounds minimum or provide safety chain between driver and structure. Provide safety chain between reflector and driver.

I. Luminaire Pole Bases: Sized and constructed as indicated on the drawings. Project anchor bolts 2 inches minimum above base. Install poles plumb with double nuts for adjustment. Grout around pole anchor base.

J. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

**3.02 CONSTRUCTION USE OF PROJECT LUMINAIRES**

A. The Contractor shall provide temporary construction lighting per the requirements of Division 1.

B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

**3.03 EMERGENCY LIGHTING UNITS AND EXIT SIGNS**

A. Install units plumb and level.

B. Aim directional lamp heads as directed.

C. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

**3.04 RELAMPING**

A. Replace failed LED light engine modules or arrays at completion of work.

**3.05 ADJUSTING AND CLEANING**

A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Touch up luminaire and pole finish at completion of work.

## 3.06 OWNER TRAINING

A. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion, with the Owner's Representative.

B. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

## 3.07 LUMINAIRE SCHEDULE

A. As shown on the drawings.

**END OF SECTION**