
PROJECT MANUAL

PHILIPS HEALTHCARE

BON SECOURS CHARITY HEALTH SYSTEM GOOD SAMARITAN HOSPITAL IMAGING RENOVATIONS INCLUDING TMP 30 – CT & TMP 92 - MRI

255 LAFAYETTE AVE
SUFFERN, NEW YORK 10901

CPL PROJECT NO: 15068.00

DOCUMENT DATE: MARCH 9, 2021

DESIGN PROFESSIONAL'S CERTIFICATION

The undersigned certifies that, to the best of his or her knowledge, information and belief, that the "Design conforms to all applicable provisions of the Building Code of New York State

ARCHITECT/ENGINEER

CPL

30 CENTURY HILL DRIVE – SUITE 104
LATHAM, NEW YORK 12110
(800) 274-9000 - PH
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**SECTION 002200
INSTRUCTIONS TO BIDDERS**

PART 1 GENERAL

1.01 SUMMARY

- A. Philips Healthcare invites bids for Imaging Department Renovations (including new CT & MRI) Work for Philips Health Care/Imaging Renovations at Bon Secours Charity Health System Good Samaritan Hospital located in Suffern, NY. Bids will be received by Brittany Drake-Koo, at 255 Lafayette Ave. Suffern, New York 10901, until 2:00 PM, local time on 04/13/2021.

1.02 PROJECT INFORMATION

- A. Notice to Bidders: Invited bidders may submit bids for project as described in this Document. Submit bids according to the Instructions to Bidders.
- B. Project Identification: Philips Healthcare Bon Secours Charity Health System at Good Samaritan Hospital.
 - 1. Project Location: 255 Lafayette Avenue Suffern, NY 10901.
- C. Contracting Agency
 - 1. Philips Healthcare – Philips Representative: Michael DiNapoli; Phone: (516) 279-9583
- D. Owner: Bon Secours Charity Health System – Good Samaritan Hospital
 - 1. Owner's Representative: Daniel Patrick Kelly; Phone: (845) 533-7105.
- E. Architect: CPL, at 30 Century Hill Drive Suite 104 Latham, NY 12110
 - 1. Architect: H. Scott Cottingham, AIA, LEED AP, Phone: (518) 915-7454.
- F. Project Description: Project consists of Phased renovation of existing Imaging Department including installation of a new CT & MRI.
- G. Construction Contract: Bids will be received for the following Work:
 - 1. General Construction work including all Trades.
- H. Bidders must submit the following with the Bid Proposal:
 - 1. Portfolio of 5 past projects of similar construction quality for this project.
 - 2. Multi-Phase Imaging projects experience.
 - 3. Philips Diagnostic Imaging equipment project experience.
 - 4. Schedule of Values – must be filled out (Blank attached at end of this section, or use similar form with like information).

1.03 PROJECT LABOR REQUIREMENTS

- A. Workforce labor for the following Union Trades shall be utilized on this project.
 - 1. Carpenters L.U.279
 - 2. Plumbing L.U. 373
 - 3. Electrical L.U. 363

1.04 PRE-BID MEETING

- A. A Pre-Bid Meeting to allow for potential bidders to become familiar with the work, will tentatively be held on Wednesday, 03/17/2021 from 12:00-1:30 PM. (details to be confirmed with hospital). Potential bidders should assemble in the Main Lobby of the Hospital where they will be greeted. Walkthrough with questions shall commence immediately following the greeting.
 - 1. Due to on-going COVID protocols, groups will be limited in size. It would be appreciated if the number of attendees from each firm would be limited to three.
 - 2. Social distancing rules will be in effect.
 - 3. All attendees are to provide their own PPE face masks, as the Hospital does not provide masks for non-employees.
- B. There will be a mandatory "sign in sheet" for all attendees to sign.
- C. Because of the difficulties of answering bidder questions individually, all questions must be submitted in writing via e-mail after the walk-thru, and will be responded to in writing via e-mail.
 - 1. See 1.05 for RFI Process
 - 2. We will respond to all RFI questions collected as an email addendum to all parties, in lieu of answering each person individually.

- D. Owner will provide Physicist Report at pre-Bid meeting.

1.05 RFI PROCESS

- A. Last date for RFIs to be submitted to CPL/Philips: **04.01.2021**. All RFIs to be submitted in writing via e-mail to **michael.dinapoli@philips.com** and **SCottingham@CPLteam.com**; no verbal responses will be provided.
- B. RFI responses will be returned to all bidders via e-mail on or before: **04.08.2021**.

1.06 BID SUBMITTAL AND OPENING

- A. Owner will receive sealed lump sum bids until the bid time and date at the location given below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:
1. Bid Date: 04/13/2021
 2. Bid Time: 2PM, local time.
 3. Location: Administrative Offices
 - a. Attn: Brittany Drake-Koo, 255 Lafayette Avenue, Suffern, New York. 10901
- B. Bids will be thereafter privately opened. Apparent low bidder to be notified by 04.16.2021.

1.07 BID SECURITY

- A. No Bid security is required.

1.08 TIME OF COMPLETION

- A. Successful bidder shall begin the Work within 5 days and shall complete the work as stipulated in Section 011000-1.4 PROJECT MILESTONE SCHEDULE.

1.09 NOTIFICATION

- A. Attention of the Bidder is particularly called to the Owner's sales tax exemption.

1.10 AWARD OF BIDS

- A. Philips Healthcare hereby reserves the right to waive any informality and reject any or all Bids or to accept the one that in its judgment will be in the best interest of Philips Healthcare.

END OF SECTION



Document G703[®] – 1992

Use Column I on Contracts where variable retainage for line items may apply.

ARCHITECT'S PROJECT NO:

(3B9ADA50)

**SECTION 003119
EXISTING CONDITION INFORMATION**

PART 1 GENERAL

1.01 EXISTING CONDITION INFORMATION

- A. This Document with its referenced report is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This referenced report is not part of the Contract Documents.
- B. Physicist report will be provided at Pre-Bid meeting.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

**SECTION 004001
FORM OF PROPOSAL – SINGLE PRIME**

PART 1 GENERAL

1.01 GENERAL

- A. Pursuant to, and in compliance with, the Procurement and Contracting Requirements, Conditions of the Contract, relative thereto and all of the Contract Documents, including any Addenda issued by the Architect and mailed or delivered to the undersigned prior to the opening of Bids, whether received by the undersigned or not, we

_____ having visited the site and being familiar with all conditions and requirements of the Work, hereby propose to furnish all plant, labor, supplies, materials and equipment incidental for all construction work as required by and in strict accord with the applicable provisions of the Drawings entitled Philips Healthcare Bon Secours Charity Health System- Good Samaritan Hospital TMP 30 CT TMP 92 MRI Renovations all to the satisfaction and approval of the Architect and the Owner in accordance with the terms and conditions of the Contract Documents for the following sum:

Dollars
(\$ _____)
Base Bid

1.02 ALLOWANCES (REFERENCE SPECIFICATION SECTION 012100.)

- A. Contingency Allowance: Include in the Base Bid an Allowance of 10% of the Base Bid (Total Base Bid for all Trades) use according to the Owner's instructions. This sum can be utilized for Architectural, Structural, Mechanical, Electrical and/or Plumbing issues.
- B. Contractor overhead and profit is provided in the Base Bid.

Dollars
(\$ _____)
Allowance-01: Contingency Allowance

1.03 TIME OF COMPLETION

- A. It is agreed by the undersigned that after receipt of a Notice of Award and a consummation of a Contract Agreement in accord with the terms of the Contract Documents, the contractor will start work upon notice to proceed and fully complete the work as indicated in the Summary of Work Section 011000.

1.04 PROJECT LABOR REQUIREMENTS

- A. Workforce labor for the following Union Trades hall be utilized on this project.
1. L.U.279
 2. L.U. 373
 3. L.U. 363

1.05 SUBCONTRACTORS AND SUPPLIERS

- A. The following companies shall execute subcontracts for the portions of the Work indicated:
1. Plumbing Work: _____.
 2. HVAC Work: _____.
 3. Electrical Work: _____.

1.06 REPRESENTATIONS

- A. By submitting this Proposal, the Bidder represents and certifies to the Owner and the Architect that
1. It has examined the Contract Documents, the site of the proposed Work, is familiar with the local conditions at the place where the Work is to be performed and fully comprehends the requirements and intent of the plans and specifications for this Project in accordance with the drawings, specifications and other Contract Documents prepared by CPL, the Owners Consultant, for this Project.

2. It has examined and reviewed, where applicable, all information and data in the Contract Documents related to existing underground facilities at or contiguous to the site. Bidder shall require of the Owner or Architect no further investigations, explorations, tests or reports in order for the Bidder to perform the Work of the Proposal within the Contract Time and in accordance with the Contract Documents.
3. It has given notice to the Architect, as required by the Contract Documents of any and all discrepancies it has discovered and accepts the resolution of those discrepancies offered by the Architect.
4. The proposal is based upon the materials, equipment and systems required by the Contract Documents, without exception, unless otherwise set forth in this Proposal in detail.

1.07 CHANGE ORDERS

- A. We propose and agree that the above lump sum shall be adjusted for changes in the Contract Work not included in unit prices by addition of the following costs:
 1. Profit and overhead as permitted in the General Conditions.

1.08 NON-COLLUSIVE BIDDING CERTIFICATION

- A. By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of knowledge and belief:
 1. The prices in this bid have been arrived at independently without collusion, consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor;
 2. Unless otherwise required by law, the prices which have been quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and
 3. No attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

1.09 ACCEPTANCE

- A. When this Proposal is accepted, the undersigned agrees to enter into a Contract with the Owner as provided in the Form of Agreement.

1.10 TYPE OF BUSINESS

- A. The undersigned hereby represents that it is a ¹ Corporation, ¹ Partnership, ¹ Individual. If a Corporation, then the undersigned further represents that it is duly qualified as a Corporation under the laws of New York State and it is authorized to do business in this State.

1.11 PLACE OF BUSINESS

- A. The following is the name and address of the person to whom all notices required in connection with this Proposal may be telephoned, mailed, or delivered.

Name of Contact Person:	
Name of Business or Firm:	
Address:	
Address:	
Telephone:	Fax:

1.12 ADDENDA

- A. Any addenda issued by the Architect and mailed or delivered to the undersigned prior to the Bid opening date shall become part of the Contract Documents. The Bidder shall enter on this list any addenda issued after this Form of Proposal has been received and shall fill in the addenda number and date.

Addendum #		Dated:	
Addendum #		Dated:	
Addendum #		Dated:	
Addendum #		Dated:	

A. The bidder certifies that no asbestos or asbestos-containing materials will be incorporated into the Work of this Contract.

Signature:

Name:

(Typed or Printed)

Title:

Firm:

(Legal Name of Person, Single Proprietorship, Partnership or Corporation)

Date:

(If Corporation, provide seal above)

CPL

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**SECTION 005100
OWNER CONTRACTOR AGREEMENT COVER**

PART 1 GENERAL

1.01 SUMMARY

- A. The following is a Sample Agreement Between Owner and Contractor, provided by the Owner. The document has been prepared for use with WESTCHESTER COUNTY HEALTH CARE CORPORATION GENERAL CONDITIONS.
- B. Also attached is the Supplier Information Form.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

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Turnkey Construction Proposal Presented To Philips Healthcare By:

Name of Contractor:	
Primary Contact:	
Phone Number:	
Fax Number:	
Cell Number:	
E-mail Address:	
Philips Supplier ID:	
State License #:	

Contractor confirms a valid, current Certificate of Insurance is available and will be provided upon request.

Room Renovation Project Located At:

Name of Facility:	Good Samaritan Hospital
Location:	Suffern, New York
Room ID#	TMP 30 / TMP 92
Date of site visit and names of all present incl. customer contact:	

Net Sum of Price Quoted For The Scope of Work:

This is a fixed cost price quote on the total project scope of work and includes all fees, licenses, insurance, surety, payment and performance bonds (if required).

Grand Total

Proposal includes Site Preparation for Installation of Philips Equipment:

Modality: **System:**

Project Description:

--

In the event of a conflict between the work described in this Scope of Work definition (the “Scope of Work” or “SOW”) set forth below, and the supplemental documents attached to this Turnkey Construction Proposal, the Scope of Work definition shall govern.

Project Reference / Project Name:	TMP 30 / TMP 92 - Good Samaritan Hospital
Contractor Proposal #:	
Proposal Date:	
Proposal Expires:	
Estimated Project Duration:	
Philips Site Plan Drawing #:	

- SCOPE OF WORK -

Project Summary:

Renovation of existing Radiology Department including a new CT (TMP 30) and new MRI (TMP 92).

CONTRACTING REQUIREMENTS

Additional Contractor Considerations for Proposal:

- Include thorough information on site conditions and project requirements.
- **Payment and performance bonds may be required for the full value of the work – please check with Philips Zone Turnkey Program Manager.**
- **It is the responsibility of the contractor to thoroughly understand and adhere to Philips site-specific technical requirements and propose a scope of work reflecting the most cost-effective and accurate solutions.**
- This design build construction proposal may include specific testing including:
 - Monitoring of the existing electrical system to determine adequacy for the new loads
 - Tests regarding the quantity and temperature of the air flowing through the space to determine adequacy to cool the new equipment
 - Structural testing necessary to determine the strength of the existing floor and ceiling systems
 - Or any other environmental assessment information, testing and analysis required to validate existing conditions meet Philips equipment-specific installation standards.
- Include preliminary project and construction schedule, phases and milestones.

TURNKEY WORK SCOPE DEFINITION FOR

A ____ PROJECT

AT _____ DATED: _____

The purpose of this work scope is to define the extent of the design and construction work required to complete the project described above. Anything not specifically included by mention in this description is excluded from the agreed upon scope of work. This document is intended to be used in conjunction with the following supplemental documents:

Philips Site Planning Department Drawings,
Project Number _____, last dated _____
Entitled: _____
- Other Drawings described as follows: _____

In the event of a conflict between the work described in this work scope definition and the supplemental documents, this work scope definition shall govern.

DESIGN:

All architectural and engineering work necessary to complete the project described above, including:

- Any further preliminary/schematic design and design development work.
- Customer meetings.
- All required survey and testing work.
- Construction document production (drawings & specs).
- Copies of the construction documents as required by all parties and other miscellaneous printing costs including read-only CADD files.
- All review and approval work and fees as required by local, State and Federal agencies or other governmental authorities having jurisdiction over the work.
- Any redesign work required by review and approval authorities.
- Any pre-construction meetings.
- Shop drawing and submittal review.
- All necessary construction progress inspections, including punch-list and occupancy inspections.
- As-built drawings and specifications showing all changes made during construction.
- Travel costs and all other miscellaneous expenses.

CONSTRUCTION:

Division 01 – General Requirements

- Maintain a job site office area.
- Keep a current and up to date copy of the construction documents in the job site office, marked with red-lines for all changes that occur during the work.
- Provide all required shop drawings and submittals, and keep a copy of all approved shop drawings and submittals in the job site office. Turn over all approved files as

well as all appropriate operation and maintenance manuals to the Owner upon completion of the project.

- Provide all necessary samples and test panels.
- Maintain a full time job superintendent.
- Conduct weekly job progress meetings which include job site safety discussions. On a weekly basis, provide (2) copies of the following to Philips designees of: Job status report and action plan; job progress and safety meeting report; an updated job schedule showing actual vs. plan; job site progress pictures with location key; any other pertinent correspondence.
- Provide all necessary temporary utility hook-ups.
- Provide all necessary permits and pay for all inspection fees.
- Pay all applicable taxes on the work.
- Provide all overtime labor as required to complete the project within the agreed upon schedule.
- Provide all airfreight costs and other expedited material delivery charges required to complete the project within the agreed upon schedule.
- Standard job site work hours are _____ to _____. Permission to work at the site during any periods other than standard work hours must be approved by _____ in advance, in writing.
- Noise restrictions at the job site are as follows:

- HEPA filters and infection control procedures as required by the facility. Maintain negative pressure in the construction area as required by the facility.
- Provide for daily broom cleaning of the job site and debris removal and appropriate disposal (including any Philips equipment containers and packing materials). Use of walk off mats as required by the facility. The entire job site shall be thoroughly cleaned upon completion of the work, prior to turnover to the customer.
- The storage, staging and delivery of materials to the job site shall be as follows:

- Parking for construction workers is restricted to:

- Compliance with the Owner's security regulations and dress codes is required.
- Use of the Owners' facilities is limited to:

- A clean unrestricted access route to the project site is to be provided by the customer.
- This proposal assumes that all of the on-site work will be accomplished in one phase, so that once work begins on site it will continue until all work has been completed.

Division 02 – Existing Conditions

- The installation of code compliant temporary partitions to secure areas, control dust, protect adjacent areas and equipment as required are included.
- The demolition and appropriate removal and disposal of all existing walls, floors, ceilings, finishes, foundations, roofing, structure, equipment and utilities as required to accommodate the new work. All items that are intended to be salvaged by the owner will be so noted and removed by the owner prior to the start of the demolition work.

- **This scope of work does not include the removal of any materials, including but not limited to asbestos, deemed hazardous by local authorities, the EPA, OSHA, or any other authority having jurisdiction over the work. If such materials are discovered at any time that the work is proceeding, the work will immediately cease, the owner will be notified, and the work will again proceed after the owner has removed all of the hazardous material from the job site.**

Division 03 – Concrete

- The new construction and equipment will have an adequate and appropriate foundation installed to transmit the attendant loads to ground. Where applicable, the foundations will be constructed to a depth below grade as is required to be unaffected by frost penetration. The assumed minimum bearing capacity of the soil is _____ lbs/sq. ft at a depth below existing grade of _____ feet. This minimum soil bearing capacity will be confirmed as a part of the design development process, and any additional foundation work that may be required if the testing fails to confirm this minimum assumed value is not included in the work.

Division 04 – Masonry

- The exterior of the new construction shall be: (brick veneer/plaster/synthetic plaster/metal panel/wood/other as depicted on the attached drawings entitled: _____ dated: _____)

Division 05 – Metals

- The new building structure shall be of the following construction type: (reinforced concrete/reinforced masonry/steel post and beam/light gauge metal framing/wood framing/other- _____)
- Unistrut (or equal) equipment support is required as follows:

- Partition framing as required constructed of (metal/wood/other- _____) studs, including all necessary backing, kickers, headers, etc.
- The exterior of the existing construction will be: (left untouched/ cleaned/ repaired/ covered with _____/other- _____)

Division 06 – Wood, Plastics and Composites

- All cabinetry and counters are to be faced with plastic laminate at a minimum, all cabinetry and countertops must meet facility standards. Included in the work is _____ lineal feet of base cabinetry with counters, _____ lineal feet of wall cabinetry, and _____ lineal feet of counter (only).
- All other existing millwork located throughout the project area will remain in existing condition and location.

Division 07 – Thermal and Moisture Protection

- The new construction shall have a roofing system consisting of: (membrane/built-up/metal pan/other _____) as

is consistent with local standards, and which carries a minimum of a ten year warranty from the manufacturer.

- All penetrations through the new or existing exterior walls and roof shall be flashed, counter-flashed, caulked and otherwise sealed as is consistent with local standards.
- The new construction shall have thermal insulation installed consistent with local standards and energy conservation standards.
- The existing construction shall have thermal insulation equal to the existing level of insulation wherever the existing insulation is disturbed by the work.

Division 08 – Openings

- All door frames shall be welded steel frames of appropriate width and 7'0" high unless otherwise noted and meet facility standards.
- All interior doors shall be solid core, appropriate thickness, hardwood veneer and meet facility standards.
- Doors and frames shall be fire rated as required, and must have labels applied by the manufacturer noting such rating.
- Hardware shall match existing, if applicable, or be commercial series if there is no existing to match. Keying of all hardware as directed by the owner is included.
- All required kick-plates, closers, hinges, stops, bumpers, guides, coordinators, etc, to meet facility standards are included.
- Ball bearing hinges, pivot hinges, continuous strip hinges and other heavy duty hardware as required for all specialty doors and openings are included.
- The exterior walls of the new construction shall contain windows and entrances as depicted on the attached drawings entitled: _____

dated: _____

The window and entrance framing will be: (aluminum/wood/steel/other _____)
The glazing shall be: (single pane/insulated/low-E/other _____)

- Access panels, new window and door openings, and other penetrations through the existing exterior walls will be patched and repaired with materials to complement the existing exterior materials.

Division 09 – Finishes

- All new construction partition framing shall have, at a minimum, 5/8ths inch thick gypsum wallboard applied to above finished ceiling height. Fire rated wallboard extending to the deck above shall be installed wherever appropriate in accordance with the applicable life-safety and building codes.
- All existing drywall and/or plaster construction disturbed by the work shall be patched, repaired or replaced as required with materials and construction type compatible with the existing construction.
- All new construction shall have interior finishes as follows: All ceilings shall be 2' x 2' washable or 2' by 4' acoustical panels in a "T" grid system, except bathroom, storage rooms, utility and exam or equipment rooms, which shall be 5/8ths inch thick gypsum board, finished and painted as required to meet facility standards.
- All walls shall be primed coat painted, and (none/25%/50%/75%/all/other _____) of the walls shall receive commercial grade vinyl wall covering of the owners choosing from samples submitted by the material supplier - the balance of the walls shall be final coat painted in no more than two different colors as selected by the owner from samples submitted by the material supplier.
- All floors shall receive 1/8th inch thick vinyl composition tile (vct) or commercial grade sheet goods to meet facility standards, except bathrooms which shall receive:

(1" by 1 1/2" by 2"/other _____) ceramic tile or vct to meet facility standards, and the following areas which will receive medium grade commercial carpet to meet facility standards: (none/waiting room(s)/reception room/patient corridors/offices/viewing room/other _____).

- All materials to be as selected by the owner from samples provided by the material supplier, carpet to be static-free.
- All rooms with either vinyl composition tile (vct), sheet vinyl or carpet shall receive 4" vinyl base, coved at the vct and sheet vinyl areas, straight at the carpeted areas. Rooms with ceramic tile floor shall receive ceramic tile base compatible with the ceramic floor tile.
- All door frames shall be painted, all doors shall be: (painted/stained, sealed and finished/other _____) to meet facility standards.
- All existing finishes disturbed by the work shall be patched, repaired or replaced as required with materials and construction type compatible with the existing construction.

Division 10 – Specialties

- NEW INTERIOR SIGNAGE: Interior signs, to match existing, shall read and be placed as follows:
 _____, or
- INTERIOR SIGNAGE: All existing interior signage will remain in existing condition and location without additions or modifications.
- NEW ILLUMINATORS, FILM BINS, PASS BOXES, MISCELLANEOUS Supply and install the following items in the following areas:
 _____, or
- ILLUMINATORS, FILM BINS, PASS BOXES, MISCELLANEOUS: All existing illuminators, film bins, pass boxes and miscellaneous items will remain in existing condition and location without additions or modifications.
- NEW WALL PROTECTION RAILS, WAINSCOTING AND CORNER GUARDS: included in this proposal is ____ lineal feet of wall rail made of acrovyn or similar material, ____ lineal feet of wainscoting made of acrovyn or similar material, and ____ corner guards made of acrovyn of similar materials, or
- EXISTING WALL RAILS, WAINSCOTING AND CORNER GUARDS: All existing wall rails, wainscoting and corner guards are to remain in existing location and condition without additions or modifications.

Division 11 – Equipment

- Rigging of the healthcare equipment shall consist of

Division 12 – Furnishings

- The services of a professional interior designer are not included, nor are any furnishings, furniture, artwork, window treatments, miscellaneous accessories, etc.

Division 13 – Special Construction

- **FLOOR PLATES:** Installation of the Philips supplied equipment base plate(s) is included
- **EXISTING RADIATION SHIELDING – X-RAY:** This proposal does not include design or post renovation testing of the radiation shielding. The scope of work is based upon the assumptions noted in this proposal. If the facility provided radiation shielding design indicates that an upgrade to the existing radiation shielding is required, a change order to the turnkey agreement for the additional work will be required.
- **NEW RADIATION SHIELDING - X-RAY:** Supply and install all radiation shielding as required. Each X-ray equipment room shall have, at a minimum (unless superseded by a qualified physicist report), 1/16th inch lead equivalent in all walls, doors, door hardware, windows and other openings, extending from no more than 6" above the floor level to at least 7'0" above the floor level. **Shielding must meet all facility and state requirements and be coordinated with the appropriate facility personnel.**
- **EXISTING RF SHIELDING:** Provide labor and equipment to conduct a pre-renovation assessment of the existing RF shield to ensure that the shield meets the Philips equipment specifications. If this testing determines that repairs to the existing RF shielding beyond what is included in this proposal, are necessary, a change order to the turnkey agreement for the additional work will be required,.
- **NEW RADIO FREQUENCY (RF) SHIELDING:** Supply and install all RF shielding as required. Each MRI scan room shall have a single shield enclosure with a minimum of 3 oz. copper (or approved equal) walls, ceiling and floor, one 4' by 7' door, one 4' by 4' view window, all required waveguides and filters for electrical (including control and other low voltage wiring), mechanical, plumbing, medical gas and fire protection systems penetrations. The enclosure shall accommodate the Philips MRI system, including base plates, filter and penetration panels, vent pipe(s), ground stud and magnet access panels. The shield enclosure shall include all required accommodations for conduits, raceways, piping, ductwork, floor trenches, cable trays, back-boxes and the fastening of the scan room finish materials. After completion of the installation of the enclosure, including all required waveguides and filters, a test shall be performed and a copy of the test results shall be provided to Philips personnel, to ensure that the RF shield meets or exceeds all Philips specifications. Any rework required to bring the shielded enclosure within Philips specifications is included.
- **SECOND RF TEST:** A second test after the installation of the all of the scan room finish materials, prior to the magnet being brought up to field strength, is included. Once again, this re-test shall be performed, and witnessed by Philips personnel, to ensure that the RF shield meets or exceeds all Philips specifications. Any rework required to bring the shielded enclosure within Philips specifications is included. 3 copies of the written results of all tests are included.
- **SITE SPECIFIC MAGNETIC SHIELDING:** Supply and install all magnetic shielding as required, including all attendant support structure, fasteners, rigging, and welding.

The magnetic shield shall include all necessary openings, penetrations and access panels to allow for the proper operation of the Philips MRI system, while also providing the magnetic fringe field containment as required by the Philips MRI Site Planning documents. The specific containment concerns relating to the magnetic shielding requirements at this site are as follows:

Division 14 – Conveying Equipment

- **PNEUMATIC TUBE SYSTEM** The existing pneumatic tube system shall be extended or modified as follows:_____

Division 21 – Fire Suppression

- All new construction work shall be protected by a water based fire protection system, which includes all required backflow preventers, pressure regulators, position indicator valves, outside screw and yoke valves, flow switches, piping, fittings, appropriate heads (all heads in equipment, exam and scan rooms to be recessed), and trim.
- All new construction work shall be protected by a water based "dry pipe" fire protection system, which includes all required backflow preventers, pressure regulators, position indicator valves, outside screw and yoke valves, flow switches, clappers, compressors, low pressure alarm, overflow protection, piping, fittings, appropriate heads (all heads in equipment, exam and scan rooms to be recessed), and trim.
- All existing areas affected by the new construction work shall be protected by relocation of the existing water based fire protection system, and shall include all required backflow preventers, pressure regulators, position indicator valves, outside screw and yoke valves, flow switches, piping, fittings, appropriate heads (all heads in equipment, exam and scan rooms to be recessed), and trim, connected to the existing fire protection system at:_____

- All existing areas affected by the new construction work shall be protected by relocation of the existing water based "dry pipe" fire protection system, which includes all required backflow preventers, pressure regulators, position indicator valves, outside screw and yoke valves, flow switches, clappers, compressors, low pressure alarm, overflow protection, piping, fittings, appropriate heads (all heads in equipment, exam and scan rooms to be recessed), and trim, connected to the existing fire protection system at:_____

- All fire protection system alarms shall be tied-in to the existing alarm system at:_____

- Tie-in timing restrictions for all fire protection alarm work is as follows:

- All new fire protection work shall be tested for proper operation as required, witnessed by the appropriate authorities and owner's representative(s). 3 copies of all test reports shall be provided.

Division 22 – Plumbing

- All required domestic water supply piping, valves and fittings, domestic and storm water waste piping and fittings is included. Fixtures, faucets and trim shall match existing, or shall be supplied and installed as follows:

- All required connections and final hook-ups to accommodate a _____ (make & model) film processor, supplied by others, are included.
- An acid neutralization basin or system is not included. A silver recovery system is not included.
- A new hot water heater (gas/electric/other _____) operated is included, sized to handle the anticipated load of the new systems and fixtures.
- A new water conditioning system is included as follows:

- The tie-in points for all supply, waste and storm water piping are as follows:

- Tie-in timing restrictions for all plumbing work is as follows:

- Installation and rigging and start-up of the Philips MRI chiller is included per Philips specifications.

NEW MEDICAL GAS SYSTEM WORK:

- A medical gas system that is: (extended from the existing systems/a new self-contained system/other _____) is included.
- The system shall consist of: (medical oxygen/medical air/vacuum/other _____) with new zone valves as required by the applicable codes and new outlets as follows (please specify wall, floor or ceiling):

- For each new medical oxygen and medical air outlet, a new pressure regulator and flow meter shall be supplied. For each new vacuum outlet, a collection bottle shall be supplied. A medical gas alarm system consisting of the following is included:

- All new medical gas system work, and any of the existing medical gas system that has been affected by the new work shall be purged and certified by qualified personnel. 3 copies of all testing and certifications are included.

- The tie-in points for all medical gas system piping are as follows:

- Tie-in timing restrictions for all medical gas system piping work is as follows:
_____, **or**
- **EXISTING MEDICAL GAS SYSTEM:** The existing medical gas system services and outlet locations are to remain in existing location and condition without additions or modifications.

Division 23 – Heating Ventilating and Air Conditioning

- A new heating, ventilating and air conditioning system shall be supplied and installed for all new building construction. This system shall consist of: (roof top air handlers with integral condensing units/ceiling space air handlers with roof top condensing units/ceiling space air handlers with pad mounted condensing units/other _____)
with reheat boxes that are: (steam/electric/other _____)
operated, an electronic control system, fresh air intake and mixing box or other damper control, grilles and diffusers, ductwork (supply and return), ductwork insulation, balancing dampers (supply and return) and pressure relief mechanisms as required.
- All existing areas affected by the new construction shall have the existing heating, ventilating and air conditioning system ductwork, dampers, grilles and diffusers relocated as required. This proposal relies upon the information about the heating, cooling, and ventilating capacity of the existing HVAC system for the project space depicted in the as-built drawings provided by the customer. This proposal assumes that the existing HVAC components are fully operational. The capacity and operation of the existing HVAC system will be verified by Philips during the design process and if additional HVAC capacity is required or existing HVAC system components need to be repaired or replaced, a change order to the turnkey agreement for the additional work will be required.
- Provide labor and material for DDC control modules with the new HVAC components to allow for customer connection to the existing or future Building/Energy Management Systems (BMS). NOTE: Conduit, wiring, connections and programming to the facility BMS is not included and is the responsibility of the customer.
- All ductwork insulation disturbed by new construction shall be repaired or replaced.
- All necessary control system modifications required due to the relocation activity is included.
- The computer/equipment room shall have a new self-contained air conditioning system, cooled via: (chilled water/condensing water/air cooled condenser located at _____/other _____)
- All required fire and smoke dampers are included.
- All required fume and vapor resistant vent piping for owner supplied and installed film processor(s) (see plumbing section for make and model) is included, vent to be taken to: (roof/side exterior wall/existing exhaust system/other _____) located at _____ and terminated with an appropriate cap/hood/elbow and screen
- **All required cryogen vent piping, as specified in Philips MRI Site Planning documents, is included, vent(s) to be taken to: (roof/side exterior wall/existing exhaust system/other located at _____ and terminated with an appropriate elbow and screen as specified in Philips MRI**

Site Planning documents including the required design submission documents.

- After completion of all HVAC work, a test and balance of the HVAC system(s) affected by the work shall be performed by a qualified independent testing agency certified for such work. Any rework required to bring the HVAC system (or portion of the system affected by the work) to within design specifications is included. 3 copies of all test reports are included.
- Tie-in timing restrictions for all HVAC system work is as follows:
- Energy Management Systems, or connections to existing energy management systems is not included.

Division 26 – Electrical

- All power feeds, transformers, distribution panels and circuit breakers (with identification labels), conduit, wiring, junction boxes, back-boxes, pull boxes, pull wire, raceways, cable trays, wall and floor duct, lighting fixtures and lamps, hospital grade receptacles and cover plates (ground fault interruptible circuit where required), switches and cover plates, connections, motors, disconnects, couplings, and other miscellaneous parts as required are included. All items must meet facility standards and local codes.
- The power feed shall connect to the existing: (primary/transformer/sub-station/distribution panel/disconnect/other _____) located at: _____ and must meet Philips imaging system requirements for power quality as specified in the Philips site planning documents.
- All required circuit breakers, taps, sub-panels, etc. as required are included.
- New room lighting consisting of _____ is included. or
- Existing room lighting is to remain as is.
- New 120V receptacles are to be provided and installed as follows: _____, or
- Existing 120V receptacles are adequate and are to remain in existing condition and location without additions or modifications.
- A shunt trip with connection to the fire alarm system shall be supplied and installed ahead of the Philips system PDU for equipment shutdown as required by local code.
- A power conditioner consisting of:

shall be supplied and installed ahead of the Philips system PDU

- Installation of misc. Philips equipment related items as specified on the referenced Philips Site Planning Department documents is included
- Tie-in timing restrictions for all electrical system work is as follows:

Division 27 – Communications

- TELEPHONE SYSTEMS: Provide all conduit, junction boxes, back-boxes, mounting boards, cover plates and pull boxes and pull strings for owners telephone system to meet facility standards (system and installation by others). Rough-ins for telephone outlets to be in the following rooms: (waiting/reception/each office/viewing/computer/each control/holding /patient prep/other _____).

Telephone equipment, final connections and wiring of the communications system is the responsibility of the customer.

- **COMPUTER NETWORK SYSTEMS:** Provide all conduit, junction boxes, racks and/or mounting boards, and pull strings for owner's computer network system to meet facility standards (system and installation by others). Rough-ins for computer outlets to be in the following rooms: (waiting/reception/each office/viewing/computer/each control/holding /patient prep/other _____) Networking equipment, final connections and wiring of the network system is the responsibility of the customer.
- **NEW INTERCOM/PAGING/PUBLIC ADDRESS/NURSE CALL/CODE BLUE/MUSIC SYSTEMS:** Provide the following systems to the following rooms:

_____ or
- **EXISTING INTERCOM/PAGING/PUBLIC ADDRESS/NURSE CALL/CODE BLUE/MUSIC SYSTEMS:** All existing intercom, paging, public address, nurse call, code blue, and music systems are to remain in their current condition and location without additions or modifications.

Division 28 – Electronic Safety and Security

- All new construction work shall be protected by a new fire detection and alarm system consisting of smoke detectors, heat detectors, strobes, horns, pull stations and control panel with tie-in to the fire protection system alarms and the existing fire alarm system as required.
- All existing areas affected by the new construction work shall be protected by relocation of the existing fire detection and alarm system consisting of smoke detectors, heat detectors, strobes, horns, pull stations and control panel with tie-in to the fire protection system alarms and the existing fire alarm system as required. or,
- The existing fire alarm components and system are to remain in the current condition and location without additions or modifications.
- The new fire detection and alarm system control panel shall be tied-in to the existing alarm system at:

- Tie-in timing restrictions for all fire alarm system work is as follows:

- All new fire detection and alarm system work shall be tested for proper operation as required, witnessed by the appropriate authorities and owner's representative(s). 3 copies of all test reports shall be provided.
- **SECURITY SYSTEMS:** Provide the following security system:

Division 31 – Earthwork

- Rough grading of existing soils to new contours as required.
- New fill material (including transportation charges) as required.
- Removal of excessive fill material from the site (including transportation and dumping charges) as required.
- Tree, bush, shrub and stump removal.

Good Samaritan Hospital - Suffern, New York

March 9, 2021 - Proposal Expires 45 Days From Today

- Any required layout, survey, stake-out or locating services.
- Geotechnical Engineering and materials testing services as required.
- Storm water drainage and run-off engineering, plans, governmental reviews and approvals as required.
- Finish and fine grading of all areas disturbed by construction activities.
- Supply and spread topsoil over all finish graded areas to a thickness required to support new grass growth.
- Seeding and appropriate cover (to promote seed growth and retard erosion).
- Supply and install sod, staked as required, at all areas disturbed by construction activities.
- Erosion control measures as required during construction.

Division 32 – Exterior Improvements

- Landscaping, including all necessary design, permits and approvals
- New concrete sidewalks, curbing, container pads, aprons and approaches as required, thickness to meet local standards.
- New asphalt driveways and parking areas, installed over a crushed stone base, thickness of each to meet local standards - all necessary striping and precast parking bumpers included.
- Fencing as follows: (wood/metal/chain-link/other _____), _____lineal feet, _____ in height, _____ # of gates.
- Exterior lighting, including parking lot lighting, as required.
- Exterior signage, including required foundations, power, permits and installation.

Division 33 – Utilities

- Relocation of existing utilities as required.
- Storm water drainage systems, including catch basins, manholes, piping and tie-ins to existing systems, water diversion structures, and retention ponds, all as required.

EXCLUSIONS

- All items not included in the scope of work must be added to this section. Bold faced items cannot be excluded.
- **This scope of work does not include the removal of any materials, including but not limited to asbestos, deemed hazardous by local authorities, the EPA, OSHA, or any other authority having jurisdiction over the work. If such materials are discovered at any time that the work is proceeding, the work will immediately cease, the owner will be notified, and the work will again proceed after the owner has removed all of the hazardous material from the job site.**
- **Additional HVAC system components or capacity other than what is included in the description of work above.**
- **Repair or replacement of existing HVAC system components other than what is included in the description of work above.**
- **Conduit, wiring, connections and programming to the existing or future facility Building/Energy Management System is not included and is the responsibility of the customer.**
- Physicist provided radiation shielding design or post renovation testing.
- Floor or ceiling mounted radiation shielding.

- Work in a bio-hazardous, radioactive, toxic or other high risk environment.
- Work involving emergency power other than what is included in the description of work above.
- New utility power services, other than what is included in the description of work above.
- Networking to other modalities, other than what is included in the description of work above.
- Work outside of normal working hours other than what is included in the description of work above.
- Removal/relocation of existing equipment is not included other than what is included in the description of work above.
- The services of a professional interior designer are not included, nor are any furnishings, furniture, artwork, window treatments, miscellaneous accessories, etc.
- Vibration testing of the site of the site is not included, nor is any vibration remediation work.

– Divisional Breakdown of Cost –

The divisional breakdown in this Schedule of Values is a generalized statement of the Cost for the understood Scope of Work.

Division 01	General Requirements	\$0.00
Division 01a	Architectural and Engineering	\$0.00
Division 02	Existing Conditions/Site Work	\$0.00
Division 03	Concrete	\$0.00
Division 04	Masonry	\$0.00
Division 05	Metals	\$0.00
Division 06	Woods, Plastics, Composites	\$0.00
Division 07	Thermal & Moisture Protection	\$0.00
Division 08	Openings	\$0.00
Division 09	Finishes	\$0.00
Division 10	Specialties	\$0.00
Division 11	Equipment	\$0.00
Division 12	Furnishings	\$0.00
Division 13	Special Construction	\$0.00
Division 14	Conveying Systems	\$0.00
Division 21	Fire Suppression	\$0.00
Division 22	Plumbing	\$0.00
Division 23	HVAC	\$0.00
Division 26	Electrical	\$0.00
Division 27	Communications	\$0.00
Division 28	Electronic Safety and Security	\$0.00
Division 31	Earthwork	\$0.00
Division 32	Exterior Improvements	\$0.00
Division 33	Utilities	\$0.00

TOTAL PROJECT COST \$0.00

TURNKEY CONSTRUCTION VENDOR AGREEMENT

This **Agreement** ("Agreement") is effective as of the day of **200** , between **Philips Medical Systems North America Company, a division of Philips Electronics North America Corporation**, with a principal place of business at 22100 Bothell Everett Highway, Bothell, Washington ("**PHILIPS**") and , with a principal place of business at _____ ("**CONTRACTOR**").

WHEREAS, PHILIPS designs, manufactures, markets and sells medical equipment ("Equipment") the installation of some of which requires construction of special room configurations, renovations and accommodations at PHILIPS' customer ("Customer") locations ("Equipment Installations");

WHEREAS, CONTRACTOR has experience and expertise in performing construction services to assist in accommodating Customer Equipment Installations, and CONTRACTOR can do so in an economical manner without sacrificing quality;

WHEREAS, PHILIPS, acting in the capacity of a general contractor or owner, is interested in utilizing the construction services of CONTRACTOR as a subcontractor to assist with Equipment Installations for the Customer, and at the Customer site, both identified on the Turnkey Construction Vendor Proposal to which this Agreement is attached (the "Proposal");

NOW, THEREFORE, in consideration of the mutual promises set forth herein, the parties agree as follows:

PARTIES/DEFINITIONS:

PROJECT: Identified in the Proposal, and exhibits attached to this Agreement for which CONTRACTOR is hired by PHILIPS to prepare the space, building, or other improvement to realty at Customer's site, to accommodate an Equipment Installation.

CONTRACTOR: _____

PHILIPS: **Philips Medical Systems North America Company, a division of Philips Electronics North America Corporation**
22100 Bothell Everett Highway
Bothell, WA 98021

WORK: All labor necessary to produce, and all materials incorporated in, the construction required to prepare the space, building, or other improvement to realty at Customer's site to accommodate Equipment Installation, as set forth in the following documents, which consist, in order of precedence, of PHILIPS' Quotation to Customer, this Agreement, PHILIPS' drawings and specifications ("Pre-Installation Drawings"), the Proposal to PHILIPS, PHILIPS' Turnkey Contracting Proposal to Customer, containing the statement of work ("SOW"), , between PHILIPS and Customer (the "Customer Turnkey Proposal"), architect's drawings, engineering documents and drawings, Project plan ("Project Plan"), and construction Project progress schedule(s) ("Project Schedule(s)) and Turnkey Construction Project Approval Addendum between PHILIPS and CONTRACTOR (the "Project Addendum"), a sample of which Project Addendum is attached as Exhibit A, which awards to CONTRACTOR and evidences

CONTRACTOR'S acceptance of, respectively, the Project (hereinafter known all together as the "Project Documents", identified in Exhibit B, attached hereto).

1. CONTRACTOR RESPONSIBILITIES

- 1.1 CONTRACTOR agrees to perform the WORK, in full accordance with and as specified by, the Project Documents, in a timely, complete, good and workmanlike manner satisfactory to PHILIPS and Customer. Complete performance of the WORK shall include, but not be limited to, provision of and payment for all necessary architectural and engineering services, labor, tools, construction equipment, supplies, materials, supervision, scaffolding, permits, fees and insurance. CONTRACTOR shall not make any changes to the WORK without the written agreement of PHILIPS.
- 1.2 Prior to commencement of the WORK, CONTRACTOR agrees to meet with PHILIPS and Customer to mutually develop and agree to the Project Plan, unless it is otherwise mutually agreed by PHILIPS, CONTRACTOR and Customer that a Project Plan is unnecessary, and, to meet with PHILIPS to review the Project Schedules and payment procedures, and any other areas related to CONTRACTOR performance. CONTRACTOR shall also verify all dimensions set forth in the Project Documents, report any errors or inconsistencies in the Project Documents to PHILIPS, and request in writing any clarifications of the Project Documents deemed necessary by CONTRACTOR. Scheduling of the WORK must be approved in writing by Customer's designated representative ("Customer's Representative") so as not to interfere with Customer's operations.
- 1.3 CONTRACTOR shall commence the WORK upon receipt of the executed Turnkey Construction Approval Addendum issued by PHILIPS. Thereafter, CONTRACTOR shall diligently proceed with the WORK so as to fully complete the WORK no later than the Completion Date. CONTRACTOR agrees that time is of the essence for the PROJECT.
- 1.4 CONTRACTOR shall be responsible for overall management of the Project, including, specifically, but not limited to, the acts and omissions of its employees and all subcontractors, their agents and employees, and all other persons performing any of the WORK under the direction of the CONTRACTOR.
- 1.5 In the event there exists a reasonable indication in PHILIPS' judgment that CONTRACTOR will not be able to fully complete the WORK by the Completion Date, PHILIPS may, upon one (1) day's written notice to CONTRACTOR and without prejudice to any other remedy PHILIPS may have, order CONTRACTOR to perform the WORK on an overtime basis, and CONTRACTOR shall, at the expense of CONTRACTOR, promptly commence and continue to perform the WORK on such basis to the extent necessary to cause the WORK to be fully completed in a timely fashion in accordance with this Agreement.
- 1.6 Anything set forth in the specifications and not shown on the drawings or shown on the drawings and not set forth in the specifications shall be included in the WORK as if shown and set forth in both. In case of conflict or discrepancy, PHILIPS' interpretation shall control. CONTRACTOR shall incorporate in the WORK anything which, though not included in the drawings or specifications, could be reasonably inferred by skilled and experienced persons as necessary to accomplish the WORK.
- 1.7 It is the CONTRACTOR'S responsibility to coordinate with the other trades and building elements in the performance of the WORK, unless PHILIPS assumes such responsibility under Section 6. Any changes to the location of the WORK or any installation requirements necessitating CONTRACTOR to coordinate with other trades and building elements shall be accomplished by the CONTRACTOR WITHOUT ADDITIONAL COST TO THE PROJECT.
- 1.8 CONTRACTOR shall supervise and direct the WORK, and shall coordinate scheduling and performing the WORK to avoid conflict, delay in or interference with the WORK of subcontractors, the OWNER or separate contractors.

- 1.9 CONTRACTOR shall secure and pay for permits, fees, licenses and inspections by government agencies necessary for proper execution and completion of the WORK.
- 1.10 CONTRACTOR shall promptly submit shop drawings, product data, samples and similar submittals required by the Project Documents with reasonable promptness and in such sequence as to cause no delay in the WORK or in the activities of CONTRACTOR or subcontractors.
- 1.11 CONTRACTOR shall furnish to PHILIPS periodic progress reports on the WORK as mutually agreed, including information on the status of materials and equipment that may be in the course of preparation, manufacture, or transit.
- 1.12 CONTRACTOR shall pay for all materials, equipment and labor used in connection with the performance of this Agreement through the period covered by previous payments received from PHILIPS, and shall furnish satisfactory evidence, when requested by PHILIPS, to verify compliance with the above requirements.
- 1.13 CONTRACTOR shall take necessary precautions to protect properly the work of subcontractors and other contractors from damage caused by operations under this Agreement.
- 1.14 CONTRACTOR assumes and is responsible for minimizing or, if possible, avoiding risks incident to the WORK including, without limitation, those for which no extension of time is allowable. CONTRACTOR is responsible for timely inspection of any work by others which may affect CONTRACTOR'S WORK or to which CONTRACTOR'S WORK must be joined, and is responsible for making such measurements and adjustments to its WORK as may be required to ensure proper fit between its WORK and any adjacent or contiguous work.
- 1.15 Any work not performed in accordance with this Agreement shall be corrected immediately without delay in the progress of the WORK and at no additional cost to PHILIPS or Customer. Correction of any defective work must be done within the terms and conditions of this Agreement.
- 1.16 Until the completion of the WORK and its final acceptance by PHILIPS, CONTRACTOR shall bear the risk of any loss or destruction of or damage to the WORK or any materials, equipment or other items incorporated or to be incorporated therein arising from any cause other than a cause against which PHILIPS undertakes to carry insurance.
- 1.17 CONTRACTOR shall keep its work and storage areas cleared of debris at all times and upon completion of the WORK, and before final acceptance, shall leave the premises in a broom-clean, neat, and workmanlike condition.

2. RELATIONSHIP OF THE PARTIES

The parties hereto shall be deemed to be independent contractors, and the employees of one party shall not be deemed to be employees of the other. CONTRACTOR shall be solely responsible for any employment related taxes, insurance premiums, or other employment benefits related to CONTRACTOR'S performance of the WORK under this Agreement, and shall hold PHILIPS harmless on account thereof. It is expressly understood that any subcontractors are also independent contractors, and that subcontractor employees are not employees of PHILIPS or CONTRACTOR. This Agreement shall not be interpreted as a joint venture, partnership, agency relationship, or formal business organization of any kind.

3. BINDING ON CONTRACTOR

PHILIPS and CONTRACTOR agree that the terms and conditions set forth in any agreement between PHILIPS and its Customer, as they relate to the WORK to be performed by CONTRACTOR ("Philips Turnkey Construction Customer Proposal") shall be binding on CONTRACTOR. If requested in advance by

CONTRACTOR, PHILIPS will give CONTRACTOR the opportunity to review the applicable Philips Turnkey Construction Customer Proposal.

4. REPRESENTATIONS AND WARRANTIES

- 4.1 CONTRACTOR represents and warrants that it is qualified to do business and is appropriately licensed to perform the WORK under this Agreement. CONTRACTOR warrants, agrees and undertakes that the WORK provided pursuant to this Agreement shall be performed with the care, skill and diligence required in accordance with standard industry practice.
- 4.2 CONTRACTOR represents that it has had full opportunity to review, carefully examine and become familiar with the Project Documents, the Project, and site and potential conditions and difficulties.
- 4.3 Unless otherwise specifically provided in this Agreement, CONTRACTOR warrants that all material to be incorporated in the WORK by CONTRACTOR shall be new, of the most suitable grade for the purpose intended, that all WORK will be of good quality, free from faults and defects, and in compliance with terms and conditions of the Project Documents and all governing federal, state and local laws, statutes, rules, ordinances, codes and regulations.
- 4.4 CONTRACTOR represents and warrants that for a period of twelve (12) months following Acceptance that all material furnished and the WORK performed will be free from defects in material and workmanship after final acceptance of the WORK by PHILIPS and the Customer of the completed Project. If the WORK is found by PHILIPS to have any defects, CONTRACTOR will promptly repair or replace such defects without charge, but in any event within 30 days of receipt of notice of such defects. If, after such repair or replacement, the WORK still has any defects, then CONTRACTOR will have a second opportunity to repair or replace such defects within 30 days of receipt of notice of such defects, without charge. If, after such second repair or replacement effort, the WORK still has any defects, then CONTRACTOR will refund to PHILIPS its cost in making suitable repairs or replacements at its own expense. In either case, CONTRACTOR shall also pay for any resulting damage to other property and work caused by its breach of any of the above-mentioned representations or warranties. Repaired or replaced WORK shall carry the same warranties as original WORK. CONTRACTOR shall also assume any additional warranty responsibilities required by the Project Documents.

5. PHILIPS' RIGHT TO COORDINATE

- 5.1 Although CONTRACTOR is responsible for overall Project management, PHILIPS reserves at all times, the right to direct the sequence of the WORK and to coordinate CONTRACTOR activities with the work of others.

6. PRICE OF THE WORK

- 6.1 The price payable under this Agreement shall, except as specifically otherwise provided in this Agreement or in any of the Project Documents or other documents incorporated herein by reference, constitute the sole compensation payable to CONTRACTOR for complete performance of the WORK and all things done by it in connection therewith.
- 6.2 CONTRACTOR'S Proposal and Bid shall be valid for a period of 120 days from the date of the Proposal and Bid. CONTRACTOR agrees to physically indicate the date of expiration of its Proposal and Bid on the face of the Proposal and Bid for the Project.

7. CHANGES AND EXTRA WORK

- 7.1 PHILIPS may request changes in the WORK from time to time. Unless otherwise directed by PHILIPS, after receipt of notice of any such change, CONTRACTOR shall not thereafter order materials or perform WORK inconsistent with such changes.
- 7.2 If such changes involve extra cost to CONTRACTOR or will adversely affect its WORK, CONTRACTOR shall promptly advise PHILIPS in writing, including an estimate of the effect of the change on time and performance, no later than five (5) working days after the change is ordered. If such notice is not given it shall be deemed that no additional compensation or other adjustment is due. If such notice is given or if, in the opinion of PHILIPS, such change involves a reduction in the amount of expense of CONTRACTOR, PHILIPS and CONTRACTOR shall attempt to agree upon an adjustment to the affected terms of the Agreement, including the Price of the WORK. Increases in price or reductions in CONTRACTOR'S obligations will only be effective if made by a Change Order signed by PHILIPS and CONTRACTOR. If so directed by PHILIPS in writing, CONTRACTOR shall proceed with the change prior to the time any adjustment is determined and the parties shall thereafter use their best efforts to reach mutual agreement on the points on which they have not agreed. In this event, PHILIPS shall pay CONTRACTOR any amounts not in dispute.

8. LABOR AND LABOR RELATIONS

- 8.1 CONTRACTOR shall not employ or retain and shall remove any person to whom PHILIPS may object. CONTRACTOR shall maintain such labor relations and take such action with respect to labor as required for the continuous prompt execution of the WORK.
- 8.2 CONTRACTOR acknowledges that Customers generally require their vendor employees to comply with certain of their policies typically covering vendor employee behavior, and credentialing and debarment requirements, prior to entering onto their premises. CONTRACTOR further acknowledges that these requirements differ by customer, but most often include drug screening, criminal background check (including the Sex Offender List and the Federal Government's OIG list of Debarred persons), immunizations and professional training. Therefore, to the extent PHILIPS is required by Customer to comply with certain Customer policies, CONTRACTOR shall ensure that any CONTRACTOR or subcontracted personnel that may be assigned to perform WORK under this Agreement at the Customer Site, shall also comply with such Customer policies. Additionally, prior to commencing any WORK on behalf of PHILIPS, CONTRACTOR agrees to contact Customer to comply with any Customer policies applicable to CONTRACTOR'S or subcontracted personnel. CONTRACTOR shall, as requested by Customer, provide documentation evidencing compliance with any such requirements. CONTRACTOR agrees to provide certification of Customer policy compliance promptly after receipt of request from PHILIPS. In the event CONTRACTOR fails to meet the obligations of this Section 8.2, PHILIPS shall have an immediate right to terminate this Agreement, without penalty or any further obligation.
- 8.3 CONTRACTOR acknowledges the Health Insurance Portability and Accountability Act of 1996 ("HIPAA"), Public Law 104-191 and regulations ("HIPAA Regulations"), promulgated by the U.S. Department of Health and Human Services, and agrees to enter into and abide by the terms and conditions of the attached Attachment F, HIPAA Contractor Addendum ("HIPAA Contractor Addendum"). Contractor further agrees to enforce compliance on the part of its personnel who are required to enter into the Contractor/Subcontractor Representative Agreement HIPAA Addendum ("HIPAA Addendum"), attached as Attachment G.

9. USE OF PREMISES

- 9.1 CONTRACTOR shall confine its activities to the areas set aside for it to do its WORK and shall not interfere with any of the Customer's activities or with WORK of other contractors. Unless specifically authorized by the Site Representative, all persons engaged on the WORK are prohibited from entering any other areas except those areas to which they are assigned or otherwise permitted to use.

10. SAFETY REQUIREMENTS

- 10.1 CONTRACTOR shall adhere to all legally mandated or generally accepted standards of safety, including without limitation all Federal, State, and Local Occupational, Health, and/or Safety Requirements, including, without

limitation, the Federal Occupational Safety and Health Act, and the oral or written instructions of the Customer Representative pertaining to protection of the Customer's property and in order to avoid injury to workers and others and damage to equipment, materials and property. CONTRACTOR will assume full responsibility for and protect and preserve all its tools and equipment and all materials to be used in connection with the completion of the WORK.

- 10.2 By Customer signing the PHILIPS Quotation and the PHILIPS Customer Turnkey Proposal, and authorizing work thereunder, PHILIPS is relying upon Customer's assurances that no asbestos or other hazardous materials as defined in the Occupational Health and Safety Act of 1970 and regulations promulgated thereunder are present on the jobsite. In the event that CONTRACTOR discovers or becomes aware of the presence of such materials during the course of its WORK, CONTRACTOR shall immediately halt all work, and notify Customer and PHILIPS. CONTRACTOR shall thereafter not resume the WORK until authorized by PHILIPS to do so. Any additional cost or schedule adjustment required as a result of such discovery shall be compensated in accordance with compensation received by PHILIPS under its Proposal to the Customer.
- 10.3 CONTRACTOR at all times shall comply with, and shall indemnify and hold PHILIPS harmless against all costs, damages and expenses resulting from any actual or claimed violation by CONTRACTOR of any and all laws and any and all rules, regulations, and orders of public authority applicable or pursuant hereto, including but not limited to, remediation of a material or substance brought to the site and negligently handled by CONTRACTOR, or, where CONTRACTOR fails to perform its obligations under Section 10.1. CONTRACTOR shall give notices, file all reports, pay all taxes, fees and charges required by such laws, rules, regulations or orders and shall, without reimbursement, indemnify PHILIPS and Customer against any and all liabilities and penalties by reason of any failure on the part of the CONTRACTOR to comply with any such laws.

11. SCHEDULE AND PERMITS

- 11.1 Time is of the essence of this Agreement. CONTRACTOR shall furnish Project Schedule(s) in accordance with the Project Plan, if any, and a Completion Date to PHILIPS, for PHILIPS' approval. The Project Schedule(s) shall contain the dates upon which CONTRACTOR proposes to begin and finish the different parts of the WORK. Notwithstanding the foregoing, CONTRACTOR agrees to complete the detailed design of the room preparation WORK as specified in the Project Documents, obtain all necessary approvals and permits and complete the WORK so that installation of the Equipment by PHILIPS can begin no later than **[TBD – to coordinate with Customer and local Sales/Service/Installation]**. If, however, PHILIPS does not instruct CONTRACTOR to proceed with the WORK immediately upon delivery of the executed Turnkey Construction Project Approval Addendum to CONTRACTOR, the Completion Date shall be adjusted accordingly.

- 11.2 Prior to commencing the WORK, CONTRACTOR shall deliver to PHILIPS:

- (a) Certificates of Insurance required by Section 25.1;
- (b) copies of performance and payment bonds or letters of credit required by Section 27; and
- (c) a copy of CONTRACTOR'S Project Schedule(s) as required by paragraph 11.1.

Upon receipt of the above documentation, PHILIPS shall issue the executed Turnkey Construction Project Approval Addendum.

12. COMPLETION AND LIQUIDATED DAMAGES

- 12.1 The WORK shall be completed as specified in the Project Schedule(s) submitted by CONTRACTOR and approved in writing by PHILIPS. To the extent there are no such schedules, the times and sequences may be fixed by PHILIPS. The Price for the WORK shall be deemed to include all sums required to meet such Completion Date, and CONTRACTOR shall, without additional charge, work such overtime and CONTRACTOR shall take such other action to avoid all delays.

- 12.2 If CONTRACTOR fails to complete the WORK by the agreed Completion Date, liquidated damages in the amount of \$ _____ per day, may be assessed against the CONTRACTOR in the amount stated for each calendar day after the Completion Date that the WORK remains uncompleted. It being practically impossible to calculate the loss to PHILIPS caused by such delay, this provision for liquidated damages represents the best estimate of PHILIPS and CONTRACTOR of loss suffered by PHILIPS due to failure to complete the WORK on time, and shall not be, or be deemed to be a penalty or forfeiture.

13. DELAYS

- 13.1 CONTRACTOR shall notify PHILIPS in writing within two (2) days after CONTRACTOR discovers or reasonably foresees any condition or event which may delay its WORK, including any act or omission on the part of the Customer, act of God, or other cause beyond its reasonable control, such as shortage of materials or equipment (providing CONTRACTOR has ordered all necessary materials and equipment at the proper times and used reasonable effort to obtain delivery as required) strike, fire, flood earthquake, or civil disturbance, and indicates the probable duration. CONTRACTOR shall not be excused by delays which are normally incidental to the WORK, for which notice is not given PHILIPS, or which is attributable to any act or omission of CONTRACTOR. In the event of an excusable delay, the time of performance shall be extended for a period equal to the time lost by reason of the delay. This shall be the sole relief to which CONTRACTOR is entitled by reason of any delay, and CONTRACTOR shall make no claim for additional compensation or damages therefor.
- 13.2 PHILIPS may direct in writing that the CONTRACTOR suspend, delay or interrupt all or any part of the WORK for such period of time PHILIPS determines to be appropriate or necessary. If the performance of the WORK is so suspended, delayed, or interrupted for an unreasonable period of time, an adjustment shall be made for any increase in the cost of performance of the Project (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption. However, no adjustment shall be made for any suspension, delay, or interruption to the extent that performance would have been suspended, delayed, or interrupted by any other non-Philips cause, including the fault or negligence of the CONTRACTOR.

14. AUTHORIZED SITE REPRESENTATIVE

CONTRACTOR shall designate a competent Site Representative who shall have complete charge of the WORK and full authorization to bind CONTRACTOR.

15. PROJECT CONTACTS

- 16.1 CONTRACTOR may have direct contact with Customer. However, discussions concerning specifications, terms, prices or delivery under this Agreement, and specifically including changes thereto, shall only be made by and between Customer and PHILIPS' Project Manager.

16. PHILIPS INSPECTION AND CLEANUP

- 16.1 All material and workmanship shall be subject to inspection and test by PHILIPS at all reasonable times and places. If the WORK is found to be defective or nonconforming in any material respect due to the fault of CONTRACTOR, CONTRACTOR shall bear the cost and expense of examination, inspection, and satisfactory correction and reconstruction of the non-conforming WORK.
- 16.2 PHILIPS may clean up the premises and charge to CONTRACTOR'S accounts all costs for said cleanup. PHILIPS also reserves the right to allocate to CONTRACTOR cleanup back-charges that have been imposed upon PHILIPS under the Project Documents without first complying with this paragraph and based upon CONTRACTOR'S presence in areas for which cleanup back-charges have been assessed against PHILIPS.

17. INDEMNIFICATION

- 17.1 CONTRACTOR agrees to defend, indemnify, and hold harmless PHILIPS and PHILIPS' officers, directors, agents, employees, and subsidiary and affiliated companies, and, any Customer or any other individual or entity that Philips is required to defend and indemnify, from and against all liabilities, penalties, claims, demands, causes of action, suits (regardless of legal theory), losses, including but not limited to economic loss, expenses and reasonable attorney's fees, and damages ("Claims") as a result of any and all personal injury, including death or tangible property damage (including loss of use) of whatever nature and however caused, in whole or in part, which results from or arises out of CONTRACTOR'S performance of the WORK, including CONTRACTOR'S employees, its subcontractors and their employees, or any other third party hired by CONTRACTOR, regardless of whether such Claim is caused, or alleged to have been caused, in part by the party seeking indemnity. CONTRACTOR, however, is not required to indemnify PHILIPS or any person seeking indemnity for Claims based solely upon the alleged negligence of PHILIPS or the person seeking indemnity, as applicable.
- 17.2 In claims by any employee of CONTRACTOR, anyone employed by CONTRACTOR, or any employee of anyone employed by CONTRACTOR against any person indemnified pursuant to this paragraph, the obligation by CONTRACTOR to indemnify pursuant to paragraph 78.1, shall not be limited in any way by any limitation on amount or type of damages, compensation, benefits payable by CONTRACTOR or anyone employed by CONTRACTOR under worker's compensation acts, disability benefit acts, or the other employee benefit acts.

18. PHILIPS' REMEDIES

- 18.1 In the event of any default or defective work which CONTRACTOR does not, in PHILIPS' sole judgment, proceed with diligence to remedy upon notice, or if CONTRACTOR for any reason fails to proceed with the WORK in accordance with the Project Documents, PHILIPS may take such action as, in its sole judgment, is advisable to remedy or to avoid such default, delay or defect, and CONTRACTOR shall reimburse PHILIPS for all additional costs incurred including costs of applicable attorneys fees. Alternatively or in addition, upon such defaults or defects or delay, or if CONTRACTOR shall become bankrupt or insolvent or if PHILIPS shall have reasonable grounds to believe that CONTRACTOR is bankrupt or insolvent, legally or equitably, or unable to pay its debts as they become due, or if the CONTRACTOR becomes involved in any labor difficulties which, in PHILIPS' opinion, impedes or slows down the WORK, or if CONTRACTOR shall fail to maintain such materials, equipment and personnel of such kinds and at such places as in PHILIPS' sole judgment are reasonably required for its performance hereunder, PHILIPS may from time to time, also terminate all or part of CONTRACTOR'S further performance and/or rights hereunder, and CONTRACTOR shall not be entitled to any further payment until the matter is remedied to the satisfaction of PHILIPS and shall then be paid only such amount as is reasonably due for work properly done by CONTRACTOR less all damages, loss, and additional expense suffered by PHILIPS as a result of such default. If such damages, loss and expense shall exceed the amount due to CONTRACTOR, such amount shall be paid immediately to PHILIPS by CONTRACTOR. No remedy afforded to PHILIPS either under this Agreement or as a matter of law shall be deemed to be exclusive.

19. MEDIATION

- 19.1 Any claim arising out of or related to the Agreement, except those waived herein, shall be subject to mediation as a condition precedent to binding dispute resolution.
- 19.2 The parties shall endeavor to resolve their claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement.

19.3 A request for mediation shall be made in writing, delivered to the other party to this Agreement and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of sixty (60) days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

19.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

20. BINDING DISPUTE RESOLUTION

20.1 For any claim subject to, but not resolved by mediation pursuant to Section 19, the method of binding dispute resolution shall be either arbitration as set forth in Section 21, or litigation in a court of competent jurisdiction, as mutually agreed to in writing by the parties. In the event the parties cannot agree to a method of binding dispute resolution, claims will be resolved by litigation in a court of competent jurisdiction.

21. ARBITRATION

21.1 If PHILIPS and CONTRACTOR have selected arbitration as the method of binding dispute resolution pursuant to Section 20, any claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement.

21.2 A demand for arbitration shall be made in writing, delivered to the other party to this Agreement, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all claims then known to that party on which arbitration is permitted to be demanded.

21.3 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the claim.

21.4 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that:

- a. the arbitration agreement governing the other arbitration permits consolidation;
- b. the arbitration to be consolidated substantially involve common questions of law or fact; and
- c. the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

21.5 Either party, at its sole discretion, may include by joinder, persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined, consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of a claim not described in the written consent.

21.6 PHILIPS and CONTRACTOR grant to any person or entity made a party to an arbitration conducted under this

Section 21, whether by joinder or consolidation, the same rights of joinder and consolidation as PHILIPS and CONTRACTOR under this Agreement.

- 21.7 This agreement to arbitrate and any other written agreement to arbitrate with an additional person or persons referred to herein shall be specifically enforceable under applicable law in any court having jurisdiction thereof. The award rendered by the arbitrator(s) shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

22. LIMITATION OF LIABILITY

- 22.1 The liability, if any, of PHILIPS for damages, whether arising from breach of the terms in this Agreement, or otherwise with respect to the Project hereunder and the performance of this Agreement by either party, is limited to an amount not to exceed the total value of the Project giving rise to the liability.

23. DISCLAIMER

- 23.1 IN NO EVENT SHALL PHILIPS BE LIABLE TO CONTRACTOR FOR ANY INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR SPECIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR PROFITS, OR GOODWILL ARISING FROM ANY FAILURE OR MATTER ARISING UNDER THIS AGREEMENT.

24. DAMAGES

- 24.1 PHILIPS shall recover all damages, costs and expenses, including compensation for direct and overhead costs, resulting from any breach of this Agreement by CONTRACTOR. To the extent that Philips has been back-charged or otherwise has paid damages to the Customer as a result of alleged defaults or nonperformance by CONTRACTOR, such back-charges shall be presumed to be valid unless CONTRACTOR disputes the validity and amount of such back-charges within 10 days after the time when CONTRACTOR first becomes aware of such back-charges and agrees in writing to indemnify, defend and hold Philips harmless for any loss, costs or expense incurred by Philips, including interest on amounts held by PHILIPS or Customer, as a result of such dispute.
- 24.2 The provisions of this paragraph shall control unless PHILIPS and CONTRACTOR specifically agree in writing to a fixed and determined sum which shall be paid by CONTRACTOR to PHILIPS for each and every day of delay, which sum shall be liquidated damages that PHILIPS will suffer by reason of said delay and not as a penalty, as set forth in Section 1.2.

25. INSURANCE

- 25.1 CONTRACTOR shall not commence WORK under this Agreement until it has obtained and provided to PHILIPS a Certificate of Insurance evidencing insurance, from carriers satisfactory to PHILIPS, to protect it from the following types of claims that may arise from CONTRACTOR'S operations under this Agreement, including acts of employees and subcontractors:
- a. workers compensation, disability benefit, and other similar employee benefit acts;
 - b. bodily injury, occupational illness or disease, or death of its employees, or any others;
 - c. injury to or destruction of tangible property, including loss of use resulting therefrom; and
 - d. bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

- 25.2 If the Project Documents do not specify more extensive coverage or higher limits, CONTRACTOR shall, at a minimum, maintain worker's compensation insurance in the amount required by applicable law and Employer's Liability Insurance for all CONTRACTOR employees who perform work under this Agreement, but no less than \$100,000, as well as policies of commercial general liability insurance (including bodily injury, contractual, XCU, products and completed operations coverage, broad form coverage for property damage) with \$1,000,000 per occurrence with a general aggregate limit of not less than \$2,000,000 per year, of automobile liability coverage in an amount of not less than \$2,000,000 combined single limit, and Umbrella/Excess Liability coverage in the amount of \$10,000,000. Philips Electronics North America Corporation and its officers, directors, employees and agents, and Customer and its trustees, directors, officers, employees and agents shall be named as additional insureds, on the above policies with the exception of workers compensation.
- 25.3 CONTRACTOR shall cause the commercial liability coverage required by the Project Documents to include:
- a. PHILIPS, OWNER, the architect and architect's consultant's, if any, as additional insureds for claims caused in whole or in part by CONTRACTOR'S negligent acts or omissions during CONTRACTOR'S operations; and
 - b. PHILIPS, as an additional insured for claims caused in whole or in part by the CONTRACTOR'S negligent acts or omissions during CONTRACTOR'S completed operations.
- 25.4 CONTRACTOR shall either require each of its subcontractors to procure all of the types of insurance specified in paragraph 25.1 and 25.2 or shall insure the activities of its subcontractors under its insurance policies.
- 25.5 CONTRACTOR'S Certificate of Insurance shall provide that such insurance may not be canceled, and that no material change may be made, without thirty (30) days' advance written notice to PHILIPS. CONTRACTOR shall provide PHILIPS with a current insurance certificate.
- 25.6 Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of CONTRACTOR'S WORK until the date of final payment and termination of any coverage required to be maintained after final payment to CONTRACTOR, and, with respect to CONTRACTOR'S completed operations coverage, until the expiration of the period for correction of WORK or for such other period for maintenance of completed operations coverage as specified in PHILIPS' agreement with OWNER.
- 25.7 CONTRACTORS, subcontractors and their insurance companies waive all rights of subrogation against the above-listed additional insureds.
- 26. PAYMENT/PERFORMANCE BONDS (if required)**
- 26.1 CONTRACTOR shall furnish payment and performance bonds, whether conditioned upon its payment for all labor, materials, or other things used in the performance of the WORK, or upon its performance of all obligations arising under this Agreement or otherwise, in a form and amount, and shall have a surety or sureties, acceptable to any governmental authority having jurisdiction, and to PHILIPS. The premiums for all such bonds which are required by law or which have been requested by PHILIPS prior to the time of CONTRACTOR'S execution of the Turnkey Construction Project Approval Addendum or required by the Project Documents shall be deemed to be included in the Price of the WORK, and no additional compensation shall be payable to CONTRACTOR with respect to such bonds. PHILIPS shall reimburse CONTRACTOR for the premiums paid on all other bonds required hereunder. No change order, extension of the time of completion, failure to enforce any rights arising under the Agreement, or other act or forbearance of PHILIPS shall, unless specifically otherwise agreed by PHILIPS, operate to release or discharge any surety or sureties under any such bond.

27. LIENS AND CLAIMS

- 27.1 CONTRACTOR shall immediately satisfy and discharge and shall indemnify and hold harmless PHILIPS and Customer against all liens, claims, demands or legal proceedings arising out of actual or alleged acts or omissions of CONTRACTOR in relation to this Agreement or the performance thereof. CONTRACTOR shall provide lien waivers, in form and substance satisfactory to PHILIPS, for itself and for its subcontractors and suppliers as a condition to each payment otherwise due hereunder. PHILIPS may, upon five (5) days notice to CONTRACTOR, pay or otherwise satisfy any claims against CONTRACTOR for which PHILIPS or Customer, in PHILIPS' sole judgment may be liable, and may reimburse itself out of funds due to or withheld from CONTRACTOR, or may recover such amount from CONTRACTOR.

28. SUBCONTRACTS

- 28.1 For portions of the WORK that CONTRACTOR intends to subcontract, CONTRACTOR shall enter into written agreements with subcontractors performing portions of the WORK, by which the CONTRACTOR and the subcontractor are mutually bound to the extent of the WORK to be performed by the subcontractor.
- 28.2 CONTRACTOR shall not subcontract work hereunder without the prior written consent of PHILIPS, and any such subcontract without consent of PHILIPS shall be null and void. If CONTRACTOR proposes to subcontract any of the WORK, it shall submit to PHILIPS the name of each proposed subcontractor(s), with the proposed scope of WORK which its subcontractor is to undertake. PHILIPS shall have the right to reject any subcontractor which it considers unable or unsuitable to satisfactorily perform the scope of WORK involved.

29. ASSIGNMENT

- 29.1 This Agreement or any part hereof, shall not be assigned by either party without the prior written consent of the other party, which consent shall not be unreasonably withheld, except that PHILIPS shall be entitled to make an assignment to an affiliate or subsidiary company without CONTRACTOR'S consent.
- 29.2 In the event OWNER terminates their agreement with PHILIPS for cause, this Agreement is assigned to OWNER, provided OWNER accepts the assignment.

30. COMPLIANCE WITH LAW

- 30.1 CONTRACTOR represents and warrants that it will conduct all WORK related to the subject matter of this Agreement in accordance with all applicable Federal, state and local statutes, regulations, ordinances and codes, as may be applicable.

31. TERMINATION

- 31.1 Either party may terminate this Agreement without obligation to the other if, for the Customer's convenience or as a result of a change of specifications for the Equipment or for any other cause beyond CONTRACTOR'S control, the start of the WORK is delayed for any reason for more than one (1) year after the date set forth in the applicable Project Documents.
- 31.2 PHILIPS may terminate, in whole or in part, CONTRACTOR'S further performance and PHILIPS' obligations at any time, by prior written notice to CONTRACTOR. In such event, CONTRACTOR shall be paid for all WORK to the date of termination, subject to withholdings and adjustments as provided in this Agreement. CONTRACTOR shall cooperate in minimizing costs and losses including transfer of WORK in progress. This clause shall not be construed as limiting any other rights or remedies available to PHILIPS.

31.3 Upon receipt of written notice of termination, CONTRACTOR shall:

- a. cease operations as directed by PHILIPS in the notice;
- b. take actions necessary, or that PHILIPS may direct, for the protection and preservation of the WORK; and
- c. except for WORK directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

31.4 In the event termination is based on termination by the OWNER, CONTRACTOR shall be entitled to receive, in addition to the amounts stated in Section 32.2, payment for costs incurred by reason of such termination.

32. SUSPENSION FOR CONVENIENCE

32.1 PHILIPS may, without cause, order CONTRACTOR, in writing, to suspend, delay or interrupt the WORK of this Agreement, in whole or in part, for such period of time as PHILIPS may determine. In the event of suspension ordered by PHILIPS, CONTRACTOR shall be entitled to an equitable adjustment of the payments under this Agreement to which they are entitled. No adjustment shall be made to the extent that:

- a. performance is, was or would have been so suspended, delayed or interrupted by another cause for which CONTRACTOR is responsible; or
- b. an equitable adjustment is made or denied under another provision of this Agreement.

33. ACCEPTANCE

33.1 CONTRACTOR shall notify PHILIPS in writing when all of the WORK is completed. PHILIPS will accept any WORK performed by CONTRACTOR only after acceptance of such WORK by Customer, and inspection by PHILIPS of the completed WORK, if so requested. Such acceptance by PHILIPS and Customer shall constitute "Acceptance" under this Agreement. Acceptance is required prior to payment of CONTRACTOR for WORK performed.

33.2 If Customer withholds Acceptance solely due to fault on the part of PHILIPS and not due to any fault, negligence or failure of CONTRACTOR, then PHILIPS may, in its sole discretion, pay CONTRACTOR related payments due even though Customer may continue to withhold Acceptance.

33.3 The provisional acceptance of sections of the WORK for the purpose of preparing partial statements and payment of money for such partial statements shall not operate as a waiver of any portion of the Agreement, and shall not be construed so as to prevent the PHILIPS Project Manager from requiring replacement of defective WORK that may become apparent after provisional acceptance, or as the basis for a CONTRACTOR claim for extra compensation for any cause whatsoever.

34. PAYMENT

34.1 PHILIPS shall pay CONTRACTOR the sum indicated in the Project Documents for the performance of the WORK ("Price of the WORK"). PHILIPS shall make (with ten percent (10%) retainage per payment) monthly, or as otherwise dictated by the nature of the Project and as mutually agreed to by PHILIPS and CONTRACTOR, progress payments for the Work completed and accepted in writing by PHILIPS' Turnkey Program Manager or his designate, based on invoices submitted by CONTRACTOR detailing the completed WORK and PHILIPS'

inspection of the completed WORK, if requested, according to the mutually agreed upon payment schedule. Applications for payment submitted by CONTRACTOR shall indicate the percentage of completion of each portion of CONTRACTOR'S WORK as of the end of the each month, or other mutually agreed upon period covered by the application for payment.

- 34.2 The balance of the Price of the WORK shall be payable upon completion of the Project by CONTRACTOR, including but not limited to, completion of all punch list items, obtaining any applicable certificates of occupancy, furnishing any documents, certificates or approvals by jurisdictions having authority over the Project, and acceptance of the WORK by PHILIPS and Customer, with commencement of CONTRACTOR warranty. As a condition to payment of final payment by PHILIPS, CONTRACTOR shall provide the Project Schedule(s) to PHILIPS showing detailed support of completion of each item. PHILIPS shall make the final payment to CONTRACTOR only if PHILIPS has received final payment from Customer.
- 34.3 Additionally, CONTRACTOR shall provide to PHILIPS waivers of lien or other documentation to verify payment of all suppliers of labor or material for the WORK as a condition precedent to final payment or, as to that part of the WORK which is in place as of the date of a progress payment, to any progress payment hereunder.
- 34.4 In the event CONTRACTOR'S request for final payment is rejected by PHILIPS, PHILIPS shall state its reasons for rejection.
- 34.5 CONTRACTOR shall maintain a clean set of "As-Built" drawings, which shall, at a minimum, identify building plans and the location of all installations, as well as the location of all penetrations of building elements such as walls and floor slabs. This includes, but is not limited to, installations hidden by building elements and major, permanent equipment such as air handling units, fans, heaters, boilers, switch-gear, etc. CONTRACTOR'S "As-Built" drawings shall dimensionally note the specific locations of such installations based upon major building elements, such as bearing walls or columns. Upon Completion of the WORK, and before application for final payment, the CONTRACTOR shall turn over the required "As-Built" drawings along with all other required final documentation.
- 34.6 The Price of the WORK includes the cost of Performance/Payment bonds (to ensure performance of its obligations and payment of all subcontractors, as further described in Section 26) for the full value of the WORK. (if required).
- 34.7 PHILIPS shall pay CONTRACTOR'S approved invoice within **sixty (60)** days of the end of the month in which PHILIPS' receives each such invoice.
- 34.8 PHILIPS reserves the right to withhold payment, in whole or in part, in the event of any reasonably possible default or insolvency of CONTRACTOR, the reasonable anticipation of the assertion of any liens, garnishments or attachments, or to cover any defective WORK.

35. TAXES

- 35.1 Except as may be specifically provided to the contrary in any of the Project Documents, CONTRACTOR'S proposal includes all federal, state, and local sales, use, excise, transportation, privilege, occupational, and other taxes applicable to materials or equipment furnished or WORK performed under the Agreement and all federal, state, and local taxes, contributions and premiums imposed upon or measured by the CONTRACTOR'S payroll. CONTRACTOR shall indemnify and save PHILIPS harmless from and against any liability for any such taxes, premiums and contributions.

36. AUDIT RIGHTS

- 36.1 At its option and expense, PHILIPS may audit CONTRACTOR'S books and records to verify and determine the

propriety of charges. At PHILIPS' option, the audit may be performed by a mutually agreeable independent auditor.

- 36.2 If this Agreement is for the provision of services that exceeds Ten Thousand Dollars (\$10,000) within a twelve (12) month period, until the expiration of four (4) years after the furnishing of any services pursuant to this Agreement, CONTRACTOR agrees to make available upon written request from the Secretary of Health and Human Services or the Comptroller General of the United States of America or any of their duly authorized representatives this Agreement and such books, documents and records of CONTRACTOR as are necessary to certify the nature and extent of reasonable cost of services to PHILIPS. If CONTRACTOR enters into an agreement with any related organization to provide services pursuant to this Agreement with a value of \$10,000 or more within a 12 month period, such agreement shall contain a clause identical in content to the first sentence of this paragraph. This provision shall be enforceable only to the extent required by P.L. 96-499.

37. SURVIVAL OF PROVISIONS

- 37.1 Sections 4, 25, 17, 22, 23, 30 and 38 of this Agreement regarding warranty, insurance, indemnity, limitation of liability, disclaimer, compliance with laws and notices shall survive the termination of this Agreement.

38. NOTICES

- 38.1 Notices or other communications shall be in writing, and shall be deemed served or given if delivered personally to the representative of the party who signed the Agreement, or if sent by facsimile transmission, by overnight mail or courier, or by certified mail, return receipt requested and addressed to the party at the address set forth on the face or above pages of this Agreement.

39. GOVERNMENT CONTRACTS

- 39.1 The clauses of the Federal Acquisition Regulation ("FAR"), set forth in Attachment E, are incorporated herein by this reference, with the same force and effect as if they were given in full text, and apply as indicated to any order, agreement or subcontract that is in support of a U.S. government contract.
- 39.2 Specifically, with respect to all federal construction contracts over \$2,000 requiring the hiring of mechanics or laborers, CONTRACTOR agrees to comply with all applicable provisions of the Davis-Bacon Act of 1931 (the "Act"), including the following:
- a. CONTRACTOR shall pay all mechanics or laborers employed directly upon the site of the WORK, unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account the full amounts accrued at the time of payment, computed at wage rates not less than those stated in the advertised specifications, regardless of any contractual relationship which may be alleged to exist between CONTRACTOR and the subcontractor and such mechanics or laborers.
 - b. CONTRACTOR agrees to permit the withholding from CONTRACTOR so much of accrued payments as may be considered necessary by the contracting officer to pay to mechanics or laborers employed by CONTRACTOR or any subcontractor on the WORK the difference between the rates of wages required by the contract to be paid mechanics or laborers on the WORK and the rates of wages received by such mechanics or laborers and not refunded to CONTRACTOR, subcontractors or their agents.
 - c. If CONTRACTOR has violated the Act, the government may, by written notice to CONTRACTOR, terminate its right to proceed with the WORK as to which there has been a failure to pay said required wages and to prosecute the WORK to completion by contract or otherwise, and CONTRACTOR or his sureties shall be liable to the government for any excess costs occasioned by the government thereby.

40. GOVERNING LAW

- 40.1 The parties agree that this Agreement will be governed by the laws of the United States and the state in which the WORK is performed without regard to the principles of choice of law.

41. MISCELLANEOUS

- 41.1 The failure of CONTRACTOR or PHILIPS at any time to require the performance of any obligation will not affect the right to require such performance at any time thereafter. Waiver of a breach of this Agreement shall not be deemed a waiver of any future breach.
- 41.2 Each party executing this Agreement warrants and represents that it has full power and authority to enter into this Agreement and to bind itself to performance hereunder. Each party warrants and represents that the individual signing this Agreement is an officer or a principal of the party on behalf of whom it signs, or has been granted or delegated all requisite power and authority to bind the party on behalf of which he signs. This Agreement is not binding upon PHILIPS unless executed by authorized representatives of PHILIPS. This representation and warranty of authority shall apply with equal force to each and every document executed by either party subsequent to this Agreement, in connection with the WORK to be performed under this Agreement.
- 41.3 The terms and conditions in this Agreement, including the Project Documents and any other documents incorporated by reference herein, constitute the entire understanding and agreement by and between the parties with respect to the Project and the WORK under this Agreement, and supersede any previous understandings or agreements between the parties, whether written or oral. No additional terms, conditions, consents, waivers, alterations, or modifications shall be binding unless in writing and signed by the parties. CONTRACTOR'S additional or different terms and conditions whether stated in an invoice or other document issued by CONTRACTOR are specifically rejected.
- 41.4 If any provision of this Agreement is deemed to be illegal, unenforceable, or invalid, in whole or in part, the validity and enforceability of the remaining provisions shall not be affected or impaired, and shall continue in full force and effect.
- 41.5 This Agreement may be executed in counterparts, each of which shall be considered an original, and together, one and the same agreement, which shall become a binding agreement when one or more counterparts have been signed by each party and delivered to the other parties.

Philips Healthcare
Turnkey Project, Site Drawing #
Project Budget and SOW for Equip
Good Samaritan Hospital - Suffern, New York
March 9, 2021 - Proposal Expires 45 Days From Today



The parties hereto have caused this Turnkey Construction Vendor Agreement to be duly executed as of the date and year first written above.

AGREED AND ACCEPTED:

CONTRACTOR (Name/Company):

PHILIPS:

**Contractor Acknowledgment and Agreement to Adhere and Abide by Philips
Turnkey Contracting Terms & Conditions:**

____ I (*Contractor Authorized Agent*) have read, understand and agree to Philips standard terms and conditions in its entirety for any and all Turnkey work contracted for the Scope of Work proposed herein:

Print Name

Date

This Turnkey Contracting Proposal (the "Turnkey Contracting Proposal") is the property of Philips and is only applicable to and may only be used on the Project described herein. This Turnkey Contracting Proposal shall not be copied or used in whole or in part without written permission of an authorized representative of Philips.
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5110-0499D Supplier Information and Approval Form

(ACH Enrollment and Authorization)

Supplier Business Information		
Business Name: (as shown on your Form W-9. Must attach completed W-9 form.)		
Business Name: (as shown on invoice)		
Address		
City	State/Province	Zip/Post code
Sales Contact:	Email:	Web Address:
Order Management Contact:	Email:	
Federal Tax ID:	DUNS Number:	GST Number (Canada only):
FDA registration number: Not Available	Health Canada license number: Not Available	
Supplier Diversity Information (Check all that apply)		
Foreign Owned	Veteran Owned	Women Owned
Minority Owned	Hub Zone Certified	Non-Profit
Small Business	Small Disadvantaged Business	Large Business
Attached Documentation		
If performing services at customer site please attach certificate of insurance	Certificate of insurance attached Not Applicable	
If managing/processing protected health information please attach HIPAA (US) or PIPEDA (Canada)	HIPAA/Privacy Agreement attached PIPEDA/Privacy Agreement attached Not Applicable	
Please attach W-9 Form	W-9 Form Attached Not Available	



Please attach copy of ISO 9001 Certificate and Quality Manual table of contents	ISO 9001 Certificate and Quality Manual information attached Not Available
Please attach copy of ISO 13485 Certificate and Quality Manual table of contents	ISO 13485 Certificate and Quality Manual information attached Not Available
Please attach Workplace safety Insurance Board Certificate (Canada Only)	Workplace safety Ins. Board Cert. attached Not Applicable

Payment Information**ACH Deposit – This is not a WIRE – Routing number will be from checking**

Philips payment terms are 65 days end of month via Electronic Funds Transfer. The information below is required to enable payment. No payments will be made via check.

Remittance email address	
Account holder name	
Account Number	
Routing Number	
Bank Name	
Bank Address	Street: City: State/Province: Country

Supplier Certification

Signature Authorized Supplier Representative _____

Date _____

Print Name and Title _____



Information below to be completed by Philips only		
Requestor Name:		Date:
Supplier No.:	Reason for change:	Type of Change: Add Update Remove
Product/Service supplier provides:		Applicability: US Canada Both
Information below to be completed by Philips procurement		
Procurement Specialist:		Date:
CLOGS:		Commodity:
Supplier Account Manager:		
Supplier Risk Classification (see 5123-0005): Low Medium High		
Supplier Type (see 5123-0005): Non-standalone Medical Device (MD) Direct Impact (Service) Standalone MD Non-standalone Non-MD Indirect impact (Service) Standalone non-Medical Device Limited impact (Service)		
Supplier Status		
Select supplier status :		Approved Disqualified Provisional Probation One-time Rejected
Supplier Quality Engineer: _____ Date _____		
Note: For supplier changes other than "ADD" only the Philips portion of the form is required to be completed. Note: If request is approved forward to ASL administrator, if request is rejected return to requestor with reason for rejection		ASL Updated: Yes No Date: Updated by:

**SECTION 006000
PROJECT FORMS AND RELATED DOCUMENTS**

PART 1 GENERAL

1.01 SUMMARY

- A. This Section lists the project forms used for administration of the project as well as documents used for administration and logistics

1.02 FORMS

- A. The following forms are attached at the end of this section:
1. FRONT END SUBMISSION LOG
 2. REQUEST FOR INFORMATION (RFI) FORM
 3. SUBCONTRACTOR LIST
 4. ALLOWANCE DISBURSEMENT FORM
 5. SUBSTITUTION REQUEST FORM
 6. SUBMITTAL COVER
 7. INFORMATION BULLETIN

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROCEDURES

- A. Front End Submission Log: This document is a checklist of the required submissions. Refer to Bidding Requirements, Section entitled "Instructions to Bidders" and Division 1, Specification Section entitled "SUBMITTAL PROCEDURES" for submission procedures.
- B. Request For Information (RFI) Form: This form is to be used for information requests. The forms are filled out by any party to the contract and sent to the Architect/Engineer. The Architect/Engineer shall number RFI before processing.
- C. Subcontractor List: This document is to be used identify subcontractors. The forms are filled out by each Prime Contractor for all proposed subcontractors and sent to the Architect/Engineer in accordance with. Division 1, section entitled "SUBMITTAL PROCEDURES"
- D. Allowance Disbursement Form: the Architect/Engineer shall issue this document after all parties have agreed to the conditions of change to be charged to the Allowance Amount in accordance with Division 1, section entitled "ALLOWANCES", if required.
- E. Substitution Request Form: This document is to be used for a Contractor to propose substitutions. The forms are filled out by each Prime Contractor and sent to the Architect/Engineer in accordance with. Division 1, section entitled "SUBMITTAL PROCEDURES" and "PRODUCT REQUIREMENTS".
- F. Submittal Cover: This document is to be used for submittal submissions. The forms are filled out by each Prime Contractor and sent to the Architect/Engineer in accordance with. Division 1, section entitled "SUBMITTAL PROCEDURES"
- G. Information Bulletin: The Architect/Engineer shall issue this document for 3 actions.
1. PROPOSAL REQUEST: A quotations for changes in the Contract Sum and / or proposed modifications to the Contract Documents
 2. SUPPLEMENTAL INSTRUCTIONS: Instructions for changes to the Contract Documents without additional cost or time
 3. CONSTRUCTION CHANGE DIRECTIVE: A directive to immediately proceed with changes to the work of the contract and to submit final cost for inclusion into a Change Order

END OF SECTION

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FRONT END SUBMISSION LOG

PROJECT NO. 15068.00

BON SECOURS CHARITY HEALTH SYSTEM - GOOD SAMARITAN HOSPITAL TMP 30 CT TMP 92 MRI

Contractor Name: _____

SUBMISSIONS

Submission	Date		Remarks
	Submitted	Approved	
Contract:			
Schedule of Values:			
Bonds:			
Insurance:			
Workers Compensation:			
Automobile Insurance:			
Safety Program:			
Schedule:			
Submittal Schedule:			
Emergency Contact:			
Substitution List:			
Subcontractor List:			
Project Manager:			
Superintendent:			

This log is to be used by the contractor to monitor and complete the required front-end submissions.

30 Century Hill Drive
Suite 104
Latham, New York 12110
CPLteam.com
800-274-9000 TEL
518-463-3223 FAX



REQUEST FOR INFORMATION

RFI #:

Date:

Bon Secours Charity Health System - Good Samaritan Hospital TMP 30 CT TMP 92 MRI

Contractor Name: _____

To: _____ Firm: _____

From: _____

WE REQUEST YOUR ATTENTION (OR CONFIRMATION) REGARDING THE FOLLOWING:

Subject: _____

Location: _____

Information is Requested By: _____

MESSAGE: _____

Contractors Name: _____

By: _____ Date: _____

30 Century Hill Drive
Suite 104
Latham, New York 12110
CPLteam.com
800-274-9000 TEL
518-463-3223 FAX

SUBCONTRACTOR LIST

Bon Secours Charity Health System - Good Samaritan Hospital TMP 30 CT TMP 92 MRI

To: CPL
30 Century Hill Drive – Suite 104
Latham, New York 12110

From:
(Contractor) _____

Contractors
No.: _____

Contract For: _____

List Subcontractors proposed for use on this Project as required by the Construction Documents.
Attach supplemental sheets if necessary.

Section
No.: _____ Section Title: _____

Firm
Name: _____ Contact: _____

Address: _____

Section
No.: _____ Section Title: _____

Firm
Name: _____ Contact: _____

Address: _____

Section
No.: _____ Section Title: _____

Firm
Name: _____ Contact: _____

Address: _____

Section
No.: _____ Section Title: _____

Firm
Name: _____ Contact: _____

Address: _____

Section
No.: _____ Section Title: _____

☐ Attachment(s)

Signed by: _____ Date: _____

Copies: ☐ Owner ☐ Consultants ☐ File
☐ ☐ ☐

ALLOWANCE DISBURSEMENT AUTHORIZATION

Owner _____
Architect/Engineer _____
Contractor _____
Field _____
Other _____
Other _____

BON SECOURS CHARITY HEALTH SYSTEM - GOOD SAMARITAN HOSPITAL TMP 30 CT TMP 92 MRI

Allowance Disbursement No. _____ Initiation Date: _____

Contract For: _____

To Contractor: _____

Contract Date: _____

Not valid until signed by Owner, Architect/Engineer, [Construction Manager] and Contractor.

The Original Contract Allowance _____

Net Allowance Disbursements previously authorized _____

Charges to Contract Allowance as a result of this authorization _____

Current Contract Allowance Balance including this authorization _____

Owner: _____

Architect/Engineer: _____
(CPL)

Contractor: _____

SUBSTITUTION REQUEST FORM

BON SECOURS CHARITY HEALTH SYSTEM - GOOD SAMARITAN HOSPITAL TMP 30 CT TMP 92 MRI

To: CPL
30 Century Hill Drive – Suite 104
Latham, New York 12110

From:
(Contractor) _____

Re: _____ Substitution Request Number: _____

Contract For: _____

Specification Title: _____ Description: _____

Section Number: _____ Page: _____ Part/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect/Engineer: _____

Contractor: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work:

☐ No
☐ Yes, explain _____

Savings to Owner for accepting substitution: _____ (\$ _____)

Proposed substitution changes Contract Time: ☐ Yes; explain ☐ No ☐ Yes [Add] [Deduct] _____ days

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted By: _____

Signed By: _____

Firm: _____

Address _____

Phone: _____

Attachments: _____

REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
- ☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
- ☐ Substitution rejected - Use specified materials.
- ☐ Substitution Request received too late - Use specified materials.

Signed By: _____ Date: _____

Additional

Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ Architect/Engineer

☐ _____

SUBMITTAL COVER

(Attach to each submittal)

#

Submittal No. Contractor only

Contractor: _____
 Address: _____
 Phone / Fax: () _____

Architect Project Number: 15068.00
 Contractors Number: _____
 Project Name: BON SECOURS CHARITY
 HEALTH SYSTEM - GOOD SAMARITAN
 HOSPITAL TMP 30 CT TMP 92 MRI
 Date returned: _____

TYPE OF SUBMITTAL

(Check one)

- | | | |
|--|--|--|
| <input type="checkbox"/> Product Data | <input type="checkbox"/> Color Selection | <input type="checkbox"/> O&M Manual |
| <input type="checkbox"/> Shop Drawings | <input type="checkbox"/> Sample | <input type="checkbox"/> Record Document |
| <input type="checkbox"/> Other | | |

SUBSTITUTION

See General Conditions

☐ YES ☐ NO

DATE OF SUBMITTAL: _____

RESUBMITTED: _____

NUMBER OF ATTACHED: _____

PRODUCT IDENTIFICATION

Specification Section No.: _____
 Contract Dwg. No.: _____
 Product Name: _____
 Part/Paragraph: _____
 Detail Reference: _____
 Manufacturer: _____

CONTRACTOR APPROVAL

Identify that this submittal has been reviewed and approved by the Contractor in accordance with the General Conditions

By: _____ Date: _____

Deviation from Contract Documents:

Contractor Comments:

FOR USE BY CPL

SHOP DRAWING

- | | |
|---|--|
| <input type="checkbox"/> No Exception Taken | <input type="checkbox"/> Revise & Resubmit |
| <input type="checkbox"/> Furnish as Corrected | <input type="checkbox"/> Rejected |

Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the drawings and specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe satisfactory manner.

Clark Patterson Lee

Date: _____ By: _____

Architect's Comments:

RECEIVED STAMP

30 Century Hill Drive
 Suite 104
 Latham, New York 12110
 CPLteam.com
 800-274-9000 TEL
 518-463-3223 FAX

INFORMATION BULLETIN

BON SECOURS CHARITY HEALTH SYSTEM
GOOD SAMARITAN HOSPITAL
TMP 30 CT TMP 92 MRI

PROJECT:

INFORMATION BULLETIN NO.:

OWNER:

DATE:

CONTRACTOR:

ARCHITECT'S PROJECT NO.: 15068.00

DESCRIPTION:

CONTRACT NO.:

CONTRACT DATE:

ATTACHMENT(S):

ACTION

- ☐ 1. **PROPOSAL REQUEST:** Submit an itemized quotation for changes in the Contract Sum and/or time required to implement the above proposed modifications to the Contract Documents. This is not authorization to proceed with the work.
- ☐ 2. **SUPPLEMENTAL INSTRUCTIONS:** Implement the above instructions without change to the Contract Sum and/or Time. Prior to proceeding, indicate acceptance below and return one copy to the Architect.
- ☐ 3. **CONSTRUCTION CHANGE DIRECTIVE:** Proceed with the above described changes to the Contract Documents immediately. Submit final costs and/or change in Contract Time for inclusion in a subsequent Change Order.

Methods: ☐ Lump Sum ☐ Unit Price ☐ Time & Material Not-to-Exceed

Change in Contract Sum of _____

Change in Contract Time of _____ days

ISSUED:

ACCEPTED:

AUTHORIZED:

BY: _____

BY: _____

BY: _____

Architect

Date

Contractor

Date

Owner

Date

☐ Owner
☐ Contractor

☐ Architect
☐ Field

☐ Structural
☐ Mechanical/Electrical

☐ Civil
☐ Other (Roofing)

SECTION 007100
WCHCC GENERAL CONDITIONS COVER

PART 1 - GENERAL

1.01 SUMMARY

- A. The following are the "Westchester County Health Care Corporation General Conditions", bound with this Section. This document sets forth the rights, responsibilities, and relationships of the Owner, Contractor, and Architect.

END OF SECTION

**BON SECOURS HEALTH CARE SYSTEM
GOOD SAMARITAN HOSPITAL
GENERAL CONDITIONS**

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MINORITY/WOMEN'S BUSINESS QUESTIONSError! Bookmark not defined.

AFFIRMATION.....ERROR! BOOKMARK NOT DEFINED.

BID BOND AND CONSENT OF SURETYERROR! BOOKMARK NOT DEFINED.

GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 DEFINED TERMS

A. Wherever used in the Contract Documents and printed with initial or all capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof.

1. *A.A.S.H.O.* - American Association of State Highway Officials.
2. *Addenda*--Written or graphic instruments issued prior to the opening of Bids, which clarify, correct, or change the Bidding Requirements or the Contract Documents.
3. *Agreement*--The written instrument which is evidence of the agreement between OWNER and CONTRACTOR covering the Work.
4. *Application for Payment*--The form acceptable to ARCHITECT which is to be used by CONTRACTOR during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
5. *ARCHITECT/ENGINEER*--The individual or entity licensed to practice architecture or engineering in the State of New York and engaged by OWNER to perform services in connection with the Work described in the Contract Documents. When any part of the Contract Documents refers to the term Engineer, such reference shall also be deemed to include the ARCHITECT.
6. ARCHITECT's Consultant--An individual or entity having a contract with ARCHITECT to furnish services as ARCHITECT's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.
7. *A.R.E.A.* -- American Railway A/E Association.

8. *Asbestos*--Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
9. *A.S.T.M.* - American Society for Testing Materials.
10. *A.W.W.A.* - American Water Works Association.
11. *Bid*--The offer or proposal of a bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
12. *Bidding Documents*--The Bidding Requirements and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).
13. *Bidding Requirements*--The Advertisement or Invitation to Bid, Instructions to Bidders, Bid security form, if any, and the Bid form with any supplements.
14. *Bonds*--Performance and payment bonds and other instruments of security.
15. *Change Order*--A document recommended by the Owner's Representative which is signed by ARCHITECT, CONTRACTOR, and OWNER and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
16. *Claim*--A demand or assertion by OWNER or CONTRACTOR seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
17. *CONSTRUCTION MANAGER*--An individual or entity having a contract with OWNER to act on their behalf to help administrate the construction contracts and monitor the construction progress.
18. *Contract*--The entire and integrated written agreement between the OWNER and CONTRACTOR concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
19. *Contract Documents*--The Contract Documents establish the rights and obligations of the parties and include the Agreement, Addenda (which pertain to the Contract Documents),

CONTRACTOR's Bid (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Award) when attached as an exhibit to the Agreement, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Agreement, together with all Written Amendments, Change Orders, Work Change Directives, Field Orders, and ARCHITECT's written interpretations and clarifications issued on or after the Effective Date of the Agreement. Approved Shop Drawings and the reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this paragraph are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by OWNER to CONTRACTOR are not Contract Documents.

20. *Contract Price*--The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of paragraph 11.03 in the case of Unit Price Work).
21. *Contract Times*--The number of days or the dates stated in the Agreement to: (i) achieve Substantial Completion; and (ii) complete the Work so that it is ready for final payment as evidenced by Owner's Representative's written recommendation of final payment.
22. *CONTRACTOR*--The individual or entity with whom OWNER has entered into the Agreement.
23. *Cost of the Work*--See paragraph 11.01.A for definition.
24. *Drawings*--That part of the Contract Documents prepared or approved by ARCHITECT which graphically shows the scope, extent, and character of the Work to be performed by CONTRACTOR. Shop Drawings and other CONTRACTOR submittals are not Drawings as so defined.
25. *Effective Date of the Agreement*--The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
26. *Field Order*--A written order issued by ARCHITECT which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
27. *General Requirements*--Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

28. *Hazardous Environmental Condition*--The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.
29. *Hazardous Waste*--The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
30. *Laws and Regulations; Laws or Regulations*--Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
31. *Liens*--Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
32. *Milestone*--A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
33. *N.E.C.* - National Electrical Code
34. *N.E.M.A.* - National Electric Manufacturer's Association.
35. *Notice of Award*--The written notice by OWNER to the apparent successful bidder stating that upon timely compliance by the apparent successful bidder with the conditions precedent listed therein, OWNER will sign and deliver the Agreement.
36. *Notice to Proceed*--A written notice given by OWNER to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform the Work under the Contract Documents.
37. *OWNER*--The Bon Secours Charity Health System
38. *Owner's Representative*--An individual or entity having a contract with OWNER to represent the interests of, act on behalf of, and otherwise assist OWNER in the supervision, administration, and general oversight of performance of the Contract and the progress of the Work.

39. *Partial Utilization*--Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.
40. *PCBs*--Polychlorinated biphenyls.
41. *Petroleum*--Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
42. *Project*--The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part as may be indicated elsewhere in the Contract Documents.
43. *Project Manual*--The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
44. *Radioactive Material*--Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
45. *Resident Project Representative*--The authorized representative of ARCHITECT who may be assigned to the Site or any part thereof.
46. *Samples*--Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
47. *Shop Drawings*--All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.
48. *Site*--Lands or areas indicated in the Contract Documents as being furnished by OWNER upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by OWNER which are designated for the use of CONTRACTOR.

49. *Specifications*--That part of the Contract Documents consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.
50. *Subcontractor*--An individual or entity having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the Site.
51. *Substantial Completion*--The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of ARCHITECT, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.
52. *Supplementary Conditions*--That part of the Contract Documents which amends or supplements these General Conditions.
53. *Supplier*--A manufacturer, fabricator, supplier, distributor, material man, or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.
54. *Underground Facilities*--All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
55. *Unit Price Work*--Work to be paid for on the basis of unit prices.
56. *Work*--The entire completed construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
57. *Work Change Directive*--A written statement to CONTRACTOR issued on or after the Effective Date of the Agreement and signed by OWNER and recommended by ARCHITECT ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be

performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

58. *Written Amendment*--A written instrument modifying the Contract Documents, signed by OWNER and CONTRACTOR on or after the Effective Date of the Agreement and normally dealing with the non-engineering or non-technical rather than strictly construction-related aspects of the Contract Documents.

1.02 TERMINOLOGY

A. *Intent of Certain Terms or Adjectives*

1. Whenever in the Contract Documents the terms "as allowed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of ARCHITECT as to the Work, it is intended that such action or determination will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to ARCHITECT any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of paragraph 9.10 or any other provision of the Contract Documents.

B. *Day*

1. The word "day" shall constitute a calendar day of 24 hours measured from midnight to the next midnight.

C. *Defective*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it does not conform to the Contract Documents or does not meet the requirements of any inspection, reference standard, test, or

approval referred to in the Contract Documents, or has been damaged prior to ARCHITECT's recommendation of final payment (unless responsibility for the protection thereof has been assumed by OWNER at Substantial Completion in accordance with paragraph 14.04 or 14.05).

D. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of CONTRACTOR, "provide" is implied.

- E. Unless stated otherwise in the Contract Documents, words or phrases which have a well-known technical or construction industry or trade meanings are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 - PRELIMINARY MATTERS

2.01 DELIVERY OF EXECUTED AGREEMENTS AND BONDS

- A. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish.

2.02 COPIES OF DOCUMENTS

- A. CONTRACTOR shall properly execute and return two duplicate original counterparts of the Agreements to OWNER within fifteen days of receiving the Agreements. Upon receipt of all acquired bonds and insurance in a form acceptable to OWNER together with delivery of any other submittal required by the Contract Documents, the OWNER shall execute the Agreements and forward one fully executed original counterpart to the CONTRACTOR.
- B. OWNER shall furnish to CONTRACTOR up to six copies of the Contract Documents. Additional copies will be furnished upon request at the cost of reproduction.

2.03 COMMENCEMENT OF CONTRACT TIMES; NOTICE TO PROCEED

- A. Unless specifically stated otherwise in the Supplementary Conditions, the Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement.

2.04 STARTING THE WORK

- A. CONTRACTOR shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 BEFORE STARTING CONSTRUCTION

- A. *CONTRACTOR's Review of Contract Documents:* Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. CONTRACTOR shall promptly report in writing to ARCHITECT any conflict, error, ambiguity, or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from ARCHITECT before proceeding with any Work affected thereby; however, the CONTRACTOR shall not be liable to OWNER or ARCHITECT for failure to report any conflict, error, ambiguity,

or discrepancy in the Contract Documents unless CONTRACTOR knew or reasonably should have known thereof.

B. *Preliminary Schedules:* Within ten days after the Effective Date of the Agreement (unless otherwise specified in the Supplementary Conditions), CONTRACTOR shall submit to Owner's Representative for its timely review:

1. A preliminary progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
2. A preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing, and processing such submittal; and
3. A preliminary schedule of values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. "Supervision" must be a separate item in the schedule of values. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

C. *Evidence of Insurance:* Simultaneous with the return of the Agreement and before any Work at the Site is started, CONTRACTOR shall deliver to the OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance which CONTRACTOR is required to purchase and maintain in accordance with Article 5.

2.06 PRECONSTRUCTION CONFERENCE

A. Within 20 days after the Contract Times start to run, but before any Work at the Site is started, a conference attended by Owner's Representative, CONTRACTOR, ARCHITECT, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in paragraph 2.05.B, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

2.07 INITIAL ACCEPTANCE OF SCHEDULES

- A. Unless otherwise provided in the Contract Documents, at least ten days before submission of the first Application for Payment a conference attended by Owner's Representative, CONTRACTOR, ARCHITECT, and others as appropriate will be held to review for acceptability to ARCHITECT as provided below the schedules submitted in accordance with paragraph 2.05.B. CONTRACTOR shall have an additional ten days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to CONTRACTOR until acceptable schedules are submitted to the Owner's Representative and ARCHITECT.
1. The progress schedule will be acceptable to the Owner's Representative and ARCHITECT if it provides an orderly progression of the Work to completion within any specified Milestones and the Contract Times. Such acceptance will not impose on ARCHITECT responsibility for the progress schedule, for sequencing, scheduling, or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility therefore.
 2. CONTRACTOR's schedule of Shop Drawing and Sample submittals will be acceptable to the Owner's Representative and ARCHITECT if it provides a workable arrangement for reviewing and processing the required submittals.
 3. CONTRACTOR's schedule of values will be acceptable to the Owner's Representative and ARCHITECT as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 INTENT

- A. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be provided whether or not specifically called for at no additional cost to OWNER.

- C. Clarifications and interpretations of the Contract Documents shall be issued by ARCHITECT as provided in Article 9.

3.02 REFERENCE STANDARDS

A. *Standards, Specifications, Codes, Laws, and Regulations*

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
2. No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of OWNER, CONTRACTOR, or ARCHITECT, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to OWNER, ARCHITECT, or any of ARCHITECT's Consultants, agents, or employees any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 REPORTING AND RESOLVING DISCREPANCIES

- A. *Reporting Discrepancies:* If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Law or Regulation applicable to the performance of the Work or of any standard, specification, manual or code, or of any instruction of any Supplier, CONTRACTOR shall report it to ARCHITECT in writing at once. CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as required by paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.04; provided, however, that CONTRACTOR shall not be liable to OWNER or ARCHITECT for failure to report any such conflict, error, ambiguity, or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

B. *Resolving Discrepancies:* Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

1. The provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
2. The provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 AMENDING AND SUPPLEMENTING CONTRACT DOCUMENTS

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways: (i) a Written Amendment; (ii) a Change Order; or (iii) a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways: (i) a Field Order; (ii) ARCHITECT's approval of a Shop Drawing or Sample; or (iii) ARCHITECT's written interpretation or clarification.

3.05 REUSE OF DOCUMENTS

- A. CONTRACTOR and any Subcontractor or Supplier or other individual or entity performing or furnishing any of the Work under a direct or indirect contract with OWNER: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of ARCHITECT or ARCHITECT's Consultant, including electronic media editions; and (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of OWNER and ARCHITECT and specific written verification or adaptation by ARCHITECT. This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude CONTRACTOR from retaining copies of the Contract Documents for record purposes.

**ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS;
REFERENCE POINTS**

4.01 AVAILABILITY OF LANDS

- A. OWNER shall furnish the Site. OWNER shall notify CONTRACTOR of any encumbrances or restrictions not of general application but specifically related to use of the Site with which CONTRACTOR must comply in performing the Work. OWNER will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If CONTRACTOR and OWNER are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in OWNER's furnishing the Site, CONTRACTOR may make a Claim therefore as provided in paragraph 10.05.

4.02 SUBSURFACE AND PHYSICAL CONDITIONS

- A. *Reports and Drawings:* The Supplementary Conditions identify:
1. Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that ARCHITECT has used in preparing the Contract Documents; and
 2. Those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that ARCHITECT has used in preparing the Contract Documents.
- B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ARCHITECT, or any of ARCHITECT's Consultants with respect to:
1. The completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and

procedures of construction to be employed by CONTRACTOR, and safety precautions and programs incident thereto; or

2. Other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 3. Any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.
- C. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.
- D. CONTRACTOR shall recognize and take notice of work to be performed by other contractors within and adjacent to the site and shall permit reasonable access to the site and make available all reasonable facilities and assistance for the completion of such adjoining work.

In the event of any interference between the operations of CONTRACTOR and any utility owner or other contractor or subcontractor, the ARCHITECT shall in good faith assess and determine the most appropriate sequence of activities to be performed in order to expedite the completion of the entire project including any competing or conflicting work and such determination by the ARCHITECT shall be final and conclusive. Any delay due to the unavailability of any part of the site caused by the interference of a conflict between CONTRACTOR and any utility owner or other contractor or subcontractor shall be compensated for solely by an adjustment to the Contract Times and the CONTRACTOR waives any claim against OWNER or ARCHITECT.

4.03 DIFFERING SUBSURFACE OR PHYSICAL CONDITIONS

- A. *Notice:* If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:
1. Is of such a nature as to establish that any "technical data" on which CONTRACTOR is entitled to rely as provided in paragraph 4.02 is materially inaccurate; or
 2. Is of such a nature as to require a change in the Contract Documents; or
 3. Differs materially from that shown or indicated in the Contract Documents; or

4. Is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

Then CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), notify OWNER, Owner's representative and ARCHITECT in writing about such condition. CONTRACTOR shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

- B. *ARCHITECT's Review:* After receipt of written notice as required by paragraph 4.03.A, ARCHITECT will promptly review the pertinent condition, determine the necessity of OWNER's obtaining additional exploration or tests with respect thereto, and advise OWNER in writing (with a copy to CONTRACTOR) of ARCHITECT's findings and conclusions.

C. *Possible Price and Times Adjustments*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in CONTRACTOR's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Such condition must meet any one or more of the categories described in paragraph 4.03.A; and
 - b. With respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of paragraphs 9.08 and 11.03.
2. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Contract Times if:
 - a. CONTRACTOR knew of the existence of such conditions at the time CONTRACTOR made a final commitment to OWNER in respect of Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
 - b. The existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study

of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such final commitment; or

- c. CONTRACTOR failed to give the written notice within the time and as required by paragraph 4.03.A.

- 3. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefore as provided in paragraph 10.05. However, OWNER, ARCHITECT, and ARCHITECT's Consultants shall not be liable to CONTRACTOR for any claims, costs, losses, or damages (including but not limited to all fees and charges of ENGINEER's, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.04 UNDERGROUND FACILITIES

- A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to OWNER or ARCHITECT by the owners of such Underground Facilities, including OWNER, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

- 1. OWNER and ARCHITECT shall not be responsible for the accuracy or completeness of any such information or data; and
- 2. The cost of all of the following will be included in the Contract Price, and CONTRACTOR shall have full responsibility for:
 - a. Reviewing and checking all such information and data,
 - b. Locating all Underground Facilities shown or indicated in the Contract Documents,
 - c. Coordination of the Work with the owners of such Underground Facilities, including OWNER, during construction, and

- d. The safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to OWNER and ARCHITECT. ARCHITECT will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility.
2. If ARCHITECT concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that CONTRACTOR did not know of and could not reasonably have been expected to be aware of or to have anticipated. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, OWNER or CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

4.05 REFERENCE POINTS

- A. OWNER shall provide ENGINEERING surveys to establish reference points for construction, which in ARCHITECT's judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ARCHITECT whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate

replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 HAZARDOUS ENVIRONMENTAL CONDITION AT SITE

A. *Reports and Drawings:* Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the ARCHITECT in the preparation of the Contract Documents.

B. *Limited Reliance by CONTRACTOR on Technical Data Authorized:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," CONTRACTOR may not rely upon or make any Claim against OWNER, ARCHITECT or any of ARCHITECT's Consultants with respect to:

1. The completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto; or
2. Other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
3. Any CONTRACTOR interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. CONTRACTOR shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. CONTRACTOR shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by CONTRACTOR, Subcontractors, Suppliers, or anyone else for whom CONTRACTOR is responsible.

D. If CONTRACTOR encounters a Hazardous Environmental Condition or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition, CONTRACTOR shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by paragraph 6.16); and (iii) notify OWNER and ARCHITECT (and promptly thereafter

confirm such notice in writing). OWNER shall promptly consult with ARCHITECT concerning the necessity for OWNER to retain a qualified expert to evaluate such condition or take corrective action, if any.

- E. CONTRACTOR shall not be required to resume Work in connection with such condition or in any affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by CONTRACTOR, either party may make a Claim therefor as provided in paragraph 10.05.
- F. If after receipt of such written notice CONTRACTOR does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then OWNER may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If OWNER and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefore as provided in paragraph 10.05. OWNER may have such deleted portion of the Work performed by OWNER's own forces or others in accordance with Article 7.
- G. To the fullest extent permitted by Laws and Regulations, OWNER shall indemnify and hold harmless CONTRACTOR, Subcontractors, Construction Manager, ARCHITECT, ARCHITECT's Consultants and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of Engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.G shall obligate OWNER to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- H. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, Construction Manager, ARCHITECT, ARCHITECT's Consultants, and the officers, directors, partners, employees, agents, other consultants, and subcontractors of each and any of

them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by CONTRACTOR or by anyone for whom CONTRACTOR is responsible. Nothing in this paragraph 4.06.H shall obligate CONTRACTOR to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- I. The provisions of paragraphs 4.02, 4.03, and 4.04 are not intended to apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 - BONDS AND INSURANCE

5.01 PERFORMANCE, PAYMENT, AND OTHER BONDS

- A. Unless otherwise required by the Supplementary Conditions, CONTRACTOR shall furnish a performance and payment Bond or separate Bonds, in an amount at least equal to one hundred percent of the Contract Price as security for the full and faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents including the payment of all persons performing labor or furnishing material in connection therewith.

The Bonds shall be the most recent AIA Document or in such other form as OWNER shall approve. CONTRACTOR shall also furnish such other Bonds as may be required by the Contract Documents.

- B. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.
- C. If the surety on any Bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in the State of New York or it ceases to meet the requirements of paragraph 5.01.B, CONTRACTOR shall within 20 days thereafter substitute another Bond and surety, both of which shall comply with the requirements of paragraphs 5.01.B and 5.02.

5.02 LICENSED SURETIES AND INSURERS

- A. All Bonds and insurance required by the Contract Documents to be purchased and maintained by CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the State of New York to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 CERTIFICATES OF INSURANCE

- A. CONTRACTOR shall obtain at its own cost and expense and deliver to OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by OWNER or any other additional insured) for the coverages and amounts which CONTRACTOR is required to purchase and maintain. If at any time any of the policies required herein shall be or become unsatisfactory to the OWNER, as to form or substance, or if a company issuing any such policy shall be or become unsatisfactory to the OWNER, the CONTRACTOR shall, upon notice to that effect from the OWNER, promptly obtain a new policy and submit the policy or a certificate thereof to the Office of General Counsel of the OWNER, for approval. Upon failure of the CONTRACTOR to furnish, deliver and maintain such insurance, the Agreement, at the election of the OWNER may be declared suspended, discontinued or terminated. Failure of the CONTRACTOR to take out or maintain any required insurance shall not relieve the CONTRACTOR for any liability under the Agreement, nor shall the insurance requirements be construed to conflict with or otherwise limit the contractual obligations of the CONTRACTOR concerning indemnification. All property losses shall be made payable to and adjusted with the OWNER.
- B. CONTRACTOR shall obtain at its own cost and expense and deliver to Construction Manager. certificate(s) of insurance, Listing Construction Manager as certificate holder, listing all of the insurance policies and amounts that CONTRACTOR is required to obtain and maintain pursuant to this Contract. Such certificates of insurance shall name Construction Manager as an additional insured.

5.04 CONTRACTOR'S LIABILITY INSURANCE

- A. CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which

may arise out of or result from CONTRACTOR's performance of the Work and CONTRACTOR's other obligations under the Contract Documents, whether it is to be performed by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable. The CONTRACTOR shall provide proof of the following coverage:

1. Workers' Compensation. Certificate C-105.2 or State Fund Insurance Company form U-26.3 is required for proof of compliance with the New York State Workers' Compensation Law.

State Workers' Compensation Board form DB-120.1 is required for proof of compliance with the New York State Disability Benefits Law. Location of operation shall be "All locations in Westchester County, New York."

(Where an applicant claims to not be required to carry either a Workers' Compensation Policy or Disability Benefits Policy, or both, a temporary permit may be issued if the employer completes form C-105.2 in duplicate. A copy of Form C-105.2 is sent to the Workers' Compensation Board, Information Unit for investigation and report).

If the employer is self-insured for Workers' Compensation, it should present a certificate from the New York State Workers' Compensation Board evidencing that fact.

2. Employer's Liability Insurance with a minimum limit of \$100,000.
3. General Liability Insurance with a minimum limit of liability per occurrence of \$1,000,000 for bodily injury and \$100,000 for property damage or a combined single limit of \$1,000,000 (c.s.l), naming the Bon Secours Charity Health System as an additional insured. If the Work described in the Contract Documents requires or may include the use of explosives or demolition or trenching, excavation or other underground work, then such coverage shall include an endorsement eliminating any XCU exclusion or other proof that XCU coverage is included. This Insurance shall indicate on the certificate of insurance the following coverages:
 - a. Premises - Operations
 - b. Broad Form Contractual
 - c. Independent Contractor and Sub-contractor.
 - d. Products and Completed Operations.
 - e. Excavation Collapse and Underground Hazards (where applicable)

4. Asbestos Abatement and Subcontractors Only. Asbestos Abatement Contractors Liability with a limit of \$2,000,000 per occurrence and aggregate. Coverage shall provide Bon Secours Charity Health System as additional insured and shall be on an occurrence basis.
5. Hazardous/Contaminated Materials Contractors including Underground Petroleum Storage Tank Contractors and Subcontractors Only Excavation including Removal, Repair, Installation, Testing and Petroleum Remediation Operations. Coverage provide:
 - a. Pollution Liability with a combined single limit of \$2,000,000 per occurrence/\$2,000,000 aggregate and shall name Bon Secours Charity Health System as additional insured.
 - b. Claims-made insurance coverage policies shall contain an extended reporting provision of up to three years after the Work is completed. If coverage is cancelled or not renewed, the Contractor shall purchase the extended reporting provision for a period of three years for any claims made during the Project but reported after the cancellation of coverage.
6. Automobile Liability Insurance with a minimum limit of liability per occurrence of \$1,000,000 for bodily injury and a minimum limit of \$100,000 per occurrence for property damage or a combined single limit of \$1,000,000 unless otherwise indicated in the Supplementary Conditions. This insurance shall include for bodily injury and property damage the following coverages:
 - a. Owned automobiles
 - b. Hired automobiles
 - c. Non-owned automobiles
 - d. Leased automobiles

B. The policies of insurance so required by this paragraph 5.04 to be purchased and maintained shall:

1. With respect to insurance required by paragraphs 5.04.A.3, 5.04.A.4, 5.04.A.5, and 5.04.A.6 include as additional insured OWNER, Owner's Representative, ARCHITECT, ARCHITECT's Consultants, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of all such additional insureds, and the

insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. All policies and certificates of insurance of the CONTRACTOR shall contain the following clauses:
 - a. Insurers shall have no right to recovery or subrogation against the Bon Secours Charity Health System or Construction Manager (including its employees and other agents and agencies), it being the intention of the parties that the insurance policies so effected shall protect both parties and be primary coverage for any and all losses covered by the above described insurance.
 - b. The clause "other insurance provisions" in a policy in which the Bon Secours Charity Health System or Construction Manager is named as an insured shall not apply to the Bon Secours Charity Health System.
 - c. The insurance companies issuing the policy or policies shall have no recourse against the Bon Secours Charity Health System for payment of any premiums or for assessments under any form of policy.
 - d. Any and all deductibles in the above described insurance policies shall be assumed by and be for the account of, and at the sole risk of the CONTRACTOR.
3. Contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least thirty days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to paragraph 5.04 will so provide);

5.05 OWNER'S LIABILITY INSURANCE

- A. In addition to the insurance required to be provided by CONTRACTOR under paragraph 5.04, OWNER, at OWNER's option, may purchase and maintain at OWNER's expense OWNER's own liability insurance as will protect OWNER against claims which may arise from operations under the Contract Documents.

5.06 PROPERTY INSURANCE

- A. Unless otherwise provided in the Supplementary Conditions, OWNER shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
1. Include the interests of OWNER, Owner's Representative, CONTRACTOR, Subcontractors, ARCHITECT, ARCHITECT's Consultants, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as an additional insured;
 2. Be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, false work, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage, and such other perils or causes of loss as may be specifically required by the Supplementary Conditions;
 3. Include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of ENGINEERS and architects);
 4. Cover materials and equipment stored at the Site or at another location that was agreed to in writing by OWNER prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Owner's Representative and ARCHITECT;
 5. Allow for partial utilization of the Work by OWNER;
 6. Include testing and startup; and
 7. Be maintained in effect until final payment is made unless otherwise agreed to in writing by OWNER and CONTRACTOR with 30 days written notice to each other additional insured to which a certificate of insurance has been issued.

- B. OWNER shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of OWNER, Owner's Representative, CONTRACTOR, Subcontractors, ARCHITECT, ARCHITECT's Consultants, and any other individuals or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured.
- C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with paragraph 5.07.
- D. OWNER shall not be responsible for purchasing and maintaining any property insurance specified in this paragraph 5.06 to protect the interests of CONTRACTOR, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by CONTRACTOR, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.07 WAIVER OF RIGHTS

- A. OWNER and CONTRACTOR intend that all policies purchased in accordance with paragraph 5.06 will protect OWNER, Construction Manager, Owner's Representative, CONTRACTOR, Subcontractors, ARCHITECT, ARCHITECT's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. OWNER, Construction Manager and CONTRACTOR waive all rights against each other and their respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any

other property insurance applicable to the Work to the extent such losses and damages are satisfied out of the proceeds of such insurance; and, in addition, waive all such rights against Subcontractors, ARCHITECT, ARCHITECT's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) under such policies for losses and damages so caused to the extent such losses and damages are satisfied out of the proceeds of such insurance. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.

5.08 RECEIPT AND APPLICATION OF INSURANCE PROCEEDS

- A. Any insured loss under the policies of insurance required by paragraph 5.06 will be adjusted with OWNER and made payable to OWNER as fiduciary for the insureds, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.08.B. OWNER shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.
- B. OWNER as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to OWNER's exercise of this power. If such objection were made, OWNER as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER as fiduciary shall adjust and settle the loss with the insurers and OWNER's determination shall be final and binding on all parties.

5.09 ACCEPTANCE OF BONDS AND INSURANCE; OPTION TO REPLACE

- A. If either OWNER or CONTRACTOR has any objection to the coverage afforded by or other provisions of the Bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of nonconformance with the Contract Documents, the

objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by paragraph 2.05.C. OWNER and CONTRACTOR shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the Bonds and insurance required of such party the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent Bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 PARTIAL UTILIZATION, ACKNOWLEDGMENT OF PROPERTY INSURER

- A. If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.01 SUPERVISION AND SUPERINTENDENCE

- A. CONTRACTOR shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of OWNER or ARCHITECT in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.
- B. At all times during the progress of the Work, CONTRACTOR shall assign a competent resident superintendent thereto who shall not be replaced without written notice to OWNER, Owner's

Representative and ARCHITECT except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the Site and shall have full and complete authority to act on behalf of CONTRACTOR. All communications given to or received from the superintendent shall be binding on CONTRACTOR. Prior to commencement of any Work, the superintendent shall report to the Owner's Representative and to OWNER's Maintenance Control Center, Room E004 on the basement level of Macy Pavilion Grasslands Campus, Valhalla, New York. Thereafter, when visiting the Site or performing work, the superintendent shall first report to the Maintenance Control Center.

6.02 LABOR; WORKING HOURS

- A. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out, and construct the Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday without OWNER's written consent (which will not be unreasonably withheld) given after prior written notice to the Owner's Representative.
- C. All employees of CONTRACTOR or of its Subcontractors, who perform any work or enter onto the Site for any purpose, shall be required to obtain and wear temporary I.D. badges, which shall be issued by OWNER. CONTRACTOR, CONTRACTOR's, Subcontractors and their respective employees shall at all times be subject to and follow the directives of the Westchester Medical Center Security forces and any and all other lawful authorities having jurisdiction.
- D. It is the CONTRACTOR's responsibility to ensure that the wages to be paid and the supplements to be provided comply in all respects with the requirements of applicable law. Each laborer, worker or mechanic employed by the CONTRACTOR, Subcontractors or other persons doing or contracting to do the whole or any part of the Work described in the Contract Documents shall be paid the prevailing wages and provided the supplements (including but not limited to health, welfare and pension benefits) as required by Article 8 (Section 220-223) and Article 9 (230-239) of the New York State Labor Law. The "Schedule of Hourly Rates and Supplements" set forth in the Supplementary Conditions shows the minimum hourly rates of wages which can be paid and the minimum supplements that can be provided as of the date of the schedule. Unless

otherwise approved by OWNER, such supplements shall be paid to a federally qualified Pension, Health and Welfare program and New York State Registered Apprentice Training Program.

CONTRACTOR shall not utilize classifications not appearing on the rate sheet except with the consent of the OWNER and then the rate to be paid will be determined by the OWNER based upon the advice of the State Department of Labor.

CONTRACTOR and each and every Subcontractor furnishing or performing any part of the Work shall file with OWNER by delivery to the Owner's Representative a properly completed and signed "CONTRACTOR'S REPORT OF EMPLOYMENT AND WEEKLY AFFIDAVIT" in the form prescribed by OWNER.

- E. CONTRACTOR and each of its Subcontractors shall certify all payrolls related to the Work and shall maintain certified copies of such payrolls at the Site in a suitable location available for inspection. In addition, CONTRACTOR shall maintain for its employees and for each Subcontractor, copies of the following information and records:

1. Record of hours worked by each worker, laborer and mechanic on each day;
2. Record of days worked each week by each worker, laborer and mechanic;
3. Schedule of occupation or occupations at which each worker, laborer and mechanic on the project is employed during each work day and week;
4. Schedule of hourly wage rates paid to each worker, laborer and mechanic together with a statement attesting that they have been provided with a written notice, informing them of the prevailing wage requirement for this contract.

- F. The CONTRACTOR and each Subcontractor shall comply in all respects with all applicable requirements of the New York State Labor Law, and any applicable regulations or directives of the New York State Labor Department including the requirement to display posters in a conspicuous location at the site and distribute wallet cards to the employees. These posters and wallet cards will inform employees that they are entitled to receive the prevailing wages and supplements as determined by the Department of Labor and will list the Department of Labor's Public Work field offices, with phone numbers for individuals to call if they believe their rights are being violated.

- G. In accordance with the requirements of New York State Labor Law section 220(3)(e) the CONTRACTOR shall only employ apprentices who are registered under a bona fide New York State Registered Apprentice Training Program.

6.03 SERVICES, MATERIALS, AND EQUIPMENT

- A. Unless otherwise specified in the Contract Documents, CONTRACTOR shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.
- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of OWNER. If required by ARCHITECT, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents
- C. CONTRACTOR shall make all required arrangements for delivery and unloading of materials and equipment at the Site. It shall be CONTRACTOR's responsibility to confirm the requirements of any applicable rules, regulations or procedures regarding delivery and unloading at the Site. The dates and times of all such deliveries shall be established in consultation with the Owner's Representative and coordinated and performed in a manner which does not unreasonably interfere with other activities occurring at or adjacent to the Site.

6.04 PROGRESS SCHEDULE

- A. CONTRACTOR shall adhere to the progress schedule established in accordance with paragraph 2.07 as it may be adjusted from time to time as provided below.
 - 1. CONTRACTOR shall submit to the Owner's Representative for acceptance (to the extent indicated in paragraph 2.07) proposed adjustments in the progress schedule that will not result in changing the Contract Times (or Milestones). Such adjustments will conform

generally to the progress schedule then in effect and additionally will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of Article 12. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

6.05 SUBSTITUTES AND "OR-EQUALS"

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to ARCHITECT for review under the circumstances described below.

1. *"Or-Equal" Items:* If in ARCHITECT's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by ARCHITECT as an "or-equal" item, in which case review and approval of the proposed item may, in ARCHITECT's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

- a. In the exercise of reasonable judgment ARCHITECT determines that: (i) it is at least equal in quality, durability, appearance, strength, and design characteristics; (ii) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole, and;
- b. CONTRACTOR certifies that: (i) there is no increase in cost to the OWNER; and (ii) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items*

- a. If in ARCHITECT's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "or equal" item under paragraph 6.05.A.1, it will be considered a proposed substitute item.
- b. CONTRACTOR shall submit sufficient information as provided below to allow ARCHITECT to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefore. Requests for review of proposed substitute items of material or equipment will not be accepted by ARCHITECT from anyone other than CONTRACTOR.
- c. The procedure for review by ARCHITECT will be as set forth in paragraph 6.05.A.2.d, as supplemented in the General Requirements and as ARCHITECT may decide is appropriate under the circumstances.
- d. CONTRACTOR shall first make written application to ARCHITECT for review of a proposed substitute item of material or equipment that CONTRACTOR seeks to furnish or use. The application shall certify that the proposed substitute item will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified. The application will state the extent, if any, to which the use of the proposed substitute item will prejudice CONTRACTOR's achievement of Substantial Completion on time, whether or not use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute item and whether or not incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute item from that specified will be identified in the application, and available ARCHITECTing, sales, maintenance, repair, and replacement services will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by ARCHITECT in evaluating the proposed substitute item. ARCHITECT may require CONTRACTOR to furnish additional data about the proposed substitute item.

- B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique,

sequence, or procedure of construction approved by ARCHITECT. CONTRACTOR shall submit sufficient information to allow ARCHITECT, in ARCHITECT's sole discretion, to determine that the substitute proposed be equivalent to that expressly called for by the Contract Documents. The procedure for review by ARCHITECT will be similar to that provided in subparagraph 6.05.A.2.

- C. *ARCHITECT's Evaluation:* ARCHITECT will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to paragraphs 6.05.A and 6.05.B. ARCHITECT will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized until ARCHITECT's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Shop Drawing for an "or equal." ARCHITECT will advise CONTRACTOR in writing of any negative determination.
- D. *Special Guarantee:* OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.
- E. *ARCHITECT's Cost Reimbursement:* ARCHITECT will record time required by ARCHITECT and ARCHITECT's Consultants in evaluating substitutes proposed or submitted by CONTRACTOR pursuant to paragraphs 6.05.A.2 and 6.05.B and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not ARCHITECT approves a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of ARCHITECT and ARCHITECT's Consultants for evaluating each such proposed substitute.
- F. *CONTRACTOR's Expense:* CONTRACTOR shall provide all data in support of any proposed substitute or "or-equal" at CONTRACTOR's expense.

6.06 CONCERNING SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- A. CONTRACTOR shall submit to ARCHITECT for acceptance by the OWNER the names and qualifications for each Subcontractor proposing to perform any part of the Work. No Subcontractor shall commence performance of any part of the Work at the Site unless and until accepted by OWNER. CONTRACTOR shall not employ any Subcontractor, Supplier, or other individual or entity (including those previously approved by OWNER as indicated in paragraph 6.06.B), whether initially or as a replacement, against whom OWNER may have reasonable objection.
- B. OWNER's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of

any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. CONTRACTOR shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity. No acceptance by OWNER of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of OWNER or ARCHITECT to reject defective Work.

- C. CONTRACTOR shall be fully responsible to OWNER and Owner's Representative for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between OWNER or Owner's Representative and any such Subcontractor, Supplier or other individual or entity, nor shall it create any obligation on the part of OWNER or Owner's Representative to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity.
- D. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR.
- E. CONTRACTOR shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Owner's Representative through CONTRACTOR.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier, which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ARCHITECT. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in paragraph 5.06, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against OWNER, Owner's Representative, CONTRACTOR, ARCHITECT, ARCHITECT's Consultants, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them) for all losses and damages

caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same.

6.07 PATENT FEES AND ROYALTIES

- A. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER, Construction Manager or ARCHITECT its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the Contract Documents. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, Construction Manager, ARCHITECT, ARCHITECT's Consultants, and the officers, directors, partners, employees or agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERS, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 PERMITS; LICENSE REQUIREMENTS

- A. Permits and Licenses. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work, and OWNER shall pay all charges of such utility owners for capital costs related thereto, such as plant investment fees.

- B. Electrical License Requirements.

1. If the Project is one where separate prime contracts are required pursuant to the provisions of the New York General Municipal Law, then CONTRACTOR for the electrical portion of the Project shall either hold licenses in the local jurisdictions in which the electrical work is to be performed or shall hold a license in any city in the County of Westchester. For purposes of this requirement, the license must be held either by the owner of the business if the CONTRACTOR is a sole proprietor, by a general partner if the CONTRACTOR is a partnership or by a person owning at least ten percent (10%) of the stock or by an officer if the CONTRACTOR is a corporation.
2. Where the Project does not involve separate bids pursuant to the New York General Municipal Law but where some electrical work is contemplated along with other work, the CONTRACTOR or any person, firm, partnership or corporation engaged to perform said electrical work as Subcontractor shall hold the applicable license in the local jurisdictions in which the electrical work is to be performed or shall hold the applicable license in any city in the County of Westchester. Said license shall be held by either the owner of the firm if a sole proprietorship; by a general partner if a partnership, or by an owner of ten percent or more of the stock or by an officer, if a corporation.

C. Plumbing License Requirements

1. In accordance with the requirements of Chapter 277, Article XV of the Laws of Westchester County, no person shall perform plumbing work under any contract to be performed within the County of Westchester except (i) a licensed Master Plumber; (ii) a certified Journey Level Plumber employed by and under the direction of a licensed Master Plumber; or (iii) an Apprentice Plumber working under the direct supervision and control of a Master Plumber or under the direct supervision and control of a certified Journey level Plumber in the employ of a licensed Master Plumber. In no event shall the OWNER incur any liability to pay for any plumbing work performed in violation of the license requirements of Chapter 277, Article XV of the Laws of Westchester County.
2. If the project is one where separate prime contracts are required pursuant to the provisions of the New York General Municipal Law, then the CONTRACTOR for the plumbing contract portion of the Project must possess a valid Master Plumber's license issued by the Westchester County Board of Plumbing Examiners pursuant to Chapter 277, Article XV of the Laws of Westchester County. Such license must be maintained at all times during the performance of the work contemplated under the contract. The suspension, revocation or the failure to maintain or renew such license shall, in addition to any other right or remedy available to the OWNER is ground for immediate suspension or termination of the contract, effective immediately upon notice.

3. Where the project does not involve separate bids pursuant to the new York General Municipal Law but where some plumbing work is contemplated along with other work, then either the CONTRACTOR or the person, firm, partnership or corporation engaged to perform said plumbing work must possess a valid Master Plumber's license issued by the Westchester County Board of Plumbing Examiners.
4. A restricted Master Plumber's license issued by the Westchester County Board of Plumbing Examiners shall satisfy the requirements of this section provided such restricted license authorizes the Master Plumber to engage in the business of plumbing within the local municipality in which the Work under the contract is to be performed.

6.09 LAWS AND REGULATIONS

- A. CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor ARCHITECT shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations.
- B. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, CONTRACTOR shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of ARCHITECTs, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR's obligations under paragraph 3.03.
- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work may be the subject of an adjustment in Contract Price or Contract Times. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in paragraph 10.05.

6.10 TAXES

- A. CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required to be paid by CONTRACTOR in accordance with any Laws and Regulations which are applicable to CONTRACTOR during the performance of the Work. Pursuant to Section 1115 of the New York State Tax Law, for capital improvement contracts entered into on or after September 1, 1974, all tangible personal property which will become an integral component of a structure, building or real property of New York State, or any of its political subdivisions or a public benefit corporation, including the Bon Secours Charity Health System, is exempt from New York State and local retail sales tax and compensating use tax.

Contractor shall exclude dollar amounts for the payment of New York State and Local retail sales tax and compensating use tax, for tangible personal property defined above. CONTRACTOR shall be responsible to file the required Contractor Exempt Purchase Certificates.

6.11 USE OF SITE AND OTHER AREAS

A. *Limitation on Use of Site and Other Areas*

1. CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.
2. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
3. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless OWNER, Construction Manager, ARCHITECT, ARCHITECT's Consultant, and the officers, directors, partners, employees, agents, and other consultants of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERS, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against OWNER, Construction Manager, ARCHITECT, or any other party indemnified hereunder to the extent caused by or based upon CONTRACTOR's performance of the Work.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work CONTRACTOR shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work CONTRACTOR shall clean the Site and make it ready for utilization by OWNER. At the completion of the Work CONTRACTOR shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading Structures:* CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 RECORD DOCUMENT

- A. CONTRACTOR shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to ARCHITECT for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to ARCHITECT for OWNER.

6.13 SAFETY AND PROTECTION

- A. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
 - 1. All persons on the Site or who may be affected by the Work;
 - 2. All the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. Other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. CONTRACTOR shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury, or loss to any property referred to in paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER or ARCHITECT or ARCHITECT's Consultant, or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them). CONTRACTOR's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Architect has issued a notice to OWNER, Construction Manager and CONTRACTOR in accordance with paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- C. In accordance with the New York State Labor Law, Section 22a, in the event a silica or other harmful dust hazard is created due to construction operations under the contract, the CONTRACTOR shall install, maintain and keep in effective operation all appliances and methods necessary for the elimination of such silica dust or other harmful dust as have been recommended and approved by State and local authorities. CONTRACTOR shall provide temporary dust barriers to seal off construction area from adjacent used areas of the Site and shall exercise every possible care to avoid damage to existing equipment and adjoining work during demolition, removal and restoration operations.
- D. The CONTRACTOR shall comply fully with all the applicable provisions of the following listed governmental regulations and standards, noting that in case of conflict, the CONTRACTOR shall comply with the most stringent rule or regulations:

1. State of New York, Department of Labor, Bureau of Standards and Appeals, Industrial Code Rule 23 "Protection of Persons Employed in Construction and Demolition Work."
2. United States Department of Labor, Bureau of Labor Standards, "Safety and Health Regulations for Construction," as promulgated in accordance with the Occupational Safety and Health Act of 1970, Public Law 91-596; 84 Stat. 1590, Laws of 91st Congress - 2nd Session.

It shall be the sole responsibility of the CONTRACTOR to ascertain which of the regulations and standards contained in the foregoing listed publications affect its construction activities, and CONTRACTOR shall be solely responsible for any penalties resulting from his failure to comply with such applicable rules and regulations.

- E. In addition to conforming to the applicable governmental regulations and standards referred to in paragraph 6.13.D, the CONTRACTOR shall conduct his work in accordance with the recommendations contained in the latest edition of the "Manual of Accident Prevention in Construction," as published by the Associated General Contractors of America, Inc. and the most recent safety codes approved by the American Standards Association. In case of the conflict with the referenced governmental regulations and standards, the most stringent regulation, standard or recommendation shall govern.
- F. The CONTRACTOR shall abide by such rules and instructions as to fire prevention and control as the authorized representative of the Corporation may prescribe. CONTRACTOR shall at all times provide the proper housekeeping to minimize potential fire hazards, and shall provide approved spark arresters on all steam engines, internal combustion engines and fuels. Free access to fire hydrants and standpipe connections shall be maintained at all times during construction operations, and portable fire extinguishers shall be provided by the CONTRACTOR and made conveniently available throughout the Site. The CONTRACTOR shall also notify its employees of the location of the nearest fire alarm box at all locations where work is in progress.

6.14 SAFETY REPRESENTATIVE

- A. CONTRACTOR shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 HAZARD COMMUNICATION PROGRAMS

- A. CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 EMERGENCIES

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, CONTRACTOR is obligated to act to prevent threatened damage, injury, or loss. CONTRACTOR shall give Architect, Owner and Owner's Representative prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Owner's Representative and Architect determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 SHOP DRAWINGS AND SAMPLES

- A. CONTRACTOR shall submit Shop Drawings to ARCHITECT for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. All submittals will be identified as ARCHITECT may require and in the number of copies specified in the Contract Documents or as otherwise reasonably requested by ARCHITECT. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show ARCHITECT the services, materials, and equipment CONTRACTOR proposes to provide and to enable ARCHITECT to review the information for the limited purposes required by paragraph 6.17.E.
- B. CONTRACTOR shall also submit Samples to ARCHITECT for review and approval in accordance with the acceptable schedule of Shop Drawings and Sample submittals. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog numbers, and the use for which intended and otherwise as ARCHITECT may require to enable ARCHITECT to review the submittal for the limited purposes required by paragraph 6.17.E. The numbers of each Sample to be submitted will be as specified in the Specifications.
- C. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submittals acceptable to ARCHITECT as required by paragraph 2.07,

any related Work performed prior to ARCHITECT's review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.

D. *Submittal Procedures*

1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:
 - a. All field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - b. All materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work;
 - c. All information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto; and
 - d. CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.
2. Each submittal shall bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review and approval of that submittal.
3. At the time of each submittal, CONTRACTOR shall give ARCHITECT specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, such notice to be in a written communication separate from the submittal; and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to ARCHITECT for review and approval of each such variation.

E. *ARCHITECT's Review*

1. ARCHITECT will timely review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals acceptable to ARCHITECT. ARCHITECT's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. ARCHITECT's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
3. ARCHITECT's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called ARCHITECT's attention to each such variation at the time of each submittal as required by paragraph 6.17.D.3 and ARCHITECT has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval; nor will any approval by ARCHITECT relieve CONTRACTOR from responsibility for complying with the requirements of paragraph 6.17.D.1.

F. *Resubmittal Procedures*

1. CONTRACTOR shall make corrections required by ARCHITECT and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ARCHITECT on previous submittals.

6.18 CONTINUING THE WORK

- A. CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by paragraph 15.04 or as OWNER and CONTRACTOR may otherwise agree in writing.

6.19 CONTRACTOR'S GENERAL WARRANTY AND GUARANTEE

- A. CONTRACTOR warrants and guarantees to OWNER, ARCHITECT, and ARCHITECT's Consultants that all Work will be in accordance with the Contract Documents and will not be defective. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:
1. Abuse, modification, or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors, Suppliers, or any other individual or entity for whom CONTRACTOR is responsible; or
 2. Normal wear and tear under normal usage.
- B. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:
1. Observations by the Owner's Representative or ARCHITECT;
 2. Recommendation by the Owner's Representative or ARCHITECT or payment by OWNER of any progress or final payment;
 3. The issuance of a certificate of Substantial Completion by the Owner's Representative and ARCHITECT or any payment related thereto by OWNER;
 4. Use or occupancy of the Work or any part thereof by OWNER;
 5. Any acceptance by OWNER or any failure to do so;
 6. Any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by ARCHITECT;
 7. Any inspection, test, or approval by others; or
 8. Any correction of defective Work by OWNER.

- C. CONTRACTOR warrants that all equipment, machinery, appliances, computer hardware, and software, or devices supplied to OWNER are designed to be used prior to, during, and after the calendar Year <<>>, and that it will operate during such time period without error directly or indirectly relating to date data. Specifically, such equipment, machinery, appliances, or devices shall be capable of accurately accepting, displaying, recognizing, and/or processing date data (including, but not limited to, calculating, comparing, and sequencing (from, into, between centuries, and leap year calculations through Year <<2035>> and beyond. It also must operate properly without any interruption due to abnormal ending and/or invalid or incorrect results when processing date data. Upon request, CONTRACTOR shall furnish to OWNER the manufacturer's certification or other appropriate documentation acceptable to OWNER to evidence compliance with the provisions of this Paragraph 6.19C. Regardless of any term or provision herein to the contrary, CONTRACTOR expressly agrees, without any limitations as to liability, to indemnify and hold the OWNER harmless from and against any and all claims, costs, expenses, and liabilities, including reasonable attorney's fees, which the OWNER may suffer by reason of any breach of the warranty contained in this paragraph.

6.20 INDEMNIFICATION

- A. To the fullest extent permitted by Laws and Regulations, CONTRACTOR shall indemnify and hold harmless Owner, Construction Manager, ARCHITECT, ARCHITECT's Consultants, and the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERS, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage:
1. Is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom; and
 2. Is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of an individual or entity indemnified hereunder or whether liability is imposed upon such indemnified party by Laws and Regulations regardless of the negligence of any such individual or entity.

- B. In any and all claims against OWNER, Construction Manager or ARCHITECT or any of their respective consultants, agents, officers, directors, partners, or employees by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of CONTRACTOR under paragraph 6.20.A shall not extend to the liability of ARCHITECT and ARCHITECT's Consultants or to the officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of them arising out of:
1. The preparation or approval of, or the failure to prepare or approve, maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 2. Giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

ARTICLE 7 - OTHER WORK

7.01 RELATED WORK AT SITE

- A. OWNER may perform other work related to the Project at the Site by OWNER's employees, or let other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:
1. Written notice thereof will be given to CONTRACTOR prior to starting any such other work; and
 2. If such other work is performed by the utility owner as of right, without the consent or direction of the OWNER, then such work shall be deemed to be beyond OWNER's

control and Contractor's sole and exclusive remedy for any delay caused by such work shall be an extension of the contract terms as described in paragraph 12.05.

3. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in paragraph 10.05.
- B. CONTRACTOR shall afford each other contractor who is a party to such a direct contract and each utility owner (and OWNER, if OWNER is performing the other work with OWNER's employees) proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of Architect and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.
- C. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to ARCHITECT in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR's Work. CONTRACTOR's failure to so report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work except for latent defects and deficiencies in such other work.

7.02 COORDINATION

- A. If OWNER intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
1. The individual or entity that will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. The specific matters to be covered by such authority and responsibility will be itemized;
and
 3. The extent of such authority and responsibilities will be provided.
- B. Unless otherwise provided in the Supplementary Conditions, OWNER shall have sole authority and responsibility for such coordination.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 COMMUNICATIONS TO CONTRACTOR

- A. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through the Owner's Representative.

8.02 REPLACEMENT OF ARCHITECT

- A. In case of termination of the employment of ARCHITECT , OWNER shall appoint an ARCHITECT whose status under the Contract Documents shall be that of the former ARCHITECT.

8.03 FURNISH DATA

- A. OWNER shall promptly furnish the data required of OWNER under the Contract Documents.

8.04 PAY PROMPTLY WHEN DUE

- A. OWNER shall make payments to CONTRACTOR promptly when they are due as provided in paragraphs 14.02.C and 14.07.C.

8.05 LANDS AND EASEMENTS; REPORTS AND TESTS

- A. OWNER's duties in respect of providing lands and easements and providing ENGINEERING surveys to establish reference points are set forth in paragraphs 4.01 and 4.05. Paragraph 4.02 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site that have been utilized by ARCHITECT in preparing the Contract Documents.

8.06 INSURANCE

- A. OWNER's responsibilities, if any, in respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 CHANGE ORDERS

- A. OWNER is obligated to execute Change Orders as indicated in paragraph 10.03.

8.08 INSPECTIONS, TESTS, AND APPROVALS

- A. OWNER's responsibility in respect to certain inspections, tests, and approvals is set forth in paragraph 13.03.B.

8.09 LIMITATIONS ON OWNER'S RESPONSIBILITIES

- A. The OWNER shall not supervise, direct, or have control or authority over, nor be responsible for, CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work. OWNER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

8.10 UNDISCLOSED HAZARDOUS ENVIRONMENTAL CONDITION

- A. OWNER's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in paragraph 4.06.

ARTICLE 9 - ARCHITECT'S STATUS DURING CONSTRUCTION

9.01 OWNER'S REPRESENTATIVE

- A. The OWNER will assign a representative during the construction period. Should the Architect be assigned to represent the OWNER, the duties and responsibilities and the limitations of authority of ARCHITECT as OWNER's representative during construction are set forth in the Contract Documents and will not be changed without written consent of OWNER and ARCHITECT.

9.02 VISITS TO SITE

- A. ARCHITECT will make visits to the Site at intervals appropriate to the various stages of construction as ARCHITECT deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work. Based on information obtained during such visits and observations, ARCHITECT, for the benefit of OWNER, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. ARCHITECT will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. ARCHITECT's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, ARCHITECT will keep OWNER and Owner's Representative informed of the progress of the Work and will use all reasonable efforts to guard OWNER against defective Work.
- B. ARCHITECT's visits and observations are subject to all the limitations on ARCHITECT's authority and responsibility set forth in paragraph 9.10, and particularly, but without limitation, during or as a result of ARCHITECT's visits or observations of CONTRACTOR's Work ARCHITECT will not supervise, direct, control, or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the performance of the Work.

9.03 PROJECT REPRESENTATIVE

- A. Owner may furnish a Resident Project Representative to assist Owner in providing more extensive observation of the Work. The responsibilities and authority and limitations thereon of any such Resident Project Representative and assistants will be as provided in paragraph 9.10 and in the Supplementary Conditions. The duties of a Resident Project Representative may, in OWNER'S sole discretion, be performed by the Construction Manager.

9.04 CLARIFICATIONS AND INTERPRETATIONS

- A. ARCHITECT will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents as ARCHITECT may determine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Documents. Such written clarifications and interpretations will be binding on OWNER and CONTRACTOR. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a written clarification or interpretation, a Claim may be made therefor as provided in paragraph 10.05.

9.05 AUTHORIZED VARIATIONS IN WORK

- A. ARCHITECT may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on OWNER and also on CONTRACTOR, who shall perform the Work involved promptly. If OWNER and CONTRACTOR are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of a Field Order, a Claim may be made therefor as provided in paragraph 10.05.

9.06 REJECTING DEFECTIVE WORK

- A. ARCHITECT or Owner's Representative will have authority to disapprove or reject Work which they believe to be defective, or that ARCHITECT believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ARCHITECT or Owner's Representative will also have authority to require special inspection or testing of the Work as provided in paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.07 SHOP DRAWINGS, CHANGE ORDERS AND PAYMENTS

- A. In connection with ARCHITECT's authority as to Shop Drawings and Samples, see paragraph 6.17.
- B. In connection with ARCHITECT's authority as to Change Orders, see Articles 10, 11, and 12.
- C. In connection with ARCHITECT's authority as to Applications for Payment, see Article 14.

9.08 DETERMINATIONS FOR UNIT PRICE WORK

- A. Owner's Representative will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. ARCHITECT will review with CONTRACTOR the Owner's Representative's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). The Owner's representative's written decision thereon will be final and binding (except as modified by ARCHITECT to reflect changed factual conditions or more accurate data) upon OWNER and CONTRACTOR, subject to the provisions of paragraph 10.05.

9.09 DECISIONS ON REQUIREMENTS OF CONTRACT DOCUMENTS AND ACCEPTABILITY OF WORK

- A. ARCHITECT will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Claims, disputes and other matters relating to the acceptability of the Work, the quantities and classifications of Unit Price Work, the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, and Claims seeking changes in the Contract Price or Contract Times will be referred initially to ARCHITECT in writing, in accordance with the provisions of paragraph 10.05, with a request for a formal decision.
- B. When functioning as interpreter and judge under this paragraph 9.09, ARCHITECT will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by ARCHITECT pursuant to this paragraph 9.09 with respect to any such Claim, dispute, or other matter (except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.07) will be a condition precedent to any exercise by OWNER or CONTRACTOR of

such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such Claim, dispute, or other matter.

9.10 LIMITATIONS ON ARCHITECT'S AUTHORITY AND RESPONSIBILITIES

- A. ARCHITECT will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- B. ARCHITECT's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.
- C. The limitations upon authority and responsibility set forth in this paragraph 9.10 shall also apply to ARCHITECT's Consultants, Resident Project Representative, and assistants.

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 AUTHORIZED CHANGES IN THE WORK

- A. Without invalidating the Agreement and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved, which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- B. If OWNER and CONTRACTOR are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in paragraph 10.05.

10.02 UNAUTHORIZED CHANGES IN THE WORK

- A. CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in paragraph 3.04, except in the case of an emergency as provided in paragraph 6.16 or in the case of uncovering Work as provided in paragraph 13.04.B.

10.03 EXECUTION OF CHANGE ORDERS

- A. OWNER and CONTRACTOR shall execute appropriate Change Orders recommended by ARCHITECT or Owner's Representative (or Written Amendments) covering:
 - 1. Changes in the Work which are: (i) ordered by OWNER pursuant to paragraph 10.01.A, (ii) required because of acceptance of defective Work under paragraph 13.08.A or OWNER's correction of defective Work under paragraph 13.09, or (iii) agreed to by the parties;
 - 2. Changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
 - 3. Changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by ARCHITECT or Owner's Representative pursuant to paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in paragraph 6.18.A.

10.04 NOTIFICATION TO SURETY

- A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility. The amount of each applicable Bond will be adjusted to reflect the effect of any such change.

10.05 CLAIMS AND DISPUTES

- A. *Notice:* Written notice stating the general nature of each Claim, dispute, or other matter shall be delivered by the claimant to Owner's Representative and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. Notice of the amount or extent of the Claim, dispute, or other matter with supporting data shall be delivered to the Owner's Representative and the other party to the Contract within 60 days after the start of such event (unless Owner's Representative allows additional time for claimant to submit additional or more accurate data in support of such Claim, dispute, or other matter). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of paragraph 12.01.B. A Claim for an adjustment in Contract Time shall be prepared in accordance with the provisions of paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to the Owner's Representative and the claimant within 30 days after receipt of the claimant's last submittal (unless Owner's Representative allows additional time).
- B. *Owner's Representative Decision:* Owner's Representative will render a formal decision in writing within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any. Owner's Representative written decision on such Claim, dispute, or other matter will be final and binding upon OWNER and CONTRACTOR unless:
1. An appeal from Owner's Representative's decision is taken within the time limits and in accordance with the dispute resolution procedures set forth in Article 16; or
 2. If no such dispute resolution procedures have been set forth in Article 16, a written notice of intention to appeal from Owner's Representative's written decision is delivered by CONTRACTOR to the Owner's Representative within 30 days after the date of such decision, and a formal proceeding is instituted by the appealing party in a forum of competent jurisdiction within 60 days after the date of such decision or within 60 days after Substantial Completion, whichever is later (unless otherwise agreed in writing by OWNER and CONTRACTOR), to exercise such rights or remedies as the appealing party may have with respect to such Claim, dispute, or other matter in accordance with applicable Laws and Regulations.

- C. If Owner's Representative does not render a formal decision in writing within the time stated in paragraph 10.05.B, a decision denying the Claim in its entirety shall be deemed to have been issued 31 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any.
- D. No Claim for an adjustment in Contract Price or Contract Times (or Milestones) will be valid if not submitted in accordance with this paragraph 10.05.

ARTICLE 11 - COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

11.01 COST OF THE WORK

- A. *Costs Included:* The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to CONTRACTOR will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in paragraph 11.01.B.
 - 1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Such employees shall include without limitation superintendents, foremen, and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by OWNER.
 - 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in

connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained

3. Payments made by CONTRACTOR to Subcontractors for Work performed by Subcontractors. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as CONTRACTOR's Cost of the Work and fee as provided in this paragraph 11.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of CONTRACTOR.
 - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of Owner's Representative, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, (exclusive of any tax-exempt tangible personal property incorporated into the Work) and for which CONTRACTOR is liable, imposed by Laws and Regulations.

- e. Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's fee.
- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expressage, and similar petty cash items in connection with the Work.
- i. When the Cost of the Work is used to determine the value of a Change Order or of a Claim, the cost of premiums for additional Bonds and insurance required because of the changes in the Work or caused by the event giving rise to the Claim.
- j. When all the Work is performed on the basis of cost-plus, the costs of premiums for all Bonds and insurance CONTRACTOR is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

- 1. Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnerships and sole proprietorships), general managers, ENGINEERS, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by CONTRACTOR, whether at the

Site or in CONTRACTOR's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in paragraph 11.01.A.1 or specifically covered by paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the CONTRACTOR's fee.

2. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the Site.
 3. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.
 4. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
 5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraphs 11.01.A and 11.01.B.
- C. *CONTRACTOR's Fee:* When all the Work is performed on the basis of cost-plus, CONTRACTOR's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, CONTRACTOR's fee shall be determined as set forth in paragraph 12.01.C.
- D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to paragraphs 11.01.A and 11.01.B, CONTRACTOR will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to ARCHITECT an itemized cost breakdown together with supporting data.

11.02 CASH ALLOWANCES

- A. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums as may be acceptable to OWNER and Owner's Representative. CONTRACTOR agrees that:

1. The allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 2. CONTRACTOR's costs for unloading and handling on the Site, labor, installation costs, overhead, profit, and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- B. Prior to final payment, an appropriate Change Order will be issued as recommended by ARCHITECT to reflect actual amounts due CONTRACTOR on account of Work covered by allowances and the Contract Price shall be correspondingly adjusted.

11.03 UNIT PRICE WORK

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by Owner's Representative subject to the provisions of paragraph 9.08.
- B. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.
- C. The quantities shown on the Proposal Sheets opposite items of the work for which unit prices have been requested are approximate estimated quantities, and during the progress of the Project, the OWNER shall have the right to omit portions of the Work, and to increase or decrease the shown approximate estimated quantities, or the scope of the whole Work. The OWNER reserves the right to add to or take from the total amount of the Work up to a limit of thirty (30%) percent of the total amount of the contract based upon the executed contract price for all the specified Work.

The CONTRACTOR waives any claim for anticipated profit or loss of profits because of any difference between the quantities of the various units of work actually done, or of the materials actually furnished, and the original shown estimated quantities. The thirty (30%) percent described in this paragraph refers to the total amount of the contract and not to any individual item. Individual items may be increased or decreased any amount or may be eliminated entirely if so ordered by the Owner's Representative excepting that the total amount of the contract shall not be increased or decreased more than thirty (30%) percent except by mutual agreement between both parties thereto.

The CONTRACTOR shall be compensated solely by payment for quantities actually furnished to the Project at the unit prices set forth in the Proposal Sheets.

ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 CHANGE OF CONTRACT PRICE

- A. The Contract Price may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Owner's Representative and the other party to the Contract in accordance with the provisions of paragraph 10.05.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:
 - 1. Where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of paragraph 11.03); or
 - 2. Where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with paragraph 12.01.C.2); or
 - 3. Where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in paragraph 11.01) plus a CONTRACTOR's fee for overhead and profit (determined as provided in paragraph 12.01.C).

C. *CONTRACTOR's Fee:* The CONTRACTOR's fee for overhead and profit shall be determined as follows:

1. A mutually acceptable fixed fee; or
2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. For costs incurred under paragraphs 11.01.A.1 and 11.01.A.2, the CONTRACTOR's fee shall be 15 percent;
 - b. For costs incurred under paragraph 11.01.A.3, the CONTRACTOR's fee shall be five percent;
 - c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of paragraph 12.01.C.2.a is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
 - d. No fee shall be payable on the basis of costs itemized under paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
 - e. The amount of credit to be allowed by CONTRACTOR to OWNER for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in CONTRACTOR's fee by an amount equal to five percent of such net decrease; and
 - f. When both additions and credits are involved in any one change, the adjustment in CONTRACTOR's fee shall be computed on the basis of the net change in accordance with paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 CHANGE OF CONTRACT TIMES

- A. The Contract Times (or Milestones) may only be changed by a Change Order or by a Written Amendment. Any Claim for an adjustment in the Contract Times (or Milestones) shall be based on written notice submitted by the party making the claim to the Owner's Representative and the other party to the Contract in accordance with the provisions of paragraph 10.05.
- B. Any adjustment of the Contract Times (or Milestones) covered by a Change Order or of any Claim for an adjustment in the Contract Times (or Milestones) will be determined in accordance with the provisions of this Article 12.

12.03 DELAYS BEYOND CONTRACTOR'S CONTROL

- A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of CONTRACTOR, the Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in paragraph 12.02.A. Delays beyond the control of CONTRACTOR shall include, but not be limited to, acts or neglect by OWNER, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

12.04 DELAYS WITHIN CONTRACTOR'S CONTROL

- A. The Contract Times (or Milestones) will not be extended due to delays within the control of CONTRACTOR. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

12.05 DELAYS BEYOND OWNER'S AND CONTRACTOR'S CONTROL

- A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay.

12.06 DELAY DAMAGES

- A. In no event shall OWNER, Owner's Representative or ARCHITECT be liable to CONTRACTOR, any Subcontractor, any Supplier, or any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:
1. Delays caused by or within the control of CONTRACTOR; or
 2. Delays beyond the control of both OWNER and CONTRACTOR including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God, or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.
- B. Nothing in this paragraph 12.06 bars a change in Contract Price pursuant to this Article 12 to compensate CONTRACTOR due to delay, interference, or disruption directly attributable to actions or inactions of OWNER or anyone for whom OWNER is responsible.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 NOTICE OF DEFECTS

- A. Prompt notice of all defective Work of which OWNER or ARCHITECT has actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 ACCESS TO WORK

- A. OWNER, Owner's Representative, ARCHITECT, ARCHITECT's Consultants, other representatives and personnel of OWNER, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspecting, and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's Site safety procedures and programs so that they may comply therewith as applicable.

13.03 TESTS AND INSPECTIONS

- A. CONTRACTOR shall give Owner's Representative timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. OWNER shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
 - 1. For inspections, tests, or approvals covered by paragraphs 13.03.C and 13.03.D below;
 - 2. That costs incurred in connection with tests or inspections conducted pursuant to paragraph 13.04.B shall be paid as provided in said paragraph 13.04.B; and
 - 3. as otherwise specifically provided in the Contract Documents.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Owner's Representative the required certificates of inspection or approval.
- D. CONTRACTOR shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for OWNER's and ARCHITECT's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to OWNER and ARCHITECT.
- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by CONTRACTOR without written concurrence of ARCHITECT or Owner's Representative, it must, if requested by ARCHITECT, be uncovered for observation.
- F. Uncovering Work as provided in paragraph 13.03.E shall be at CONTRACTOR's expense unless CONTRACTOR has given Owner's Representative or ARCHITECT timely notice of CONTRACTOR's intention to cover the same and Owner's Representative or ARCHITECT has not acted with reasonable promptness in response to such notice.

13.04 UNCOVERING WORK

- A. If any Work is covered contrary to the written request of Owner's Representative or ARCHITECT, it must, if requested by ARCHITECT or Owner's representative, be uncovered for observation and replaced at CONTRACTOR's expense.
- B. If ARCHITECT considers it necessary or advisable that covered Work be observed by ARCHITECT or inspected or tested by others, CONTRACTOR, at ARCHITECT's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as ARCHITECT may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment. If it is found that such Work is defective, CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERS, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a Claim therefor as provided in paragraph 10.05.

13.05 OWNER MAY STOP THE WORK

- A. If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER or Owner's Representative may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 CORRECTION OR REMOVAL OF DEFECTIVE WORK

- A. CONTRACTOR shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Owner's Representative or ARCHITECT, remove it from

the Project and replace it with Work that is not defective. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERS, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.07 CORRECTION PERIOD

- A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for CONTRACTOR's use by OWNER or permitted by Laws and Regulations as contemplated in paragraph 6.11.A is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's (Owner's Representative) written instructions: (i) repair such defective land or areas, or (ii) correct such defective Work or, if the defective Work has been rejected by OWNER, remove it from the Project and replace it with Work that is not defective, and (iii) satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or repaired or may have the rejected Work removed and replaced, and all Claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERS, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.
- B. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.
- C. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

- D. CONTRACTOR's obligations under this paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this paragraph 13.07 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitation or repose.

13.08 ACCEPTANCE OF DEFECTIVE WORK

- A. If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ARCHITECT's recommendation of final payment, (ARCHITECT) prefers to accept it, OWNER may do so. CONTRACTOR shall pay all Claims, costs, losses, and damages (including but not limited to all fees and charges of ENGINEERS, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to OWNER's evaluation of and determination to accept such defective Work (such costs to be approved by ARCHITECT as to reasonableness) and the diminished value of the Work to the extent not otherwise paid by CONTRACTOR pursuant to this sentence. If any such acceptance occurs prior to ARCHITECT's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and OWNER shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, OWNER may make a Claim therefor as provided in paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER.

13.09 OWNER MAY CORRECT DEFECTIVE WORK

- A. If CONTRACTOR fails within a reasonable time after written notice from Owner's Representative or ARCHITECT to correct defective Work or to remove and replace rejected Work as required by ARCHITECT or Owner's Representative in accordance with paragraph 13.06.A, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven days written notice to CONTRACTOR, correct and remedy any such deficiency.
- B. In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the Site, take possession of all or part of the Work and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are

stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees, OWNER's other contractors, and ARCHITECT and ARCHITECT's Consultants access to the Site to enable OWNER to exercise the rights and remedies under this paragraph.

- C. All Claims, costs, losses, and damages (including but not limited to all fees and charges of ARCHITECTs, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by OWNER in exercising the rights and remedies under this paragraph 13.09 will be charged against CONTRACTOR, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and OWNER shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, OWNER may make a Claim therefor as provided in paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of CONTRACTOR's defective Work.
- D. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies under this paragraph 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 SCHEDULE OF VALUES

- A. The schedule of values established as provided in paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Owner's Representative. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 PROGRESS PAYMENTS

A. *Applications for Payments*

1. At least 20 days before the date established for each progress payment (but not more often than once a month), CONTRACTOR shall submit to Owner's Representative for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that OWNER has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect OWNER's interest therein, all of which must be satisfactory to OWNER.
2. Beginning with the second Application for Payment, each Application shall include an affidavit of CONTRACTOR (with proof of payment to subcontractors and suppliers) in a form reasonably satisfactory to OWNER stating that all previous progress payments received on account of the Work have been applied on account to discharge CONTRACTOR's legitimate obligations associated with prior Applications for Payment.
3. Owner shall withhold from any payment requested in an Application for Payment:
 - a. An amount equal to five percent (5%) of any amount recommended for payment by the Owner's Representative pursuant to paragraph 14.02.B to be held as retainage in accordance with the requirements of New York General Municipal Law Section 106; and
 - b. An amount equal to two hundred percent (200%) of the amount necessary to satisfy any claims, liens or judgments against the CONTRACTOR which have not been suitably discharged.

B. *Review of Applications*

1. Owner's Representative will, within 10 calendar days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER or return the Application to CONTRACTOR indicating in writing Owner's Representative's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application.
2. Owner's Representative's recommendation of any payment requested in an Application for Payment will constitute a representation by Owner's Representative's to OWNER, based on Owner's Representative's observations on the Site of the executed Work and review of the Application for Payment and the accompanying data and schedules, that to the best of Owner's Representative's knowledge, information and belief:
 - a. The Work has progressed to the point indicated;
 - b. The quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under paragraph 9.08, and to any other qualifications stated in the recommendation); and
 - c. The conditions precedent to CONTRACTOR's being entitled to such payment appear to have been fulfilled in so far as it is Owner's Representative's responsibility to observe the Work.
3. By recommending any such payment Owner's Representative will not thereby be deemed to have represented that: (i) inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Architect in the Contract Documents; or (ii) that there may not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

4. Neither Owner's Representative nor ARCHITECT's review of CONTRACTOR's Work for the purposes of recommending payments nor Owner's Representative or ARCHITECT's recommendation of any payment, including final payment, will impose responsibility on ARCHITECT to supervise, direct, or control the Work or for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for CONTRACTOR's failure to comply with Laws and Regulations applicable to CONTRACTOR's performance of the Work. Additionally, said review or recommendation will not impose responsibility on ARCHITECT to make any examination to ascertain how or for what purposes CONTRACTOR has used the moneys paid on account of the Contract Price, or to determine that title to any of the Work, materials, or equipment has passed to OWNER free and clear of any Liens.
5. Owner's Representative or ARCHITECT may refuse to recommend the whole or any part of any payment if, in the Owner's Representative's or ARCHITECT's opinion, it would be incorrect to make the representations to OWNER referred to in paragraph 14.02.B.2. Owner's Representative or ARCHITECT may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Owner's Representative or ARCHITECT's opinion to protect OWNER from loss because:
 - a. The Work is defective, or completed Work has been damaged, requiring correction or replacement;
 - b. The Contract Price has been reduced by Written Amendment or Change Orders;
 - c. OWNER has been required to correct defective Work or complete Work in accordance with paragraph 13.09; or
 - d. ARCHITECT has actual knowledge of the occurrence of any of the events enumerated in paragraph 15.02.A.

C. *Payment Becomes Due*

1. Forty five calendar days after presentation of the Application for Payment to OWNER's Finance Department with Owner's Representative or ARCHITECT's recommendation, the amount recommended will (subject to the provisions of paragraph 14.02.D) become due, and when due will be paid by OWNER to CONTRACTOR less any applicable retainage

or withheld amounts necessary to satisfy claims, liens and judgments as decided in Paragraph 14.02A.3.

D. *Reduction in Payment*

1. OWNER may refuse to make payment of the full amount recommended by Owner's Representative because:
 - a. Claims have been made against OWNER on account of CONTRACTOR's performance or furnishing of the Work;
 - b. There are other items entitling OWNER to a set-off against the amount recommended; or
 - c. OWNER has actual knowledge of the occurrence of any of the events enumerated in paragraphs 14.02.B.5.a through 14.02.B.5.c or paragraph 15.02.A.
2. If OWNER refuses to make payment of the full amount recommended by Owner's Representative or ARCHITECT, OWNER must give CONTRACTOR immediate written notice stating the reasons for such action and promptly pay CONTRACTOR any amount remaining after deduction of the amount so withheld. OWNER shall promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, when CONTRACTOR corrects to OWNER's satisfaction the reasons for such action.
3. If it is subsequently determined that OWNER's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by paragraph 14.02.C.1.

E. *Payments to Subcontractors and Suppliers by CONTRACTOR.*

1. CONTRACTOR within seven (7) calendar days of the receipt of any payment from the OWNER, the CONTRACTOR shall pay each of his Subcontractors and suppliers the proceeds from the payment representing the value of the work performed and materials furnished by the Subcontractor and suppliers as reflected in the payment from the OWNER less an amount necessary to satisfy any claims, liens or judgment against the Subcontractor or Supplier which have not been suitably discharged. Within seven (7) calendar days of the receipt of payment from the CONTRACTOR, the Subcontractor or

supplier shall pay each of lower tier Subcontractors and suppliers in the same manner as the CONTRACTOR has paid the Subcontractor.

14.03 CONTRACTOR'S WARRANTY OF TITLE

- A. CONTRACTOR warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment free and clear of all Liens.

14.04 SUBSTANTIAL COMPLETION

- A. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify OWNER, Owner's Representative and ARCHITECT in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that Owner's Representative or ARCHITECT issue a certificate of Substantial Completion. Promptly thereafter, OWNER, CONTRACTOR, Owner's Representative and ARCHITECT shall make an inspection of the Work to determine the status of completion. If ARCHITECT does not consider the Work substantially complete, ARCHITECT will notify OWNER, Owner's Representative and CONTRACTOR in writing giving the reasons therefor. If ARCHITECT considers the Work substantially complete, ARCHITECT will prepare and deliver to OWNER a tentative certificate of Substantial Completion, which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. OWNER shall have seven days after receipt of the tentative certificate during which to make written objection to ARCHITECT as to any provisions of the certificate or attached list. If, after considering such objections, ARCHITECT concludes that the Work is not substantially complete, ARCHITECT will within 14 days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating the reasons therefor. If, after consideration of OWNER's objections, ARCHITECT considers the Work substantially complete, ARCHITECT will within said 14 days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as ARCHITECT believes justified after consideration of any objections from OWNER. At the time of delivery of the tentative certificate of Substantial Completion ARCHITECT will deliver to OWNER and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless OWNER and CONTRACTOR agree otherwise in writing and so inform ARCHITECT in writing prior to

ARCHITECT's issuing the definitive certificate of Substantial Completion, ARCHITECT's aforesaid recommendation will be binding on OWNER and CONTRACTOR until final payment.

- B. OWNER shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.05 PARTIAL UTILIZATION

- A. Use by OWNER at OWNER's option of any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which OWNER, ARCHITECT, and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following conditions.

1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to OWNER and ARCHITECT that such part of the Work is substantially complete and request ARCHITECT to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify OWNER, Owner's Representative and ARCHITECT in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request ARCHITECT to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, OWNER, Owner's Representative CONTRACTOR, and ARCHITECT shall make an inspection of that part of the Work to determine its status of completion. If ARCHITECT does not consider that part of the Work to be substantially complete, ARCHITECT will notify OWNER and CONTRACTOR in writing giving the reasons therefor. If ARCHITECT considers that part of the Work to be substantially complete, the provisions of paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
2. No occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of paragraph 5.10 regarding property insurance.

14.06 FINAL INSPECTION

- A. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, ARCHITECT will promptly make a final inspection with OWNER, Owner's Representative and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 FINAL PAYMENT

A. *Application for Payment*

1. After CONTRACTOR has, in the opinion of Owner's Representative and ARCHITECT, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance certificates of inspection, marked-up record documents (as provided in paragraph 6.12), and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments.
2. The final Application for Payment shall be accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by subparagraph 5.04.B.7; (ii) consent of the surety, if any, to final payment; and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all Lien rights arising out of or Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in paragraph 14.07.A.2 and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

B. *Review of Application and Acceptance*

1. If, on the basis of ARCHITECT's observation of the Work during construction and final inspection, and ARCHITECT's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, ARCHITECT is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled, ARCHITECT will, within ten days after receipt of the final Application for Payment, indicate in writing ARCHITECT's recommendation of payment and present the Application for Payment to OWNER for payment. At the same time ARCHITECT will also give written notice to OWNER, Owner's Representative and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.09. Otherwise, ARCHITECT will return the Application for Payment to CONTRACTOR, copy to OWNER and Owner's representative indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due*

1. Forty five days after the presentation to OWNER's Finance Department of the Application for Payment and accompanying documentation, the amount recommended by ARCHITECT and the Owner's Representative will become due and, when due, will be paid by OWNER to CONTRACTOR.

14.08 FINAL COMPLETION DELAYED

- A. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, and if ARCHITECT so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ARCHITECT, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to the Owner's Representative with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 WAIVER OF CLAIMS

A. The making and acceptance of final payment will constitute:

1. A waiver of all Claims by OWNER against CONTRACTOR, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and
2. A waiver of all Claims by CONTRACTOR against OWNER other than those previously made in writing which are still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 OWNER MAY SUSPEND WORK

A. At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than 120 consecutive days by notice in writing to CONTRACTOR and ARCHITECT which will fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR may be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if CONTRACTOR makes a Claim therefor as provided in paragraph 10.05 and provided that CONTRACTOR was not in any part responsible for the suspension.

15.02 OWNER MAY TERMINATE FOR CAUSE

A. The occurrence of any one or more of the following events will justify termination for cause:

1. CONTRACTOR's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.07 as adjusted from time to time pursuant to paragraph 6.04); or man the job each day and progress the job.

2. CONTRACTOR's disregard of Laws or Regulations of any public body having jurisdiction, including but not limited to the failure of CONTRACTOR in one or more instances to pay the prevailing wages or provide the supplements required under the applicable provisions of the New York State Labor Law.
 3. CONTRACTOR's disregard of the authority of ARCHITECT or Owner's Representative
 4. CONTRACTOR's violation in any substantial way of any provisions of the Contract Documents.
 5. CONTRACTOR fails to pay subcontractors and /or suppliers within 7 days of receipt of payment from OWNER.
- B. If one or more of the events identified in paragraph 15.02.A occur, OWNER may, after giving CONTRACTOR (and the surety, if any) seven days written notice, terminate the services of CONTRACTOR, exclude CONTRACTOR from the Site, and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the Site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of ARCHITECTs, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by OWNER arising out of or relating to completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses, and damages exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such claims, costs, losses, and damages incurred by OWNER will be reviewed by Owner's Representative as to their reasonableness and, when so approved by, Owner's Representative incorporated in a Change Order. When exercising any rights or remedies under this paragraph OWNER shall not be required to obtain the lowest price for the Work performed.
- C. Further, OWNER reserves the right to terminate this agreement in the event it is found that the certification filed by CONTRACTOR in accordance with the New York state Finance Law § 139-j was intentionally false or intentionally incomplete. Upon such finding, the OWNER may exercise its termination right by providing written notification to the CONTRACTOR in accordance with written notification terms of this agreement.

- D. Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.03 OWNER MAY TERMINATE FOR CONVENIENCE

- A. Upon seven days written notice to CONTRACTOR and ARCHITECT, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, elect to terminate the Contract. In such case, CONTRACTOR shall be paid (without duplication of any items):
1. For completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination and consistent with the percentage completed as listed on the Contractor's Schedule of Values;;
 2. For expenses sustained prior to the effective date of termination for materials or equipment as required by the Contract Documents in connection with uncompleted Work stored on the jobsite, plus fair and reasonable sums for overhead and profit on such expenses;
 3. For expenses sustained prior to the effective date of termination for materials or equipment as required by the Contract Documents in connection with uncompleted Work in fabrication or completed and stored off site waiting to be delivered to the jobsite, plus fair and reasonable sums for overhead and profit on such expenses;
 4. For reasonable expenses directly attributable to termination including field office demobilization expenses. OWNER will not pay for expenses associated with Contractor's main office overhead including bonds and insurances, attorney's, architects and other professionals and all court or arbitration or other dispute resolution costs incurred in settlement of terminated contracts with subcontractors and suppliers,
- B. CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 CONTRACTOR MAY STOP WORK OR TERMINATE

- A. If, through no act or fault of CONTRACTOR, the Work is suspended for more than 150 consecutive days by OWNER or under an order of court or other public authority, or ARCHITECT

fails to act on any Application for Payment within 30 days after it is submitted, or OWNER fails to pay CONTRACTOR any sum finally determined to be due 45 days after receipt by OWNER'S finance department, then CONTRACTOR may, upon fifteen days written notice to OWNER, Owner's Representative and ARCHITECT, and provided OWNER, Owner's Representative or ARCHITECT do not remedy such suspension or failure within that time, terminate the Contract and recover from OWNER payment on the same terms as provided in paragraph 15.03. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Owner's Representative or ARCHITECT has failed to act on an Application for Payment within 30 days after it is submitted, or OWNER has failed for 45 days after receipt of such Application for Payment by OWNER'S finance department to pay CONTRACTOR any sum finally determined to be due, CONTRACTOR may, fifteen days after written notice to OWNER, Owner's Representative and ARCHITECT, stop the Work until payment is made of all such amounts due CONTRACTOR.

ARTICLE 16 - DISPUTE RESOLUTION

16.01 METHODS AND PROCEDURES

- A. Dispute resolution methods and procedures, if any, shall be as set forth in the Supplementary Conditions. If no method and procedure has been set forth, and subject to the provisions of paragraphs 9.09 and 10.05, OWNER and CONTRACTOR may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any dispute.

ARTICLE 17 - COMPLIANCE WITH OWNER'S POLICIES

17.01 SEXUAL HARASSMENT POLICY

- A. It is the policy of the OWNER to prohibit sex discrimination, including sexual harassment of its employees in any form. The OWNER will take all steps necessary to prevent and stop the occurrence of sexual harassment in the workplace. This policy applies to all OWNERS' employees and all CONTRACTOR personnel. This policy shall apply to the conduct of employees of the CONTRACTOR, its Subcontractors, suppliers and others for whom CONTRACTOR has responsibility with respect to sexual harassment of OWNER'S employees in the workplace. This sexual harassment policy includes, but is not limited to, inappropriate forms of behavior described by the Equal Employment Opportunity Commission. CONTRACTOR shall take all necessary steps to ensure that its employees and those of its Subcontractors, suppliers and others for

whom it is responsible fully comply with the OWNER'S Sexual Harassment Policy.

- B. Sexual Harassment refers to behavior that is not welcome, that is personally offensive, that fails to respect the rights of others, that lowers morale and that, therefore, interferes with an employee's work performance and effectiveness or creates an intimidating, hostile or offensive working environment. Sexual advances that are not welcome, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitutes sexual harassment when:
1. Submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment; or
 2. Submission to or rejection of such conduct by an individual is used as the basis for employment decisions, such as promotion, transfer, or termination, affecting such individuals; or
 3. Such conduct has the purpose or effect of reasonably interfering with an individual's work performance or creating an intimidating, hostile or offensive working environment.

17.02 MINORITY PARTICIPATION POLICY

- A. It is the policy of the OWNER to encourage the meaningful and significant participation at all levels (CONTRACTOR, Subcontractor, Suppliers and others) for business enterprises owned by persons of color and women - Minority Business Enterprise (MBE) and Women Business Enterprise (WBE). The CONTRACTOR is encouraged to use its reasonable efforts to encourage, promote and increase participation of business enterprises owned and controlled by persons of color or women (MBE/WBE) in the Project and to develop a policy to efficiently and effectively monitor such participation.
- B. A business enterprise owned and controlled by women or persons of color shall be construed to mean a business enterprise including a sole proprietorship, partnership or corporation that is: (a) at least 51% owned by one or more persons of color or women; (b) an enterprise in which such ownership by persons of color or women is real, substantial and continuing; (c) an enterprise in which such ownership interest by persons of color or women has and exercises the authority to control and operate, independently, the day-to-day business decisions of the enterprise; and (d) an enterprise authorized to do business in this state which is independently owned and operated. In addition, a business enterprise owned and controlled by persons of color or women shall be deemed to include any business enterprise certified as an MBE or WBE pursuant to Article 15-a of the New York State Executive Law and implementing

regulations, 9 NYCRR Subtitle N Part 540 et seq., or as a small disadvantaged business concern pursuant to the Small Business Act, 15 U.S.C. 631 et. seq. and the relevant provisions of the Code of Federal Regulations as amended.

17.03 AFFIRMATIVE ACTION PROVISION

- A. During the performance of the Project, the CONTRACTOR will not discriminate against any disability, marital status, sexual orientation, genetic predisposition or carrier status. CONTRACTOR in accordance with the goals and procedures set forth in its duly established affirmative action plan shall take all reasonable actions necessary to ensure that applicants are employed and that employees are treated during employment without regard to their race, creed, color, religion, sex, national origin, age or disability, marital status, sexual orientation, genetic predisposition or carrier status. Such action shall include, but not be limited to, the following: employment, upgrading, promotion or transfer; recruitment or recruitment advertising; layoffs or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. CONTRACTOR agrees to include, or require the inclusion of the above provision in any subcontract made pursuant to its contract with the OWNER.

17.04 NEW YORK STATE LABOR LAW REQUIREMENTS

Pursuant to New York State Labor Law § 220-d, the CONTRACTOR expressly agrees:

- (i) That in the hiring of employees for the performance of work under this Agreement or any subcontract or Agreement hereunder, no CONTRACTOR, subcontractor, nor any person acting on behalf of such CONTRACTOR or subcontractor, shall by reason of race, creed, color, national origin, age, sex, disability or marital status, discriminate against any citizen of the State of New York who is qualified and available to perform the work to which the employment relates; and
- (ii) That no CONTRACTOR, subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this Agreement on account of race, creed, color, national origin, age, sex, disability or marital status; and
- (iii) That there may be deducted from the amount payable to the CONTRACTOR by the OWNER under this Agreement a penalty of FIFTY (\$50.00) DOLLARS for each person for each calendar

day during which such person was discriminated against or intimidated in violation of the provision hereof; and

- (iv) That this Agreement may be canceled or terminated by the OWNER, and all monies due or to become due hereunder may be forfeited, for a second or any subsequent violation of this paragraph 17.04.

ARTICLE 18 - MISCELLANEOUS

18.01 GIVING NOTICE

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

18.02 COMPUTATION OF TIMES

- A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the State of New York, such day will be omitted from the computation.

18.03 CUMULATIVE REMEDIES

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 SURVIVAL OF OBLIGATIONS

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the

Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Agreement.

18.05 CONTROLLING LAW

- A. This Contract is to be governed by the internal laws of the State of New York regardless of any conflict of law rules. Any action or proceeding related to or arising directly or indirectly out of this Agreement shall be commenced and maintained in the Supreme Court, Westchester County or the Federal District Court for the Southern District of New York.

0300 SUPPLEMENTARY CONDITIONS

THESE SUPPLEMENTARY CONDITIONS AMEND OR SUPPLEMENT THE GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT AND OTHER PROVISIONS OF THE BIDDING DOCUMENTS AS INDICATED BELOW. ALL PROVISIONS OF THE BIDDING DOCUMENTS SHALL REMAIN IN FULL FORCE AND EFFECT EXCEPT AS EXPRESSLY INDICATED OTHERWISE HEREIN AND NOT BY IMPLICATION SUPPLEMENTED OR AMENDED AS PROVIDED HEREIN.

THE CAPITALIZED TERMS USED IN THESE SUPPLEMENTARY CONDITIONS HAVE THE SAME MEANING AND DEFINITION AS SET FORTH IN THE GENERAL CONDITIONS.

1.1 GENERAL CONDITIONS 5.01 PERFORMANCE, PAYMENT AND OTHER BONDS

Subparagraph 5.01.1 is supplemented as follows:

As security for the faithful performance of the contract and the payment of all obligations arising there under the CONTRACTOR, at its sole cost and expense, shall furnish separate Performance and Payment Bonds each in the amount of 100% percent of the Total Contract Sum or, in the alternative, a single Performance Bond containing appropriate provisions protecting Labor and Material men and providing for a direct right of action with separate Penal sums for the Surety's Performance and Payment obligations, each in the amount of 100% percent of the Total Contract Sum. Such Bond or Bonds shall be in such form as the Owner's General Counsel shall approve, which approval shall not be unreasonably withheld. In no event shall any Bond submitted by CONTRACTOR be construed to limit, enlarge, alter or impair the rights and obligation of OWNER, CONTRACTOR or ARCHITECT as defined in the Contract Documents. Said bonds shall remain in full force and effect during the term of any warranty or guarantee to be furnished hereunder, and in no event for a period of less than one year following the issuance of a final certificate.

2.1 LABOR; WORKING HOURS

Subparagraph 6.02 is Supplemented as follows:

The Schedule of Hourly Wages and Supplements issued by the New York State Department of Labor and applicable to the Work described in the Contract Documents is appended to the end of these Supplementary Conditions and made a part hereof .

3.1 GENERAL CONDITIONS 5.03 CERTIFICATES OF INSURANCE

Subparagraph 5.03.1 is supplemented as follows:

The Additionally Insured are as follows: Architect, Engineer(s), (as herein noted).

Schedule B-1
INSURANCE REQUIREMENTS

1. Prior to providing the Services hereunder, the Contractor shall obtain at its own cost and expense the insurance required herein from a licensed insurance company, carrying a Best's financial rating of A or better, and shall provide evidence of such insurance to the Corporation, which evidence shall be subject to Corporation's approval. The policies or certificates thereof shall provide that Corporation shall receive thirty (30) days' written notice prior to cancellation of or material change in the policy, which notice shall name Contractor, identify this Agreement, and be sent via registered mail, return receipt requested. Failure of the Contractor to obtain and maintain any insurance required hereunder shall not relieve the Contractor from any of its obligations hereunder, including but not limited to indemnification, or from any Contractor liability hereunder. All property losses shall be made payable to, and adjusted with, the Corporation. If claims for which Contractor may be liable are filed against either Party, and if such claims exceed the coverage amounts required herein, Corporation may withhold such excess amount from payment due to Contractor until the Contractor furnishes additional security covering such claims in a form satisfactory to the Corporation.

2. The Contractor shall provide proof of the following coverage:*

(a) Workers' Compensation. Contractor shall provide to Corporation a certificate form C-105.2 or State Fund Insurance Company form U-26.3 as proof of compliance with the New York State Workers' Compensation Law, and State Workers' Compensation Board form DB-120.1 as proof of compliance with the New York State Disability Benefits Law, provided, however, that if Contractor is self-insured for Worker's Compensation and/or Disability coverage, a New York State Workers' Compensation Board certificate evidencing such fact. Location of operation shall be "All locations in Westchester County, New York."

(b) Employer's liability insurance with a minimum limit of \$1,000,000.

(c) General liability insurance with a minimum limit of liability of \$2,000,000 per occurrence/\$4,000,000 aggregate for combined bodily injury and property damage, naming the Westchester County Health Care Corporation as an additional insured. This insurance shall indicate the following coverage on the certificate of insurance:

(i) Premises - Operations.

(ii) Broad Form Contractual.

(iii) Independent Contractor and Sub-Contractor.

(iv) Products and Completed Operations.

(d) Architects and Engineers Professional liability insurance ("acts and omissions") on an occurrence basis covering the Contractor and its employees and agents, with minimum limits of \$5,000,000.

(e) Vehicle liability insurance with a minimum limit of liability per occurrence of \$1,000,000 for bodily injury and a minimum limit of \$100,000 per occurrence for property damage or a combined single limit of \$1,000,000. This insurance shall include the following coverage for bodily injury and property damage arising out of the use of owned, hired and non-owned vehicles.

3. All policies and certificates of insurance required herein shall provide that:

(a) The insurer, or Contractor if it is self-insured, shall have no right to recovery or subrogation against the Corporation (including its employees and agents), it being the intention of the Parties that the insurance policies shall protect both Parties and be primary coverage for any and all losses covered by the insurance.

(b) The insurer, or Contractor if it is self-insured, shall have no recourse against the Corporation (including its employees or agents) for payment of any premiums or for assessments under the policy.

(c) Contractor assumes responsibility, and is solely at risk for, any and all deductibles.

(d) The clause "other insurance provisions" shall not apply to the Corporation.

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3. Commencement and Substantial Completion.

- a. Commencement and Substantial Completion. The Work to be performed pursuant to this Agreement shall commence promptly upon full execution of this Agreement and shall be substantially completed by the 270th day following the date of award of this Agreement (the "Substantial Completion Date"). Execution of this Agreement shall serve as Notice to Proceed. 260TH
- b. Liquidated Damages for Failure to Achieve Substantial Completion.
- i. Contractor and Owner acknowledge and agree that the Contractor's failure to achieve substantial completion of the Work by the Substantial Completion Date will cause the Owner to incur substantial economic damages and losses of types and in amounts which are impossible to compute and ascertain with certainty as a basis for recovery by the Owner of actual damages, and that liquidated damages represent a fair, reasonable and appropriate estimate thereof. Accordingly, in lieu of actual damages for such delay, the Contractor agrees that liquidated damages may be assessed and recovered by the Owner as against Contractor and its Surety, without the Owner being required to present any evidence of the amount or character of actual damages sustained by reason thereof.
 - ii. In the event of a delay of the Substantial Completion Date that is attributable to, and within the control of, Contractor (or its subcontractor or supplier), Contractor shall pay liquidated damages to Owner at a rate of a quarter of a percent (0.25%) of the Total Cost of the Work per day for each day that Contractor fails to substantially complete the Work in accordance with the terms and provisions hereof, provided however, that such liquidated damages shall not exceed a maximum of twenty percent (20%) of the Total Cost of the Work. Such liquidated damages shall be deemed to be a genuine estimate of the foreseeable damages incurred by Owner due to Contractor's delay.



Contractor Handbook

Construction Safety Program for Contractors

Effective Date: January 1, 2017

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1. Introduction

This packet contains the *WMC Health* Contractor Safety Program for all construction/demolition/repair related personnel working within any *WMC Health* facility.

This Contractor Safety Program provides guidelines and workplace conduct expectations for anyone working on *WMC Health* properties. Contractors, their employees and all other personnel are required to be familiar with the rules and to abide by them. Violation of these rules may subject the contractor and/or his personnel to disciplinary action and/or be discharged from the premises. The contractor shall keep a copy of these rules on the job site.

In case of an emergency, a supervisor having jurisdiction over persons in danger, may modify or suspend any of these instructions as may be considered temporarily necessary to permit proper handling of this specific emergency. In this case, it shall be the responsibility of the supervisor to see that any work carried out under suspension of these instructions will be performed in a safe manner.

Contractor will develop an inspection protocol acceptable to the contracting entity that will address environmental safety issues applicable to, though not limited to, their contracted responsibilities (ie housekeeping, landscaping, snow removal, property maintenance). Contractor will submit the inspection protocol to the appropriate Facility Department Manager.

Additionally, contractor will report immediately any environmental safety issues observed on or about the facility to the contracting officer representative including but not limited to such conditions as damaged pavement, sidewalk, tiles, fall, trip and/or slip hazards, sharp hazards, improperly barricaded areas, lighting, and other such issues which pose a safety risk to employees, visitors and/or patients.

Any such issues observed during the course of the contractor’s daily and/or routine inspection/duties which pose a risk to employees, visitors and/or patients is to be addressed preliminarily by the contractor to secure the area and, if within their duties, address the issue to resolution.

If the observed issue is unable to be resolved by the handling contractor notification to the appropriate Facility Department Manager or Facility Call Center for further handling is required with appropriate documentation maintained by contractor.

Contractor will provide a summary of reported issues with any required periodic reports specified elsewhere but at least no less than quarterly.

Contractors shall comply with all applicable federal, state, local regulations, OSHA, EPA, and NYS DEC as well as the requirements of the *WMC Health* Safety Program.

Please email suggested additions, deletions and corrections to Safety@WMCHealth.org . This document is intended to provide the foundation for a collaborative partnership, so it will be updated frequently to reflect changes in codes and regulations, as well as, operational requirements.

Pre-Construction Risk Assessment Conference

1. Introduction of general and sub-contractors, Architects, Engineers, hospital staff and various key personnel related to the project to be discussed.
2. Agenda: Discuss items of importance that could affect progress including such topic as:
 - a. Issue copies of the latest edition of the *WMC Health* System Alternate Life Safety Measures (ALSM) for construction projects.
 - b. Review ALSM policies and who is responsible for maintaining them during the project being discussed.
 - c. Review Infection Risk Assessment and expectations.
HEPA Filters, Negative Pressure, Particle Monitoring
 - d. Discuss whether the work will have to be done at times other than normal working hours.
 - e. Discuss requirements of utility shutdown request form, and the time frame requirements.
 - f. Tentative construction schedule.
 - g. Schedule of Architect and Engineer visits.
 - h. Critical work sequencing.
 - i. Designation of responsible personnel. (Current list is in item A above).
 - j. Use of the premises: restrooms, cafeteria, and parking, etc.
 - k. HIPPA-Health insurance portability and accountability Act of 1996.
 - l. Construction office, work, and storage areas.
 - m. Equipment deliveries and priorities.
 - n. Priority on safety and fire prevention practices.
 - o. First Aid, transport of injured and use of emergency room.
 - p. Fire-stopping requirements.
 - q. Site Apparatus and equipment security.
 - r. Housekeeping of work area, covering waste containers while in transport, location and routes to take to the disposal area.
 - s. Delivery of maintenance testing results, balance reports, safety inspections, hot work permits, medical gas certifications and installer certifications.

Minimizing the impact of construction activities on hospital operations

Hospitals and medical offices are healing places and it is necessary to conduct construction activities in a manner that minimizes the adverse impacts on patient care. Care must be taken to reduce or eliminate noise and vibrations caused by construction equipment that can damage sensitive hospital equipment or interfere with patient care activities. Cutting, drilling and demolition activities must be planned and carried out by such methods that produce the least amount of noise, dust and vibration as possible. Also, you may be asked to schedule shutdowns of hospital utilities on days and at times that minimize the adverse impact of the construction activity. Contractors are required to notify the hospital 10 days in advance of the above activities.

There are times when you will be asked to stop, postpone or reschedule your work because of the need to give priority to patient care activities.

Use of Elevators

Hospital operations must take priority over all others in the use of hospital elevators. If an elevator is needed to transport a patient, you may be asked to vacate the elevator. When elevators are in use transporting food or hospital supplies, you will have to adjust the construction activities to give priority to those hospital functions. Exact hours for elevator use will be set during the pre-construction conference.

Patient Privacy

The Contractor must instruct their employees that proper behavior is expected in a Patient Care Environment. If your work takes you into a patient care area, the privacy of a patient's care must be strictly understood and followed.

PATIENT PRIVACY AND PATIENT CONFIDENTIALITY IS THE LAW. PATIENTS' NEEDS TAKE PRIORITY OVER CONSTRUCTION NEEDS.

Common Definitions

Fire Barrier¹ is continuous from outside wall to outside wall or from one fire barrier to another, including continuity through all concealed spaces, such as those found above a ceiling, including interstitial spaces. For example, a typical 2 hour rated wall would consist of two layers 5/8" FireBloc Type X wallboard attached vertical to each side of 2 1/2" steel studs.

Smoke Barrier² shall form an effective membrane continuous from outside wall to outside wall and from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, deck or slab above, including continuity through concealed spaces, such as those found above suspended ceilings, and interstitial structural and mechanical spaces. The supporting construction shall be protected to afford the required fire-resistance rating of the wall or floor supported in buildings of other than Type IIB, IIIB or VB construction. A 1-hour fire-resistance rating is required for smoke barriers³. A

¹ NFPA 101, 2013, 8.3.1.2

² IBC 709

³ IBC 710.3

typical 1-hour barrier consists of one layer of 5/8" FireBloc Type X wallboard attached vertical or horizontal to 3 5/8" steel studs with 1" screws.

Smoke Partitions⁴ shall comply with the following:

1. They shall extend from the floor to the underside of the floor or roof deck above, through any concealed spaces, such as those above suspended ceilings, and through interstitial structural and mechanical spaces
2. They shall be permitted to extend from the floor to the underside of a monolithic or suspended ceiling system where all of the following are met:
 - a. The ceiling system forms a continuous membrane
 - b. A smoke tight joint is provided between the top of the smoke partition and the bottom of the suspended ceiling
 - c. The space above the ceiling is not used as a plenum
3. Smoke partitions enclosing hazardous areas shall be permitted to terminate at the underside of a monolithic or suspended ceiling system where all of the following are met:
 - a. The ceiling system forms a continuous membrane
 - b. A smoke tight joint is provided between the top of the smoke partition and the bottom of the suspended ceiling
 - c. Where the space above the ceiling is used as a plenum, return grilles from the hazardous area into the plenums are not permitted

2. General Policy Statement on Safety

It is *WMC Health* policy that all efforts are to be made to provide a safe environment of care for all patients, visitors, and staff. *WMC Health* management is committed to preventing accidents and controlling losses through an active Accident Prevention Program. *WMC Health* expects and requires all associated contractors and vendors to be equally committed to this program. *WMC Health* reserves the right to prohibit any employee from entering the property for any reason.

It is therefore required that all contractors and their supporting personnel abide by all Federal, State, and Local regulations as they pertain to construction. In addition, Contractors must abide by applicable National Fire Protection Association (NFPA), New York State Department of Health (NYS DOH) and Centers for Medicare (CMS) life safety requirements. Contractors and their staff are expected to apply good sense and safe practices as dictated by locations, conditions, and circumstances to all jobs. They must exercise good judgment in the application of this policy. Hospitals are complex environments where patient safety must be considered at all times. All tasks must consider the impact to infection control procedures, and the impact to all utilities.

Radio Frequency Devices

WMC Health restricts the use of radio frequency transmitting devices in patient care areas. This includes patient bed units, ICU, OR and Emergency Room. These restricted devices include cellular phones, walkie-talkies, ham and CB radios.

⁴ NFPA 101, 2013, 8.4.2

Radio frequency devices can cause interference when operated near certain electronic medical equipment. Infusion pumps, monitors, ventilators and defibrillators are known to be especially susceptible to radio frequency interference. These devices may be used in public, non-patient care areas.

Responsibilities and Lines of Authority

The contractor assumes full responsibility for their employees and their subcontractor's employee's conduct and activity while on hospital property. The contractor is responsible for any specific job training with respect to work procedures in accordance with any State, Federal and Local laws (e.g., as may be required for confined spaces, or hazards specific to a job, not covered by regulatory activity, as in work to be performed above any ceiling).

Damages caused by the contractors' workers must be immediately brought to the attention of the Project Manager. The contractor assumes full responsibility for the repairs and/or corrective measures.

It is the responsibility of the Contractor to communicate all information contained in this Contractor's Handbook to its employees, sub-contractors, agents, etc. Construction personnel found not in compliance with the above will be removed from the project if requested by [WMC Health](#).

The contractor will appoint a person that has the ultimate responsibility for implementing the [WMC Health](#) Safety Plan. He will communicate with the on-site supervisors to insure that all safety policies are followed and the project's goals are met. The appointed person will have the appropriate experience and training to fulfill the responsibility. The designated person must also have completed the OSHA 30 hour course with the appropriate topics.

The contractor will:

- Establish rules and programs designed to promote safety.
- Make known to all employees the rules established.
- Require all Subcontractors as a matter of contract to follow all safety rules.
- Encourage all Contractors to work safely.
- Record all instances of violations and investigate all accidents.
- Discipline any employees willfully disregarding this policy.
- Provide protective equipment for employees where required.
- Inform employees of changes to safety rules.
- Appoint a Competent Person with full enforcement authority over safety matters.
- Conduct safety inspections of all jobsites and maintain records.
- Provide all supervisors with copies of appropriate rules and regulations.

The on-site supervisor for the contractor will:

- Be completely responsible for on-the-job safety and health.
- Make sure proper safety materials and protective devices are available and used and all equipment is in safe working order.
- Instruct foremen in safety requirements and make sure they pass on these instructions to their crews.

- Take advantage of offered safety training and be aware of all safety rules.
- Review all accidents, oversee correction of all unsafe practices, and file accident/loss investigation reports.
- Report all safety violations.
- Report all injuries except those requiring only minor first aid treatment immediately to the [WMC Health](#) Safety Officer (914) 774-7886
- Secure prompt medical attention for any injured employees.
- Conduct jobsite safety meetings & maintain records of same.
- Require conformance to safety standards from all Subcontractor's.
- Notify office employees with proper instruction on safety requirements.
- Accompany all outside agents, such as OSHA inspectors, insurance company representatives, safety consultants, or others engaged in an official inspection of work areas.
- Ensure that all hazardous and universal waste is properly collected and removed. If a Uniform Hazardous Waste Manifest is completed, a copy will be forwarded to the Safety Officer within 1 day of shipment.

Site Employees:

- Work safely.
- Wear Company and WMC ID at all times.
- Be OSHA 10-hour trained.
- Ask for help when unsure how to perform any task safely.
- Report any unsafe acts to supervision.
- Work in such a manner as to insure his safety as well as that of his co-workers.
- Avail himself of company and industry sponsored safety programs.
- Use and maintain all safety devices provided to him.
- Maintain and properly use all tools under his control.
- Follow all safety rules including use of hard hats.
- Provide fellow employees help with safety requirements.
- Report all injuries immediately to supervision.

Subcontractors and Suppliers:

- Abide by all safety rules of [WMC Health](#).
- Notify all other Contractor's when actions or activities undertaken by them could affect health or safety of employees of other companies.
- Check in with jobsite supervision before entering jobsite.
- Notify [WMC Health](#) Safety Officer immediately all injuries to workers.
- Report to General Contractor any unsafe conditions that come to their attention.
- Contractor will only utilize qualified subcontractors who are familiar with working in a hospital environment.
- The contractor must emphasize site requirements by starting each project with a kick-off meeting to review the hospital's specific safety concerns. In addition, weekly safety meetings should be conducted to review policies and identify other potential safety issues.

- All subcontractors are required to read and acknowledge this safety Manual.
- All workmen are required to be OSHA 10-Hour certified.
- Notify all other Contractor's when actions or activities undertaken by them could affect health or safety of employees of other companies.
- Check in with jobsite supervision before entering jobsite.
- Notify the [WMC Health](#) Safety Officer immediately of all injuries to workers.
- Report any unsafe conditions that come to their attention.

All Personnel:

- Strive to make all operations safe.
- Display hospital identification.
- Maintain mental and physical health conducive to working safely.
- Keep all work areas clean and free of debris.
- Assess results of their actions on the entire workplace. Work will not be performed in ways that cause hazards for others.
- Replace or repair safety precautions removed or altered before leaving work areas. Unsafe conditions will not be left to imperil others.
- Abide by [WMC Health](#) safety rules and regulations.
- Work in strict conformance with OSHA regulations.

Safety & Health Inspections

The hospital is involved in ongoing safety surveillance. The Project Manager, the Hospital Fire Inspector, System Director of Emergency Management, Safety & Security, Engineering Director, and Director of Infection Control & Prevention or designees will monitor the construction project. The hospital Infection Control Practitioner(s) may survey an area for proposed construction for the possibility of aspergilli, and any other construction-related infectious diseases. Results of this survey will be given to the contractor. The contractor will monitor the project area HEPA filters and change air filters as needed.

If any worker observes any material that may potentially contain asbestos, do not disturb and notify the Project Manager immediately.

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THAT ALL STAFF ARE HEALTHY TO WORK IN A PATIENT CARE ENVIRONMENT.

DOCUMENTATION AND RECORDS

The hospital is required by law to keep records and documentation of safety activities during the construction project. The general contractor and subcontractors are required to maintain current, up-to-date records and files as required by the hospital and the authority(s) having jurisdiction.

The Project Manager will complete a daily job site inspection. Completed forms are kept of file for WMC review.

3. Prohibited Conduct

It is expected that all contractor personnel will comply with all rules set forth by this policy. Violation of the following prohibited conduct rules may result in immediate dismissal from the site.

1. Disabling any fire detection or suppression device, that has not been pre-approved by the Fire Safety Inspector.
2. Disabling any security related device that has not been pre-approved by the Director of Security.
3. The possession of, or drinking of, alcohol on any *WMC Health* facility.
4. The suspected use of any substances which alter mental or physical capacity including but not limited to prescription or non-prescription drugs, narcotics, marijuana, or other "controlled substances" on the jobsite.
5. Intentional damage to any property, including graffiti.
6. Possession of firearms on the jobsite or inside of vehicles.
7. Sleeping, or assuming the position of sleep, during work hours.
8. Engaging in fighting or horseplay.
9. Failure to use designated sanitary facilities.
10. Operating switches, valves, or push buttons not related to the required work.
11. Sexual Harassment
12. Unlawful Conduct
13. Theft
14. Gambling

General Jobsite Work Conduct

1. All personnel will read these rules and complete the sign-off sheet prior to commencing any work.
2. Staff will utilize established areas for lunch breaks and coffee breaks.
3. The possession and/or consumption of alcoholic beverages and/or use of any illegal drugs or narcotics are prohibited on the job site.
4. *WMC Health* is a tobacco free facility. The use of tobacco products is prohibited on *WMC Health* property, including the use of electronic cigarettes.
5. Contractors will enter the job site from the designated entrances.
6. Contractors will confine themselves to the area in which they are working and/or their designated break areas. They are not to be roaming the facility.
7. Facility telephones are not to be used for personal use.
8. Vehicle passes, if required, will be issued by security personnel for contractor owned vehicles which are to be parked in designated parking lots.
9. In case of personal injury, property damage or any unusual circumstance, the appropriate *WMC Health* personnel shall be contacted immediately. Copies of contractor & subcontractor accident reports shall be furnished to *WMC Health* Safety Officer within 48 hours.
10. Suitable footwear shall be worn by all contractor personnel. Sneakers are not permitted.

11. Suitable clothing shall be worn by all contractor personnel. Shirts, with a minimum sleeve length of 4 (four) inches, are to be worn at all times. Full length trousers are required. Sweat pants and shorts are prohibited.
12. OSHA approved hard hats and safety glasses are to be worn as necessary by all personnel on the project.
13. Reading materials that are not project related will not be allowed on the site.
14. All contractors will conduct weekly safety meetings with mandatory attendance by all employees working on site. The meeting content and attendance is to be documented and signed by all attendees. Copies of Safety Meeting documentation must be made available to the Safety Officer upon request.
15. The contractor shall employ a Site-Specific "Safety and Orientation System" with each employee new to the project site being required to attend and acknowledge orientation to the specific jobsite, prior to commencing any work. [WMC Health](#) specific emergency codes will be included in this briefing.
16. No pets will be allowed on the [WMC Health](#) site.
17. Utilization of radios, boom boxes, iPods, etc. are prohibited.
18. Spills will be cleaned up immediately and appropriate actions taken to prevent anyone from slipping/injuring themselves

BUILDING ROOF

Precautions must be taken to maintain your workers safety while working on the roof. Debris and leftover material must be removed from the respective work area at the completion of the project. Do not load materials on a roof so as to cause a structural overload. Do not let dropped fasteners remain on a roof. Use roof walk pads if provided. If not provided, contractor shall provide temporary protection to ensure that the roof membrane is not damaged during construction activities. Appropriate training and fall protection will be implemented by the contractor.

All items will be secured at end of work-day in such a manner that a severe thunderstorm with high winds will not cause material to be moved.

CORE DRILLING

In order to protect the integrity of the hospital's structure and utility systems, contractors performing core drilling through concrete floor and ceiling slabs must employ a "drill stop box" equal to Model # DS-69A as manufactured by Drillco Devices, . Long Island City, N.Y. 11102. Phone (800) 391-0052.

4. Control of Contractor Tools, Equipment and Materials

Contractors must maintain inventory control over their own equipment and tools brought to the job site. [WMC Health](#) is not responsible for lost or stolen equipment or tools.

Contractors shall ensure that there is limited access to the construction site. Site should be accessible only to the construction crew and authorized representatives from Design & Construction, Engineering, Safety, Security and Administration.

No tools or equipment which can be accessed by hospital employees, patients or the general public will be left unattended.

All contractors must have identified their equipment and tools brought to the job site with some form of permanent identification i.e. stamped, etched or tagged (paint is not acceptable).

All contractor toolboxes, vehicles, and tool carts are subject to inspection by [WMC Health](#) security.

Gasoline powered equipment and propane heaters are prohibited within the hospital.

The Contractor will ensure that a Safety Data Sheet will be on-site and readily available for all chemicals brought on-site. If corrosives (pH of <4 or >11) are utilized, installation of an appropriate eye wash station needs to be completed. See Section 15 for complete details on the use of chemicals.

Flammable liquids should be stored off-site. If on-site storage is required, the flammable liquids will be stored within a flammable liquid cabinet located at an approved location.

Powder actuated cartridges shall not be stored within the hospital. They may be stored on the grounds in an appropriate container.

The contractor will notify the Safety Office whenever they intend to use any chemical with a NFPA rating of 3 or greater.

Doors to mechanical rooms and electrical closets will not be left open when unoccupied. Latching mechanisms and locks will not be disabled.

It should be understood that the [WMC Health](#) safety personnel have authority, after proper inspection, to prohibit the use of any tools, protective devices and other equipment, regardless of ownership, which are considered unsafe. This includes clothing of flammable material such as acetate, nylon, polyester and rayon.

All broken or ineffective tools must be removed from service immediately and reported promptly so that they may be repaired or replaced. Guards and shields on grinders and saws must be in place and be fully operational.

Workers must inspect the general area where welding, grinding, or flame cutting is to take place prior to the start of the job to ensure that there are no flammable materials present. Firefighting equipment shall be in a standby condition at the site of the welding. Welding, grinding or flame cutting operations must be shielded to protect workers in the same area from flash and sparks. An additional worker must inspect the area during work and for one half hour after work for falling sparks and fire. "Hot Work" permit must be obtained from [WMC Health](#) prior to start of hot work and posted outside the work area. "Hot Work" permit precautions and instructions must be followed. See section 11 for complete details.

When working in a secure psychiatric or correctional unit, the following additional rules apply:

Entering / leaving the unit	Look through the glass in the door to ensure no patients are near the door prior to opening the door.
	Ensure the door closes completely
Tools	Only bring the tools required to complete the job into the unit with you.
	List tools in tool bag or on cart, including extension cords,
	Do not bring extra blades for utility knife into unit
	Count tools before entering unit
	Count tools after leaving unit
	When working on repair, one person performs the repair, one person watches equipment, tools and supplies.
	Immediately advise staff if any tool or equipment is determined to be missing
	Only tamper resistant hardware may be utilized between floor and ceiling
Team	All work must be completed in teams
Trash	Advise staff member if patient is too close to work area Do not place plastic wrapping, bags, or other material in trash. Remove from unit.

5. Selection, Observation and Instruction of Workers

The contractor supervisors shall ensure that their workers are qualified physically, mentally and by training to perform safely the work assigned to them. The supervisor shall ensure that workers are trained in and familiar with the

safety related work practices, safety procedures, and other safety requirements in this manual that pertain to their respective job assignments. Workers shall also be trained in and familiar with any other safety practices, including applicable emergency procedures that are related to their work and are necessary for their safety. In compliance with OSHA Standard 1926.50 "Medical Services and First Aid" with regard to the availability of medical services and the training of employees in first aid practices shall be adhered to. All training shall be documented and be available for review by [WMC Health](#).

The worker in charge of a project shall thoroughly explain the details of the job and possible hazards to all crewmembers before work begins. The worker in charge shall conduct at least one job briefing with workers involved before they start each job. The briefing shall cover at least the following subjects: hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements. They shall also cover the specific site working rules of [WMC Health](#). A worker working alone need not conduct a job briefing. However, the employer shall ensure that the tasks to be performed are planned as if a briefing were required.

6. Notification of Unsafe Working Conditions

In any case where a worker is called upon to do work which the worker considers dangerous and not protected with sufficient safeguards, or if in doubt as to the proper performance of the work, it shall be the workers duty to bring the matter to the attention of his supervisor before proceeding with the work. In the event the worker believes he has not received adequate safety training to accomplish his assigned task, he shall likewise bring this to the attention of his supervisor.

7. Personal Protective Equipment

ANSI approved personal hearing protective equipment shall be provided by the contractor whenever noise levels and time constraints exceed standards. Coordination of loud noise events needs to be coordinated with hospital staff to ensure minimal patient care disruptions.

Suitable gloves shall be worn at all times by those handling sharp and rough materials. Appropriate gloves shall be used when handling chemicals.

All contractors will be responsible for providing their workers with ANSI approved safety glasses. The safety glasses shall be equipped and worn with side shields. Safety glasses are not intended to take the place of goggles, full-face shields or welding helmets. Approved goggles, full face shields or welding helmets shall be used when chipping, chiseling, grinding, welding or doing any other kind of work in which the eyes are exposed to flying objects or particles, splashing liquids or harmful intensities of light. Cracked or broken eyewear shall be replaced as soon as noticed.

All contractors will ensure that OSHA approved hard hats (ANSI Z89.1-1969) are to be worn at all times in the proper manner by all personnel at all construction jobsites with the exception of in a vehicle and job trailers.

All contractor employees are required to wear protective footwear on all construction and work sites. At a minimum, leather work boots that cover the ankle are required. Sneakers are specifically excluded.

Footwear with spark producing surfaces, or with metal cleats, nails or inserts attached to the sole or heel are not to be worn in or around flammable areas.

Appropriate protective footwear shall be worn when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards. Smooth or slippery-soled footwear is not to be worn.

Shirts, with a minimum sleeve length of 4 (four) inches shall be worn at all times. Muscle shirts, tank-tops, crop-tops are not permitted.

At all times where hazards may exist, such as working on or within reaching distance of energized equipment or lines, workers shall wear shirts or garments which extend below the elbow so that no skin is exposed at any time. Clothing such as acetate, nylon and polyester materials shall not be worn. Workers that perform work within reaching distance of energized parts shall not wear conductive articles such as key or watch.

Chains, rings, wristbands and necklaces shall not be worn unless such articles do not increase the hazards associated with energized parts.

8. Fall Protection

Only approved fiberglass ladders will be used. Defective ladders shall be so tagged and removed from service.

Ladders must be equipped with approved safety feet. Ladders used on cement, tile or iron floors or other smooth or slippery surfaces shall be held by another worker or firmly lashed (this does not necessarily apply to stepladders). Where practicable, the top of the ladder shall be lashed to prevent sideslip. All ladders are to be properly used in the manner for which they are intended. Care shall be taken that stepladders are fully opened out with braces in place before stepping on them. Workers shall not work from the top or top step of a stepladder. A stepladder is not to be used in a leaning position. Tools and other materials shall not be left on the steps of ladders.

Three points of contact shall be maintained at all times while ascending or descending a ladder. Workers shall not carry anything on a ladder that will interfere with sufficient use of the hands for holding on to the ladder and they shall grasp the sides rather than the rungs of the ladder. Workers shall not slide down ladders and shall always face the ladder when ascending or descending.

The foot of a ladder should not be placed less than one-quarter of its length and not more than one-third of its length from the wall or vertical surface against which the top is leaned unless lashed or otherwise secured. When on ladders, workers shall avoid leaning or reaching too far to the side.

The Contractor shall ensure that ladders comply with and are maintained and used in accordance with OSHA 1910.25, 1910.26 and 1926.105.3. The Contractor shall ensure that scaffolds comply with and are maintained and used in accordance with OSHA 1910.28, 1910.29 and 1926.45.1. The Contractor shall provide a "competent person" as defined in OSHA's Scaffold Safety Standard 1926.451(a)(3) to be on site.

The Contractor will ensure that all workers meet the minimum OSHA fall protection construction industry safety standards (29 *Code of Federal Regulations*, Subpart M, *Fall Protection*, 1926.500, 1926.501, 1926.502, and 1926.503) designed to prevent employees from falling off, onto, or through working levels and to protect employees from being struck by falling objects.

9. Electrical Safety

All temporary wiring will be in accordance with the National Electrical Code (NEC) and the National Fire Protection Association (NFPA). GFCI protection is required on all extension cords. Extension cords will be inspected for damage before each use and removed from service as necessary. Extension cords will be carefully routed to minimize trip hazards. Cords will be monitored for damage during use. All new or remodeled electrical circuits must be properly identified with a P-Touch or similar label. Spare breakers will also be labeled and left in the "off" position. Strict adherence to the Barrier Maintenance Policy must be followed.

10. Plumbing & Air Conditioning

Abandoned pipes should be removed and capped at the main feed to reduce the risk of water borne illness, i.e. Legionella. New pipes should be labeled with the name of service being served and the direction of flow.

Controlled pipe repair with depressurization after shutdown. In this situation, after the repair site has been exposed and secured from trench soil/water contamination, the water main is depressurized by a shutdown to complete the repair. The repair site should be cleaned and disinfected by spraying or swabbing with a minimum 1 percent chlorine solution. The water main is then returned to service with flushing to scour the pipe and obtain three volumes of water turnover, making sure that the flushed water is visually clear. It is advisable to check for a typical system chlorine residual, and if not found, to continue flushing until residuals are restored to levels maintained in the distribution system by the water utility-if the system operates with a disinfectant residual.

When the existing pipe has to be opened and the interior surfaces of the water system exposed to the environment, additional procedures need to be followed. The existing pipe should be inspected and cleaned with the help of flushing water into the trench, where possible, until the flush water runs visually clear. The repair site should be accessible and the trench adequately dewatered so that the repair site can be cleaned and disinfected by spraying or swabbing with a minimum 1 percent chlorine solution. Additionally, any accessible upstream and

downstream interior of the existing pipe should be disinfected by swabbing or spraying with a minimum 1 percent chlorine solution. If the repair requires a full pipe section replacement, the new pipe should be inspected, cleaned, and disinfected from both ends by swabbing with a minimum 1 percent chlorine solution. The water main may then be returned to service after flushing to scour the pipe and obtain three volumes of water turnover. The flushed water should run visually clear, have a measurable chlorine residual if the system operates with a residual, and be checked with bacteriological testing. The pipeline may be returned to service prior to obtaining bacteriological results.

When installing new air conditioning ductwork, old ducting should be removed. When eliminating thermostats, lines should be removed and permanently capped at the main airline and air conditioning unit.

The use of matches or open flame lights for illumination is forbidden. Only approved flashlights or extension lights shall be used.

All portable powered hand tools shall be equipped with a three-wire cord having the ground wire permanently connected to the tool frame and means for grounding the other end; or be of the double insulated type and permanently labeled as "Double Insulated".

11. Housekeeping/Fire Prevention

Hot Work Cutting, grinding, abrasive work that generates heat and sparks, welding, or the use of open flame shall be permitted only in areas that have been made "fire safe". The area may be made "fire safe" by:

Clearing a 35' radius of all combustible material

OR

Covering all combustible material (within a 35' radius) with flame retardant protective materials.


Hot Work Permits must be obtained & posted from [WMC Health](#) Fire Inspector or Facilities department prior to the performance of any hot work on site. The signed permit will be posted in a conspicuous location. See Attachment A for copy of Hot Work Permit.

The contractor's supervisor is held responsible for general housekeeping conditions in and around the work of which he is in charge. Cleanup shall occur on a daily basis. Spilled oil or other materials, which might cause falls, must be promptly cleaned up and absorptive material applied if needed. All workers shall be given thorough instructions in the use of fire extinguishers, protective equipment and also fire fighting and prevention procedures that apply to the worker's assignment.

Wall & Floor penetration Policy & Procedure

ALL FIRE and SMOKE barriers that are not being completely removed within a construction site, shall have their rating maintained.

PENETRATION POLICY

To comply with NFPA, LSC 101, 2000 edition, fire walls and smoke barriers have been constructed throughout the hospital to provide safe areas of refuge for patients, visitors, and staff in the event of a fire. Firewalls and smoke barriers are placed from the floor to the adjacent floor and from the exterior wall to exterior wall. Penetrations to fire and smoke barriers, as depicted on [WMC Health](#) Life Safety drawings, shall be sealed with an appropriate UL  system at the end of each day.⁵

Penetrations to fire or smoke barrier walls or floors must be repaired and filled with a UL approved fire barrier material installed in accordance with NFPA requirements. Combinations of sealants are NOT permitted, unless specifically authorized by the manufacturers.

CABLE PENETRATIONS

All cables that pass through fire or smoke barriers must be housed in a solidly set steel pipe sleeve that extends four (4) inches beyond each side of the wall. The void area between the pipe and the wall must be filled with a UL approved fire barrier material installed in accordance NFPA requirements. In addition, WMC HEALTH requires the approved product to be of an odor free nature. The void inside of the pipe must also be filled with the same material installed in accordance with manufacturers' instructions.

CONDUIT AND PIPE PENETRATIONS: (i.e., drain lines vacuum, piping, pneumatic tubes).

All voids created by all pipe penetrations must be filled with a UL approved fire barrier material installed in accordance with NFPA requirements.

OTHER PENETRATIONS: (i.e., ducts, access doors)

All other openings made through walls and floors must be approved by [WMC Health](#). Breaches in barriers for ducts will be sealed with angle iron.

Penetrations made by Contractor and/or Subcontractor and not repaired according to the aforementioned specifications will be charged back to the Contractor and/or Subcontractor performing the work on a time and materials basis according to market conditions at the time of discovery.

PENETRATION PROCEDURE

⁵ [UL 1479/ASTM E 814 and/or UL 2079/ASTM E 1966.](#)

Contractor will review the Statement of Conditions fire drawings for inclusion of wall patching in the contract prior to beginning work, which can be obtained from the [WMC Health](#) Facilities Department.

Contractor will report all existing wall or floor penetrations found to Facilities department before work commences. A photographic record of the existing penetrations shall be submitted to the Project Manager prior to work.

The Contractor will notify Project Manager when the project is complete and request an inspection.

The Contractor's final application for payment shall not be processed until all wall and floor penetrations have been filled in accordance with the aforementioned listed above and approved by [WMC Health](#) Facilities department.

Questions regarding wall and floor penetrations should be directed to Facilities

Compressed Gas

All workers involved in handling and/or using industrial bottled gas shall be instructed in its proper handling, moving, storage, installation and use. All gas cylinders shall be secured while in storage, in transport and while in use. Storage shall be in compliance with all OSHA and [WMC Health](#) compressed gas handling policies. The valve protective cap shall always be in place except while using gas. Gas cylinders shall be stored secured and used in a vertical position.

All gas cylinders shall be removed from the project area at the end of each workday and stored outside in an appropriate container.

Alternate Life Safety Measures

It is the policy of [WMC Health](#) to assure the safety of all building occupants from fire risks and to require contractors to implement Alternate Life Safety Measures during construction. The area under construction must be assessed for possible compromise to the Building Life Safety System. Alternate Life Safety Measures will be developed with the Contractor and Hospital for all such items and a plan will be maintained by the Contractor including specific issues, plans during impairment, responsible individuals and schedule/times. A Hospital ALSM Audit form will be used for documentation purposes and identifying which measures will be implemented and shall be maintained daily. A new ALSM Audit Form must be performed for every phase of the job.

DISABLEMENT, DISCONNECTION AND IMPAIRMENT OF HOSPITAL FIRE SAFETY EQUIPMENT

Any impairment of the fire alarm, detection or sprinkler systems must be approved and coordinated prior to the onset of work with the [WMC Health](#) project manager. Fire Alarm "off line" requests must be made by the contractors superintendent 48 hours prior to the start of work. The contractor is responsible for informing the project manager immediately when no longer needed. Generally, these "off line" requests will expire at the end of each shift and Engineering staff will, without an additional request 1 hour prior to the shift end expiration, automatically return the system to normal operation.

Fire Sprinkler Shutdown procedure:

The Project Manager will complete Fire Protection Impairment Request Form at least 24 hours in advance of any planned Fire Sprinkler System shut down.

The following precautions will be taken before, during and after the impairment of the Fire Sprinkler System:

Before the impairment

The Project Manager or designee, i.e., Facilities Department, verifies there will be one planned impairment at a time.

The Project Manager or designee will notify Department Managers, Director of Engineering, Fire Inspector, where the fire protection will be impaired and documented.

The Contractor will assure that emergency access to the facility will not be impaired and the area is maintained.

The Project Manager or designee will verify that all other fire protection equipment is in normal operation.

The Contractor or designee will have all materials, tools and manpower ready when protection is shut off so that the job can be completed as swiftly as possible.

All unrelated "Hot Work" will be suspended for the duration of the sprinkler impairment.

During the impairment (In the area of impairment)

The Contractor(s) or designee will minimize all hazardous operations.

The Contractor(s) will minimize the use or processing of flammable or combustible liquids.

The Contractor(s) will prohibit cutting, welding or other hot work.

The Contractor(s) will strictly enforce "No Smoking" policy.

The Contractor(s) or designee will maintain continuous fire watch patrols per Fire Code and Fire Watch Protocol

The Contractor(s) or designee will keep all fire doors closed within the affected area whenever possible.

The Contractor(s) will insure that an adequate supply of portable extinguishing equipment is available.

The Contractor(s) or designee will attach a shut off tag to each shut valve or impaired equipment as required by NYS Fire Code

The Contractor(s) or designee will insure that the work continues until protection is restored.

After the impairment

The Contractor(s) will verify that full protection has been restored.

The Project Manager or designee will notify restoration of the system to the Fire Inspector of the affected areas.

Fire Alarm Zone Shut Down:

Before fire-warning systems are taken out of service, appropriate measures will be implemented or instituted to compensate.

Temporary systems must be inspected and tested monthly. If needed, provide additional firefighting equipment and train staff personnel in their use.

The Project Manager will complete the Fire Protection Impairment Request Form at least 24 hours in advance of any planned Fire Alarm shut down.

The following precautions will be taken before, during and after the impairment of the Fire Alarm System:

Smoke heads will be covered before daily construction activities begin, and the covers will be removed at the end of the day. It's the responsibility of the Contractor to insure that the smoke heads are uncovered before the end of the shift. Facilities will ensure that the zone is active and operational.

The failure of a contractor to follow these guidelines which result in a false alarms resulting in fines⁶ will be the responsibility of the contractor and will be deducted from scheduled payments.

Description of Required Alternate Life Safety Measures by Contractors

The Contractor shall institute ALSM as directed by the Fire Inspector and/or Safety Officer to temporarily compensate for any physical, fire, and health hazards to building and grounds during construction. ILSMs should be implemented for all projects impacting any components of the Hospital's life safety systems.

It shall be the responsibility of the Contractor to adhere to the requirements of all associated Alternate Life Safety Measures (ALSM). ALSMs shall include but not be limited to:

- a. All exits shall be unobstructed. All staff in the areas affected by construction shall be notified and receive training if an alternative exit must be designated. Buildings or areas in buildings under construction shall maintain escape facilities for construction workers at all times. All means of egress in a construction area shall be inspected daily by the project manager.
- b. There shall be a free and unobstructed access to the Hospital's entrances for all emergency services.

- c. All major construction areas will be maintained at negative pressure relative to adjacent areas. It is required to maintain a minimum pressure differential of $-0.02''$ H₂O gauge through the use of HEPA filters exhausted directly outside the building. If outside access is not available, the HEPA filter exhaust may be ducted into the return side of the ventilation system. Approval from the Engineering Director is required **BEFORE** utilizing a return vent for exhaust.
- d. The size and quantity of HEPA air filters must provide for 12 air exchanges/hour for the area served.
- e. All construction areas shall be maintained in a clean and fire safe manner.
- f. If normal access routes are affected, there should be an alternate route provided for public access.
- g. All walkways shall be maintained in a safe and passable manner.
- h. If the fire alarm system needs to be taken out of service and a fire watch is required, the contractor must provide competent fire watch personnel until the system is restored to previous capability.
- i. All construction areas shall be properly separated from all other building operations. Temporary smoke tight, 1 hour barriers shall be constructed (steel studs and a minimum layer of 5/8" Fire Rated sheetrock and metal doors with self-closing and positively latching hardware). The barriers will be "slab to slab." Fire separations shall be inspected for penetrations daily during construction. All barriers shall have clean, smooth surfaces and will extend from floor to underside of slab. These barriers will be sealed and intact to prevent the airborne spread of dust and mold spores to adjacent areas as well as prevent the spread of smoke and fire.
- j. The contractor shall provide additional firefighting extinguishers, in sufficient number and type to adequately equip the project area (1 fire extinguisher for every 1,500 sq ft).



Figure 1 - Example of Fire Extinguisher located in construction site

- k. Storage, housekeeping, and debris removal policies shall be enforced during construction to reduce the combustible and fire load to the lowest levels necessary for daily operations.
- l. Hazard surveillance inspections of all construction sites shall be done with special attention paid to storage areas.
- m. An onsite inspection of the construction site shall be performed during normal working hours. The project manager shall document this daily inspection using the enclosed checklist.

- n. Additional fire drills shall be properly organized and performed. Construction workers shall be trained in the hospital's fire response measures.

Trench Safety Measures

Trenches 5 feet (1.5 meters) deep or greater require a protective system unless the excavation is made entirely in stable rock. If less than 5 feet

deep, a competent person may determine that a protective system is not required. Trenches 20 feet (6.1 meters) deep or greater require that the protective system be designed by a registered professional engineer or be based on tabulated data prepared and/or approved by a registered professional engineer in accordance with OSHA 1926.652(b) and (c).

OSHA standards require safe access and egress to all excavations, including ladders, steps, ramps, or other safe means of exit for employees working in trench excavations 4 feet (1.22 meters) or deeper.

These devices must be located within 25 feet of all workers.

General Trenching and Excavation Rules

- Keep heavy equipment away from trench edges.
- Identify other sources that might affect trench stability.
- Keep excavated soil (spoils) and other materials at least 2 feet (0.6 meters) from trench edges.
- Know where underground utilities are located before digging.
- Test for atmospheric hazards such as low oxygen, hazardous fumes and toxic gases when > 4 feet deep.
- Inspect trenches at the start of each shift.
- Inspect trenches following a rainstorm or other water intrusion.
- Do not work under suspended or raised loads and materials.
- Inspect trenches after any occurrence that could have changed conditions in the trench.
- Ensure that personnel wear high visibility or other suitable clothing when exposed to vehicular traffic.

12. Protecting the Public

During construction work, every precaution must be taken to protect people and property. *WMC Health* contains a large children's hospital, and often has young patients and visitors walking through the facility. Measures to protect the job site and the public will include the use of barricades and signage that consider the age, health, and language of our patients. In case of any obstruction in the street or walkways, DANGER SIGNALS, in the form of warning signs or reflective tape by day and warning lights or reflective tape by night, must be displayed. When trucks are parked along streets and highways, the flashing lights on the vehicle must be used. Keep pedestrians and vehicles away from the jobsite or work area.

13. Control of Hazardous Energy: Lock-Out/Tag-Out

Control of hazardous energy (29 CFR 1910.147 Lock-out/tag-out) procedures apply when there is a possibility of injury due to the unexpected energization, start up or release of stored energy while constructing, installing, setting up, adjusting, inspecting, modifying, maintaining or servicing fixed machinery. Lock-

out/tag-out is not required for work on cord and plug connected electric equipment for which exposure to hazards can be controlled by unplugging equipment, nor to hot tap operations.

Failure to follow lock-out/tag-out procedures may result in being crushed, dismembered, mangled, paralyzed, electrocuted, sliced, or punctured by the sudden release of energy from the following types of sources: capacitor; chemical, counter weight, electrical, engine, flywheel, hydraulic, pneumatic, spring, thermal, or gravity.

WMC Health requires lock-out/tag-out procedures on all valves and breakers that control energy. *WMC Health* requires at least 10 days notice prior to shutdown to coordinate a stakeholders meeting to understand the impact of the request. Utility shutdowns must be noted on the project schedule so proper planning can be made and the impact to patient operations minimized.

Authorized employees will lock-out/tag-out the energy isolating devices with assigned individual locks. Locks or other lock-out/tag-out devices will be used for no other purpose, will be color coded, and will indicate the identity of the authorized employee applying the device. A lock can be used without a tag if only one circuit or piece of equipment is being de-energized, the lockout period does not extend beyond the work shift, and employees are aware that a tag is not being used with the lock.

A tag may be used alone if it provides full employee protection and is used with another safety measure. Other safety measures include the removal of an isolating circuit element, the blocking of a controlling switch, or the opening of an extra disconnecting device. Tags must warn against the hazardous conditions if the machine or equipment is energized and shall include a legend like the following: Do Not Start; Do Not Open; Do Not Close; Do Not Operate; etc.

All stored energy must be isolated. Should there be a possibility of re-accumulation of stored energy, verification of isolation must be continued until servicing is complete. The authorized employee shall operate the normal operating controls to verify that the machine or equipment has been de-energized and that it will not operate. After the above test, the operating controls will be returned to the "Neutral" or "Off" position.

Before the lock-out/tag-out devices are removed and energy is restored: the work area will be inspected to ensure the nonessential items have been removed and the machine or equipment components are operationally intact; the work area will be checked to ensure all employees have been positioned safely or removed. A device can only be removed by the one who applied it unless that person is not available.

Another competent person may remove the device as long as the employee who applied it is informed.

If service and maintenance require more than one individual, one person will be designated as Group Leader and will maintain overall responsibility for employees working under him/her.

Lock-out/tag-out procedures extending into a second shift:

- a. If the energy isolation device will accept two lock-out/tag-out devices, the authorized employee coming on duty will put his device in place before the employee going off duty removes his device.
- b. If the energy isolation device will not accept two devices, the incoming and outgoing authorized employees will notify affected employees that a lock-out/tag-out change is taking place; both employees will insure the surrounding area is free of tools and employees; the outgoing employee will remove his device and the incoming employee will install his; finally, the incoming employee will notify affected employees the change

15. Emergency Action Plan/Crisis Management

WMC Health emergency codes will be posted at each site.

Fire evacuation plan will be posted at each site.

In the event of an emergency or crisis, contractor employees will follow the Hospital's emergency escape procedures and emergency escape route assignments.

The on-site contractor supervisor will take immediate steps to protect life and neutralize any threats to the safety of their employees, subcontractors, and the public. The on-site contractor supervisor will seek the appropriate assistance, e.g. *WMC Health* engineering staff, ambulance, fire department, or police, as necessary.

Safety and Health Inspections

Daily job site safety and health inspections will be conducted by the contractor and will document any deficiencies, notify the responsible party, and follow up to insure that corrective measures are taken.

Accident Investigation and Reporting

In the event of an accident, a collaborative team will assemble the facts including the following: What happened? When did it happen? Who was involved? Should the jobsite be closed?

They will:

- Assure that the injured are promptly cared for. The first concern at an accident scene, regardless of its seriousness, is care of the injured. Nothing should interfere with this concern, except the safety of the rescuers themselves.
- Protect other people and property. The actual investigation will begin only after the accident site is safe to approach.
- Preserve the scene as it was after the accident. Cordon off or barricade the area.
- Make a visual walkthrough of the accident site. Conditions at an accident scene will change rapidly. Take notice of the location of all items of evidence. Record this information as the walk-thru is made. Mark the location of items likely to be moved -injured people, lightweight or high value items, etc.

- Obtain the identity of all people who might have information about the accident. Record their full names, crafts, and company work for. If members of the public, obtain their names, addresses, and telephone numbers.
- Examine the evidence. The items that will provide information about what happened, how it happened, and why it happened must be identified and examined.
- Photograph all evidence. Photographs of the general area, major elements of the accident site, and articles of evidence should be taken as soon as possible after the accident.
- Make a diagram of the accident site. A sketch should be made of the accident scene, showing the location of all evidence essential to understanding the accident situation. Distances involved should be measured and recorded on the sketch. At a later time, information from the sketch can be used to prepare a scaled diagram for inclusion in the accident report.
- Interview and obtain statements from all witnesses. All persons who may be able to contribute information about the accident should be interviewed as soon as possible after the accident. Recorded and signed statements should be obtained from them.
- Prepare an accident report. A written report must be prepared for all serious accidents. The report should contain details of what happened, when it happened, and who was involved. It should develop conclusions regarding the physical cause of the accident, but should not deal with the placement of legal liability upon any party. The contractor will distribute this report to the appropriate parties including the Hospital's Contracting Officer & Safety Officer within five (5) working days following the accident.
- Implement corrective actions as soon as reasonably possible.

Emergency Overhead Pages/Announcements

Code Red	Fire Disaster or Fire Alarm
Code Amber	Missing Child or Patient
Code Silver	Person with a weapon
Code Clear	Resume normal operations
Emergency Phone Number	7911

Severe Weather

When the National Weather Service is forecasting high winds for this area, contractors are required to secure their construction sites. If construction sites are not safely secured in preparation for the inclement weather, WMC HEALTH will take immediate action and bill the contractor for services, and potentially issue Stop Work Orders if necessary. All contractors must take steps to secure their construction sites, which includes cranes, suspended and supported scaffolding, hoists and any other building appurtenances that may come loose

under heavy winds and rain. To secure construction sites, contractors should take all precautionary measures including but not limited to the following:

- Tie down and secure material and loose debris at construction sites.
- Cover electrical equipment from exposure to the weather.
- Store loose tools, oil cans and extra fuses in a tool box.
- Secure netting, scaffolding and sidewalk sheds.
- Suspend crane operations and secure crane equipment when wind speeds reach 30 mph or greater.
- Suspend hoist operations and secure exterior hoists when wind speeds reach 35 mph or greater, unless manufacturer specifications state otherwise.
- Brace and secure construction fences.

16. Hazard Communication Program and SDS Information

WMC Health is firmly committed to providing all of its employees with a safe and healthy work environment. It is a matter of policy that all contractors provide *WMC Health* with information about hazardous chemicals on the worksite through our Hazard Communication Program, which includes container labeling, Safety Data Sheets (SDS), and employee information/training.

The contractor will appoint a designated employee who will have the overall responsibility for coordinating the Hazard Communication Program for all work performed at *WMC Health*. He will make the Hazard Communication Program available, upon request, to *WMC Health* staff, local first response agencies, and other affected parties.

SDS reports will be provided to *WMC Health* Safety Officer for review and approval prior to any chemicals and/or other hazardous material being brought on site.

Labeling

All containers of hazardous chemicals must be properly labeled. The labels will list:

- The contents of the container
- Appropriate hazard warnings; and
- The name and address of the Manufacturer, importer, or other responsible party.

To further ensure that employees are aware of the chemical hazards of materials used in their work areas, it is our policy to label all secondary containers. Secondary containers will be labeled with either an extra copy of the Manufacturer's label, or with a sign or generic label that lists the container's contents and appropriate hazard warnings.

SAFETY DATA SHEETS (SDS)

Copies of SDS for all hazardous chemicals to which employees may be exposed must be kept at the project location and are readily accessible to employees in the work area during each work shift. The Contractor is responsible for obtaining, maintaining, and updating the file of SDS.

The Contractor will ensure the following employee training:

- An overview of the hazard communication requirements.
- A review of the chemicals present in their workplace operations.
- The location and availability of the Contractor's written Hazard Communication Program, a list of hazardous chemicals and SDS.
- Methods and observation techniques that may be used to detect the presence or release of hazardous chemicals in the work area.
- The physical hazards of the chemicals in the work area.
- The health hazards of the chemicals in the work area including signs and symptoms of exposure and any medical condition known to be aggravated by exposure to the chemical.
- How to lessen or prevent exposure to hazardous workplace chemicals by using good work practices, personal protective equipment, etc.
- Emergency procedures to follow if employees are exposed to hazardous chemicals.
- An explanation of the hazard communication program including how to read labels and SDS to obtain appropriate hazard information.
- Appropriate disposal of hazardous waste

When a new type of product is introduced into a work area or the chemical composition of a product changes, the Contractor will review the above items as they are related to the new chemicals.

If any chemical/waste is stored on-site, it will be appropriately labeled, separated and stored in accordance with good chemical hygiene practices.

Informing Other Employers

To ensure that the employees of other Contractor's have access to information on the hazardous chemicals at a jobsite, it is the responsibility of the Contractor to provide the other Contractor's the following information:

- Where the SDS are available.
- The name and location of the hazardous chemicals to which their employees may be exposed and any appropriate protective measures required to minimize their exposure.
- An explanation of the labeling system used at the jobsite.

Each Contractor bringing chemicals onto a jobsite must provide [WMC Health](#) with the appropriate hazard information on those substances to which our own employees may be exposed within our facility.

Note: An ANZI compliant eye wash station must be kept onsite through the duration of work with corrosives.

17. Crane Safety - General Operating Information

Prior to all crane operations, the crane operator will provide a task hazard analysis (lift plan) and conduct a pre-event safety review with WMC Health representatives

The task hazard analysis must include:

- Scope of work & site plan
- Hazards
- Actions required, including areas to be evacuated or impacted
- Site/Traffic Controls
- Permits
- Communications
- Miscellaneous rigging
- Personal Protective Equipment

Operating Procedures

Note: These are generic procedures, provided to illustrate expected actions. Each specific crane will be operated per the operating manual provided by the manufacturer and operated in a manner consistent with industry standards.

The safe design capacity of a crane, or other hoisting equipment, must not be exceeded. All cranes and hoisting equipment must be in safe working condition and be inspected by a competent person before use, and during use, to make sure it is in safe working condition. Proper guards must be in place for exposed gears, belts, electrical equipment, couplings and fans. All operators must be familiar with and be trained to operate the equipment they are assigned to operate. Documentation of the operators training must be available upon request. Equipment shall be inspected by a competent person before each use and during use, and all deficiencies corrected before further use. A documented annual inspection log must be kept with the crane at all times. Boom cable installation documents must be readily available as well. No persons shall ever be under a load while it is being lifted. To avoid tipping, outriggers must be fully extended and remain firmly on the ground. Cribbing is necessary when the ground cannot support outriggers. Boom angle indicators and load charts and a standard hand signal chart must be visibly posted in the crane. While moving a crane, the "headache" ball must be retracted to avoid swinging. Minimum clearance between power lines and any part of the crane shall be at least 10 feet. For power lines rated over 50 kV, additional clearance is required (29 CFR 1910.333: Electrical, Selection of use of work practices). Overhead cranes shall have stops at the limit of travel of the trolley. Bridge and trolley bumpers or equivalent automatic devices shall be provided. Bridge trucks shall have tail sweeps. A preventive maintenance program based on the crane manufacturer's recommendations shall be established for all overhead and gantry cranes. Cranes that exceed an overall height of 200 feet above ground level or that fall under the notification requirements shall be marked and/or lighted, in accordance with the guidelines of the FAA publication Advisory Circular AC 70/7460-1K. Crane operations will stop when wind speeds exceed 31 mph.

The operator of the aforementioned devices shall perform his/her duties as follows:

Equipment shall be operated by a qualified operator. Trainees are not permitted to operate cranes at [WMC Health](#) locations.

The operator, when operating the equipment, shall maintain full attention on the task being performed (e.g., no use of headsets, music).

The operator shall ensure that hand signals used during the lift are understood and followed by all involved.

No load in excess of the rated capacity shall be lifted, unless for test purposes and the test shall be an engineered lift.

Before leaving the crane or carrier unattended, the operator shall land any load, place the controls or master switch in the off position and open the main line device of the specific crane or carrier.

Attaching the Load

- Hoist chains or ropes shall be free of kinks or twists.
- Hoist chains or ropes shall not be wrapped around the load.
- The load shall be attached to the load block.
- Prior to lifting the load, the operator shall make certain that the load, sling, attachments, lifting devices and the load block are unobstructed.

Moving the Load

The person responsible for directing the lift shall make sure that the load is properly secured, balanced and positioned in the sling or other lifting device.

The person responsible for directing the lift shall make another visual inspection of the hoist chain or rope to make sure there are no kinks or twists.

The load block shall be brought over the load in a manner that will prevent swinging when lifting the load.

The chain or rope shall be inspected to ensure that it is properly seated in the chain sprocket or drum groove.

Lift equipment shall not be used for side pulls.

The operator shall not move the load while a person is on the load or hook.

The operator shall avoid lifting the load over people.

If the load being lifted approaches the rated load to be handled, the operator shall test the brakes by lifting the load a few inches and applying the brakes.

The load shall not be lowered below the point where there are less than two wraps of rope on the hoisting drum, unless a lower limit device is provided.

If a lower limit device is provided, no less than one wrap shall remain.

Parking the Load

The operator shall not leave a suspended load unattended.

The load block of the hoist shall be raised above head level when not in use.

Hand Signals

Hand signals shall be used unless the participants of the lift are equipped with telephones, radios or other equivalent means of communication.

18. Infection Control during Construction

It is the policy of *WMC Health* to require contractors to implement infection control protection procedures during construction as determined by a ICP representative. Hospital and clinic construction, demolition and remodeling can be a risk factor for the spread of certain hospital acquired infections in patients, especially those who are immunosuppressed. Activities that disturb dust may be associated with transmission of *Aspergillus*, a fungus found in ceiling and wall spaces where dust has accumulated. Dispersing fungal spores which can be contacted or inhaled by a susceptible patient can cause disease. *WMC Health* may require Health screening for Contractors' Employees.

PROCEDURE

- a. Planning for new construction or renovation must be reviewed by the Infection Prevention and Control Department to assure appropriate design elements for infection prevention in patient care areas, as well as barriers to contain dust during construction.
- b. Consultation will be obtained as necessary from Infection Control and Project Managers.
- c. The Project Manager is responsible for monitoring construction/renovation areas for compliance with this policy daily.
- d. The Project Manager is responsible to contact the ICP Department and obtaining a Infection Control Risk Assessment *PRIOR* to the start of any work.

A project specific risk assessment will be conducted by the *WMC Health* Infection Prevention and Control Department in concert with the contractor. The results of that assessment will dictate the required preventative measures, but generally the following special practices must be observed when working in the hospital:

Description of Required Infection Control Precautions by Contractors

During Construction Project:

- e. It is critically important that dust NEVER reaches patient care areas.
- f. Execute work by methods to minimizing raising dust from the construction operators.
- g. Immediately replace a ceiling tile displaced for visual inspection.

- h. Provide active mean to prevent airborne dust from dispersing into the atmosphere.
- i. Water mist work surfaces to control dust while cutting.
- j. Seal unused doors with duct tape.
- k. Block off and seal air vents.
- l. Place adhesive dust mat at entrance and exit of the work area. Replace frequently.
- m. Remove or isolate HVAC system in area where work is being done to prevent contamination of duct system.
- n. Complete all critical barriers i.e. sheetrock, plywood, plastic to seal area from non-work area before construction begins. Doors must be self-closing.
- o. Maintain negative air pressure within work site utilizing a sufficient quantity of HEPA equipped air filtration units exhausted directly to the outside of the building. A minimum pressure differential of -0.02 inches H₂O gauge is to be maintained within the work area for the duration of the project.
- p. A manometer must be placed outside the work area for verification of negative pressure.
- q. Contain construction waste before transport in tightly covered containers.
- r. Construction waste carts are to be HEPA vacuumed prior to exiting the work site.
- s. Cover transport receptacles or carts. Tape covering unless solid lid.

If the project involves major demolition and creation of dust, especially near a sensitive environment, also comply with the following:

- t. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can leave the work site if they wear paper overalls that are removed each time they leave the work site.
- u. Wipe off surfaces with hospital approved disinfectant.
- v. Remove isolation of HVAC system in area where work is being performed.
- w. Do not remove barriers from work area until completed project is inspected by the Safety Department and Infection Prevention and Control Department and thoroughly cleaned by the contractor.
- x. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.
- z. Vacuum work area with HEPA filtered vacuums.
- aa. Wet mop area with hospital approved disinfectant.

19. Confined Spaces & Permit Required Confined Spaces

All contractors are required to strictly follow the [WMC Health](#) policy regarding access into confined spaces and permit required confined spaces. A listing of confined spaces and the confined space policy are available from the safety office or the engineering office.

Attachment A - CONSTRUCTION SAFETY GUIDELINES

IN THE EVENT OF **FIRE** IN THE CONSTRUCTION AREA:

- REMOVE ANYONE FROM IMMEDIATE HARM.
- PULL THE NEAREST PULL STATION AND DIAL **EXT. 7911** (IDENTIFY YOUR SPECIFIC LOCATION).
- CLOSE DOORS TO THE IMMEDIATE FIRE AREA.
- USE EXTINGUISHER ONLY ON NON-STRUCTURAL FIRES.
- EVACUATE TO OUTSIDE OF CONSTRUCTION ZONE IF NECESSARY & NOTIFY HOSPITAL STAFF OF STATUS.
- THE FIRE ALARM CHIME SEQUENCE FOR YOUR AREA IS: _____

IF THE **FIRE** IS OUTSIDE OF YOUR AREA

- HALT ALL WORK ACTIVITIES.
- REMAIN IN PLACE & WAIT FOR INSTRUCTIONS.
- CLOSE ALL DOORS, HALT HOT WORK and SHUT OFF ALL FANS.
- AWAIT NOTIFICATION OF ALL CLEAR VIA OVERHEAD PAGE.

GENERAL SAFETY RULES:

- SMOKING IS STRICTLY PROHIBITED ANYWHERE IN THE BUILDING.
- ALL WORK ACTIVITIES SHALL BE CONDUCTED IN ACCORDANCE TO OSHA SAFEGUARD MEASURES.
- ALL HOT WORK ACTIVITIES & OPEN FLAME WORK SHALL REQUIRE A FIRE EXTINGUISHER WITHIN 5 FEET FROM WORK AREA / OBTAIN PERMIT FROM FIRE INSPECTOR PRIOR TO WORK.
- ALL CORRIDOR WALL AND SMOKE BARRIER PENETRATIONS SHALL BE FILLED WITH FIRE RATED MATERIALS AS SOON AS WORK IS COMPLETED IN THE AREA
- ENSURE ALL CYLINDERS ARE APPROPRIATELY SECURED.
- NOTIFY ENGINEERING DEPT. PRIOR TO ANY UTILITY SERVICE INTERRUPTIONS.
- BARRIERS SHALL BE CONSTRUCTED AT ALL FLOOR OPENINGS AT THE END OF EACH WORK DAY.
- YOUR ATTENDANCE AT THE MONTHLY CONSTRUCTION SAFETY COMMITTEE IS MANDATORY.
- IF YOU HAVE ANY SAFETY QUESTIONS RELATIVE TO THE HOSPITAL, YOU MAY CALL SAFETY OFFICER - **EXT. 8251**
- PARTICIPATION IN REQUIRED CONSTRUCTION FIRE DRILLS IS MANDATORY & YOUR PERFORMANCE WILL BE CRITIQUED.
- ALL TEMPORARY CONSTRUCTION BARRIERS WILL BE CONSTRUCTED & MAINTAINED WITH SMOKE/DUST PROOF PROPERTIES AND BE OF LIMITED COMBUSTIBILITY
- DO NOT DEFEAT ANY FIRE ALARM / SUPPRESSION SYSTEM DEVICES WITHOUT NOTIFYING FIRE INSPECTOR AT **EXT.**
- WEARING OF IDENTIFICATION BADGE IS MANDATORY EVERYWHERE ON HOSPITAL PROPERTY.
- ALL ALTERNATE LIFE SAFETY MEASURES WILL BE ADHERED TO AT ALL STAGES OF PROJECT CONSTRUCTION.
- TREAT ALL EMPLOYEES, PATIENTS AND VISITORS WITH RESPECT.
- ALL QUESTIONS/CONCERNS RELATED TO CONSTRUCTION SHOULD BE DIRECTED TO THE PROJECT MANAGER: _____ **EXT.** _____

FAILURE TO ADHERE/ FOLLOW ANY OF THE ABOVE RULES

OR

**REQUIREMENTS SHALL RESULT IN YOUR IMMEDIATE AND / OR
PERMANENT REMOVAL FROM THIS FACILITY.**

Attachment B – Contractor's Receipt

I have received a copy of the WMC Health's Contractor's Safety Manual. I will abide by all WMC Health standards and policies. I will familiarize myself and understand that compliance is a condition for working at WMC Health.

Company Name (print): _

Date: _____

Print Name: _

Signature: _

Memorandum

DATE: June 9, 2020

TO: All Contracted Services Agencies – Flat Rate Contracts

FROM: Jordy Rabinowitz
Senior Vice President – Human Resources

RE: New Process Starting in June

Effective June 22, 2020, there is a change to the process of onboarding and badging for all contracted services vendors that provide agency staffing.

WMCH Health will be utilizing a new Vendor Management System, Green Security. Green Security will verify credentials via our WMCH Health attestation form for applicable background checks, health clearance and any other clearances needed to approve contracted service onboarding. All personnel must be processed through Green Security and be approved by HR, in order to obtain a badge from HR or Security.

For existing agency staff, all rosters must be sent in to Kelly Lawlor, HR Business Partner (Kelly.Lawlor@wmchealth.org) immediately in order to be processed by Green Security. If this process is followed, you will not be charged a fee. Any staff not listed on a roster by 6/15/2020 will be considered new personnel you will be required to follow the new process and pay applicable fees.

Please contact HR to schedule an appointment to discuss the new process in detail. In order to complete the process with Green Security, you must register. Please reach out to them via the contact information below:

Primary Contact: Kim Meier kimm@greensecurityllc.com

Secondary Contact: Customer Service support@greensecurityllc.com

Phone: 866-750-3373

We look forward to working with you to make this transition smooth for all involved.

**GOOD SAMARITAN HOSPITAL
RADIOLOGY RENOVATIONS - TMP 30 CT / TMP 92 MRI
CONTRACTOR PARKING / STORAGE / TRAILER**



✱ Hospital Facilities Department will coordinate with GC to provide an area adjacent to the Power Plant for location of a construction trailer (by GC)

SECTION 011000 SUMMARY

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Access to site.
 - 4. Work restrictions.
- B. Related Sections:
 - 1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.02 PROJECT INFORMATION

- A. Project Identification: Philips Healthcare – Bon Secours Charity Health System – Good Samaritan Hospital, Imaging Renovations including TMP 30 – CT / TMP 92 – MRI.
- B. Project Location: Good Samaritan Hospital, 255 Lafayette Avenue, Suffern, New York 10901
- C. Architect: CPL
 - 1. Contact Person: H.Scott Cottingham, AIA LEED AP
 - 2. Telephone Number: (800) 274-9000 x 2234; (518)915-7454

1.03 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and consists of the following:
 - 1. All work required for phased renovation of a portion of the existing Imaging Department including installation of a new CT & MRI, including but not limited to:
 - a. Miscellaneous removal of equipment shown on the drawings
 - b. Selective demolition of items to be removed as indicated on the drawings
 - c. Dust and noise control including negative ventilations of the work areas.
 - d. Miscellaneous structural work; including installation of a new roof opening
 - e. Provide doors, frames, hardware and radiation protection work.
 - f. Finishes including but not limited to flooring, ceilings, wall protection and painting.
 - g. Cabinets, Countertops and accessories indicated as by the contractor.
 - h. Mechanical, electrical, plumbing, fire protection and medical gas work as indicated on the drawings.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

1.04 PROJECT MILESTONE SCHEDULE

- A. Bidding period: March 09, 2021 to April 13, 2021.
- B. Bids due: April 13, 2021 @ 2PM
- C. Bid Award Notification: April 16, 2021
- D. Phase One MRI Construction turnover to Philips: September 10, 2021.
- E. Phase One CT Construction turnover to Philips: September 17, 2021.
- F. Phase Two Construction Completion: January 21, 2022
- G. Total Project Completion Date: no more than 60 workdays after commencement of Phase Three*.
 - 1. *Please note Phase Three cannot begin until the replacement of the Emergency Department CT is completed and operational. This work is a separate construction project (not part of this project scope) projected to be completed on or about February 25, 2021.

1.05 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except as otherwise indicated.
 - 1. Weekend Hours: Work may occur at any times, as approved.
 - 2. Hours for Utility Shutdowns: Only after normal business hours, weekends, holidays as approved.
 - 3. Hours for Noisy Activity: For core drilling, powder-activated fasteners, and other disruptive activities, 5:00 p.m. to 11:00 p.m., or as otherwise approved.
 - 4. Special Events: The Owner will provide dates and times of special events that will restrict construction operations.
 - 5. GC to budget work associated with renovations of main hospital and departmental corridors for third shift (night) and weekend hours to minimize disruption to existing hospital operation. GC to coordinate specific times with owner.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Architect and Owner not less than five days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Architect and Owner not less than three days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or grounds.

1.06 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.07 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.08 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular

situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
3. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
4. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:
 - B. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 1. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
 2. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 012100 ALLOWANCES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to the Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Contingency allowances.

1.02 SELECTION AND PURCHASE

- A. Coordinate first paragraph below with Section 013300 "Submittal Procedures." Indicate critical dates on both Contractor's construction schedule and submittal schedule.
- B. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- C. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- D. Purchase products and systems selected by Architect from the designated supplier.

1.03 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.04 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.05 COORDINATION

- A. Coordinate allowance items with other portions of the Work.

1.06 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, for work ordered by Owner under the contingency allowance is included in the Contract Sum and is not part of the Allowance.
- C. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

PART 2 PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.02 GENERAL CONSTRUCTION SCHEDULE OF ALLOWANCES

- A. Allowance-01: Contingency Allowance: Include in the Base Bid an Allowance of 10 % of the Base Bid (Total Base Bid for all Trades) for use according to the Owner's instructions. This sum can be utilized for Architectural, Structural, Mechanical, Electrical and/or Plumbing issues.
 - 1. Contractor overhead and profit is provided in the Base Bid.

END OF SECTION

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**SECTION 012600
CONTRACT MODIFICATION PROCEDURES**

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections:
 - 1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award. MINOR

1.02 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on the Information Bulletin bound in the Project Forms Section of Project Manual.

1.03 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 10 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times and activity relationship. Use available total float before requesting an extension of the Contract Time.

1.04 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 5 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 5 days after such authorization.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.05 ADMINISTRATIVE CHANGE ORDERS

- A. Adjustment from Allowances: Refer to Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

1.06 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on the Information Bulletin bound in the Project Forms Section of Project Manual.

1.07 CONSTRUCTION CHANGE DIRECTIVE

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

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 013300 SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. This specification describes the procedures for submission of submittals and shop drawings using Newforma Info Exchange.
 - 1. The Contractor will be required to use the Newforma Info Exchange for the transfer of Submittals, Shop Drawings and RFI's. There will be **no exceptions** to this requirement. The contractor will be given a login and password free of charge. For more information follow the procedure below.
 - a. Information and instructions for use are available for review by the contractor by contacting CPL. The Contractor is to provide an email address for the file to be sent. A PDF file will be emailed to the requesting contractor.
- C. Related Requirements:
 - 1. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
 - 2. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.02 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.03 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.04 SUBMITTAL GENERAL ADMINISTRATIVE REQUIREMENTS

- A. The Contractor shall prepare a Submittal Log containing the information required to be submitted under the Submittal article from each respective Specification Section. With each item listed the Contractor shall provide anticipated dates for submission to the Architect. The Architect will review and accept or request that corrections be made for subsequent acceptance. This acceptance will constitute an approval for the submittal, shop drawings and sample submissions to commence. **No Submittals or Shop Drawings will be reviewed by the Architect until an approved Submittal Schedule is in place.**

- B. The contractor shall prepare expected submittals in Newforma that correspond to all submittals listed on the submittal schedule at the time of submission of the submittal log. These expected submittals are to follow the naming conventions laid out in section "1.5 Submittal Schedule" and "1.6 Submittal Identification"
- C. The Contractor is responsible for all costs for creating electronic files for the submittal process. The Architect will not provide this service.
 - 1. The Submittal Cover Sheet located in Specification Section 006000 Project Forms shall be used for all Submittals.
 - a. An electronic form of the submittal cover is available from the Architect.
 - 2. The Submittal Cover sheet when scanned to a .PDF shall be the first page viewed in the individual file.
 - a. Each product submitted within a specification section shall have a Submittal Cover sheet attached. Combined submittals with one cover page will not be accepted
 - b. Each Submittal Cover sheet shall be filled in completely. **Files that are sent with the Submittal Cover Sheet missing or not filled in correctly will not be reviewed.** The Architect will send a notice that the submittal is missing information. If the Contractor fails to correct or provide the proper submittal within 15 days, notice will be provided, and the submittal will be REJECTED.
 - 3. The Contractor(s) will be provided with a link to upload files to the Newforma Info Exchange. The site address and a "log in" will be provided to the Contractor(s) free of charge.
 - 4. A read only Record Submittal Log and RFI Log will be available from the Newforma Info Exchange for the Contractors reference in checking the status of the submittals and shop drawings.
- D. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittals of different types of submittals from related section for parts of the work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received. Delays associated with the above are the not the Architects responsibility and rests solely with the Contractor.
- E. Architect's Digital Data Files: For Projects where Project Building Information Modeling Protocol is NOT executed. Provide digital PDF's only.
 - 1. Architect will not furnish Contractor with digital drawings for the preparation of shop drawings.
 - 2. The Architect will provide digital PDF's of Contract Drawings for the purpose of producing project record drawings.
 - a. Contract documents are graphic representations of approximate locations of materials. Therefore, information contained within these files should not be assumed to be accurate and users of the Files accept full responsibility for verifying the accuracy and completeness of the Files with field conditions and the contract documents.
 - 3. Document Transfer Agreement - For Projects where Architect's work files are not a deliverable: The Contractor shall execute an Electronic Document Transfer Agreement for all electronic transfers of files, other than PDFs. The contractor must provide acknowledgement, accept the information regarding drawings, ownership and Limitations of Liability. Agreement is found with Project Forms.
 - a. The following plot files will by furnished for each appropriate discipline:
 - 1) Floor plans.

2) Reflected ceiling plans.

1.05 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Submit a preliminary if not final Submittal Schedule for approval a minimum of 15 days after award of contract. Failure to submit a submittal schedule within the required time frame will result in the refusal by the Architect to review any submittals. Delays associated with failure to receive the Submittal Schedule are the not the Architects responsibly and rest solely with the Contractor.
- B. The information is required to be submitted under the Submittal article from each respective Specification Section. With each item listed the Contractor shall provide anticipated dates for submission to the Architect. The Architect will review and accept or request that corrections be made for subsequent acceptance. This acceptance will constitute a review for the submittal, shop drawings and sample submissions may commence. No Submittals or Shop Drawings will be reviewed by the Architect until an approved Submittal Schedule is in place.
 - 1. The Submittal Schedule shall be coordinated with the overall Project Schedule to ensure that submittals are submitted and reviewed so as not to delay the Project Schedule.
 - 2. The Architect will not be responsible for ensuring that all required Shop Drawings, Product Data, Samples or similar submittals that are required to be submitted and reviewed under the Contract Documents are submitted by the Contractor. Submissions of Shop Drawings, Product Data, Samples or similar submittals are the Contractor's sole responsibility. Delays associated with the contractor's failure to provide the required submittals are the Contractors responsibility.
 - 3. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 4. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 30 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 5. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
 - 6. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's [and Construction Manager's] final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.

1.06 SUBMITTAL IDENTIFICATION

- A. Submittal Cover Sheet: Attach one cover sheet for each product, shop drawing or sample. DO NOT combine submittals together with one cover sheet for multiple items. They will not be reviewed.
- B. Submittal Information: Include the following information in each submittal. Use the submittal cover form found in specification section 060000 Project Forms. An electronic form can be sent to the contractor upon request
 - 1. Contractor, Address, Phone/fax and or Email

2. Contractors Submittal Number.
 3. Architects Project Number.
 4. Project Name (if not filled in by the Architect)
 5. Type of submittal being sent (select box)
 6. Product Identification including the following: Provide one submittal cover sheet for each product within a specification section
 - a. Specification Section Number
 - b. Contract Drawing Number
 - c. Product Name
 - d. Specification Reference: Part/Paragraph
 - e. Detail Reference
 - f. Manufacturer
 7. Contractors Approval: The contractor must acknowledge that they have reviewed the submittal for conformance with the Contract Documents and must sign and date the approval.
 8. Deviation from the Contract Documents: Where the submittal may not meet all of the requirements of the specified item. The contractor must indicate how the submitted item differs from the specified item.
 9. Contractor Comments: Any additional comments by the contractor should be indicated in this space. (Provide an attachment sheet for any other information required that will not fit on the cover sheet.)
- C. Deviations and Additional Information: On each individual submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information, revisions, line by line comparison and other information requested by Architect [and Construction Manager]. Indicate by highlighting on each submittal or noting on attached separate sheet. Identify options requiring selection by Architect.
- D. File Naming (for uploading): Each submittal or shop drawing file uploaded to the project on the Newforma Info Exchange, shall have in the file name, the specification section number followed by the submittal number, the submittal abbreviation and the specification section name. For re-submissions an R1 would be added following submittal number. The file name must include the following information:

Example:

081416	001	PD	Flush Wood Doors
Spec Section	Submittal No.	Submittal Abbr	Specification Name

File to Read: 081416-001 PD - Flush Wood Doors

Re-submission to Read:081416-001-R1-Flush Wood Doors

Submittal Abbr. required to be used in the file name on submittals are as follows:

CD - Coordination Drawings
CERT - Certification(s)
CLC - Calculations
DD - Design Data
EJ - Engineer's Judgement
LEED - LEED or PD/LEED
O&M - Operations and Maintenance Manuals
PD - Product Data
PHOTO - Photo
QD - Qualification Data
RPT - Report
SAMP - Sample
SCH - Schedule

SEL - Make A Selection

SD - Shop Drawing(s)

STDY - Study

TR - Test Results

WAR - Warranty

- E. When uploading submittals or RFI's to the Newforma Info Exchange, complete the online transmittal. The information required is derived from the contractor's submittal cover sheet or RFI. Instructions using the Newforma Info Exchange are available from CPL. These instructions can be emailed to the contractor.

1.07 SUBMITTAL DATA AND TESTING REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment. Each product within a specification section shall have a separate submittal cover.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable. Send full submittals for each product. Partial submittals will not be reviewed until all required submittal information is received. The architect will not be responsible for project delays due to the contractor's failure to submit the required submittal information in a complete package.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. Shop Drawings: Prepare project-specific information for each shop drawing. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Description any conflicts with other trades.
 - h. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package. If samples are delivered with product data, only the samples will be reviewed. The Product Data must be uploaded to the Newforma Info Exchange. A duplicate submittal cover sheet is to be uploaded to the Newforma Info exchange as a record of sample delivery.

- a. The Product Data is to be loaded concurrent with the delivery of samples. Samples may be delivered/given to the Architect. In the remarks column of the transmittal place "given to the Architect"
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 - g. In addition to all hard copy and physical samples submitted, duplicate digital submittal is to be produced for review, record and tracking purposes through Newforma Info Exchange. Include same information as above as well as a high resolution, color, digital image of all samples with labeled information clearly visible for each physical sample.
 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit [one] or Insert number full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect [, through Construction Manager,] will return submittal with options selected.
 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit [three] or Insert number sets of Samples. Architect [and Construction Manager] will retain [two] or Insert number Sample sets; remainder will be returned. [Mark up and retain one returned Sample set as a project record Sample.]
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least [three] or Insert number sets of paired units that show approximate limits of variations.
- D. Information requirements for each submittal: Where submittal is requiring Schedules, Product Data, Qualification Data, Design Data, Certificates and Tests use the following protocol.
1. Schedules: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 2. Product Data. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 - a. Manufacturer and product name, and model number if applicable.
 - b. Number and name of room or space.
 - c. Location within room or space.

3. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
4. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
5. Certificates:
 - a. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 - b. Insert definition of Contractor certificates here if required by individual Specification Sections. See the Evaluations.
 - c. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - d. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - e. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 - f. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 - g. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
 - h. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - i. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - j. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 - k. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
6. Test and Research Reports:
 - a. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 - b. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 - c. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 - d. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 - e. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

- f. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1) Name of evaluation organization.
 - 2) Date of evaluation.
 - 3) Time period when report is in effect.
 - 4) Product and manufacturers' names.
 - 5) Description of product.
 - 6) Test procedures and results.
 - 7) Limitations of use.
- E. Submit the following submittals: Within 15 days of contract award.
 - 1. Submittal Schedule including dates of anticipated review and approval.
 - a. No submittals will be reviewed without an approved Submittal Schedule in place.
 - 2. Subcontractor List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - a. Name, address, telephone number and email address of entities performing subcontract or supplying products.
 - b. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Contractor's Construction Schedule.
- F. Submit within the first 30 days after Contract Award
 - 1. Test and Inspection Reports and Schedule of Tests and Inspections Submittals.
 - 2. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 - 3. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- G. Submit Field Test Reports during construction within 15 days of the testing date and as follows:
 - 1. Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- H. Submit a minimum 30 days prior to Project Closeout:
 - 1. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

1.08 SUBMITTAL PROCESSING

- A. Processing Time: Allow time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.
- B. The architect will not be responsible for project delays due to the contractor's failure to submit the required submittal information in time to allow for review based on the stipulated review time and to meet the project schedule.
- C. Initial Review: Allow 10 Calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
- D. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
- E. Re-submittal Review: Allow 10 Calendar days for review of each re-submittal.
- F. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 Calendar days for initial review of each submittal.

- G. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 Calendar days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- H. Where submittal are required to be approved that are part of an assembly or for items such as finishes where color selections are required. The submittal will be retained until all of the information related to these systems and color selections is provided and accepted.
- I. Products with multiple submittals may be held until all necessary information has been submitted for architect to make a complete review. Submittals dependent on coordinating information from related or dependent products; or products with critical interface with other products may be held until all information is submitted for architect to make a complete review and coordinate all required information. (example door frames will not be reviewed without door hardware)
- J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with reviewed notation from Architect's [and Construction Manager's] action stamp.
- K. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

1.09 SUBMITTAL PROCEDURES

- A. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- B. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- C. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- D. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- E. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- F. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- G. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- H. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- I. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.

5. Description of product.
6. Test procedures and results.
7. Limitations of use.
- J. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- K. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- L. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- M. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- N. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

1.10 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractors Approval: Provide Contractor's approval signature and date on the Submittal Cover sheet certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1.11 ARCHITECT'S ACTION

- A. Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will respond to each submittal indicating one of the following actions required:
 1. No Exceptions Taken: Architect takes no exception to the submittal. This part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 2. Furnish as Corrected: No exceptions taken except what is identified by the Architect. The part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance. Furnish any additional related information as requested.
 3. Revise and Re-Submit: Revise the submittal based on the Architects comments and resubmit the submittal. Do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - a. Do not permit submittals marked "Revise and Resubmit" to be used at the Project Site, or elsewhere where Work is in progress.
 4. Rejected: The submittal is rejected. See Architects comments on why submittal was rejected.
 - a. Submittal has not been reviewed by the Contractor and so noted.
 - b. Submittal has been prepared without due regard for information called for or logically implied by the Contract Documents.
 - c. Information is not sufficiently complete or accurate to verify that work represented is in accordance with the Contract Documents.
 - d. Do not permit submittals marked "Rejected" to be used at the Project Site, or elsewhere where Work is in progress.
 5. No Action Taken: The submittal is not required and will not be reviewed.

- B. Submittals by Newforma Info Exchange: Architect will indicate, on Newforma Info Exchange, the appropriate action.
- C. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements. The Architects action will be noted in the Newforma Info Exchange.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect. The Architects action will be noted in the Newforma Info Exchange and noted as a partial review until a full submittal can be received.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for re-submittal without review.
- F. Submittals not required by the Contract Documents will not be reviewed and will receive no action.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 013513.16
SPECIAL PROJECT PROCEDURES FOR HEALTHCARE FACILITIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes special procedures for Healthcare work.
- B. Attached to this Section are specific project requirements for The Bon Secours Charity Health System Good Samaritan Hospital Infection Prevention & Control Risk Assessment
 - 1. Project Activity
 - 2. Risk Groups
 - 3. Step Three: Risk Matrix

END OF SECTION

Infection Prevention & Control Risk Assessment
Matrix of Precautions for Construction & Renovation**Step One:****Using the following table, identify the Type of Construction Project Activity (Type A-D)**

TYPE A	Inspection and Non-Invasive Activities. Includes, but is not limited to: <ul style="list-style-type: none"> ▪ removal of ceiling tiles for visual inspection only, e.g., limited to 1 tile per 50 square feet ▪ painting (but not sanding) ▪ wallcovering, electrical trim work, minor plumbing, and activities which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection.
TYPE B	Small scale, short duration activities which create minimal dust Includes, but is not limited to: <ul style="list-style-type: none"> ▪ installation of telephone and computer cabling ▪ access to chase spaces ▪ cutting of walls or ceiling where dust migration can be controlled.
TYPE C	Work that generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies Includes, but is not limited to: <ul style="list-style-type: none"> ▪ sanding of walls for painting or wall covering ▪ removal of floorcoverings, ceiling tiles and casework ▪ new wall construction ▪ minor duct work or electrical work above ceilings ▪ major cabling activities ▪ any activity which cannot be completed within a single workshift.
TYPE D	Major demolition and construction projects Includes, but is not limited to: <ul style="list-style-type: none"> ▪ activities which require consecutive work shifts ▪ requires heavy demolition or removal of a complete cabling system ▪ new construction.

Step Two:

Using the following table, identify the Patient Risk Groups that will be affected.

If more than one risk group will be affected, select the higher risk group:

Low Risk	Medium Risk	High Risk	Highest Risk
<ul style="list-style-type: none"> Office areas 	<ul style="list-style-type: none"> Cardiology Echocardiography Endoscopy Nuclear Medicine Physical Therapy Radiology/MRI Respiratory Therapy 	<ul style="list-style-type: none"> CCU Emergency Room Labor & Delivery Laboratories (specimen) Medical Units Newborn Nursery Outpatient Surgery Pediatrics Pharmacy Post Anesthesia Care Unit Surgical Units 	<ul style="list-style-type: none"> Any area caring for immunocompromised patients Burn Unit Cardiac Cath Lab Central Sterile Supply Intensive Care Units Negative pressure isolation rooms Oncology Operating rooms including C-section rooms

Step Three: Match the

Patient Risk Group (Low, Medium, High, Highest) with the planned ...

Construction Project Type (A, B, C, D) on the following matrix, to find the ...

Class of Precautions (I, II, III or IV) or level of infection control activities required.

Class I-IV or Color-Coded Precautions are delineated on the following page.

IC Matrix - Class of Precautions: Construction Project by Patient Risk**Construction Project Type**

Patient Risk Group	TYPE A	TYPE B	TYPE C	TYPE D
LOW Risk Group	I	II	II	III/IV
MEDIUM Risk Group	I	II	III	IV
HIGH Risk Group	I	II	III/IV	IV
HIGHEST Risk Group	II	III/IV	III/IV	IV

Description of Required Infection Control Precautions by Class**During Construction Project****Upon Completion of Project**

	<ol style="list-style-type: none"> 1. Execute work by methods to minimize raising dust from construction operations. 2. Immediately replace a ceiling tile displaced for visual inspection 	<ol style="list-style-type: none"> 1. Clean work area upon completion of task.
CLASS II	<ol style="list-style-type: none"> 1. Provide active means to prevent airborne dust from dispersing into atmosphere. 2. Water mist work surfaces to control dust while cutting. 3. Seal unused doors with duct tape. 4. Block off and seal air vents. 5. Place dust mat at entrance and exit of work area 6. Remove or isolate HVAC system in areas where work is being performed. 	<ol style="list-style-type: none"> 1. Wipe work surfaces with cleaner/disinfectant. 2. Contain construction waste before transport in tightly covered containers. 3. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area. 4. Upon completion, restore HVAC system where work was performed.
CLASS III	<ol style="list-style-type: none"> 1. Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system. 2. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. 3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 4. Contain construction waste before transport in tightly covered containers. 5. Cover transport receptacles or carts. Tape covering unless solid lid. 	<ol style="list-style-type: none"> 1. Do not remove barriers from work area until completed project is inspected by the owner's Safety Department and Infection Prevention & Control Department and thoroughly cleaned by the owner's Environmental Services Department. 2. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction. 3. Vacuum work area with HEPA filtered vacuums. 4. Wet mop area with cleaner/disinfectant. 5. Upon completion, restore HVAC system where work was performed.

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CLASS IV	<ol style="list-style-type: none"> 1. Isolate HVAC system in area where work is being done to prevent contamination of duct system. 2. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. 3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 4. Seal holes, pipes, conduits, and punctures. 5. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site. 6. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area. 	<ol style="list-style-type: none"> 1. Do not remove barriers from work area until completed project is inspected by the owner's Safety Department and Infection Prevention & Control Department and thoroughly cleaned by the owner's Environmental Services Dept. 2. Remove barrier material carefully to minimize spreading of dirt and debris associated with construction. 3. Contain construction waste before transport in tightly covered containers. 4. Cover transport receptacles or carts. Tape covering unless solid lid. 5. Vacuum work area with HEPA filtered vacuums. 6. Wet mop area with cleaner/disinfectant. 7. Upon completion, restore HVAC system where work was performed.

Infection Prevention & Control Construction Permit

						Permit No:
Location of Construction:				Project Start Date:		
Project Coordinator:				Estimated Duration:		
Contractor Performing Work				Permit Expiration Date:		
Supervisor:				Telephone:		
YES	NO	CONSTRUCTION ACTIVITY	YES	NO	INFECTION CONTROL RISK GROUP	
		TYPE A: Inspection, non-invasive activity			GROUP 1: Low Risk	
		TYPE B: Small scale, short duration, moderate to high levels			GROUP 2: Medium Risk	
		TYPE C: Activity generates moderate to high levels of dust, requires greater 1 work shift for completion			GROUP 3: Medium/High Risk	
		TYPE D: Major duration and construction activities Requiring consecutive work shifts			GROUP 4: Highest Risk	
CLASS I		<ol style="list-style-type: none"> 1. Execute work by methods to minimize raising dust from construction operations. 2. Immediately replace any ceiling tile displaced for visual inspection. 3. Minor Demolition for Remodeling 				
CLASS II		<ol style="list-style-type: none"> 1. Provides active means to prevent air-borne dust from dispersing into atmosphere 2. Water mist work surfaces to control dust while cutting. 3. Seal unused doors with duct tape. 4. Block off and seal air vents. 5. Wipe surfaces with cleaner/disinfectant. 6. Contain construction waste before transport in tightly covered containers. 7. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area. 8. Place dust mat at entrance and exit of work area. 9. Isolate HVAC system in areas where work is being performed; restore when work completed. 				
CLASS III		<ol style="list-style-type: none"> 1. Obtain infection control permit before construction begins. 2. Isolate HVAC system in area where work is being done to prevent contamination of the duct system. 3. Complete all critical barriers or implement control cube method before construction begins. 6. Vacuum work with HEPA filtered vacuums. 7. Wet mop with cleaner/disinfectant 8. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction. 9. Contain construction waste before transport in 				

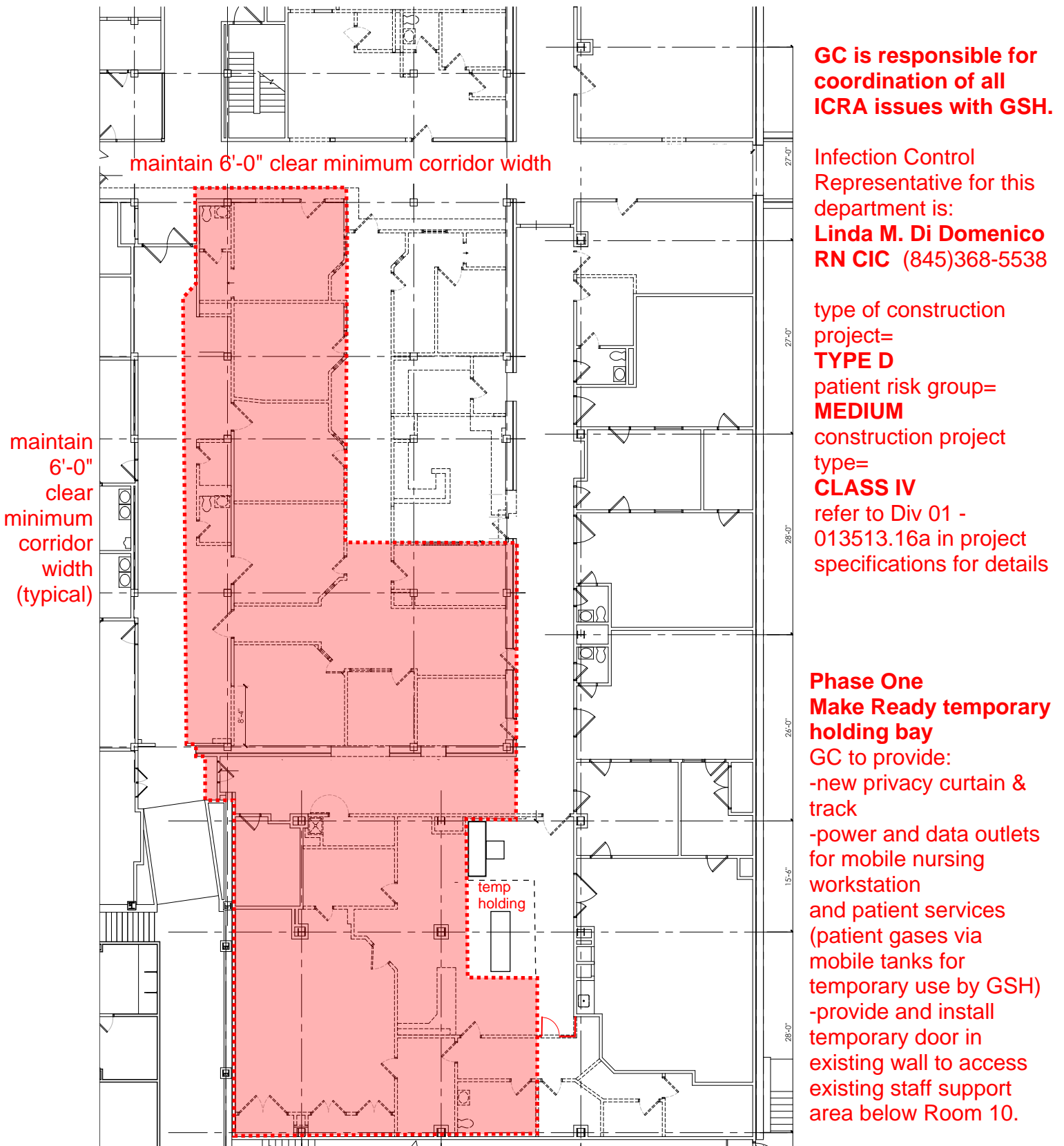
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Date	4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.	tightly covered containers.
Initial	5. Do not remove barriers from work area until complete project is checked by Infection Prevention & Control and thoroughly cleaned by Environmental Services.	10. Cover transport receptacles or carts. Tape covering. 11. Upon completion, restore HVAC system where work was performed.
CLASS IV	1. Obtain infection control permit before construction begins. 2. Isolate HVAC system in area where work is being done to prevent contamination of duct system. 3. Complete all critical barriers or implement control cube method before construction begins.	8. Do not remove barriers from work area until completed project is checked by Infection Prevention & Control and thoroughly cleaned by Environmental Services. 9. Vacuum work area with HEPA filtered vacuums. 10. Wet mop with disinfectant.
Date	4. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.	11. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.
Initial	5. Seal holes, pipes, conduits, and punctures appropriately. 6. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site. 7. All personnel entering work site are required to wear shoe covers.	12. Contain construction waste before transport in tightly covered containers. 13. Cover transport receptacles or carts. Tape covering. 14. Upon completion, restore HVAC system where work was performed.
Additional Requirements:		
Date Initials		Exceptions/Additions to this permit Date Initials are noted by attached memoranda
Permit Request By:		Permit Authorized By:
Date:		Date:

GOOD SAMARITAN HOSPITAL

RADIOLOGY RENOVATIONS - TMP 30 CT / TMP 92 MRI

ICRA REQUIREMENTS DIAGRAM



Phase One ICRA enclosure shown.

Future Phases Two and Three to adhere to similar provisions (6'-0" minimum clear corridors, etc).
Exhaust ventilation to be coordinated by GC with Facilities Department prior to each construction phase.

SECTION 014000 QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections:
 - 1. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.02 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- D. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- E. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- F. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.
- G. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.03 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.04 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.05 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.
 - 1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Architect.
 - 2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Architect.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.06 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and re-inspecting.
- B. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.07 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.08 QUALITY CONTROL

- A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 3. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- C. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- D. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 6. Security and protection for samples and for testing and inspecting equipment at Project site.
- E. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.01 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.02 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 014200 REFERENCES

PART 1 GENERAL

1.01 KEY DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.02 DEFINITIONS

- A. Air Handling Unit: A blower or fan used for the purpose of distributing supply air to a room, space or area.
- B. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved according to the requirements established in this Section and as required by the Code Official having jurisdiction over this project.
- C. Architect: Other terms including "Architect/Engineer" and "Engineer" have the same meaning as "Architect".
- D. Company Field Adviser: An employee of the Company which lists and markets the primary components of the system under the name who is certified in writing by the Company to be technically qualified in design, installation, and servicing of the required products or an employee of an organization certified by the foregoing Company to be technically qualified in design, installation, and servicing of the required products. Personnel involved solely in sales do not qualify.
- E. Concealed Location: A location that cannot be accessed without damaging permanent parts of the building structure or finish surface. Spaces above, below or behind readily removable panels or doors shall not be considered as concealed.
- F. Concealed Piping: Piping that is located in a concealed location. (See "concealed location".)
- G. Connect: A term contraction and unless otherwise specifically noted is to mean "The labor and materials necessary to join or attach equipment, materials or systems to perform the functions intended".
- H. Drain: Any pipe that carries wastewater or water-borne wastes in a building drainage system.
- I. Drainage Fittings: Type of fitting or fittings utilized in the drainage system. Drainage fittings are similar to cast-iron fittings, except that instead of having a bell and spigot, drainage fittings are recessed and tapped to eliminate ridges on the inside of the installed pipe.

- J. Drainage System: Piping within a public or private premise that conveys sewage, rainwater or other liquid wastes to a point of disposal. A drainage system does not include the mains of a public sewer system or a private or public sewage treatment or disposal plant.
 - 1. Building Gravity: A drainage system that drains by gravity into the building sewer.
 - 2. Sanitary: A drainage system that carries sewage and excludes storm, surface and ground water.
 - 3. Storm: A drainage system that carries rainwater, surface water, condensate, cooling water or similar liquid wastes.
- K. Duct: A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.
- L. Duct System: A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.
- M. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- N. Headroom: Minimum clearance between the floor and the underside of the point of lowest installed mechanical construction above. In case of stairways and walkways, the minimum clearance between the step or surface of the walkway and the lowest installed mechanical construction above the stairway or the walkway.
- O. Include: When used in any form other than "inclusive", is non-limiting and is not intended to mean "all-inclusive."
- P. Indicated: Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- Q. Inspection Certificate: Identification applied on a product by an approved agency containing the name of the manufacturer, the function and performance characteristics, and the name and identification of an approved agency that indicates that the product or material has been inspected and evaluated by an approved agency.
- R. Installer: An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
 - 2. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.
 - 3. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.
- S. Label: An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency.
- T. Location:
 - 1. Damp Location: Partially protected locations under canopies, marquees, roofed open porches and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns and some cold-storage warehouses.
 - 2. Dry Location: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of

- a building under construction.
- 3. Wet Location: Installations underground or in concrete slabs or masonry in direct contact with the earth and locations subject to saturation with water or other liquids, such as vehicle-washing areas, and locations exposed to weather and unprotected.
- U. Manufacturer's Designation: Identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules (see also "Inspection Certificate," "Label" and "Mark").
- V. Mark: An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material (see also "Inspection Certificate," "Label" and "Manufacturer's Designation").
- W. Mechanical: Other terms including "HVAC", "Plumbing", "Sprinkler", "Laboratory Equipment", "Food Service Equipment", "Laundry Equipment", and "Refrigeration" have the same meaning as "Mechanical".
- X. Owner: Phillips Healthcare / Westchester Medical Health System.
- Y. Piping: This term includes pipe, tube and appurtenant fittings, flanges, valves, traps, hangers and supports.
- Z. Piping, Concealed: Piping built into construction and not accessible without removal of construction Work such as masonry, plaster or other finish material, and piping installed in floors, furred spaces, suspended ceilings, non-walk-in tunnels, conduits, and behind removable panels and cabinet doors.
- AA. Piping, Distribution: Domestic water supply piping, starting with a connection to service piping, and continuing throughout the building to point of connection to equipment and fixture supply piping.
- BB. Piping, Exposed: Piping directly accessible by normal accesses without removal of any construction Work or material.
- CC. Piping, Service: Underground domestic water supply piping with a connection to a water main or supply as noted, and continuing to and into a building and terminating with the exposed fitting inside the building.
- DD. Piping, Tunnel: Piping installed in walk-in or non-walk-in tunnels or conduits up to first shut-off valve inside building.
- EE. Plumbing System: Includes the water supply and distribution pipes; plumbing fixtures and traps; water-treating or water-using equipment; soil, waste and vent pipes; and sanitary and storm sewers and building drains, in addition to their respective connections, devices and appurtenances within a structure or premises.
- FF. Product: As used includes materials, systems and equipment.
- GG. Registered Design Professional: An individual who is a registered architect (RA) in accordance with Article 147 of the New York State Education Law or a licensed professional engineer (PE) in accordance with Article 145 of the New York State Education Law.
- HH. Space, Finished: A space which has a finishing material applied to walls or ceilings, such as paint, plaster, ceramic tile, enamel glazing, face brick, vinyl wall covering, etc. to provide a finished appearance or which will have such finishes applied under a related Contract.
- II. Space, Unfinished: A space which does not meet the definition of a finished space.
- JJ. Special Inspection: Inspection as herein required of the materials, installation, fabrication, erection, or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards.
- KK. Steam-Heating Boiler: A boiler operated at pressures not exceeding 15 psi for steam.
- LL. Supplier: Any person or organization who supplies materials or equipment for the work, including that fabricated to a special design.
- MM. Utility: Any gas, steam, water, sanitary sewer, storm sewer, electrical or other such service.
- NN. Water Supply System: The water service pipe, water distribution pipes, and the necessary connecting pipes, fittings, control valves and all appurtenances in or adjacent to the structure or premises.
 - 1. Chilled: Water-cooled by refrigeration.

2. Cold: Water with at temperature between 33 degrees F and 80 degrees F and which is neither cooled nor heated mechanically.
3. Domestic: Water for use in buildings, except water used in connection with space heating and space cooling.
4. High Temperature: Water with a supply water temperature above 350 degrees.
5. Hot: Water at a temperature greater than or equal to 110°F.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.
- D. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 ABBREVIATIONS AND ACRONYMS

A.

AA	Aluminum Association, Inc. (The)
AABC	Associated Air Balance Council
AAALAC	Association for Assessment and Accreditation of Laboratory Animal Care
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	ACI International (American Concrete Institute)
ACPA	American Concrete Pipe Association
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America (The)
AHA	American Hardboard Association (part of CPA)
AI	Asphalt Institute

AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	Architectural Precast Association
APA	APA - The Engineered Wood Association
ARI	Air-Conditioning & Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International
AWCMA	American Window Covering Manufacturers Association (WCSC)
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
CBM	Certified Ballast Manufacturers
CCC	Carpet Cushion Council
CDA	Copper Development Association
CISCA	Ceilings & Interior Systems Construction Association

CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPA	Composite Panel Association
CRI	Carpet & Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute
CSI	Cast Stone Institute
CSI	Construction Specifications Institute (The)
CTI	Cooling Technology Institute
DHI	Door and Hardware Institute
EIA	Electronic Industries Alliance
EIMA	EIFS Industry Members Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association
FM Approvals	Factory Mutual Approvals
FSA	Fluid Sealing Association
GA	Gypsum Association
GANA	Glass Association of North America
GSI	Geosynthetic Institute
HI	Hydraulic Institute
HI	Hydronics Institute
HMMA	Hollow Metal Manufacturers Association
HPVA	Hardwood Plywood & Veneer Association
ICEA	Insulated Cable Engineers Association, Inc
ICRI	International Concrete Repair Institute, Inc.

IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IESNA	Illuminating Engineering Society of North America
IST	Institute of Environmental Sciences and Technology
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
IPCEA	Insulated Power Cable Engineer Associates
ISO	International Organization for Standardization
ISSFA	International Solid Surface Fabricators Association
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LEED	Leadership in Energy and Environmental Design
MBMA	Metal Building Manufacturers Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MIA	Marble Institute of America
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International
NADCA	National Air Duct Cleaners Association
NAIMA	North American Insulation Manufacturers Association
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute

NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	National Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	NOFMA: The Wood Flooring Manufacturers Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NWWDA	National Wood Window and Door Association (WDMA)
PCI	Precast/Prestressed Concrete Institute
PDCA	Painting & Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections

RFCI	Resilient Floor Covering Institute
SAE	SAE International
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers
SGCC	Safety Glazing Certification Council
SIA	Security Industry Association
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPIB	Southern Pine Inspection Bureau (The)
SPRI	Single Ply Roofing Industry
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWRI	Sealant, Waterproofing, & Restoration Institute
TCA	Tile Council of America, Inc.

1.05 FEDERAL GOVERNMENT AGENCIES:

- A. Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce
DOD	Department of Defense

DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FDA	Food and Drug Administration
GSA	General Services Administration
HUD	Department of Housing and Urban Development
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety & Health Administration
PHS	Office of Public Health and Science
SD	State Department
TRB	Transportation Research Board
USDA	Department of Agriculture
USPS	Postal Service

- B. Codes, Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines
BCNYS	Building Code of New York State
CFR	Code of Federal Regulations
DOD	Department of Defense Military Specifications and Standards
FS	Federal Specification
MILSPEC	Military Specification and Standards

1.06 NEW YORK STATE GOVERNMENT AGENCIES:

- A. Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

DASNY	Dormitory Authority of the State of New York
DEC	Department of Environmental Conservation

DHCR	Division of Housing and Community Renewal
DOH	Department of Health
NYSDOL	New York State Department of Labor
DOS	Department of State
DOT	Department of Transportation
NYSPA	New York State Power Authority
OGS	Office of General Services
OCFS	Office of Children and Family Services
OMRD	Office of Mental Retardation and Developmental Disabilities
OPRHP	Office of Parks, Recreation and Historic Preservation
NYSED	New York State Education Department (Department of Education)
SHPO	State Historic Preservation Office
SUCF	State University Construction Fund
SUNY	State University of New York

1.07 OTHER TERMS OR ACRONYMS:

- A. Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name in the following list.
1. ACM Asbestos Containing Materials
 2. ACT Acoustical Tile
 3. ICRA Infection Control Risk Assessment
 4. RVT Resilient Vinyl Tile
 5. SAT Suspended Acoustical Tile
 6. SFRM Spray on Fire Resistive Materials
 7. TSI Thermal Systems Insulation
 8. VAT Vinyl Asbestos Tile
 9. VCT Vinyl Composition Tile

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

**SECTION 015000
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection.

1.02 TEMPORARY UTILITIES INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:

- A. Temporary electric power and light.
- B. Support facilities include, but are not limited to, the following:
 - 1. Temporary partitions and enclosures.
 - 2. Waste disposal services and dumpsters.
 - 3. Security and protection facilities include, but are not limited to, the following:
 - 4. Warning signs, and lights.
 - 5. Environmental protection.
 - 6. Security enclosure and lockup.
- C. Related Sections:
 - 1. Division 01 Section "Summary"

1.03 INFORMATIONAL SUBMITTALS

- A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- B. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of the work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air filtration system discharge.
 - 4. Other dust-control measures.
 - 5. Waste management plan.

1.04 DEFINITIONS

- A. Temporary Facilities: Construction, fixtures, fittings, and other built items required to accomplish the work but which are not incorporated into the finished work.
- B. Temporary Utilities: A type of temporary facility, primary sources of electric power, other main distribution systems, or temporary sources constructed for the project, but not including the fixtures and equipment served.
- C. Temporary Services: Activities required during construction, which do not directly accomplish the work.

1.05 QUALITY ASSURANCE

- A. Regulations: The contractor shall comply with industry standards and with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, fire department and rescue squad rules.
 - 5. Environmental protection regulations.
- B. Standards: The Contractor shall comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
- C. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with the normal application of trade regulations and union jurisdictions.

- D. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.06 USE CHARGES

- A. Cost or use charges for temporary facilities are not chargeable to the Owner or the Architect. The Architect will not accept a prime contractor's cost or use charges for temporary services or facilities as a basis of claim for an adjustment in the Contract Sum or the Contract Time.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Gypsum Wallboard: Provide 5/8 type x gypsum wallboard on interior wall temporary partitions.
- B. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.
- C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.02 EQUIPMENT

- A. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- B. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- C. Air Filtration Units: HEPA primary and secondary filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.
- D. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 EXECUTION

3.01 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that eliminate possible air, contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Division 01 Section "Summary."
- C. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
 - 1. Connect temporary service to Owner's existing power source, as directed by Owner.
- D. Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- E. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors for each site. Unauthorized signs are not permitted.
 - 1. For warning signs as required

3.02 TEMPORARY UTILITY INSTALLATION

- A. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to

produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

3.03 OPERATION, TERMINATION, AND REMOVAL

- A. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- B. Termination and Removal: Remove each temporary facility when need for its service has ended..
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

SECTION 016000 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for products selected under an allowance.
 - 2. Section 014200 "References" for applicable industry standards for products specified.

1.02 DEFINITIONS

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

1.03 ACTION SUBMITTALS

- A. Comparable Product Requests, if allowed: After award of contract submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 10 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.04 QUALITY ASSURANCE

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

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.
 - 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.06 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **will not** be considered.
 - b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 EQUIVALENT PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for equivalent product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 017300 EXECUTION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Installation of the Work.
 - 3. Cutting and patching.
 - 4. Progress cleaning.
 - 5. Protection of installed construction.

1.02 DEFINITIONS

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

1.03 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Visual Elements: Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect.

3.03 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings. If discrepancies are discovered, notify Architect promptly.

3.04 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.05 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Utility Services: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- C. Protection: Protect in-place construction during cutting and patching to prevent damage.
- D. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. Concrete and Asphalt: Cut using a cutting machine, such as an abrasive saw..
 - 2. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements

specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch extending to an inside or outside corner of a wall. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.06 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Pre-installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.07 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
 3. Maintain work site free of waste materials and debris.
- C. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials

specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

- D. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- E. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- F. Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."
- G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.08 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.09 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 017700 CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Final cleaning.
 - 4. Repair of the Work.

1.02 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.03 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.

1.04 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete. The Architect will not perform a punch list inspection until the contractor's punch list is received and reviewed.
- B. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Terminate and remove temporary facilities from Project site..
- C. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 5 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - a. The Architects basic services include (1) initial punch list and (1) follow-up punch list inspection to insure all corrective action and or incomplete work has been finished. The Contractor is responsible to the Owner for all costs incurred by the Architect for additional services to provide multiple punch lists for the same work area. The cost for these additional services, may be deducted from the Contractors Contract by deduct Change Order.
 - 2. Results of completed inspection will form the basis of requirements for final completion.

1.05 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
 - 1. Submit a final Application for Payment.
 - 2. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
- B. Inspection: Submit a written request for final inspection to determine acceptance, a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected

before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.06 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, starting with exterior areas first.

2. Submit list of incomplete items in the following format:

- a. PDF electronic file. Architect will return annotated file.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Leave Project clean and ready for occupancy.

3.02 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements.

END OF SECTION

**SECTION 017839
PROJECT RECORD DOCUMENTS**

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
- B. Related Requirements:
 - 1. Divisions 02 through 49 Sections for specific requirements for project record documents of the Work in those Sections.

PART 2 PRODUCTS

2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Locations and depths of underground utilities.
 - d. Revisions to routing of piping and conduits.
 - e. Revisions to electrical circuitry.
 - f. Actual equipment locations.
 - g. Changes made by Change Order or Construction Change Directive.
 - h. Changes made following Architect's written orders.
 - i. Details not on the original Contract Drawings.
 - j. Field records for variable and concealed conditions.
 - k. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Format: Submit record Drawings as paper copy.
 - 3. Identification: As follows:
 - a. Project name.
 - b. Date.

- c. Designation "PROJECT RECORD DRAWINGS."
- d. Name of Contractor.

2.02 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 - 5. Note related Change Orders and record Drawings where applicable.
- B. Format: Submit record Specifications as paper copy.

PART 3 EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents: Store record documents apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

**SECTION 024119
SELECTIVE STRUCTURE DEMOLITION**

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Refer to Demolition Drawings for Owner requested salvage items.
- B. Related Sections include the following:
 - 1. Division 01 Section "Summary" for use of premises and Owner-occupancy requirements.
 - 2. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
 - 3. Division 01 Section "Execution" for cutting and patching procedures.

1.02 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
 - 1. Refer to Demolition Drawings for Owner requested salvage items.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.03 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Pre-demolition Photographs or Video: Submit before Work begins.

1.04 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6 and NFPA 241.

1.05 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. Loose furniture and equipment.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
- E. Storage or sale of removed items or materials on-site is not permitted.

- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that services have been disconnected and capped before starting selective demolition operations.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
 - 1. Provide photographs of conditions that might be misconstrued as damage caused by salvage or demolition operations.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Division 01 "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - c. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - e. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.03 PREPARATION

- A. Work Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with adjacent occupied portions of the building.
 - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary protection required to prevent injury and damage to adjacent areas to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 3. Cover and protect furniture, furnishings, and equipment that have not been removed.

4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

3.04 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Dispose of demolished items and materials promptly.
- B. Removed and Reinstalled Items:
 1. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.
 1. If tile is removed by asbestos abatement refer to specific removal requirements in part 3 of the asbestos abatement specification.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 1. Do not allow demolished materials to accumulate.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.07 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

**SECTION 061053
MISCELLANEOUS ROUGH CARPENTRY**

GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Rooftop equipment bases and support curbs.
 - 3. Wood blocking, cants, and nailers.
 - 4. Wood furring.
 - 5. Plywood backing panels.

1.02 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.

1.04 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Fire-retardant-treated wood.
 - 2. Power-driven fasteners.
 - 3. Post-installed anchors.
 - 4. Metal framing anchors.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, provide certificates of grade compliance issued by grading agency.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2[for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground].
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat all miscellaneous carpentry unless otherwise indicated.
 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood members attached directly to the interior of below-grade exterior masonry or concrete walls.
 3. Wood members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.

2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 1. Treatment shall not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all miscellaneous carpentry unless otherwise indicated.
 1. Concealed blocking.
 2. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 3. Plywood backing panels.

2.04 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.05 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Screws for Fastening to Framing: ASTM C954, length as recommended by screw manufacturer for material being fastened.

- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

EXECUTION

3.01 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- F. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.

3.02 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

END OF SECTIONB 061053

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**SECTION 064116
PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS**

GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-clad architectural cabinets.
 - 2. Section 123623.16 "Solid Surfacing Countertops"

1.02 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.03 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. Samples for Verification: For the following:
 - 1. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer
- B. Product Certificates: For each type of product.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.06 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.08 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PRODUCTS

2.01 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Architectural Woodwork Standards Grade: Premium.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
 1. Refer to Finishes List on Drawing A/A101 for manufacturers and finish selection.
- F. Laminate Cladding for Exposed Surfaces:
- G. Horizontal Surfaces: Grade HGS.
 1. Vertical Surfaces: Grade HGS.
 2. Edges: PVC edge banding, (3 mm) thick, matching laminate in color, pattern, and finish as selected by the Architect.
- H. Thru Color Laminate Cladding for Exposed Surfaces:
 1. Manufacturer: Wilsonart
 2. Sheet Thickness: 0.028
 3. Color: As selected by the Architect.
- I. Materials for Semi-exposed Surfaces:
 1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3 mm thick, matching laminate in color, pattern, and finish.
 - b. Edges of Thermoset Decorative Panel Shelves: PVC edge banding.
 - c. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 2. Drawer Sides and Backs: Thermoset decorative panels with PVC edge banding.
 3. Drawer Bottoms: Thermoset decorative panels.
- J. Drawer Construction: Fabricate with exposed fronts fastened to sub front with mounting screws from interior of body.
 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. As indicated on the Finishes List, Drawing I-100

2.02 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

2.03 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Butt Hinges: Stainless-steel, semi concealed, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.
 - 1. Semi concealed Hinges for Overlay Doors: BHMA A156.9, B01521.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter. (Pull Type 1); coordinate with owner.

2.04 CATCHES: MAGNETIC CATCHES, BHMA A156.9, B03141.

- A. Shelf Rests: BHMA A156.9, B04013; metal.
- B. Drawer Slides: BHMA A156.9, B05091.
 - 1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
 - 2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
 - 3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.
 - 4. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide.
 - 5. Keyboard Slides: Grade 1HD-100; for computer keyboard shelves.
 - 6. Trash Bin Slides: Grade 1HD-200; for trash bins not more than 20 inches high and 16 inches wide.
- C. Door Locks: BHMA A156.11, E07121.; coordinate with owner.
- D. Drawer Locks: BHMA A156.11, E07041.; coordinate with owner.
- E. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
- F. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.05 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.
- D. Adhesive for Bonding Plastic Laminate: PVA.
- E. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.06 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

EXECUTION

3.01 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

3.02 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean cabinets on exposed and semi exposed surfaces.

END OF SECTION 064116

**SECTION 075323
ETHYLENE PROPYLENE DIENE MONOMER (EPDM) ROOFING**

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Adhered EPDM membrane roofing system.
 - 2. Substrate board.
 - 3. Vapor retarder.
 - 4. Roof insulation.
 - 5. Cover board.
- B. Related Sections:
 - 1. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Division 07 Section "Roof Accessories" for roof mounted accessories

1.02 DEFINITIONS

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.03 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.
- C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
 - 1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings, and on the following:
 - a. Risk Occupancy Category: III
 - b. Basic Wind Speeds (3-second gust as measured 33 ft above ground):
 - 1) 120 mph ultimate
 - 2) 93 mph nominal
 - c. Exposure Category: C.
 - 2. Field of Roof Uplift Pressure (Zone 1): -25 lbf/sf.
 - 3. Perimeter Uplift Pressure (Zone 2): -30 lbf/sq. ft.
 - 4. Corner Uplift Pressure (Zone 3): -35 lbf/sq. ft
- D. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals' markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.
 - 2. Hail Resistance: MH.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
- C. Qualification Data: For qualified Installer and manufacturer.

- D. Manufacturer Certificate: Signed by roofing manufacturer certifying that membrane roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of complying with performance requirements.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.
- F. Field quality-control reports.
- G. Maintenance Data: For membrane roofing system to include in maintenance manuals.
- H. Warranty:
 - 1. Sample of Total System Warranty.
 - 2. Certification of the manufacturer's warranty reserve.
- I. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the Architect prior to the issuance of the manufacturer's warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and FM Approvals approved for membrane roofing system identical to that used for this Project.
 - 1. The manufacturer must have a minimum of 20 years' experience in the manufacturing of vulcanized thermal set sheeting and be the primary manufacturer of the EPDM membrane.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
- C. The installer shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.
- D. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 1. The roofing system must be installed by an applicator authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer.
The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having at least ten years' successful experience installing single-ply EPDM roofing systems and having installed at least one roofing application of similar or equal scope. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturer's current specifications and details.
 - 2. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and experienced superintendent on the job at all times roofing work is in progress.
 - 3. There shall be a supervisor on the job site at all times while work is in progress.
- E. Source Limitations: Obtain components including roof insulation fasteners for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.
- F. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.
- G. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- H. Preinstallation Roofing Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.07 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed sections of the membrane system.
- C. Do not disrupt activities in occupied spaces.

1.08 WARRANTY

- A. Total System Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Twenty (20) years from date of Substantial Completion.
 2. Warranty shall cover wind speeds up to 90 mph.
 3. Metal edge terminations shall be included in the warranty.

PART 2 PRODUCTS

2.01 EPDM MEMBRANE ROOFING

- A. EPDM: ASTM D 4637, Type I, non-reinforced, uniform, flexible EPDM sheet.
 1. Manufacturers: Subject to compliance with requirements, provide Carlisle SynTec Incorporated or an equivalent from one of the following:
 - a. GAF
 - b. Genflex
 2. Thickness: 60 mils, un-reinforced.
 3. Exposed Face Color: Black.
 4. When a 10-foot wide membrane is to be used, the membrane shall be manufactured in a single panel with no factory splices to reduce splice intersections with 6-inch

factory applied tape.

2.02 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
- B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.
- C. Bonding Adhesive: Manufacturer's standard.
- D. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 6-inch-wide minimum, butyl splice tape with release film.
- E. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.
- F. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.
- G. Low-Rise, Urethane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with membrane roofing.
- H. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8-inch-thick; with anchors.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to roofing system manufacturer.
- J. RUSS (Reinforced Universal Securement Strip): a 6-inch-wide, 100-foot-long strip of reinforced EPDM membrane.
 - 1. 6-inch-wide RUSS shall be utilized horizontally or vertically (in conjunction with Seam Fastening Plates) below the EPDM membrane for additional membrane securement.
- K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

2.03 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C 1278/C 1278M, fiber-reinforced gypsum board.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. USG Corporation.
 - 1) Securerock Gypsum Fiber Roof Board
 - 2. Thickness: Type X, 5/8 inch.
 - 3. Surface Finish: Unprimed.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to metal roof deck.

2.04 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: ASTM D 1970, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil-total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.05 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by EPDM membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Use Type II, Class I, Grade 3 where indicated for higher compressive strength.
- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.
 - 1. Provide minimum slope of 1/8 inch per 12 inches at reroofed areas.

- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.
- E. Insulation transitions/step offs greater than 1/2" will require a transition board such as a wood fiberboard tapered edge strip. Tapered insulation or crickets shall be overlaid with 1/2"

2.06 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation[and cover boards] to substrate, and acceptable to roofing system manufacturer.
- C. Bonding Adhesive: Manufacturer's standard.
- D. Cover Board: ASTM C 1278/C 1278M, fiber-reinforced gypsum board.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. USG Corporation.
 - 1) Securock Gypsum Fiber Roof Board
 - 2. Thickness: 3/8 inch.
 - 3. Surface Finish: Unprimed.

2.07 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16-inch-thick, and acceptable to membrane roofing system manufacturer.]

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that gypsum and concrete substrates are visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.03 SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.
 - a. Omit substrate board at gypsum decks and concrete decks.

3.04 VAPOR-RETARDER INSTALLATION

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Seal laps by rolling.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.05 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Minimum Average Thickness: As required to obtain an average thermal resistance of R-30ci.
 1. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards.
- F. Installation Over Concrete Decks:
 1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.
 - a. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - b. Fill gaps exceeding 1/4 inch with insulation.
 - c. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - d. Adhere base layer of insulation to vapor retarder according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
 - 1) Set insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
 2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - e. Fill gaps exceeding 1/4 inch with insulation.
 - f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - g. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:

- 1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.06 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
 - a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
 5. Walk the boards into the adhesive and roll using a 30" wide, 150 pound weighted steel roller to ensure full embedment. Constant weight may be required to achieve adequate adhesion.

3.07 ADHERED MEMBRANE ROOFING INSTALLATION

- A. Adhere membrane roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax a minimum of thirty (30) minutes before bonding.
- B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water.
- D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.
- E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeters.
- F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
 1. Roll the coated membrane into the coated substrate while avoiding wrinkles. Brush down the bonded half of the membrane sheet with a soft bristle push broom to achieve maximum contact.
 2. Fold back the un-bonded half of the membrane sheet and repeat the bonding procedure.
 3. Install adjoining membrane sheets in the same manner, overlapping edges approximately 6" inches with 6" seam tape is required.
- G. Apply membrane roofing with side laps shingled with slope of roof deck where possible.
- H. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.
 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 2. Apply lap sealant and seal exposed edges of roofing terminations.
- I. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.
 1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
 2. Apply lap sealant and seal exposed edges of roofing terminations.

3.08 REPAIR TEARS, VOIDS, AND LAPPED SEAMS IN ROOFING THAT DOES NOT COMPLY WITH REQUIREMENTS.

- A. Install membrane roofing and auxiliary materials to tie in to existing membrane roofing to maintain weather-tightness of transition [and to not void warranty for existing membrane roofing system].

3.09 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

3.10 DAILY SEAL

- A. New roofing shall be complete and weather tight at the end of the workday. Care must be taken to avoid wicking water through the fleece by properly sealing exposed edges of the membrane

3.11 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.12 FIELD QUALITY CONTROL

- A. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
 - 2. Flood each area for 24 hours.
 - 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.
- C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- D. Prior to the manufacturer's inspection for warranty, Contractor must perform a pre-inspection to review all work and to verify all flashing and caulking has been completed.

3.14 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner:

2. Address: _____
 3. Building Name/Type: _____
 4. Address: _____
 5. Area of Work: _____
 6. Acceptance Date: _____
 7. Warranty Period: 2 Years.
 8. Expiration Date: _____
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 90 mph;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether

Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of

_____, _____.

1. Authorized Signature: _____.

2. Name: _____.

3. Title: _____.

END OF SECTION

SECTION 077200 ROOF ACCESSORIES

GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Equipment supports.
 - 2. Pipe and duct supports.
 - 3. Pipe portals.
 - 4. Preformed flashing sleeves.
 - 5. Roof Walkway Pavers
- B. Related Sections:

1.02 SECTION 076200 "SHEET METAL FLASHING AND TRIM" FOR SHOP- AND FIELD-FORMED METAL FLASHING, MISCELLANEOUS SHEET METAL TRIM AND ACCESSORIES.

- 1. Section 237413 "Packaged, Outdoor, Central-Station Air-Handling Units" for standard curbs specified with rooftop units.

1.03 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories.
 - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- B. Sample Warranties: For manufacturer's special warranties.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.02 EQUIPMENT SUPPORTS

- A. Equipment Supports: Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads

and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, integral metal cant, and integrally formed structure-mounting flange at bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Curbs Plus, Inc.
 - b. Pate Company (The).
 - c. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Aluminum sheet, [0.090 inch] [0.125 inch] or as indicated by manufacturer.
 1. Finish: [Mill]
- D. Construction:
 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 2. Nailer: Factory-installed continuous wood nailers [5-1/2 inches] wide on top flange of equipment supports, continuous around support perimeter.
 3. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
 5. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
 - a. Product: Pipe Portal flashing system or approved equivalent manufacturer.

2.03 PREFORMED FLASHING SLEEVES

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve, insulation filled, with deck flange, 12 inches high, with removable metal hood and perforated metal collar.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thaler Metal Industries Ltd or approved equivalent manufacturer.
 2. Metal: Aluminum sheet, [0.063 inch]
 3. Diameter: As indicated on Drawings
 4. Finish: Manufacturer's standard
- B. Vent Stack Flashing: Metal flashing sleeve, insulated, with integral deck flange.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Custom Solution Roof and Metal Products.
 - b. Thaler Metal Industries Ltd.
 2. Metal: [Aluminum sheet, 0.063 inch thick]
 3. Height: 19 inches .
 4. Diameter: As indicated on Drawings
 5. Finish: Manufacturer's standard .
 6. Finish: [Manufacturer's standard] .

2.04 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, [containing no arsenic or chromium.] and complying with AWPA C2; not less than 1-1/2 inches thick.
- D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- E. Elastomeric Sealant: ASTM C 920, elastomeric [polyurethane] [silicone] polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

2.05 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of [uncoated aluminum] [stainless-steel] roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
 - 1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- F. Preformed Flashing-Sleeve[and Flashing Pipe Portal] Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.
- G. Seal joints with [elastomeric] [or] [butyl] sealant as required by roof accessory manufacturer.

3.03 REPAIR AND CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.
- B. Clean off excess sealants.
- C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

PHILIPS HEALTHCARE
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Bon Secours Charity Health System
Good Samaritan Hospital TMP 30 CT TMP 92 MRI
077200 - 4

END OF SECTION 077200

SECTION 078100 APPLIED FIREPROOFING

GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Concealed SFRM.
- B. Related Sections include the following:
 - 1. Division 07 Section "Penetration Firestopping" for fire-resistance-rated firestopping systems.
 - 2. Division 07 Section "Fire-Resistive Joint Systems" for fire-resistance-rated joint systems.

1.02 DEFINITIONS

- A. SFRM: Sprayed fire-resistive material.
- B. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed or that are exposed in mechanical rooms.
- C. Exposed: Fire-resistive materials applied to surfaces that are exposed to view when the Work is completed and that are identified as exposed on Drawings.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Structural framing plans indicating the following:
 - 1. Locations and types of surface preparations required before applying SFRM.
 - 2. Extent of SFRM for each construction and fire-resistance rating, including the following:
 - a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
- C. Samples for Initial Selection: For each type of colored, exposed SFRM indicated.
- D. Product Certificates: For each type of SFRM, signed by product manufacturer.
- E. Compatibility and Adhesion Test Reports: From SFRM manufacturer indicating the following:
 - 1. Materials have been tested for bond with substrates.
 - 2. Materials have been verified by SFRM manufacturer to be compatible with substrate primers and coatings.
 - 3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by SFRM manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its SFRM to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
- B. Source Limitations: Obtain SFRM through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide SFRM with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing SFRM with appropriate markings of applicable testing and inspecting agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" acceptable to authorities having jurisdiction, for SFRM serving as direct-applied protection tested per ASTM E 119.

2. Surface-Burning Characteristics: ASTM E 84.
- D. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1 "Polarized Light Microscopy".
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to SFRM including, but not limited to, the following:
 1. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, calculations, densities, thicknesses, bond strengths, and other performance requirements.

1.05 REVIEW AND FINALIZE CONSTRUCTION SCHEDULE AND VERIFY SEQUENCING AND COORDINATION REQUIREMENTS.

1. Review weather predictions, ambient conditions, and proposed temporary protections for SFRM during and after installation.
2. Review surface conditions and preparations.
3. Review field quality-control testing procedures.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
- B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
- C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply SFRM when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of SFRM. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

1.08 COORDINATION

- A. Sequence and coordinate application of SFRM with other related work specified in other Sections to comply with the following requirements:
 1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
 2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
 3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
 4. Do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
 5. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 6. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
 8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace SFRMs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of SFRM from substrates.
 - b. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.
2. Warranty Period: Two years from date of Substantial Completion.

PRODUCTS

2.01 CONCEALED SFRM

- A. Products: Subject to compliance with requirements, provide one of the following:
 1. Concealed Cementitious SFRM:
 - a. Carbolite Co., Fireproofing Products Div.; Pyrolite 15 High Yield.
 - b. Grace, W. R. & Co. - Conn., Construction Products Div.; Monokote Type MK-6.
 - c. Isolatek International Corp.; Cafco 300.
- B. Material Composition: Manufacturer's standard product, or either of the following:
 1. Concealed Cementitious SFRM: Factory-mixed, dry formulation of gypsum or portland cement binders, additives, and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
 2. Concealed Sprayed-Fiber Fire-Resistive Material: Factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 1. Thickness: Minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
 - a. Where the referenced fire-resistance design lists a thickness of 1 inch or more, the minimum allowable individual thickness of SFRM is the design thickness minus 0.25 inch.
 - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of SFRM is the greater of 0.375 inch or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft..
 2. Bond Strength: 150 lbf/sq. ft. minimum per ASTM E 736 based on laboratory testing of 0.75-inch minimum thickness of SFRM.
 3. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
 4. Deflection: No cracking, spalling, or delamination per ASTM E 759.
 5. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
 6. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - a. Flame-Spread Index: 10 or less.
 - b. Smoke-Developed Index: 0.
 7. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.02 AUXILIARY FIRE-RESISTIVE MATERIALS

- A. General: Provide auxiliary fire-resistive materials that are compatible with SFRM and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:
 1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory" for coating materials based on a series of bond tests per ASTM E 736.

2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of SFRM per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of SFRM.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive SFRM.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by manufacturer of SFRM.

EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:
 1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
 2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
 3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.
- B. Verify that concrete work on steel deck has been completed.
- C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work are completed.
- D. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.
- B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.
- C. Prime substrates where recommended in writing by SFRM manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive SFRM.

3.03 APPLICATION, GENERAL

- A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- B. Apply SFRM that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.
- C. Install metal lath and reinforcing fabric, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath and fabric to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by SFRM manufacturer. Attach accessories where indicated or required for secure attachment of lath and fabric to substrate.

- D. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by SFRM manufacturer for material and application indicated.
- E. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by SFRM manufacturer, install body of fire-resistive covering in a single course.
- F. Spray-apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by SFRM manufacturer.

3.04 APPLICATION, CONCEALED SFRM

- A. Apply concealed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 2 "Concealed SFRM" Article.
- B. Apply water overspray to concealed sprayed-fiber fire-resistive material as required to obtain designated fire-resistance rating.
- C. Cure concealed SFRM according to product manufacturer's written recommendations.

3.05 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspection and prepare reports on SFRM.

3.06 TESTING AGENCY: OWNER WILL ENGAGE A QUALIFIED TESTING AGENCY TO PERFORM TESTS AND INSPECTIONS AND PREPARE TEST REPORTS.

- 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Tests and Inspections: Testing and inspecting of completed applications of SFRM shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of SFRM for the next area until test results for previously completed applications of SFRM show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.
 - 1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. sample area, with sample width of not less than 6 inches per ASTM E 605.
 - 2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.
 - 3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 - 4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-sq. ft. area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.
 - a. Field test SFRM that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving SFRM are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. minimum per ASTM E 736.
- C. If testing finds applications of SFRM are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.
- D. Remove and replace applications of SFRM that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.

- E. Apply additional SFRM, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

3.07 CLEANING, PROTECTING, AND REPAIR

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect SFRM, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.
- C. Coordinate application of SFRM with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect SFRM and patch any damaged or removed areas.
- D. Repair or replace work that has not successfully protected steel.

END OF SECTION 078100

SECTION 078413 THROUGH-PENETRATION FIRESTOP SYSTEMS

GENERAL

1.01 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:
 - 1. Floors.
 - 2. Walls and partitions.
 - 3. Smoke barriers.

1.02 DEFINITIONS

- A. UL-classified through-penetration firestop systems are identified in UL's Fire Resistance Directory under product Category XHEZ by an alpha-alpha-numeric identification system, which is explained below:
 - 1. "C-AJ": Indicates penetrations through either floors or walls. Floor construction to be concrete with a minimum thickness less than or equal to 5-inches. Wall construction to be either concrete or masonry with a minimum thickness less than or equal to 8-inches.
 - 2. "W-L": Indicates penetrations through framed walls.

1.03 PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
 - 1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
 - 2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
 - 3. Fire-resistance-rated floor assemblies.
- B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
- C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
- D. Penetrations located outside wall cavities.
 - 1. Penetrations located outside fire-resistive shaft enclosures.
 - 2. Penetrations located in construction containing fire-protection-rated openings.
 - 3. Penetrating items larger than 4-inch- diameter nominal pipe or 16 sq. in. in overall cross-sectional area.
- E. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- F. For through-penetration firestop systems exposed to view, provide products with the following requirements as determined per ASTM E 84.:
 - 1. Flame-spread: less than 25
 - 2. Smoke-developed: less than 450,

1.04 SUBMITTALS

- A. Product Data: For each type of through-penetration firestop system product indicated.
 - 1. Indicate intended location for each product.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 - 2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
- E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. An experienced installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
 - 1) UL in "Fire Resistance Directory."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration

firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.08 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems

PRODUCTS

2.01 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application in the Through-Penetration Firestop System Schedule at the end of Part 3, that are produced by one of the following manufacturers:
 - 1. A/D Fire Protection Systems Inc.
 - 2. Hilti Construction Chemicals, Inc.
 - 3. Specified Technologies Inc.
 - 4. 3M Fire Protection Products.
 - 5. United States Gypsum Company.
 - 6. R. Grace & Co.

2.02 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - 2. Substrate primers.
 - 3. Collars.
 - 4. Steel sleeves.

2.03 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
- B. Coordinate all support items (hangers, clamps etc) that must be attached to the substrate for subsequent work are in place prior to installation of fireproofing materials
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.03 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

- A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
 - 1. The words: "Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Through-penetration firestop system manufacturer's name.
 - 6. Installer's name.

3.05 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of

Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

3.06 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

- A. Firestop Systems with No Penetrating Items: Comply with the following:
 - 1. Available UL-Classified Systems:
 - a. C-AJ-0001-0999.
 - b. W-L-0001-0999.
 - 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Mortar.
- B. Firestop Systems for Metallic Pipes, Conduit, or Tubing: Comply with the following:
 - 1. Available UL-Classified Systems:
 - a. C-AJ-1001-1999.
 - b. W-L-1001-1999.
 - 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Mortar.
- C. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing: Comply with the following:
 - 1. Available UL-Classified Systems:
 - a. C-AJ-2001-2999.
 - b. W-L-2001-2999.
 - 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Intumescent wrap strips.
 - e. Firestop device.
- D. Firestop Systems for Electrical Cables: Comply with the following:
 - 1. Available UL-Classified Systems:
 - 2. C-AJ-3001-3999.
 - a. W-L-3001-3999.
 - 3. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Silicone foam.
- E. Firestop Systems for Cable Trays: Comply with the following:
 - 1. Available UL-Classified Systems:
 - a. C-AJ-4001-4999.
 - b. W-L-4001-4999.
 - 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Intumescent putty.
 - 3. Silicone foam.
 - a. Pillows/bags.
- F. Firestop Systems for Insulated Pipes: Comply with the following:
 - 1. Available UL-Classified Systems:
 - a. C-AJ-5001-5999.
 - b. W-L-5001-5999.
 - 2. Type of Fill Materials: One or more of the following:

- a. Latex sealant.
 - b. Intumescent putty.
 - c. Silicone foam.
- G. Intumescent wrap strips.
- H. Firestop Systems for Miscellaneous Electrical Penetrants: Comply with the following:
- 1. Available UL-Classified Systems:
 - a. C-AJ-6001-6999.
 - b. W-L-6001-6999.
 - 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Intumescent putty.
 - c. Mortar.
- I. Firestop Systems for Miscellaneous Mechanical Penetrations: Comply with the following:
- 1. Available UL-Classified Systems:
 - a. C-AJ-7001-7999.
 - b. W-L-7001-7999.
 - 2. Type of Fill Materials: One or both of the following:
 - a. Latex sealant.
 - b. Mortar.
- J. Firestop Systems for Groupings of Penetrations: Comply with the following:
- 1. Available UL-Classified Systems:
 - a. C-AJ-8001-8999.
 - b. W-L-8001-8999.
 - 2. Type of Fill Materials: One or more of the following:
 - a. Latex sealant.
 - b. Mortar.
 - c. Intumescent wrap strips.
 - d. Firestop device.
 - e. Intumescent composite sheet.
- K. Smoke-stop Systems
- 1. For all non-rated partitions required to control smoke only provide the following:
 - a. Mineral wool
 - b. Fire and smoke stopping sealant

END OF SECTION 078413

SECTION 078446 FIRE-RESISTIVE JOINT SYSTEMS

GENERAL

1.01 SUMMARY

- A. This Section includes fire-resistive joint systems for the following:
 - 1. Joints in or between fire-resistance-rated constructions.
 - 2. Joints in smoke barriers.

1.02 PERFORMANCE REQUIREMENTS

- A. General: For joints in the following constructions, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed:
 - 1. Fire-resistance-rated load-bearing walls, including partitions.
 - 2. Fire-resistance-rated non-load-bearing walls, including partitions.
 - 3. Fire-resistance-rated floor assemblies.
- B. Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equaling or exceeding fire-resistance rating of constructions in which joints are located, as determined by UL 2079.
 - 1. Load-bearing capabilities as determined by evaluation during the time test.
- C. Fire Resistance of Perimeter Fire-Containment Systems: Integrity and insulation ratings indicated as determined by UBC Standard 26-9 and UL 2079.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed and relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
- C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.
- D. Qualification Data: For qualified Installer.
- E. Compatibility and Adhesion Test Reports: From fire-resistive joint system manufacturer indicating the following:
 - 1. Materials forming joint substrates have been tested for compatibility and adhesion with fill materials.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.
- G. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire-resistive joint systems for each kind of joint and construction condition indicated through one source from a single manufacturer.
- B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.
- C. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in "Performance Requirements" Article:
- D. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and

follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.

1. Fire-resistive joint systems are identical to those tested per UL 2079. Perimeter fire-containment systems are identical to those tested per both UBC Standard 26-9 and UL 2079. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint systems correspond to those indicated by referencing system designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.07 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 1. Basis-of-Design Products: The design for each fire-resistive joint system is based on products named in Part 2 articles. Subject to compliance with requirements, provide products by one of the following:
 - a. Fire-Resistive Joint Systems:
 - 1) A/D Fire Protection Systems Inc.
 - 2) Hilti, Inc.
 - 3) Specified Technologies Inc.
 - 4) 3M Fire Protection Products.
 - b. Perimeter Fire-Containment Systems:
 - 1) Specified Technologies Inc.
 - 2) Hilti, Inc.
 - 3) 3M Fire Protection Products

2.02 FIRE-RESISTIVE JOINT SYSTEMS, GENERAL

- A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- B. Accessories: Provide components of fire-resistive joint systems, including forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems

indicated.

2.03 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where UL-classified fire-resistive joint systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.
- B. Floor-to-Floor (Concrete to Concrete Floor), Fire-Resistive Joint System:
 - 1. FF-D -0005.
 - 2. Assembly Rating: 2 hours.
 - 3. Nominal Joint Width: 1-inch
 - 4. Movement Capabilities: Class II - 12.5 percent compression or extension.
- C. Floor-to-Wall (Concrete Floor to Masonry Wall), Fire-Resistive Joint System:
 - 1. FW-D -1005.
 - 2. Assembly Rating: 2 hours.
 - 3. Nominal Joint Width: 4-inches
 - 4. Movement Capabilities: 15 percent compression or extension.
- D. Head-of-Wall (Steel Stud/Gypsum Board Wall to Concrete Floor Slab with or without Metal Deck), Fire-Resistive Joint System:
 - 1. HW-D -0043.
 - 2. Assembly Rating: 2 hours.
 - 3. Nominal Joint Width: 1-inch
 - 4. Movement Capabilities: Class II - 18.75 percent compression and extension.
- E. Head-of-Wall (Masonry Wall to Concrete Floor Slab with or without Metal Deck), Fire-Resistive Joint System:
 - 1. HW-D -0041.
 - 2. Assembly Rating: 2 hours.
 - 3. Nominal Joint Width: 1-inch
 - 4. Movement Capabilities: Class II - 12.5 percent compression and extension.
- F. Wall-to-Wall (Masonry to Masonry Wall), Fire-Resistive Joint System:
 - 1. WW-D -0004.
 - 2. Assembly Rating: 2 hours.
 - 3. Nominal Joint Width: 1-inch
 - 4. Movement Capabilities: Class II - 12.5 percent compression or extension.
- G. Wall-to-Wall (Masonry to Masonry Wall), Fire-Resistive Joint System:
 - 1. WW-D -0001.
 - 2. Assembly Rating: 3 hours.
 - 3. Nominal Joint Width: 2-inches
 - 4. Movement Capabilities: 25 percent compression or extension.
- H. Wall-to-Wall (Masonry to Masonry Wall), Fire-Resistive Joint System (Limited to Fire Exposure On Interior Face Only):
 - 1. WW-S-0020.
 - 2. Assembly Rating: 2 hours.
 - 3. Nominal Joint Width: 2-inches maximum.

2.04 PERIMETER FIRE-CONTAINMENT SYSTEMS

- A. Where UL-classified perimeter fire-containment systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHDG.
- B. Perimeter Fire-Containment System (Steel Stud/Gypsum Board Wall to Concrete Floor Slab with or without Metal Deck), Fire-Resistive Joint System:
 - 1. Basis-of-Design UL-Classified Product: CW-S-1002.
 - 2. Integrity Rating: 2 hours.
 - 3. Insulation Rating: ¼-hour.
 - 4. Linear Opening Width: 2-1/2 inches, maximum.

EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.03 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 078446

SECTION 079200 JOINT SEALANTS

GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Non-staining silicone joint sealants.
 - 2. Mildew-resistant joint sealants.
 - 3. Latex joint sealants.
- B. Related Requirements:
 - 1. Section 079100 "Preformed Joint Seals" for preformed compressible foam and precured joint seals.
 - 2. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
 - 3. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.02 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
- D. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- E. Field-Adhesion-Test Reports: For each sealant application tested.
- F. Sample Warranties: For special warranties.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
 - 1. Sealant and Waterproofing Specialist: Engage an experienced sealant and waterproofing firm to perform work of this Section. Firm shall have completed work similar to extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing sealants is insufficient experience for this work.
 - a. Field Supervision: Sealant and waterproofing specialist firms shall maintain experienced full-time supervisors on Project site during times that sealant and waterproofing work is in progress.
 - 2. Provide a list of a minimum of 5 projects where sealant and waterproofing work was successfully installed
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
 - 2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

1.05 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.06 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PRODUCTS

2.01 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content: Sealants and sealant primers shall comply with the following:
 - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
 - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 - 3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.

2.02 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation.
 - 1) Product :786-M
 - 2. GE Construction Sealants; Momentive Performance Materials Inc.
 - a. Product :Sanitary SCS1700
 - 3. Tremco Incorporated.
 - a. Product :Tremsil 200

2.03 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Pecora Corporation.
 - 1) Product: AC-20s
 - b. Sherwin-Williams Company (The).
 - 1) Product: PowerHouse
 - c. Tremco Incorporated.
 - 1) Product: Tremflex 834

2.04 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - b. Construction Foam Products; a division of Nomaco, Inc.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.05 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Unglazed surfaces of ceramic tile.
 3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.04 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement[].
 - 1. Joint Locations:
 - a. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - b. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Acrylic latex.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.

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2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081416 FLUSH WOOD DOORS

1.01 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
 - 1. Section 088000 "Glazing" for glass view panels in flush wood doors.
 - 2. Section 134900 "Radiation Protection" for Lined Doors

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
- C. Fire-protection ratings for fire-rated doors.
- D. Samples for Initial Selection: For factory-finished doors.
- E. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.03 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.05 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
- B. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 1. Warranty Period for Solid-Core Interior Doors: Life of installation.

PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Marshfield Door Systems; Signature Series
 - 2. Graham Wood Doors; ASSA ABLOY Group company.

3. VT Industries Inc.
4. AD Systems - High performance doors.
5. ForBuild - Solid, DIRT Standard Thermofoil.

2.02 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
 1. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- C. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 5. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

2.03 PARTICLEBOARD-CORE DOORS:

1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
- B. Mineral-Core Doors:
 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: 400 lbf per WDMA T.M.-10.

2.04 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 1. Grade: Premium, with Grade A faces.
 2. Species: Select white birch.
 3. Cut: Plain sliced (flat sliced).
 4. Pair and Set Match: Provide for doors hung in same opening.
 5. Exposed Vertical and Top Edges: Same species as faces.
 6. Core: Particleboard or Structural composite lumber.
 7. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
 8. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.05 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: Manufacturer's standard shape.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.06 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.07 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 - 1. Grade: Premium.
 - 2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
 - 3. Sheen: Satin.

EXECUTION

3.01 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 ACCESS DOORS AND FRAMES

GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Wall access doors and frames.
 - 2. Fire-rated wall access doors and frames.

1.02 SUBMITTALS

- A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- B. Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. NFPA 252 for vertical access doors.

PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Access Doors:
 - 1. J. L. Industries, Inc.
 - 2. Karp Associates, Inc.
 - 3. Larsen's Manufacturing Company.
 - 4. Nystrom Building Products Co.

2.02 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, and surface defects; pickled and oiled; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.
- C. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.03 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

2.04 ACCESS DOORS AND FRAMES

- A. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
 - 1. Locations: Masonry Ceramic-tile wall surfaces.

2. Door: Minimum 0.060-inch- thick sheet metal, set flush with exposed face flange of frame.
 3. Frame: Minimum 0.060-inch- thick sheet metal with 1-1/4-inch- wide, surface-mounted trim.
 4. Hinges: Spring-loaded concealed pin type.
 5. Latch: Knurled-knob-operated cam latch.
 6. Lock: Key-operated cylinder lock.
- B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.
1. Locations: Gypsum board wall and ceiling surfaces.
 2. Door: Minimum 0.060-inch- thick sheet metal, set flush with surrounding finish surfaces.
 3. Frame: Minimum 0.060-inch- thick sheet metal with drywall bead.
 4. Hinges: Spring-loaded concealed pin type.
 5. Latch: Knurled-knob-operated cam latch.
 6. Lock: Key-operated cylinder lock.
- C. Fire Rated, Uninsulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
1. Locations: Wall surfaces in fire-rated construction.
 2. Fire-Resistance Rating: Not less than that of adjacent construction
 3. Door: Minimum 0.060-inch- thick sheet metal, flush construction.
 4. Frame: Minimum 0.060-inch- thick sheet metal with 1-inch- wide, surface-mounted trim.
 5. Hinges: Continuous piano.
 6. Automatic Closer: Spring type.
- D. Latch: Self-latching device operated by flush key with interior release.

2.05 FABRICATION

- A. General: Provide access door assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. For trimless frames with drywall bead for installation in gypsum board assembly, provide edge trim for gypsum board securely attached to perimeter of frames.
 2. Provide mounting holes in frames to attach frames to metal framing in plaster and drywall construction and to attach masonry anchors in masonry construction. Furnish adjustable metal masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
1. For cylinder lock, furnish two keys per lock and key all locks alike.

2.06 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.07 STEEL FINISHES

- A. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

- B. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

EXECUTION

3.01 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.02 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install access doors with trimless frames flush with adjacent finish surfaces or recessed to receive finish material.

3.03 ADJUSTING AND CLEANING

3.04 ADJUST DOORS AND HARDWARE AFTER INSTALLATION FOR PROPER OPERATION.

- A. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083100

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SECTION 088000 GLAZING

GENERAL

1.01 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Doors
 - 2. Specialty Glazing

1.02 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1.03 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.04 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass the following products; 12 inches square.
 - 1. Fire-resistive glazing products.
 - 2. Insulating glass.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-e coatings glass testing agency.
- B. Product Certificates: For glass and glazing products, from manufacturer.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulating glass glazing sealants and glazing gaskets.
- D. Warranties: Sample of special warranties.

1.06 QUALITY ASSURANCE

1.07 INSTALLER QUALIFICATIONS: A QUALIFIED INSTALLER WHO EMPLOYS GLASS INSTALLERS FOR THIS PROJECT WHO ARE CERTIFIED UNDER THE NATIONAL GLASS ASSOCIATION'S CERTIFIED GLASS INSTALLER PROGRAM.

- A. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Glazing Manual."
- C. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- D. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label

shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 WARRANTY

- A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.02 GLASS PRODUCTS

- A. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - 2. For uncoated glass, comply with requirements for Condition A.
 - 3. For coated vision glass, comply with requirements for Condition C (other coated glass).
- B. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.

2.03 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
- B. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch total nominal thickness; complying with testing requirements in 16 CFR 1201 for

Category II materials.

1. Products: Subject to compliance with requirements, provide the following:
 - a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus

2.04 SPECIALTY GLAZING

- A. Switchable Privacy Glass: Instant switchable privacy glass with a translucent, milky white, laminated panel. Panel becomes transparent with the application of an electrical current (65VAC) to an embedded layer of liquid crystal particles.
 1. Manufacturer Saint Gobain Building Glass Europe - PRIVA-LITE XL
 - a. Energy/Performance Data:
 - 1) Power Consumption = ~5w / sq meter (transparent)
 - b. Power Consumption = 0w / sq meter (translucent)
 - 1) Light Transmission = 77% - on / 50% - off
 2. Glazing:
 - a. Standard Thickness: 12 mm
 - b. Power Module: Provide PSU XL power supply - input 120VAC, output 65 VAC.

2.05 GLAZING SEALANTS

- A. General:
 1. Compatibility: As approved by glazing manufacturer. Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.06 GLAZING TAPES

- A. Provide products approved by glazing manufacturer.
- B. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- C. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.

2.07 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

- F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.08 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

EXECUTION

3.01 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.03 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

3.04 PROVIDE EDGE BLOCKING WHERE INDICATED OR NEEDED TO PREVENT GLASS LITES FROM MOVING SIDEWAYS IN GLAZING CHANNEL, AS RECOMMENDED IN WRITING BY GLASS MANUFACTURER AND ACCORDING TO REQUIREMENTS IN REFERENCED GLAZING PUBLICATIONS.

- A. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- B. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.05 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.06 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

3.07 CLEANING AND PROTECTION

- A. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

END OF SECTION 088000

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

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 014000 - Quality Requirements: Additional requirements relating to testing agencies and testing.
- B. Section 033000 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.
- C. Section 033000 - Cast-in-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.
- D. Section 033000 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

1.03 PRICE AND PAYMENT PROCEDURES

1.04 REFERENCE STANDARDS

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2020b.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 2020.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.
- E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

1.05 ADMINISTRATIVE REQUIREMENTS

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

1.06 SUBMITTALS

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:

1. Moisture and alkalinity (pH) limits and test methods.
2. Manufacturer's required bond/compatibility test procedure.
- C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 1. Manufacturer's qualification statement.
 2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
 4. Manufacturer's installation instructions.
 5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.
- D. Testing Agency's Report:
 1. Description of areas tested; include floor plans and photographs if helpful.
 2. Summary of conditions encountered.
 3. Moisture and alkalinity (pH) test reports.
 4. Copies of specified test methods.
 5. Recommendations for remediation of unsatisfactory surfaces.
 6. Submit report to Architect.
 7. Submit report not more than two business days after conclusion of testing.
- E. Adhesive Bond and Compatibility Test Report.
- F. Floor Moisture Testing Technician Certificate: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician- Grade I certificate.
- G. Copy of RFCI (RWP).

1.07 QUALITY ASSURANCE

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- D. Contractor's Responsibility Relating to Independent Agency Testing:
 1. Provide access for and cooperate with testing agency.
 2. Confirm date of start of testing at least 10 days prior to actual start.
 3. Allow at least 4 business days on site for testing agency activities.
 4. Achieve and maintain specified ambient conditions.
 5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- E. Floor Moisture Testing Technician Qualifications: International Concrete Repair Institute (ICRI) Concrete Slab Moisture Testing Technician Certification- Grade I.
- F. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.09 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - 1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
 - 3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
 - 4. Products:
 - a. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim Coat: www.tecspecialty.com/#sle.
 - b. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: www.usg.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
 - 1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
 - 2. Products:
 - a. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.
 - b. Custom Building Products; TechMVC Moisture Vapor and Alkalinity Barrier: www.custombuildingproducts.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
- D. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
 - 1. Thickness: 28 mil (0.028 inch).
 - 2. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.
 - 3. Products:
 - a. GCP Applied Technologies; Kovara MBX: www.gcpat.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Follow recommendations of testing agency.
- B. Perform following operations in the order indicated:
 - 1. Preliminary cleaning.
 - 2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
 - 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.

4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 5. Specified remediation, if required.
 6. Patching, smoothing, and leveling, as required.
 7. Other preparation specified.
 8. Adhesive bond and compatibility test.
 9. Protection.
- C. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

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

3.04 MOISTURE VAPOR EMISSION TESTING

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

3.05 INTERNAL RELATIVE HUMIDITY TESTING

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

F. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

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

3.07 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

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

3.09 APPLICATION OF REMEDIAL FLOOR COATING

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

3.10 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

- A. Install in accordance with sheet membrane manufacturer's instructions.

3.11 PROTECTION

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

END OF SECTION

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**SECTION 092116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acoustic insulation.
- B. Cementitious backing board.
- C. Gypsum wallboard.
- D. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 078400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- C. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- D. Section 092216 - Non-Structural Metal Framing.
- E. Section 093000 - Tiling.

1.03 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.
- C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2020.
- E. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2019.
- F. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- G. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2019.
- H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
- I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.
- J. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

- A. Product Data: Provide data on gypsum board, accessories, and joint finishing system.
- B. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- C. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

1. See PART 3 for finishing requirements.
- B. Fire-Resistance-Rated Assemblies: Provide completed assemblies as indicated
 1. Fire-Resistance-Rated Partitions: UL listed assembly No. As noted on drawings.
 2. Head of Fire-Resistance-Rated Partitions: UL listed assembly No. As noted on drawings..
 3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 1. National Gypsum Company: www.nationalgypsum.com/#sle.
 2. USG Corporation: www.usg.com/#sle.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - a. Mold resistant board is required at all locations.
 3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 4. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
 5. Mold Resistant Paper Faced Products:
 - a. National Gypsum Company; Gold Bond XP Gypsum Board: www.nationalgypsum.com/#sle.
- C. Backing Board For Wet Areas: One of the following products:
 1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
 2. Application: Horizontal surfaces behind tile in wet areas including countertops and sinks and toilets and floors.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 4. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch.
 - b. Products:
 - 1) National Gypsum Company; PermaBase Cement Board: www.nationalgypsum.com/#sle.
 5. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
 - a. Thickness: 1/2 inch.
 - b. Products:
 - 1) James Hardie Building Products, Inc: www.jameshardie.com/#sle.

2.03 GYPSUM WALLBOARD ACCESSORIES

- A. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 1. Types: As detailed or required for finished appearance.
 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead and LC-bead at exposed panel edges.
 3. Products:
 - a. Same manufacturer as framing materials.
- B. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 1. Corner Beads: Low profile, for 90 degree outside corners.
 - a. Products:
 - 1) ClarkDietrich; Strait-Flex Big-Stick: www.clarkdietrich.com/#sle.

2. Corner Beads: Low profile, for archways.
 - a. Products:
 - 1) ClarkDietrich; Strait-Flex Arch-Stick: www.clarkdietrich.com/#sle.
3. Splayed Corner Beads with Paper Face: degree outside corner.
4. Bullnose Corner Beads with Paper Face:
 - a. Products:
 - 1) Phillips Manufacturing Co; Everlast Bullnose Corner Bead: www.phillipsmfg.com/#sle.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
 2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 3. Products:
 - a. Continental Building Products; www.continental-bp.com/#sle.
 4. Joint Compound: Drying type, vinyl-based, ready-mixed.
 - a. Products:
 - 1) CertainTeed Corporation; Extreme All-Purpose Joint Compound: www.certainteed.com/#sle.
- D. Finishing Compound: Surface coat and primer, takes the place of skim coating.
 1. Products:
 - a. CertainTeed Corporation; Quick Prep Plus Interior Prep Coat: www.certainteed.com/#sle.
- E. Glass-Fiber-Reinforced Gypsum Access Panels: Wall- and ceiling-mounted; natural white color, smooth finish, square corners.
 1. Material: Glass-fiber-reinforced gypsum cement.
 2. Exposed fasteners: Stainless steel.
 3. Class A flame spread rating in accordance with ASTM E84.
 4. Comply with ASTM E1264 for acoustical ceiling use.
 5. Products:
 - a. Castle Access Panels & Forms Inc; Hinged Access Panel: www.castleaccesspanels.com/#sle.
- F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- H. Adhesive for Attachment to Wood, ASTM C557 and Metal:
 1. Products:
 - a. Franklin International, Inc; Titebond PROvantage Professional Drywall Adhesive: www.titebond.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
 1. Level ceiling system to a tolerance of 1/1200.
 2. Laterally brace entire suspension system.
 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs as indicated at 16 inches on center.
 1. Extend partition framing to structure in all locations.
 2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified

mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
 - 1. Orientation: Horizontal.
 - 2. Spacing: At 12 inches on center.
- F. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated.
- G. Blocking: Install wood blocking for support of:
 - 1. Framed openings.
 - 2. Wall-mounted cabinets.
 - 3. Plumbing fixtures.
 - 4. Toilet partitions.
 - 5. Toilet accessories.
 - 6. Wall-mounted door hardware.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- F. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- G. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

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

3.05 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 3: Walls to receive textured wall finish.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
 - 6. Level 0: Temporary partitions.

- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 - 2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 - 3. Taping, filling, and sanding are not required at base layer of double-layer applications.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.06 TOLERANCES

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

3.07 FIRE AND SMOKE BARRIER IDENTIFICATION

- A. Mark wall above ceiling every 8 feet maximum, once per wall section minimum, with its fire and/or smokebarrier designation
 - 1. Designations to be marked clearly using die-cut mylar stencils.
 - 2. Characters to be 4" minimum in height of a legible font type.
 - 3. Character to be marked with bright red spray paint.
 - a. Character Designations:
 - 1) One hour fire barrier
(a) 1FB
 - 2) Two hour fire barrier
(a) 2FB
 - 3) One hour smoke barrier
(a) 1SB
 - 4) One hour fire/smoke barrier
(a) 1FSB
 - 5) Two hour fire/smoke barrier
(a) 2FSB
 - 6) Smoke Tight Partitions
(a) ST

END OF SECTION

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**SECTION 092216
NON-STRUCTURAL METAL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal partition, ceiling, and soffit framing.
- B. Framing accessories.

1.02 RELATED REQUIREMENTS

- A. Section 055000 - Metal Fabrications: Metal fabrications attached to stud framing.
- B. Section 061000 - Rough Carpentry: Wall sheathing.
- C. Section 078400 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.
- D. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board.
- E. Section 083100 - Access Doors and Panels.
- F. Section 092116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2018).
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.
- D. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. Indicate component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
 - 2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.
- B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.
- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- D. SSMA Manufacturer Qualification: Submit documentation of manufacturer association membership.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Sustainable Design Submittal: Documentation of recycled content and location of manufacture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories:
 - 1. CEMCO; []: www.cemcosteel.com/#sle.
 - 2. ClarkDietrich; []: www.clarkdietrich.com/#sle.
 - 3. Marino; []: www.marinoware.com/#sle.

2.02 FRAMING MATERIALS

- A. Fire-Resistance-Rated Assemblies: Comply with applicable code and as indicated on Drawings.
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
 - 1. Studs: C shaped with knurled or embossed faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Ceiling Channels: C shaped.
 - 4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
 - 5. Resilient Furring Channels: Single leg configuration.
 - a. Products:
 - 1) ClarkDietrich; RC Deluxe Resilient Channel: www.clarkdietrich.com/#sle.
- C. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and screwed to secondary deflection channel set inside but unattached to top track.
- D. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
 - 1. Products:
 - a. ClarkDietrich; BlazeFrame Firestop Deflection Track: www.clarkdietrich.com/#sle.
- E. Non-Loadbearing Framing Accessories:
 - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 - 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
 - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
 - b. Products:
 - 1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.
 - 3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
 - a. Products:
 - 1) ClarkDietrich; FastBridge Clip (FB33): www.clarkdietrich.com/#sle.
 - 4. Sheet Metal Backing: 0.036 inch thick, galvanized.
 - 5. Fasteners: ASTM C1002 self-piercing tapping screws.
 - 6. Anchorage Devices: Powder actuated.
 - 7. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

- A. Comply with requirements of ASTM C754.
- B. Extend partition framing to structure in all locations.
- C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- D. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- E. Align and secure top and bottom runners at 24 inches on center.
- F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- G. Install studs vertically at 16 inches on center.

- H. Align stud web openings horizontally.
- I. Secure studs to tracks using fastener method. Do not weld.
- J. Stud splicing is not permissible.
- K. Fabricate corners using a minimum of three studs.
- L. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.
- M. Brace stud framing system rigid.
- N. Coordinate erection of studs with requirements of door frames; install supports and attachments.
- O. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- P. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.
- Q. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.
- R. Use sheet metal backing for reinforcement of as indicated on drawings.

3.03 CEILING AND SOFFIT FRAMING

- A. Comply with requirements of ASTM C754.
- B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- C. Install furring independent of walls, columns, and above-ceiling work.
- D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated.
- E. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.
- H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
- I. Laterally brace suspension system.

3.04 TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch in 10 feet.
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

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SECTION 093000 TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Stone thresholds.
- E. Ceramic accessories.
- F. Ceramic trim.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
- C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
- D. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement 1999 (Reaffirmed 2016).
- E. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.
- F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive 2009 (Revised).
- G. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- H. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy 1999 (Reaffirmed 2010).
- I. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2010).
- J. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2010).
- K. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.
- L. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- M. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- N. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2016).

- O. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2017.
- P. ANSI A118.1 - American National Standard Specifications for Dry-Set Cement Mortar 2012 (Revised).
- Q. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2013 (Revised).
- R. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).
- S. ANSI A118.5 - American National Standard Specifications for Chemical Resistant Furan Mortars and Grouts for Tile Installation 1999 (Reaffirmed 2016).
- T. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).
- U. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).
- V. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).
- W. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.
- X. ANSI A118.11 - American National Standard Specifications for EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2010).
- Y. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.
- Z. ANSI A118.13 - American National Standard Specifications for Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation 2014.
- AA. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2012.
- BB. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile 2008 (Reaffirmed 2013).
- CC. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2019.
- DD. ANSI A137.2 - American National Standard Specifications for Glass Tile 2013.
- EE. ANSI A137.3 - American National Standard Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs 2017.
- FF. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.
- GG. ASTM C150/C150M - Standard Specification for Portland Cement 2020.
- HH. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018.
- II. ASTM C847 - Standard Specification for Metal Lath 2018.
- JJ. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- KK. ASTM D4068 - Standard Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane 2017.
- LL. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine 2009, with Editorial Revision (2016).
- MM. ASTM E2179 - Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors 2003 (Reapproved 2016).

- NN. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2019, with Editorial Revision (2020).
- OO. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.
- PP. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- QQ. ICC-ES AC308 - Acceptance Criteria for Termite Physical Barrier Systems 2014, with Editorial Revision (2017).
- RR. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Samples: Full-size samples of each type of trim and accessory for each color and finish required.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.
- G. Installer's Qualification Statement:
 - 1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
 - 2. Submit documentation of completion of apprenticeship and certification programs.
 - 3. Submit documentation of Natural Stone Institute Accreditation.
- H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 5 percent of each size, color, and surface finish combination, but not less than 5 of each type.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of the ANSI A108/A118/A136 and the current TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications:
 - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.
 - a. Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).

1.07 MOCK-UP

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
 - 1. Minimum size of mock-up is indicated on drawings.

1.08 DELIVERY, STORAGE, AND HANDLING

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

1.09 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

- A. Refer to Interior Drawings for Manufacturer, Product and Color..
- B. Substitutions: See Section 016000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

- A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.
- B. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
 - 1. Applications:
 - a. Open Edges: Bullnose.
 - b. Inside Corners: Jointed.
 - c. Floor to Wall Joints: Cove base.
 - 2. Manufacturers: Same as for tile.
- C. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
 - 1. Thickness: 1/2 inch.
 - 2. Material: Marble, honed finish.
 - 3. Material: Solid surface acrylic resin, mineral filler, and pigments; non-porous, color and pattern consistent throughout thickness.
 - 4. Material: Artificial stone tile; 93 percent quartz aggregate, resin, color pigments.
 - 5. Color and Pattern: As indicated on drawings.
 - 6. Applications: As indicated on Interior Drawings.

2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 - 1. Custom Building Products; www.custombuildingproducts.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- C. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
 - 1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
 - 2. Products:
 - a. Custom Building ProductsPro Lite Premium Large Format Tile Mortarwww.custombuildingproducts.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- D. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
 - 1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
 - 2. Products:
 - a. Custom Building Products; MegaLite Ultimate Crack Prevention Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- E. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.
 - 1. Products:

- a. Custom Building Products: Thick Bed Mortar.
- b. Substitutions: See Section 016000 - Product Requirements.

2.04 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 1. Custom Building Products; www.custombuildingproducts.com/#sle.
 2. Substitutions: See Section 016000 - Product Requirements.
- C. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 3. Color(s): As selected by Architect from manufacturer's full line.
 4. Products:
 - a. Custom Building Products; Prism Color Consistent Grout: www.custombuildingproducts.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
 1. Applications: Between tile and plumbing fixtures.
 2. Color(s): As selected by Architect from manufacturer's full line.
 3. Products:
 - a. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.06 ACCESSORY MATERIALS

- A. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
 1. Products:
 - a. Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
 3. Follow moisture and alkalinity remediation procedures in Section 090561.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.

- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and current TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Install thresholds where indicated.
- I. Sound tile after setting. Replace hollow sounding units.
- J. Keep control and expansion joints free of mortar, grout, and adhesive.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- N. Install movement joints in accordance with TCNA (HB) Method EJ171F.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
 - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
 - 3. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.
 - 4. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F115.

3.05 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- B. Install movement joints in accordance with TCNA (HB) Method EJ171F.

3.06 CLEANING

- A. Clean tile and grout surfaces.

3.07 PROTECTION

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

END OF SECTION

SECTION 095100 ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 083100 - Access Doors and Panels: Access panels.
- C. Section 092116 - Gypsum Board Assemblies: Gypsum board
- D. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.
- E. Section 233700 - Air Outlets and Inlets: Air diffusion devices in ceiling.
- F. Section 265100 - Interior Lighting: Light fixtures in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.
- C. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.
- D. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- F. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.
- G. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2019.
- H. ASTM E1414/E1414M - Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum 2021.
- I. ISO 14644-1 - Cleanrooms and associated controlled environments - Part 1: Classification of air cleanliness by particle concentration 2015.
- J. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

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

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Evaluation Service Reports: Show compliance with specified requirements.
- E. Samples: Submit two samples 6 x 6 inch in size illustrating material and finish of acoustical units.
- F. Samples: Submit one sample each, 8 inches long, of suspension system main runner, cross runner, and perimeter molding.
- G. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system through one source from a single manufacturer.
- B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.07 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

- A. Refer to Interior Drawings for Manufacturer, Product and Color.
- B. Acoustical Units - General: ASTM E1264, Class A.
 - 1. VOC Content: As specified in Section 016116.
 - 2. VOC Content: Certified as Low Emission by one of the following:
 - a. Product listing in UL (GGG).
- C. Acoustical Tiles: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type III.
 - a. Form: 2, water felted.
 - b. Pattern: "C" - perforated, small holes; and "E" - lightly textured..
 - 2. Size: 24 by 24 inches.
 - 3. Thickness: 7/8 inches.
 - 4. Light Reflectance: .86 percent, determined in accordance with ASTM E1264.
 - 5. NRC Range: .75, determined in accordance with ASTM E1264.
 - 6. Articulation Class (AC): 170, determined in accordance with ASTM E1264.
 - 7. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 - 8. Panel Edge: Square.
 - 9. Tile Edge: Square.
 - 10. Color: White.
 - 11. Suspension System Type 15/16": Exposed grid.
 - 12. Suspension System: Concealed.
- D. Acoustical Panels: Mineral fiber with membrane-faced overlay, with the following characteristics:
 - 1. Application(s): Clean room.
 - 2. Classification: ASTM E1264 Type IV.
 - a. Form: 2, water felted.
 - b. Pattern: "G" - smooth.
 - 3. Size: 24 by 24 inches.
 - 4. Thickness: 3/4 inch.
 - 5. Light Reflectance: .79 percent, determined in accordance with ASTM E1264.
 - 6. NRC Range: .55, determined in accordance with ASTM E1264.
 - 7. Articulation Class (AC): determined in accordance with ASTM E1264.
 - 8. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 - 9. Clean Room Classification: ISO 14644-1, Class 5.
 - 10. Panel Edge: Square.
 - 11. Color: White.
 - 12. Suspension System Type 15/16": Exposed grid.

2.02 SUSPENSION SYSTEM(S)

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

and splices as required.

1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
 1. Application(s): As indicated on drawings
 2. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
 3. Profile: Tee; 15/16 inch face width.
 4. Finish: Baked enamel.
 5. Color: White.

2.03 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
 1. Size: As required for installation conditions.
 2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
 3. Shadow Molding: Shaped to create a perimeter reveal.
 4. Channel Molding: U-shaped, for hold-down type installations.
 5. Gaskets For Perimeter Moldings: Closed-cell foam, factory-applied to molding.
 6. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
- E. Gypsum Board: Fire rated type; 5/8 inch thick, ends and edges square, paper faced.
- F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.
- C. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Locate system on room axis according to reflected plan.
- E. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 1. Install with continuous gasket.
 2. Use longest practical lengths.
 3. Miter corners.
- F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.
- K. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.
- L. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units per reflected ceiling plans.
- D. Fit border trim neatly against abutting surfaces.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
 - 3. Double cut and field paint exposed reveal edges.
- G. Where round obstructions occur, provide preformed closures to match perimeter molding.
- H. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.
- I. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.
- J. Install hold-down clips on panels within 20 ft of an exterior door.

3.05 TOLERANCES

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

END OF SECTION

SECTION 096500 RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- C. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- D. Section 090561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- B. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring 2006 (Reapproved 2018).
- C. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading 2017.
- D. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).
- E. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing 2004 (Reapproved 2014).
- F. ASTM F1344 - Standard Specification for Rubber Floor Tile 2015.
- G. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2020.
- H. ASTM F1859 - Standard Specification for Rubber Sheet Floor Covering Without Backing 2014, with Editorial Revision (2016).
- I. ASTM F1861 - Standard Specification for Resilient Wall Base 2016.
- J. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing 2019.
- K. ASTM F2169 - Standard Specification for Resilient Stair Treads 2015 (Reapproved 2020).
- L. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.
- M. NSF 332 - Sustainability Assessment for Resilient Floor Coverings 2015.
- N. UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance From Various Sources Using Static Environmental Chambers Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Verification Samples: Submit one samples, 6 by 6 inch in size illustrating color and pattern for each resilient flooring product specified.

- E. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.
- F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: Quantity equivalent to 5 percent of each type and color.
 - 3. Extra Wall Base: Quantity equivalent to 5 percent of each type and color.
 - 4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 SHEET FLOORING

- A. Refer to Interior Drawings for Manufacturer, Product and Color.
- B. Vinyl Sheet Flooring: Homogeneous without backing, with color and pattern throughout full thickness.
 - a. Minimum Requirements: Comply with ASTM F1913.
 - b. VOC Content Limits: As specified in Section 016116.
 - c. Thickness: 0.080 inch nominal.
 - d. Sheet Width: 72 inch minimum.
 - e. Static Load Resistance: 250 psi minimum, when tested as specified in ASTM F970.
 - f. Seams: Heat welded.
 - g. Integral coved base with cap strip.
 - h. Pattern: as indicated on drawings.
 - i. Color: As indicated on drawings.
- C. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

2.02 TILE FLOORING

- A. Refer to Interior Drawings for Manufacturer, Product and Color.
- B. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
 - 1. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
 - 2. Size: As indicated on Interior Drawings
 - 3. VOC Content Limits: As specified in Section 016116.
 - 4. Thickness: 0.125 inch.
 - 5. Pattern: as indicated on drawings.
 - 6. Color: As indicated on drawings.

2.03 RESILIENT BASE

- A. Refer to Interior Drawings for Manufacturer, Product, and Color.
- B. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
 - 1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 2. Height: 4 inch.
 - 3. Thickness: 0.125 inch.
 - 4. Finish: Satin.
 - 5. Length: Roll.
 - 6. Color: As indicated on drawings.
 - 7. Accessories: Premolded external corners and internal corners.

2.04 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
 - 1. VOC Content Limits: As specified in Section 016116.
- C. Adhesive for Vinyl Flooring: As recommended by manufacturer, or as follows:
 - 1. Tarkett 926 Adhesive - to be used with tarkett products.
 - 2. Toli International - CBC 5001 High Performance Adhesive - to be used with Toli products.
- D. Moldings, Transition and Edge Strips: As indicated on Interior Drawings.
- E. Filler for Coved Base: Plastic.
- F. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test in accordance with Section 090561.
 - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
 - 3. Follow moisture and alkalinity remediation procedures in Section 090561.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates for installation of flooring in accordance with Section 090561.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.

- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.
 - 2. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 260526 for grounding and bonding to building grounding system.
 - 3. Fit joints and butt seams tightly.
 - 4. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
 - 2. Resilient Strips: Attach to substrate using adhesive.
- F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- G. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 INSTALLATION - SHEET FLOORING

- A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.
- B. Cut sheet at seams in accordance with manufacturer's instructions.
- C. Seal seams by heat welding where indicated.
- D. No "Sharpie" type indelible or permanent type markers are to be used for marking of floor surfaces for layout or installation of resilient sheet flooring.
- E. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

3.05 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.
- D. Install loose-laid tile, fit interlocking edges tightly.
- E. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.06 INSTALLATION - RESILIENT BASE

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

3.07 CLEANING

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

3.08 PROTECTION

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

- B. Install Ram Board with Vapor Cure Seam Tape for protection after installation

END OF SECTION

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SECTION 099123 INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Prime surfaces to receive wall coverings.
 - 3. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
 - c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 - d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 055100 - Metal Stairs: Shop-primed items.
- C. Section 099300 - Staining and Transparent Finishing: Wood substrates.
- D. Section 099600 - High-Performance Coatings.

1.03 DEFINITIONS

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

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.
- C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).
- D. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application 2018.
- E. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- F. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- G. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

- H. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1 2016.
- I. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2 2015.
- J. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- K. SSPC-SP 2 - Hand Tool Cleaning 2018.
- L. SSPC-SP 3 - Power Tool Cleaning 2018.
- M. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- N. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum [] years experience and approved by manufacturer.

1.07 MOCK-UP

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 4 feet long by 4 feet wide, illustrating paint color, texture, and finish.
- C. Locate where directed by Architect.
- D. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 50 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Base Manufacturer: Refer to Interior Finish Schedule on Drawings for Manufacturer, Product, and Color.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 016116.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: Refer to Interior Finish Schedule on Drawings for Manufacturer, Product, and Color.
 - 1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, uncoated steel, shop primed steel, and acoustical ceilings.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
 - a. Products:
 - 3. Top Coat Sheen:
 - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
 - b. Eggshell: MPI gloss level 3; use this sheen at MRI & CT walls.
 - c. Semi-Gloss: MPI gloss level 5; use this sheen at walls, trim and door frames.
 - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
 - 1. Medium duty applications include door frames.
 - 2. Two top coats and one coat primer.
 - 3. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.

- a. Products:
- 4. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 ACCESSORY MATERIALS

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

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.02 APPLICATION

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

END OF SECTION

**SECTION 102123
CUBICLE CURTAINS AND TRACK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface mounted overhead curtain track and guides.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Blocking and supports for track.
- B. Section 095100 - Acoustical Ceilings: Suspended ceiling system to support track.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2019.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for curtain fabric characteristics.
- C. Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.
- D. Samples: Submit one fabric samples, 8 by 8 inch in size illustrating fabric color.
- E. Samples: Snap Cubicle curtain: Provide an actual 3' wide x 84" long snap curtain system which accurately represents the mesh, snap tape, and inventory labeling system that will be implemented.
- F. Samples: Submit 12 inch sample length of curtain track including typical splice, wall and ceiling hanger, and escutcheon.
- G. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention .
- H. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.
- I. Maintenance Data: Include methods for maintaining and servicing track system.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Curtains: 10% of each type and size.
 - 3. Extra Carriers: Ten.

1.05 MOCK-UP

- A. Provide a single mock-up of the specified SnapCubicle curtain and track for evaluation of mounting, appearance and desired privacy goals.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept curtain materials on site and inspect for damage.
- B. Store curtain materials on site and deliver to Owner for installation when requested.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cubicle Track :
 - 1. A. R. Nelson Co; []: www.arnelson.com/#sle.
 - 2. Construction Specialties, Inc; Track Systems: www.c-sgroup.com/#sle.
 - 3. Imperial Fastener Co., Inc; []: www.imperialfastener.com/#sle.
 - 4. Inpro; Clickeze: www.inprocorp.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.

- B. Cubicle Curtain :
 - 1. SnapCubicle curtain by Drapery Industries, Inc. Rochester, NY 14610 Toll Free: (844-737-2533) www.draperyindustries.com
 - 2. Construction Specialties, Inc; Track Systems: www.c-sgroup.com/#sle.
 - 3. Imperial Fastener Co., Inc; []: www.imperialfastener.com/#sle.
 - 4. Inpro; []: www.inprocorp.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.02 TRACKS AND TRACK COMPONENTS

- A. Tracks: Extruded aluminum sections; one piece per track run.
 - 1. Profile: Channel.
 - 2. Mounting: Surface.
 - 3. Structural Performance: Capable of supporting vertical test load of 50 lbs without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
 - 4. Track End Stop: To fit track section.
 - 5. Track Bends: Minimum 12 inch radius; fabricated without deformation of track section or impeding movement of carriers.
 - 6. Finish on Exposed Surfaces: White enamel.
 - 7. Products:
 - a. C/S General Cubicle # 6062 Traditional Track Series
 - b. InPro; Clickeze - Formatrac Bendable Cubicle Track
 - c. Substitutions: See Section 016000 - Product Requirements.
- B. Curtain Carriers: Nylon rollers, size and type compatible with track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal.
 - 1. Provide a single carrier for each corresponding curtain grommet.
 - 2. Finish to match track.
- C. Wand: SafeGrip by Drapery Industries; featuring EPA registered CuVerro Bactericidal Copper Surfaces.
- D. Installation Accessories: Types required for specified mounting method and substrate conditions. Finish to match track.

2.03 CURTAINS

- A. Cubicle Curtains:
 - 1. The SnapCubicle two-part curtain system consists of a mesh header and a standard length fabric panel that snap together. The finished curtain shall hang from track system to 12"-15"" above finished floor. (AFF)
 - 2. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
 - 3. Material: Close weave polyester; anti-bacterial, self deodorizing, sanitized, and preshrunk.
 - 4. Color/Pattern: As indicated on Interior Drawings.
 - 5. Open Mesh Cloth: Open weave to permit air circulation; flameproof material, white color.
 - 6. Attachment of Curtain Fabric to Open Mesh Cloth: Snap fasteners.
 - 7. Curtain Tieback: fabric tieback at each curtain termination. Provide 2 per curtain.
- B. Curtain Fabrication:
 - 1. Width of curtain to be 15 percent wider than track length.
 - 2. Length of curtain to end 15 inches above finished floor.
 - 3. Railroad fabric without vertical seams.
 - 4. Pattern match fabric with vertical seams.
 - 5. Top hem to have 1" polyester snap tape that is joined on to a triple layer of folded fabric with a double straight stitch spaced at 5/8". The polyester snap tape shall be the male snap that is inserted 4-1/4" on center.
 - 6. The side and bottom hems shall be 1" wide and a triple layer of fabric.
 - 7. The finished dimensions of the fabric panel shall equal the width of the mating mesh header x 66" in height.
 - 8. Include open mesh cloth at top of curtain for room air circulation, attached to curtain as specified above and below.

- a. The finished dimensions of the mesh heading shall be 20-36" in height (depending on ceiling height) X 15% greater than the track in width, unless otherwise specified.
 - b. Mesh material shall be inherently flame retardant (IFR) and pass NFPA-701. The mesh shall have 1/2" aperture throughout the body of the curtain and have tightly woven top and bottom edges to allow the mesh to be securely joined (sewn) to the nylon webbing and polyester snap tapes. The color shall be white, unless otherwise stated.
 - c. Side hems to have 1" nylon webbing that is flat rolled into three layers of mesh and double straight stitched with 5/8" spacing.
 - d. Top hem to have 1-1/2" nylon webbing that is flat rolled and joined onto a double layer of the tightly woven mesh edge with a double straight stitch spaced at 5/8". Insert # 1 nickel plated brass grommets at both corners and every six inches on center.
 - e. Bottom hem to have 1-1/2" nylon webbing that is flat rolled and joined onto a double layer of the tightly woven mesh edge with a double straight stitch spaced at 5/8". The polyester snap tape shall be the female snap that is inserted 4-1/4" on center.
9. Seams and Hems: Manufacturer's standard fabrication method for securely sewn and finished seams and hems.
 10. There shall be identification labels on both the mesh and the curtain (that correspond to each other) that are sewn into the corner of each, that correctly identifies the size, room location, and flame retardant properties. The label shall be made from thermal transfer tape and be designed to withstand multiple washing and drying cycles at high temperatures. All labeling shall be done with a thermal printing machine (no hand writing or permanent ink markers allowed)

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.
- B. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION

- A. Install curtain track to be secure, rigid, and true to ceiling line.
- B. See Section 061000 for track supports above ceiling.
- C. Secure track to ceiling system.
- D. Install end cap and stop device.
- E. Install curtains on carriers ensuring smooth operation.
- F. Coordinate location of tie-back installation with Owner.

3.03 SCHEDULES

- A. See Drawings.

END OF SECTION

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**SECTION 102600
WALL AND DOOR PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Protective corridor handrails.
- B. Corner guards.
- C. Protective wall covering.
- D. Door and frame protection.

1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Blocking for wall and corner guard anchors.
- B. Section 092116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.
- C. Section 092216 - Non-Structural Metal Framing: Placement of supports in stud wall construction.
- D. Section 097200 - Wall Coverings: Terminating wall covering at wall and door protection.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2010 (Reapproved 2018).
- C. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents 2020.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.
- F. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit one sections of corner guards, protective corridor handrails, and crash rails, 12 inches long.
 - 2. Submit one samples of protective wall covering and door surface protection, 6 by 6 inches square.
 - 3. Submit one full-size samples of door edge protectors.
- E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Stock Materials: One package(s) of minimum 24 inches long unit of each kind of covers for corner guards, bumper rails, and protective corridor handrails.
 - 3. Extra Stock Materials: 50 square feet of each kind of protective wall covering and door surface protection.

- H. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

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

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.
- C. Provide five year manufacturer and installer warranty for metal crash rails.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, internal connection failures, and/or detachment of rail system from substrates.
 - b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Protective Wall Covering.
- B. Protective Wall Covering:
 - 1. Construction Specialties, Inc; Acrovyn High-Impact Wall Covering: www.c-sgroup.com/#sle.
- C. Plastic Door, Frame, and Knob/Lever Protection:
 - 1. Construction Specialties, Inc; Acrovyn Door Cladding: www.c-sgroup.com/#sle.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

- A. Refer to Interior Drawings for Manufacturer, Product and Color.
- B. Protective Corridor Handrails: Factory- or shop-fabricated, with preformed end caps and internal and external corners:
 - 1. Comply with accessibility requirements of ICC A117.1 and ADA Standards.
 - 2. Performance of Installed Assembly:
 - a. Support vertical live load of 100 lb/lineal ft with deflection not to exceed 1/50 of span between supports.
 - b. Resist lateral force of 250 lbs at any point without damage or permanent set.
 - 3. Material: As indicated on Interior Drawings
 - 4. Mounting: Surface.
- C. Corner Guards - Surface Mounted:
 - 1. Material: High impact vinyl with full height extruded aluminum retainer.

2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
 - a. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- D. Protective Wall Covering:
 1. Material: High-impact acrylic-modified vinyl.
 2. Thickness: 0.040 inch, or as indicated on Interior Drawings.
 3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 4. Mounting: Adhesive.
- E. Doorway Protection:
 1. Frames Protection: Formed to fit frame profile.
 - a. Material: High-impact acrylic-modified vinyl.
 - b. Profile: One-piece.
 - c. Configuration: For flush frames.
 - d. Thickness: 0.040 inch.
 - e. Length at Hanging Jamb: 48 inches.
 - f. Length at Latching Jamb: 48 inches.
 - g. Color: As selected from manufacturer's standard colors.
 - h. Mounting: Adhesive.
- F. Adhesives and Primers: As recommended by manufacturer.
- G. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.
- H. See Section 061000 for wood blocking for wall and corner guard anchors.

2.04 FABRICATION

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

2.05 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.
 1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.
- D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Install wall protection at heights indicated on Interior Drawings.
- C. Position top of corridor hand rail 36 inches from finished floor.
- D. Terminate rails 1 inch short of door openings and intersecting walls.
- E. Where wood grain handrails or crash rails are specified, install optional black reveal when provided by manufacturer.

- F. Coordinate installation of vinyl fabric wall covering specified in Section 097200 with corner guard retainer and cover.
- G. Position protective wall covering no less than 1 inch above finished floor to allow for floor level variation.
 - 1. Full-Height Installation: Establish a plumb line located at edge of starting point of first sheet to ensure following sheets will be installed plumb.
 - 2. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
 - 3. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
 - 4. Do not install top and edge moldings, corners, and divider bars by manufacturer. Caulk all joints and edges per wall protection details on Interior Drawings.
 - 5. Use a roller to ensure maximum contact with adhesive.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

- A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

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

GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Healthcare accessories.
- B. Owner-Furnished Material: Refer to drawings

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.

1.03 ANCHORING AND MOUNTING REQUIREMENTS, INCLUDING REQUIREMENTS FOR CUTOUTS IN OTHER WORK AND SUBSTRATE PREPARATION.

- 1. Material and finish descriptions.
 - 2. Features that will be included for Project.
 - 3. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.07 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.08 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PRODUCTS

2.01 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.02 PUBLIC-USE WASHROOM ACCESSORIES

- A. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain one of first two paragraphs and list of manufacturers below. See Section 016000 "Product Requirements."
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
- C. Grab Bar:
 - 1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc. – B-5806 series
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch thick.
 - a. Finish: Smooth, No. 4 finish (satin).
 - 4. Outside Diameter: 1-1/4 inches.
 - 5. Configuration and Length: As indicated on Drawings.
- D. Mirror Unit:
 - 1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc.
 - a. Model B-165 24"x 36" Toilet Rooms
 - b. Model B-165 24"x 60" Locker Room
 - 2. Frame: Stainless-steel channel.
 - a. Corners: Manufacturer's standard.
 - 3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

2.03 HEALTHCARE ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. A & J Washroom Accessories, Inc.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.
- B. Stainless Steel Shelf
 - 1. Basis-of-Design Product: Bobrick Washroom Equipment, Inc. – B-298
 - 2. Description: 18-8S type 304, 18 gauge stainless steel shelf with 3/4" return edges with mounting brackets.
 - 3. Size: 24 inches
 - 4. Material and Finish: Stainless steel, No. 4 finish (satin).
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Specialties, Inc.
 - 2. Bobrick Washroom Equipment, Inc.
 - 3. Bradley Corporation.
- D. Mop and Broom Holder:
 - 1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 - 2. Length: 36 inches.

3. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
4. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
 - b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.04 CLOTHES HOOK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. American Specialties, Inc.
 2. Bobrick Washroom Equipment, Inc. B 211 (Basis of Design)
 3. Bradley Corporation.
- B. Locations: As indicated on the drawings.
 1. Description: Heavy duty clothes hook
 2. Material and Finish: Stainless steel, No. 4 finish (satin).

2.05 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

EXECUTION

3.01 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.02 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

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SECTION 105100 LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 LOCKERS OF THE FOLLOWING TYPES:

- A. Wood Lockers
- B. Aluminum Lockers
- C. Locker accessories.

1.03 RELATED SECTIONS

1.04 REFERENCES

- A. ADAAG - American with Disabilities Act, Accessibility Guidelines.
- B. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- C. ASTM International (ASTM):
- D. ASTM A 1008 - Standard Specification for Steel Sheet, Carbon, Cold-Rolled, Commercial Quality.
- E. ASTM D 4976 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
- F. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.05 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in [the USDOJ's "2010 ADA Standards for Accessible Design"] [the ABA standards of the Federal agency having jurisdiction] [and] [ICC A117.1] .

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker[and bench].

1.07 SHOP DRAWINGS: FOR LOCKERS.

- A. Include plans, elevations, sections, and attachment details.
- B. Show details full size.
- C. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
- D. Show locations and sizes of cutouts and holes for items installed in lockers.
- E. Show locker fillers, trim, base, sloping tops, and accessories.
- F. Show locker identification system and numbering sequence.

1.08 SAMPLES FOR INITIAL SELECTION: FOR EACH TYPE OF THE FOLLOWING:

- A. Manufacturer's color charts showing the full range of colors available.
 - 1. Aluminum
 - 2. High-pressure decorative laminates.

1.09 SAMPLES FOR VERIFICATION: FOR THE FOLLOWING PRODUCTS:

- A. For each color specified, in manufacturer's standard size.
- B. Standard aluminum colors and finishes.
- C. Thermoset decorative-overlay-surfaced panels, not less than 8 by 10 inches for each type, color, pattern, and surface finish.
- D. Corner pieces of locker front frame joints between stiles and rail, as well as exposed end pieces, not less than 18 inches wide by 18 inches high by 6 inches deep.
- E. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.10 MANUFACTURER'S DATA SHEETS ON EACH PRODUCT TO BE USED, INCLUDING:

- A. Preparation instructions and recommendations.
- B. Storage and handling requirements and recommendations.
- C. Installation methods.
- D. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms.
- E. Verification Samples: For finish product specified, two samples, minimum size 6 inches square, representing actual product and color selected.

1.11 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.12 QUALITY ASSURANCE

- A. Provide all lockers from a single manufacturer.

1.13 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.14 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. The following metal locker hardware items equal to [10] percent of amount installed for each type and finish installed, but no fewer than [five] units:
 - 1. Locks.
 - 2. Blank identification plates.
 - 3. Hooks.

1.15 DELIVERY, STORAGE, AND HANDLING

- A. Inspect lockers upon receipt for visible damage. Further inspection if necessary for hidden damage.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Sequence deliveries to avoid project delays, but minimize on-site storage.
- D. Deliver [master and control keys] [combination control charts] to Owner by registered mail or overnight package service[.], addressed as follows:]

1.16 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.17 COORDINATION

- A. Coordinate sizes and locations of [concrete] [concrete masonry] [wood] bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.18 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
- B. Failures include, but are not limited to, the following:
 - 1. Structural failures.
 - 2. Faulty operation of latches and other door hardware.
- C. Damage from deliberate destruction and vandalism is excluded.
- D. Warranty Period: [Two] years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Salsbury Industries, which is located at: 18300 Central Ave., Carson CA 90746; Tel: 706-827-2720; Fax: 706-827-2710; Web: www.lockers.com
- B. Substitutions: Not permitted.

2.02 MATERIALS

2.03 CONSTRUCTION:

- A. 12" wide 72" tall Double tier, S-Style designer wood lockers, industrial grade particleboard, covered with high pressure plastic laminate.
- B.
- C. Hinges: Segmented 120 Degree, piano style hinge.
 - 1. Finish: Powder coated in black color.
- D. Interior Equipment:
 - 1. ADA Compliant lockers (recessed handles with multi point latch)
 - a. Handicapped locker compartment bottom: minimum of 15 inches off of the floor.
 - b. Handicapped symbol attached to door.
 - 2. Standard hardware features
 - a. Padlock hasp
 - b. One top mounted two pronged stainless steel coat hook.
 - c. One full depth hat shelf.
 - d. Two heavy duty concealed door hinges.
- E. Finish: Doors and exposed body parts shall be finished in a finish in color indicated.
 - 1. Color: Blue.

2.04 ALUMINUM CELL PHONE LOCKERS

- A. Aluminum Lockers
 - 1. Acceptable Product: Salsbury Industries 19800
 - 2. Type of Lockers: Recessed mounted.
 - 3. Locker construction: Heavy duty aluminum with fully integrated flanged collar.
 - a. Seven tier:
 - 1) Size; Height: 31 inches, Width 24 inches, Depth 9-1/4 inches.
 - b. Finish: Powder coated
 - c. Hinges: Continuous
 - d. Clear plastic card holder: Height 5/8 inch, Width 2 inches.
 - 4. Locks:
 - a. Cell phone locker: Resettable combination.
 - b. Panel: Master control keyed, include 3 keys and locker key wristbands.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Condition lockers to average prevailing humidity conditions in installation areas before installation.
- B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.
- C. Do not begin installation until substrates and bases have been properly prepared.
- D. If substrate and bases are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

- A. Install lockers and accessories at locations shown in accordance with manufacturer's instructions.
- B. Install lockers level and plumb with flush surfaces and rigid attachment to anchoring surfaces.
- C. Install front bases between legs without overlap or exposed fasteners. Provide end bases on exposed ends.

- D. Install wood support base with 1/2-inch- (13-mm-) thick, plywood top.
- E. Knocked-Down Lockers: Assemble with manufacturer's standard fasteners, with no exposed fasteners on face frames.
- F. Install lockers level, plumb, and true; use concealed shims.
- G. Connect groups of lockers together with manufacturer's standard[brass-finished] fasteners, through predrilled holes, with no exposed fasteners on face frames. Fit lockers accurately together to form flush, tight, hairline joints.
- H. Install lockers without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings, providing unencumbered operation. Complete installation of hardware and accessory items as indicated.
- I. Installation Tolerance: No more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line. Shim as required with concealed shims.
- J. Locker Anchorage: Fasten lockers through wood locker base, at ends, and not more than 36 inches (910 mm) o.c. with No. 8 brass-finished, flush-head wood screws sized for 1-inch (25-mm) penetration into wood base.
- K. Locker Anchorage: Fasten lockers through back, near top and bottom, at ends with No. 8 brass-finished, flush-head wood screws sized for 1-inch (25-mm) penetration into wood base wood framing, blocking, or furring and spaced not more than 16 inches (400 mm) o.c.
- L. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.
- M. Install number identification plates after lockers are in place.
- N. Attach number identification plate on each locker door, near top, centered, with at least two screws with finish matching the plate.
- O. Provide protective mat at each shoe shelf.

3.03 ADJUSTING AND CLEANING

- A. Adjust doors and latches to operate without binding. Verify that latches are operating satisfactorily.
- B. Clean, lubricate, and adjust hardware. Adjust doors[and drawers] to operate easily without binding.[Verify that integral locking devices operate properly.]
- C. Touch-up factory-finish and repair or replace damaged products before Substantial Completion.

3.04 PROTECTION

- A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Protect installed products until completion of project.

END OF SECTION

SECTION 123616 METAL COUNTERTOPS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
- B. Stainless-steel countertops.

1.02 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded wall-mounted shelves.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For metal fabrications.
- C. Include plans, sections, details, and attachments to other work. Detail fabrication and installation.
- D. For countertops, show locations and sizes of cutouts and holes for items installed in metal countertops.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products only after casework and supports on which they will be installed has been completed in installation areas.
- B. Keep finished surfaces of products covered with polyethylene film or other protective covering during handling and installation.

1.05 FIELD CONDITIONS

- A. Field Measurements: Where products are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Established Dimensions: Where products are indicated to fit to other construction, establish dimensions for areas where products are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 1 PRODUCTS

2.01 STAINLESS-STEEL FABRICATIONS

- A. Countertops: Fabricate from 0.062-inch-thick, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects. Provide front and end overhang of 1 inch over the base cabinets.
- B. Joints: Fabricate countertops without field-made joints.
- C. Weld shop-made joints.
- D. Sound deaden the undersurface with heavy-build mastic coating.
- E. Extend the top down to provide a 1-inch-thick edge with a 1/2-inch return flange.
- F. Form the backsplash coved to and integral with top surface, with a 1/2-inch-thick top edge and 1/2-inch return flange.

2.02 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
- B. Sealant for Countertops: Manufacturer's standard sealant that complies with applicable requirements in Section 079200 "Joint Sealants" and the following:
- C. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, acid curing, silicone.

2.03 STAINLESS-STEEL FINISH

- A. Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

PART 1 EXECUTION

3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install metal countertops level, plumb, and true; shim as required, using concealed shims.
- B. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.
- C. Seal junctures of countertops and walls with sealant for countertops.

3.03 CLEANING AND PROTECTION

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces. Remove and replace damaged products or touch up and refinish damaged areas to match original factory finish, as approved by Architect.
- C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION

**SECTION 123623.13
PLASTIC-LAMINATE-CLAD COUNTERTOPS**

GENERAL

1.01 SUMMARY

- A. Section includes plastic-laminate countertops.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate and fire-retardant-treated materials.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of cutouts and holes for plumbing fixtures installed in plastic-laminate countertops.
 - 2. Apply WI Certified Compliance Program label to Shop Drawings.
 - 3. Apply AWI Quality Certification Program label to Shop Drawings.
- C. Samples for Initial Selection:
 - 1. Plastic laminates.
- D. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches, for each color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.06 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PRODUCTS

2.01 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.
 - 1. Provide certificates from AWI certification program indicating that countertops comply with requirements of grades specified.
 - 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Premium.
- C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS.
- D. Products: Refer to Finishes Schedule, on drawing I 1000 for Manufacturer, Product, and Finish.
- E. Chemical-Resistant, High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP, and as follows:
 - 1. Laminate has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.9.5:
 - a. Nitric Acid (30 Percent): Moderate effect.
 - b. Sulfuric Acid (77 Percent): Moderate effect.
 - c. Hydrochloric Acid (37 Percent): Moderate effect.
 - d. Phosphoric Acid (75 Percent): No effect.
 - e. Acetic Acid (98 Percent): No effect.
 - f. Formaldehyde: No effect.
 - g. Ethyl Acetate: No effect.
 - h. Ethyl Ether: No effect.
 - i. Phenol (85 Percent): Moderate effect.
 - j. Benzene: No effect.
 - k. Xylene: No effect.
 - l. Butyl Alcohol: No effect.
 - m. Furfural: No effect.
 - n. Methyl Ethyl Ketone: No effect.
 - o. Sodium Hydroxide (25 Percent): No effect.
 - p. Sodium Sulfide (15 Percent): No effect.
 - q. Ammonium Hydroxide (28 Percent): No effect.
 - r. Zinc Chloride: No effect.
 - s. Gentian Violet: No effect.
 - t. Methyl Red: No effect.
- F. Edge Treatment: 3-mm PVC edging.
- G. Core Material: 3/4" Pywood.
- H. Core Thickness: 1-1/8 inch.
 - 1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.
- I. Paper Backing: Provide paper backing on underside of open bottom countertops.

2.02 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
 - 1. Wood Moisture Content: 8 to 13 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2.

2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having Note that fire-retardant particleboard contains urea formaldehyde. It complies with requirements for Class I (Class A) finish but not requirements of model codes for use where noncombustible materials are required.

2.04 ACCESSORIES

- A. Countertop Support: Work Station Bracket
 - 1. Supplier: A&M Hardware Inc.
 - 2. Model ; 909-58
 - a. Form from 1/8" steel
 - b. 1000 lb. load limit
 - c. Powder coat finish
- B. Grommets for Cable Passage through Countertops: 2-inch OD, brown or black, molded-plastic grommets and matching plastic caps with slot for wire passage.

2.05 MISCELLANEOUS MATERIALS

- A. Adhesive for Bonding Plastic Laminate: PVA.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.06 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets.
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- E. Seal edges of openings in countertops with a coat of varnish.

EXECUTION

3.01 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 - 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
 - 2. Seal edges of cutouts by saturating with varnish.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
- H. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.03 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 123623.13

SECTION 123661.16
SOLID SURFACING COUNTERTOPS

GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Solid surface material countertops.
 - 2. Integral Solid Surface Bowls

1.02 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
 - 1. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining.
- B. Samples for Initial Selection: For each type of material exposed to view.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

1.06 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.07 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PRODUCTS

2.01 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 1. Type: Provide Standard type unless Special Purpose type is indicated.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. E. I. du Pont de Nemours and Company.
 - 3. Product: Corian
 - 4. Type: Provide Standard Type unless Special Purpose Type is indicated.
 - 5. Colors and Patterns: As indicated on the Color and Finish Schedule.
- B. Integral Bowls: Corian Models 804 and 810
- C. Colors and Patterns: Products: Refer to Color and Finish Schedule for Manufacturer, Product, and Finish.

2.02 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Premium.
- B. Configuration: As indicated on the drawings
- C. Countertops: 3/4-inch-thick, solid surface material with front edge built up with same material.
- D. Backsplashes: 3/4-inch-thick, solid surface material.
- E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
- F. Joints: Fabricate countertops without joints.

2.03 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

EXECUTION

3.01 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- E. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 134900 RADIATION PROTECTION

GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Lead sheet, strip, and plate.
 - 2. Lead-lined gypsum board.
 - 3. Lead glass.
 - 4. Lead-lined, hollow-metal door frames.
 - 5. Lead-lined flush wood doors.
 - 6. Lead-lined, observation-window frames.

1.02 DEFINITIONS

- A. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.
 - 1. Lead equivalence specified for materials used in diagnostic x-ray rooms is as measured at 100 kV unless otherwise indicated.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to radiation protection including, but not limited to, the following:
 - a. Sequence and schedule of radiation protection work in relation to other work.
 - b. Supplementary lead shielding at duct, pipe, and conduit penetrations of radiation protection.
 - c. Methods of attaching other construction and equipment to lead-lined finishes.
 - d. Notification procedures for work that requires modifying radiation protection.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show layout of radiation-protected areas. Indicate lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.
 - 1. Show ducts, pipes, conduit, and other objects that penetrate radiation protection; include details of penetrations.
 - 2. Show details of neutron-shielding doors and frames, including anchorage to and coordination with other work. Show locations of electrical conduit and boxes for connecting door operators, door operator switches, and door interlock switches.
 - a. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Product Schedule: For observation windows, doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For flush wood door manufacturer.

1.06 SAMPLE WARRANTY: FOR WARRANTY.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For neutron-shielding doors to include in operation and maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Flush Wood Door Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Lead-Lined Gypsum Panels: Neatly stack panels flat to prevent deformation.

- B. Lead-Lined, Hollow-Metal Doors and Frames: Deliver doors and frames cardboard wrapped or crated to provide protection during delivery and storage. Inspect for damage on delivery. Minor damage may be repaired provided the refinished repair matches new work and is approved by Architect; otherwise, remove and replace damaged items as directed.
- C. Lead-Lined Flush Wood Doors: Comply with manufacturer's written instructions and requirements in WDMA I.S.1-A.
 - 1. Package doors individually in plastic bags or cardboard cartons.
 - 2. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.10 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings for by field measurements before fabrication.

1.11 WARRANTY

- A. Warranty for Lead-Lined Flush Wood Doors: Comply with requirements in Section 081416 "Flush Wood Doors."

PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.
 - 1. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor on request.
- B. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in doors, door frames, window frames, penetration shielding, joint strips, film transfer cabinets, and other items located in lead-lined assemblies not less than that indicated for assemblies in which they are installed.
- C. Lead Glazing: Unless otherwise indicated, provide lead equivalence not less than that indicated for assembly in which glazing is installed.

2.02 MATERIALS

2.03 MATERIALS

- A. Lead Sheet, Strip, and Plate: ASTM B 749, Alloy UNS No. L51121 (chemical-copper lead).
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Radiation Protection Products, Inc.
- B. Lead-Lined Gypsum Board: 5/8-inch-thick gypsum board of width and length required for support spacing and to prevent cracking during handling, and with a single sheet of lead laminated to the back of the board.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Radiation Protection Products, Inc.
 - 2. Lead Sheet Lining: Full width and length of board or board height as indicated on Drawings.
 - 3. Furnish 3-inch-wide lead strips for wrapping metal stud flanges.
 - 4. Furnish 5/16-inch lead disks for covering screw heads.
 - 5. Furnish lead-headed nails for fastening gypsum board, accessories, and trim to wood members.
 - 6. Furnish gypsum veneer plaster, accessories, and trim for lead-lined gypsum base complying with Section 092613 "Gypsum Veneer Plastering."
 - 7. Furnish finishing materials, accessories, and trim for lead-lined gypsum board complying with Section 092900 "Gypsum Board."
- C. Lead Glass: Lead-barium, polished glass containing not less than 60 percent heavy metal oxides, including not less than 48 percent lead oxide by weight.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- D. Radiation Protection Products, Inc.
 - a. Schott North America, Inc.
- 2. Safety Glass: Laminated glass. (Where Required)
 - a. Outer Ply: Clear float glass.
 - b. Interlayer: Clear polyvinyl butyral.
 - c. Inner Ply: Lead glass; thickness as needed to provide lead equivalence indicated.
- E. Accessories and Fasteners: Manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.

2.04 LEAD-LINED, HOLLOW-METAL DOOR FRAMES

- A. General: Steel door frames complying with NAAMM-HMMA 861, except 0.0667 inch thick, lined with lead sheet of thickness not less than that required for doors and walls where frames are used.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Radiation Protection Products, Inc.
 - b. Republic Doors and Frames.
 - 2. Furnish with additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.
 - 3. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.
 - 4. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

2.05 LEAD-LINED FLUSH WOOD DOORS

- A. Lead-Lined Flush Wood Doors: Solid-core wood doors with lead lining, thickness not less than that required for partition in which door is installed.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Marshfield (Basis of Design
 - 1) Durable Door Radiation Shielded Door
 - b. A&L Shielding, Inc.
 - 2. Door Construction: Veneer face, five ply, bonded structural composite lumber core.
 - 3. Lead Lining: Two sheets of lead extending from top to bottom and edge to edge, constructed at each face between the core and faces.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
 - 1. Face Veneer Species and Cut: Match wood doors that are not lead lined.
 - a. Factory finish with to match existing with transparent catalyzed lacquer or conversion varnish.
- C. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- D. Prepare doors to receive observation windows; cut and trim openings through doors in factory. Provide removable wood stops for glazed openings.
- E. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining.
- F. Furnish lead-lined astragals for pairs of doors.
- G. Factory fit doors to suit frame openings indicated with 1/16-inch clearance at heads and jambs and minimum clearance at bottom. Factory machine doors for hardware not surface applied.

2.06 LEAD-LINED, OBSERVATION-WINDOW FRAMES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Radiation Protection Products, Inc.
- B. General: Fabricate from 0.043-inch-thick, formed-steel sheet or 0.064-inch-thick aluminum extrusions with mitered corners, welded or bolted with concealed fasteners.

1. Line with lead sheet formed to match frame contour, continuous in each jamb and across head and sill, lapping the stops, and fabricated wide enough to maintain an effective lap with lead of adjoining assemblies.
2. Construct so lead lining overlaps glazing material perimeter by at least 3/8 inch and furnish removable stops.
3. Form sill with an opening for sound transmission. Offset sound passage to make opening lightproof and to maintain required lead equivalence at all points and in all directions.

2.07 DOOR AND DOOR FRAME FABRICATION

- A. Hardware Preparation: Factory prepare doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished.

EXECUTION

3.01 EXAMINATION

- A. Examine substrates in areas to receive radiation protection, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of radiation protection.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF LEAD-LINED GYPSUM BOARD

- A. Install with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints. Install using construction adhesive and supplementary fasteners.
- B. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum board manufacturer.
 1. Install lead strips, 2 inches wide and same thickness as lead lining, to face of supports and blocking where joints occur. Secure lead strips with construction adhesive. Provide shims at face of supports and blocking where joints do not occur.
 2. Apply lead disks recessed flush with surface of board over heads of screws securing gypsum board and trim.
- C. Openings: Extend lead-lined gypsum board into frames of openings, lapping lead lining with lead frames or frame linings at least 1 inch. Arrange board around openings so neither horizontal nor vertical joints occur at corners of openings.
- D. Install control and expansion joints where indicated, with appropriate trim accessories. Install lead strip on face of framing, extending across joint, and lap with lead lining of gypsum board.
- E. Finish lead-lined gypsum base to comply with Section 092613 "Gypsum Veneer Plastering."

3.03 FINISH LEAD-LINED GYPSUM BOARD TO COMPLY WITH SECTION 092900 "GYPSUM BOARD."

3.04 INSTALLATION OF LEAD-LINED DOORS AND DOOR FRAMES

- A. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced standards.
 1. Install fire-rated doors according to NFPA 80.
- B. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- C. Frames: Comply with HMMA 840 unless otherwise indicated. Except for frames located in existing walls or partitions, place frames before constructing walls. Set frames accurately in position, plumb, and brace securely until permanent anchors are set.
 1. Provide three anchors per jamb, located adjacent to hinge on hinge jamb and at corresponding heights on strike jamb.
 2. In masonry construction, use wire or T-strap anchors and apply a coat of asphalt mastic or paint to lead lining where lead comes in contact with masonry or grout.
 3. In metal stud construction, use wall anchors attached to studs with screws.
 4. In wood stud construction, use strap anchors attached to studs with screws.
- D. Lap lead lining of frames over lining in walls at least 1 inch.
- E. Lead Lining of Frames: Lap lining over lining in walls at least 1 inch.

- F. Install doors in frames level and plumb, aligned with frames and with uniform clearance at each edge.
- G. Line astragals with lead sheet.
- H. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. See Section 087100 "Door Hardware" for other installation requirements.
- I. Touch up damaged finishes with compatible coating after sanding smooth.
- J. Operation: Rehang or replace doors that do not swing or operate freely. Check and readjust operating hardware items, leaving doors and frames undamaged and in proper operating condition.

3.05 INSTALLATION OF LEAD-LINED OBSERVATION WINDOWS

- A. Install observation windows according to manufacturer's written installation instructions.
- B. Install windows level, plumb, square, true to line, and anchored securely in place to structural support.
- C. Install leaded side of frame on radiation side of wall. Lap lead lining of frames over lining in walls at least 1 inch.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with manufacturer's written instructions.

3.06 INSTALLATION OF PENETRATING ITEMS

- A. At penetrations of lead linings, provide lead shields to maintain continuity of protection.
- B. Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.
- C. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners unless indicated on Drawings.
- D. Outlet Boxes and Conduit: Cover or line with lead sheet lapped over adjacent lead lining at least 1 inch. Wrap conduit with lead sheet for a distance of not less than 10 inches from box.
- E. Duct Openings: Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to three times the largest opening dimension. Lap lead sheet with adjacent lead lining at least 1 inch.
- F. Piping: Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than 10 inches from point of penetration.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections after radiology equipment has been installed and placed in operating condition.
- B. Correct deficiencies in or remove and replace radiation protection that inspection reports indicate does not comply with specified requirements.
- C. Prepare test and inspection reports.

3.08 PROTECTION

- A. Lock radiation-protected rooms once doors and locks are installed, and limit access to only those persons performing work in the rooms.

END OF SECTION 134900

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**SECTION 139006
MODULAR RADIO FREQUENCY MAGNETIC SHEILDING**

GENERAL

1.01 DESCRIPTION

- A. The purpose of RF and magnetic shield construction is to create an enclosure in which radio frequency (RF) and/or electromagnetic interference (EMI) is contained and/or prevented from entering. This environment is necessary to ensure proper performance of Magnetic Resonance Imaging (MRI) equipment.

1.02 WORK INCLUDED

- A. This section includes furnishing all labor, materials, equipment, tools, and related items to engineer, pre-fabricate, deliver, install and test an RF & Magnetic shield for an MRI scan room.

1.03 WORK NOT INCLUDED

- A. The following work is excluded, but shall be coordinated with the shielding vendor:
 - 1. Construction or preparation of the parent structure to receive the shield assembly.
 - 2. Weatherproofing and climate control of the parent structure prior to the installation of the shield assembly.
 - 3. Calculations and specifications for thickness, location, and composition of magnetic shielding.
 - 4. Connections of other work to the RF shield.
 - 5. Delivery and installation of the MRI equipment.
 - 6. Any final finishes including but not limited to HVAC ducting, electrical wiring, drywall, paint, VCT, etc.

1.04 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section.
 - 1. American Welding Society
 - a. AWS D1.1, Structural Welding Code – Steel
 - 2. Military Standard
 - a. MIL-STD-220A, Method of Insertion Loss for Radio Frequency Filters.
 - b. MIL-STD-285, Method of Attenuation Measurements for Electromagnetic
 - 3. Shielding Enclosures for Electronic Test Purposes.
 - 4. Underwriters Laboratories Inc.
 - a. UL-1283, Standard for Safety - Electromagnetic Interference Filters.
 - 5. American Standard for Testing and Materials
 - a. ASTM F1869, Standard Test Method for Measuring Moisture Vapor Emission

1.05 PERFORMANCE REQUIREMENTS

- A. ATTENUATION: The shield must meet the following performance criteria according to specifications supplied by the MRI equipment manufacturer:
 - 1. Attenuation of magnetic field.
 - 2. Attenuation of electric field.
 - 3. Attenuation of plane wave.
 - 4. Attenuation of sound.
- B. GROUND: The shield structure must be electrically grounded at a single point, with a minimum resistance to alternate ground of 1,000 ohms.

1.06 QUALITY ASSURANCE

- A. STANDARDS: Perform work of this section in accordance with provisions of the following:
 - 1. MIL-STD-285.
 - 2. MIL-STD-220A.
- B. WARRANTIES
 - 1. The shielding vendor shall supply a signed written warranty stating that the RF shield enclosure is guaranteed as follows: As long as it is maintained according to industry standards and written maintenance procedures, the structure is guaranteed against defective materials and workmanship and to retain the specified shielding

characteristics for a period of five (5) years from date of completion of acceptance test. The electrical RF filters, waveguides, and door system are guaranteed against defective materials and workmanship and to retain the specified shielding characteristics for a period of one (1) year from date of completion of acceptance test.

PRODUCTS

2.01 MANUFACTURERS

- A. This section is based on products manufactured by:
 - 1. National MRI Shielding, Inc. 201 Brothers Blvd Ste 6 Red Oak, TX 75154 (214) 614-8103 national@mri-shielding.com
 - 2. Equivalent Manufacturer:
 - a. ETS-Lindgren – An ESCO Technologies Company
- B. Alternative products (substitutions): Contractor must furnish appropriate and complete product data, environmental characteristics, and sample warranty with bid for the Architect to consider the substitutions as “equal” to the manufacturer, product specified and quality assurance requirements. Further additional information may be requested by the Architect for determination that the proposed product substitution is fully equal to the specified products. There is no guarantee that proposed substitutions will be approved, and the Contractor is hereby directed not to order any materials until said approval(s) are received in writing.

2.02 MATERIALS AND COMPONENTS

- A. **MAGNETIC SHIELDING:** For shield installations where attenuation of the MRI magnetic field is required, magnetic shielding (typically M36 silicon steel) will be installed according to precise specifications as to thickness, location, and type of material. These specifications are normally supplied by others (typically the MRI equipment vendor) to the shielding vendor prior to shield fabrication.
- B. **RF SHIELD PANELS:** Walls, ceiling, and floor shall consist of modular, rigid panels constructed of ¾” composition board laminated on two sides with 26 gauge galvanized steel.
 - 1. **PANEL JOINING SYSTEM:** Continuous 1/8 ” thick galvanized steel hat & flat and corner cove framing shapes, configured to hold RF shield panels rigidly in place. The hat & flat and corner cove framing shapes are mated by fasteners spaced every 4 inches on center.
- C. **FLOOR**
 - 1. **UNDERLAYMENT:**
 - a. Install polyethylene sheet vapor retardant 6 mils minimum thickness over slab.
 - b. Bottom of floor panel, 1/8” hard board shall be applied between hat & flat framing members to serve as filler material and ensure level support.
 - c. Top of floor panel, 1/8” VCT tile shall be applied between hat & flat framing members to serve as filler material, providing a smooth, level surface for finished floor by others.
 - 2. Magnet supports / anchors shall be installed according to Equipment Vendor’s specifications.
 - a. Wiring trenches / raceways shall be lined with formed 10 ounce copper and made electrically contiguous with the floor panels.
- D. **CEILING:** Shall consist of modular RF panels as described above, with the following additions.
 - 1. **CEILING SUPPORTS:** Dielectric adjustable hangers are clamped to overhead structures such as bar joists, concrete slabs, trusses or beams, and are then through-bolted to the RF shield ceiling panels. These dielectric hangers are typically mounted in a four foot grid pattern and are field located/installed.
 - 2. **ATTACHMENT POINTS:** Attachment points for interior finish shall be installed by the shielding vendor for support of other work and materials to be installed by others. Load, location and quantity of attachment points shall be specified prior to shield fabrication.
- E. **WALLS:** Shall consist of modular RF panels as described above, with the following additions.

1. The penetration panel opening location will be field verified. An opening will be cut thru the RF panels. The opening will be framed in accordance with MRI manufacturer's specifications.
 2. Grounding buss bar shall be 1/2" diameter brass threaded rod with a brass attachment bar mounted through the RF shielding adjacent to the power line filters. This structure shall serve as a single point grounding point for the RF shield. Intended for subsequent attachment of a dedicated wire to the electrical ground point of the building, it shall be external as well as internal to the RF shield, electrically contiguous with the shield, and shall be the sole attachment point for the "green wire" system (by others) within the shield.
 3. A removable section will be provided in the shield to allow entry or exit of the MRI magnet. The location shall be specified prior to shield fabrication.
- F. DOOR ASSEMBLY: RF SHIELDED DOOR: The door and frame assembly shall provide RF integrity while presenting the overall appearance of a conventional medical facility door. Door and frame assembly will be fit and hung at the factory. RF attenuation shall be accomplished by means of a continuous RF door seal around the entire perimeter of the door.
1. DOOR FRAME: Stainless steel plated wood.
 2. DOOR LEAF: Solid core, laminated with 3 ounce copper. 4'-0" x 7'-0" shall be considered the standard size.
 3. DOOR HINGES: The door assembly is factory mounted with one continuous piano style hinge running the entire length of the door.
 4. THRESHOLD: Stainless steel tapered ramp directly fastened to the jambs. This will serve as an integral mating part of the seal assembly affixed to bottom of the door. Threshold is to be made electrically contiguous with the door frame.
 5. DOOR LATCHING DEVICE: T series extra heavy duty grade 1 cylindrical lever lock.
 6. RF DOOR SEALS: High performance RF gasket material providing 100db shielding attenuation.
 7. DOOR FINISH: Wilsonart Laminate or standard unfinished paint-grade white birch applied to both sides. Anodized aluminum trim applied to both sides.
 8. The RF shielded door shall provide >100db RF shielding attenuation.
 9. The RF shielded door shall provide >34 STC rating.
- G. RF WINDOWS: Two (2) internal layers of 304 stainless steel screen material, mounted to become electrically contiguous with the shield, and painted flat black to minimize reflection. The two layers of screen material shall be laid at opposing angles totaling 30° in order to minimize the optical effect known as "moiré". The window frames shall conform to the attachment system described above.
1. INTERIOR: (Control Room Window) is glazed with 1/4" tempered glass on both sides. 3'-0" x 4'-0" Shall be considered standard size.
 2. EXTERIOR: (View Window) View windows are typically located to match exterior windows on the parent structure. View windows shall be glazed with 1/4" tempered glass on one side only.
 3. SKYLIGHT: Skylight RF windows are typically located to match exterior skylights of the parent structure. Skylight RF windows normally do not require glass, and consist of window framing and screen only. Because the RF shielded skylight assembly does not have glass applied, the space above the assembly will be open to the conditioned space below the assembly, and therefore the walls of the skylight assembly should be sealed by others to prevent dust and debris from falling on the RF screen.
 4. Large RF windows may require mullions.
 5. RF shielded window shall provide >100db RF shielding attenuation.
- H. PENETRATIONS
1. HVAC WAVEGUIDES: Shall provide RF attenuation while allowing air flow penetration through the shield, typically for HVAC supply, HVAC return, exhaust, and passive pressure equalization. Waveguides consist of 3/16" x 1" aluminum honeycomb vents with integral collars for mounting and attachment to the RF shield. Wave grilles will include attachment points for dielectric connection by others outside the RF shield and an attachment point for conventional connection on the inside. The sizes and quantity of wave grilles are to be specified by others prior to shield fabrication.
 2. PIPE WAVEGUIDES: RF attenuation for medical gases, cryogen vents, vacuum, fire sprinkler and other pipe penetrations through the shield. Pipe waveguides are to be

- compliant with MRI vendor's requirements, mounted by the shielding vendor so as to be electrically contiguous with the shield, and materially, structurally, and mechanically compatible with connections by others. Connections of other work to waveguides are made by others and must be dielectric on the outside of shield unless otherwise noted.
3. **ELECTRICAL FILTERS:** Electrical filters for RF attenuation of all power circuits and data circuits within shielding. Filters provided will attenuate RF energy on the incoming conductor at 100db from 150 kHz to 10 GHz. Electrical filters will be mounted in the area of the magnet penetration panel.
 4. **OTHER PENETRATIONS:** The shielding vendor shall be notified of all other penetrations to the shield prior to fabrication. Under no circumstances is the RF shield to be penetrated without prior consent of the shielding vendor.
- I. **THIRD PARTY COMPONENTS:** Any third party components requiring installation by the shielding vendor, including MRI equipment vendor's penetration panel and/or floor anchors/supports, shall be made available in accordance with the shielding vendor's installation schedule.

EXECUTION

3.01 DESIGN

- A. **ARCHITECTURAL DRAWINGS** shall be supplied to the shielding vendor as complete, accurate and approved for construction in order to ensure accurate preparation the shielding vendor's shop drawings.
- B. **MRI EQUIPMENT VENDOR'S DRAWINGS** shall be supplied complete and approved to the shielding vendor before fabrication. The shielding vendor will combine information contained therein with the architectural data in order to provide a comprehensive set of shop drawings. In cases where a discrepancy exists between Architectural and MRI Equipment Vendor's drawings, The shielding vendor shall notify both parties, along with the General Contractor, and any other appropriate responsible party and proceed as directed.
- C. **FIELD MEASUREMENTS:** The shielding vendor may elect, at its discretion, to gather field measurements as necessary to complete timely and accurate shop drawings. In cases where a discrepancy exists between written and actual dimensions, the shielding vendor shall notify the parties involved and proceed as directed.
- D. **SHOP DRAWINGS:** The shielding vendor shall use its best efforts to gather information and provide timely and accurate shop drawings prior to fabrication. Shop drawings will be approved in writing before fabrication takes place. Approval of shop drawings shall constitute 10% completion of the project.

3.02 FABRICATION

- A. The shielding vendor shall use its best means and methods to substantially pre- fabricate all necessary components for the shield, based upon the approved shop drawings.
- B. All raw materials and components used in the manufacturing process will be new, unused material and will conform to local and NEC codes.
- C. The shielding vendor shall use established means and methods for quality control assurance during the fabrication process.

3.03 EXAMINATION

- A. Verify that substrates are ready to receive work of this section and openings correspond to locations and dimensions indicated on approved shop drawings.
 1. Verify that floors are level to within 1/8 inch in 10 feet.
 2. Verify that required utilities are available.
- B. Do not begin work of this section until unacceptable conditions have been corrected.
- C. **SITE CONDITIONS:** General Contractor shall examine the areas and conditions under which the RF shielded enclosure is to be installed and notify the shielding vendor of conditions detrimental to the proper and timely completion of work. Work shall not proceed until unsatisfactory conditions have been corrected.
- D. **DIMENSIONS:** Upon arrival for installation, the shielding vendor shall verify that the job site is ready to receive work of this section and openings correspond to locations and dimensions indicated on approved shop drawings.

3.04 INSTALLATION

- A. **JOB SITE READINESS:** The following conditions are necessary to have the status of a "Ready Site". The General Contractor shall verify these conditions before the shielding vendor arrives at the job site to begin installation:
1. **WORK AREA**
 - a. There is a designated area adjacent to the MRI exam room for staging of the RF shield components and materials.
 - b. There is a clean, clear, pathway for wheeled transport of materials and equipment from the delivery truck to the staging area.
 - c. The MRI exam room and staging area is free of other work, workmen, clutter, and/or debris and the floor has been broom swept.
 - d. The MRI exam room and staging area is weatherproofed, dry (non-condensing), and temperature controlled between 60°F & 90°F.
 - e. The General Contractor will provide a secure area for storage of the shielding vendor's tools and equipment.
 - f. The General Contractor will provide proper work lighting in the area where the RF shield will be installed.
 - g. The General Contractor will provide two (2) 120 VAC, 20 AMP service connections at the installation location. These services must be grounded and comply with any and all applicable local and N.E.C. codes.
 - h. The General Contractor will provide containers for the disposal of refuse materials from the RF shield installation site. The General Contractor shall be responsible for the removal of the containers after completion.
 - B. **PARENT STRUCTURE**
 1. **CONCRETE SLAB**
 - a. **DEPRESSION:** If level, non-ramped, threshold-to-floor junction is required, the slab within the shield footprint will be provided to the shielding vendor as a depressed section measuring 1-1/8" below the surrounding slab for an inward-opening or an outward-opening door. These measurements assume a finished floor thickness of 1/8". In addition to these measurements, the slab depression may need to increase to allow for any specified floor magnetic shielding.
 - b. **LEVELING:** Slab is to be made level by others to within 1/8" in 10 feet with maximum difference of 1/4" between the highest and lowest point across the entire footprint of the shield.
 - c. **CURING:** Slab shall be cured to less than or equal to 5 lbs moisture vapor transmission per 1000 sq. ft. per 24 hours prior to installation (per ASTM F1869).
 - d. **POSITIONING:** The intended location of the MRI isocenter shall be established and marked on the slab by others prior to installation of the RF shield.
 - C. **OVERHEAD SUPPORT.** The RF shield ceiling is typically supported by the parent room construction. The RF shield ceiling system load is approximately 4.5 pounds per square foot. This weight does not include any magnetic shielding or interior structures, such as lights, duct work, wiring, plumbing, suspended ceilings or other construction. It is the responsibility of the Customer (or other appropriate responsible party) to ensure that the parent room overhead construction will adequately support the RF shield ceiling system and any other additional weight.
 - D. **ELECTRICAL ISOLATION.** To ensure against grounding of the RF shield, all external RF shield surfaces must have no electrical contact with existing building construction. Therefore, all metallic surfaces such as conduit, duct work, metal framing studs & piping that may contact the RF shield must be (electrically) isolated or removed.
 - E. **WAVE GUIDES:** Attach securely to RF shielded enclosure with frames or attachment collars as detailed.
 - F. **Mechanical Sleeves:** Attach securely to RF shielding with dielectrics, as required to allow penetration of shield without degradation of RF shield attenuation characteristics.
 - G. **FILTERS:** Attach securely to RF shielding at all power line and communication wire penetrations, as required to prevent degradation of RF shield attenuation characteristics.

3.05 GROUND BUSS BAR: INSTALL A GROUND STUD ON THE RF SHIELD ADJACENT TO POWER LINE FILTERS INSIDE THE SHIELD, AS SHOWN ON SHOP DRAWINGS, FOR SUBSEQUENT ATTACHMENT OF A DEDICATED WIRE TO THE ELECTRICAL GROUND POINT OF THE BUILDING.

- A. FINISHES: Installation of room finishes is to be performed by others.

3.06 FIELD QUALITY CONTROL

- A. The shielding vendor will exercise care in handling and protecting materials and finishes during fabrication, shipment, erection and finishing, as necessary to prevent damage to finished surfaces and shielding linings.
- B. The shielding vendor shall field-verify specs and dimensions of all components during installation of RF shielding. If non-critical discrepancies exist, we will notate the approved shop drawings and make field corrections if possible. As built drawings will be provided after completion of the project.
- C. The shielding vendor shall coordinate with other trades on site to ensure compliance with schedules, proper progression of work, and proper connections of other work to shield.
- D. Upon completion of the RF shield enclosure installation, it shall become the responsibility of the Owner, General Contractor, or other responsible party to maintain the integrity of the RF enclosure. In addition to the testing procedures outlined below, this responsibility shall also include:
1. Ensure that the parent room and the RF shielded enclosure remain free of moisture.
 2. Prevent unauthorized attachments, penetrations, or connections to the RF shielded enclosure.

E. TESTING

1. GROUND ISOLATION TESTING

- a. During installation, the shielding vendor shall test the enclosure daily for electrical isolation from ground by a minimum of 1,000 OHMS. Upon completion of the shield assembly, the shielding vendor will confirm that the RF shield remains isolated from electrical ground.
- b. After installation of the shield, but before MRI equipment delivery, the General Contractor, or other appropriate responsible party will assume responsibility that the RF shield remains isolated from electrical ground. The General Contractor or other appropriate responsible party on site will confirm ground isolation at least four (4) times daily. If a ground condition should be created by others during this period, they will be notified to immediately take measures to correct the situation. If ground condition persists after corrective measures, the General Contractor shall promptly notify the shielding vendor so that appropriate action may be taken to correct the situation.
- c. Prior to departure, the shielding vendor shall provide a battery operated audible ground alarm system as a convenience to others. During the shielding vendor's absence, the monitoring and maintenance of the alarm shall be the responsibility of the General Contractor, or other appropriate responsible party on site.

2. ATTENUATION TESTING

- a. Upon completion of the shield assembly, and prior to the application of finishes, the shielding vendor shall seal the delivery access point and test the enclosure in accordance with MIL-STD 285, MIL-STD-220-A, and MRI equipment vendor requirements for magnetic field, and/or electric field, and/or plane wave attenuation. This test shall be witnessed by the General Contractor, or other appropriate responsible party. If shield fails to conform to specifications, the shielding vendor shall immediately make such modifications as necessary to the shield to correct any non-compliance, and shall then re-test. Upon completion of a successful test, the shielding vendor will then remove the magnet access panel and store it on-site in a designated area until the time of magnet delivery.
- b. Upon delivery of the MRI equipment, the shielding vendor will return to the site to seal the delivery access point and test the enclosure in accordance with MIL-STD-285, MIL-STD-220-A, and MRI equipment vendor requirements for magnetic field, and/or electric field, and/or plane wave attenuation. This final testing shall be performed in the presence of the General Contractor, or other appropriate responsible parties, to verify compliance with specified attenuation versus

frequency characteristics.

- F. COMPLETION: Upon completion of successful final testing, the shielding vendor shall provide the following:
1. A formal report detailing the test results and certifying the shield for its intended use.
 2. A written warranty document as specified.
 3. As-built drawings.
 4. Instructions for care and maintenance of shield.

END OF SECTION 139006

**SECTION 033000
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Floors and slabs on grade.
- C. Concrete reinforcement.
- D. Joint devices associated with concrete work.
- E. Miscellaneous concrete elements, including equipment pads and equipment pits.
- F. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
- B. Section 079513 - Expansion Joint Cover Assemblies.

1.03 REFERENCE STANDARDS

- A. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).
- B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete 1991 (Reapproved 2009).
- C. ACI 301 - Specifications for Structural Concrete 2016.
- D. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.
- E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).
- F. ACI 305R - Guide to Hot Weather Concreting 2010.
- G. ACI 306R - Guide to Cold Weather Concreting 2016.
- H. ACI 308R - Guide to External Curing of Concrete 2016.
- I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).
- J. ACI 347R - Guide to Formwork for Concrete 2014, with Errata (2017).
- K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.
- L. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.
- M. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2020.
- N. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2020.
- O. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2020b.
- P. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.
- Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete 2016.
- R. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).
- S. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2019.
- T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019.
- U. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2019.

- V. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing 2017.
- W. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures 2016.
- X. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2020a.
- Y. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete 2013.
- Z. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2017.
- AA. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures 2020.
- BB. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete 2019.
- CC. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2012.
- DD. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.
- EE. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.
- FF. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.
- GG. NSF 61 - Drinking Water System Components - Health Effects 2020.
- HH. NSF 372 - Drinking Water System Components - Lead Content 2020.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
 - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
- B. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
 - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
- C. Test Reports: Submit report for each test or series of tests specified.
- D. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.
- D. For slabs required to include moisture vapor reduction admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Slabs with Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover cost of flooring failures due to moisture migration from slabs for ten years.
 - 1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.

- C. Moisture Emission-Reducing Curing and Sealing Compound, Membrane-Forming: Provide warranty to cover cost of flooring delamination failures for 10 years.
 - 1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.
- D. Moisture Emission-Reducing Curing and Sealing Compound, Penetrating: Provide non-prorated warranty to cover cost of flooring delamination failures for 20 years.
 - 1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Facing for Exposed Finish Concrete: Steel.
 - 2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
 - 3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.
 - 1. Form: Flat Sheets.
 - 2. WWR Style: As indicated on drawings.
- C. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - 3. Provide galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
- C. Fly Ash: ASTM C618, Class C or F.
- D. Calcined Pozzolan: ASTM C618, Class N.
- E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.
- F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
- D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
- F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- G. Accelerating Admixture: ASTM C494/C494M Type C.
- H. Retarding Admixture: ASTM C494/C494M Type B.

- I. Water Reducing Admixture: ASTM C494/C494M Type A.
- J. Moisture Vapor Reduction Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission with no adverse effect on concrete properties or finish flooring.
 - 1. Provide admixture in slabs to receive adhesively applied flooring.
- K. Waterproofing Admixture: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties.
 - 1. Admixture Composition: Crystalline, functioning by growth of crystals in capillary pores.
 - 2. Manufacturers:
 - a. Aquafin, Inc; []: www.aquafin.net/#sle.
 - b. Euclid Chemical Company; Eucon Vandex AM-10: www.euclidchemical.com/#sle.
 - c. Kryton International, Inc; Krystol Internal Membrane (KIM): www.kryton.com/#sle.
 - d. Xypex Chemical Corporation; XYPEX Admix C-500: www.xypex.com/#sle.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
 - 1. Installation: Comply with ASTM E1643.
 - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
 - 3. Manufacturers:
 - a. Fortifiber Building Systems Group ; Moistop Ultra 10: www.fortifiber.com/#sle.
 - b. ISI Building Products; Viper VaporCheck II 10-mil (Class A): www.isibp.com/#sle.
 - c. Stego Industries, LLC 15-mil: www.stegoindustries.com/#sle.
 - d. W. R. Meadows, Inc; PERMINATOR Class A - 10 mils (0.25 mm): www.wrmeadows.com/#sle.
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Grout: Comply with ASTM C1107/C1107M.
 - 2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:
 - a. Maximum: Plus 4 percent.
 - b. Minimum: Plus 1 percent.
 - 3. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch.

2.06 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
- B. Epoxy Bonding System:
 - 1. Complying with ASTM C881/C881M and of Type required for specific application.
- C. Waterstops: Bentonite and butyl rubber, complying with NSF 61 and NSF 372.
 - 1. Configuration: As indicated on drawings.
 - 2. Size: As indicated on drawings.
 - 3. Manufacturers:
 - a. CETCO, a division of Minerals Technologies Inc; WATERSTOP RX: www.mineralstech.com/#sle.
- D. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
 - 1. Material: ASTM D1751, cellulose fiber.
- E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.

1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
 2. Height: To suit slab thickness.
- F. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.
1. Manufacturers:
- G. Plate Dowel System: Steel plate dowel and plastic dowel sleeve; with integral fasteners for attachment to formwork.

2.07 CURING MATERIALS

- A. Curing and Sealing Compound, Moisture Emission-Reducing, Membrane-Forming: Liquid, membrane-forming, clear sealer, for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
 2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
 3. VOC Content: Less than 100 g/L.
- B. Curing and Sealing Compound, Moisture Emission-Reducing, Penetrating: Liquid for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission, moisture vapor emission, and alkalinity.
1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
 2. Compressive Strength of Treated Concrete: Equal to or greater than strength after 28-day water cure when tested according to ASTM C39/C39M.
 3. Comply with ASTM C309 and ASTM C1315 Type I Class A.
 4. VOC Content: Zero.
- C. Moisture-Retaining Sheet: ASTM C171.
1. Curing paper, regular.
 2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
 3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.
- D. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete: Slab-on -Grade (interior)
1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3500 pounds per square inch.
 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 3. Cement Content: Minimum 540 pounds per cubic foot.
 4. Water-Cement Ratio: Maximum 45 percent by weight.
 5. Maximum Slump: 3 1/2 inches. (+/-1")
 6. Maximum Aggregate Size: 3/4 inch.

2.09 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94/C94M.
- C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 - 2. Use latex bonding agent only for non-load-bearing applications.
- E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. An independent testing agency, as specified in Section 014000, will inspect finished slabs for compliance with specified tolerances.
- B. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/8 inch in 10 feet.
 - 2. Under Seamless Resilient Flooring: 1/8 inch in 10 feet.

3. Under Carpeting: 1/8 inch in 10 feet.
- C. Correct the slab surface if tolerances are less than specified.
- D. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/8 inch or more in height. Provide finish as follows:
 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
 2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
 2. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.08 CURING AND PROTECTION

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Surfaces Not in Contact with Forms:
 1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
 2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water-fog spray or saturated burlap.
 - a. Spraying: Spray water over floor slab areas and maintain wet.
 - b. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
 3. Final Curing: Begin after initial curing but before surface is dry.
 - a. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

- E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.
- F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- H. Slab Testing: Cooperate with manufacturer of specified moisture vapor reduction admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

3.10 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

3.11 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

**SECTION 034113
PRECAST CONCRETE HOLLOW CORE PLANKS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precast roof planks.
- B. Connection plates with brackets and hangers.
- C. Grouting plank joint keys.

1.02 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete 2016.
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- D. ASTM A416/A416M - Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete 2018.
- E. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel 2018.
- F. IAS AC157 - Accreditation Criteria for Fabricator Inspection Programs for Reinforced and Precast/Prestressed Concrete 2017.
- G. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products 1999.
- H. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete 2017.
- I. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete 1988.
- J. PCI MNL-124 - Design for Fire Resistance of Precast Prestressed Concrete 1989.
- K. PCI MNL-126 - Manual For The Design of Hollow Core Slabs 2015.
- L. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction 2000.
- M. PCI (CERT) - PCI Plant Certification Current Edition.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate plank locations, unit identification marks, connection details, edge conditions, bearing requirements, support conditions, dimensions, openings, openings intended to be field cut, and relationship to adjacent materials.
- C. Fabricator's Qualification Statement: Provide documentation showing precast concrete fabricator is accredited under IAS AC157.

1.04 QUALITY ASSURANCE

- A. Designer Qualifications: Design precast concrete hollow core planks under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Precast Concrete Hollow Core Planks:
 - 1. Any manufacturer with PCI Plant Certification.

2.02 PRECAST UNITS

- A. Precast Hollow Core Planks: Comply with PCI MNL-120, PCI MNL-126, PCI MNL-124 ACI 318, and ACI 301.

1. Dimensions as indicated on drawings.
2. Nominal thickness: 8 inches; nominal width: 48 inches.
3. Design components to withstand dead loads and design loads in the configuration indicated on drawings and as follows:
 - a. Roof Assembly: [] pounds per square foot live load.
 - b. Maximum Allowable Deflection of Roof Planks: $1/240$ of span .
4. Design connections in accordance with PCI MNL-123.
5. Design components to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

2.03 MATERIALS

- A. Concrete Materials: ACI 301.
- B. Tensioning Steel Tendons: ASTM A416/A416M, Grade 250 - 250K psi; seven-wire stranded steel cable; low-relaxation type; full length without splices; weldless; uncoated.
- C. Cement Grout: Minimum compressive strength of 3,000 psi at 28 days.

2.04 ACCESSORIES

- A. Connecting and Supporting Devices: Plates, angles, items cast into concrete, and inserts: ASTM A36/A36M carbon steel; prime painted.
- B. Core Hole End Plugs: Cardboard insert with stiff concrete fill.
- C. Bearing Pads: High density plastic, 1/8 inch thick, smooth on one side. Vulcanized elastomeric compound molded to size.
- D. Sill Seal: Compressible glass fiber strips.

2.05 FABRICATION

- A. Weld reinforcing in accordance with AWS D1.4/D1.4M.
- B. Embed anchors, inserts, plates, angles, and other items at locations indicated.
- C. Cut exposed ends flush.
- D. Plant Finish: Finish members to PCI MNL-116 Commercial Grade.
- E. Connecting and Supporting Steel Devices: Do not paint surfaces in contact with concrete or surfaces requiring field welding.

2.06 FABRICATION TOLERANCES

- A. Comply with PCI MNL-116 and PCI MNL-135, except as specifically amended below.
 1. Maximum Variation From Nominal Dimensions:
 - a. Width: Plus or minus $1/4$ in.
 - b. Length: Plus or minus $1/2$ in.
 - c. Depth: Plus or minus $1/4$ in.
 2. Maximum Variation from Plan End Squareness: Plus or minus $1/4$ in.

2.07 SOURCE QUALITY CONTROL

- A. Produce planks in accordance with requirements of PCI MNL-116. Maintain plant records and quality control program during production of precast planks. Make records available upon request.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that site conditions are ready to receive work and field measurements are as indicated on shop drawings.

3.02 PREPARATION

- A. Prepare support devices for the erection procedure and temporary bracing.

3.03 ERECTION

- A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
- B. Install bearing pads and sill seal at bearing ends of planks as indicated.
- C. Align and maintain uniform horizontal and end joints, as erection progresses.

- D. Maintain temporary bracing in place until final connection is made. Protect members from staining.
- E. Adjust differential camber between precast members to tolerance before final attachment and grouting.
- F. Adjust differential elevation between precast members to tolerance before final attachment.
- G. Tape seal underside of plank joints to prevent grout leakage.
- H. Make plank-to-plank joints smooth using grout, troweled smooth. Transition differential elevation of adjoining planks with grout to a maximum slope of 1:12.

3.04 TOLERANCES

- A. Erect members level and plumb within allowable tolerances. Comply with PCI MNL-135, except as specifically amended below.

3.05 PROTECTION

- A. Protect members from damage caused by field welding or erection operations.
- B. Provide non-combustible shields during welding operations.

3.06 CLEANING

- A. Clean weld marks, dirt, and blemishes from surface of exposed members.

END OF SECTION

**SECTION 042000
UNIT MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Accessories.

1.02 REFERENCE STANDARDS

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.
- B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.
- C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016, with Editorial Revision (2018).
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.
- E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2016a.
- F. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.
- G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
- H. ASTM C150/C150M - Standard Specification for Portland Cement 2020.
- I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.
- J. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019.
- K. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
- L. ASTM C476 - Standard Specification for Grout for Masonry 2019.
- M. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry 2019.
- N. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry 2016.
- O. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

1.04 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches.
 - 2. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block, as indicated.
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.

2.02 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M, Type N.
- B. Portland Cement: ASTM C150/C150M, Type I.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.
- G. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Type: Type N.
 - 2. Color: Standard gray.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.
- B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 - 1. Type: Ladder.
 - 2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
 - 3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

2.04 ACCESSORIES

- A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.05 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. Exterior, loadbearing masonry: Type N.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Remove excess mortar and mortar smears as work progresses.

- D. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- E. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.06 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place continuous joint reinforcement in first and second joint below top of walls.
- C. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.
- D. Lap joint reinforcement ends minimum 6 inches.

3.07 GROUTED COMPONENTS

- A. Reinforce bond beams with 1, No. 5 bars, 1 inch from bottom web.
- B. Lap splices minimum 24 bar diameters.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.

3.08 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.10 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.

3.11 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

**SECTION 051200
STRUCTURAL STEEL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members.
- B. Structural steel support members and struts.

1.02 RELATED REQUIREMENTS

- A. Section 055000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual 2017.
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2016.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014, with Editorial Revision (2017).
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2020.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.
- G. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2015.
- H. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2007 (Reapproved 2013).
- I. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2020.
- J. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film 2017.
- K. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments 2019.
- L. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry 2018.
- M. ASTM E709 - Standard Guide for Magnetic Particle Testing 2015.
- N. 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 2019, with Editorial Revision (2020).
- O. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2019.
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- Q. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel 2018.
- R. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections 2014, with Errata (2015).

1.04 SUBMITTALS

- 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
- 2. Connections not detailed.
- B. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- C. Fabricator's Qualification Statement.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.
- C. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- D. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Angles and Plates: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.
- E. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.
- F. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.
- G. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.
- H. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.
- I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- J. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Fabricate connections for bolt, nut, and washer connectors.

2.03 FINISH

- A. Prepare structural component surfaces in accordance with SSPC-SP 3.
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

2.04 SOURCE QUALITY CONTROL

- A. Provide shop testing and analysis of structural steel.
- B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts," testing at least 10 percent of bolts at each connection.
- C. Welded Connections: Visually inspect all shop-welded connections

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

- A. Erect structural steel in compliance with AISC 303.
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components indicated on shop drawings.

- D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
- E. Do not field cut or alter structural members without approval of Architect.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL

- A. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts," testing at least 20 percent of bolts at each connection.
- B. Welded Connections: Visually inspect all field-welded connections and test at least 25 percent of welds using one of the following:
 - 1. Radiographic testing performed in accordance with ASTM E94/E94M.
 - 2. Ultrasonic testing performed in accordance with ASTM E164.
 - 3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
 - 4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION

**SECTION 055000
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- 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 2014, with Editorial Revision (2017).
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- I. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- J. 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 2019, with Editorial Revision (2020).
- K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.
- L. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- M. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata.
- N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).
- O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).
- P. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.04 SUBMITTALS

- A. 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.
 - 2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
 - a. Include the following, as applicable:
 - 1) Design criteria.
 - 2) Engineering analysis depicting stresses and deflections.
 - 3) Member sizes and gauges.
 - 4) Details of connections.
 - 5) Support reactions.
 - 6) Bracing requirements.

1.05 QUALITY ASSURANCE

- A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

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. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- I. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- K. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 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. 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.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of Precast Plank; no paint finish.
- B. Lintels: As detailed; galvanized finish.
- C. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
 - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
- G. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

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. Supply 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. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

**SECTION 055100
METAL STAIRS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Stairs with grating treads.
- B. Structural steel stair framing and supports.
- C. Handrails and guards.

1.02 REFERENCE STANDARDS

- A. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling 2019.
- 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 2020.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014, with Editorial Revision (2017).
- H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021.
- I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.
- J. 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 2019, with Editorial Revision (2020).
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- L. NAAMM AMP 510 - Metal Stairs Manual 1992.
- M. NAAMM MBG 531 - Metal Bar Grating Manual 2017.
- N. NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual 2009.
- O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

1.03 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.
- C. Fabricator Qualifications:
 - 1. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

- A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
 2. Handrails: Comply with applicable requirements of OSHA Standards.
 3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
 - a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/360 of span.
 4. Dimensions: As indicated on drawings.
 5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
 6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
 7. Separate dissimilar metals using paint or permanent tape.
- B. Metal Jointing and Finish Quality Levels:
1. Industrial: All joints made neatly.
 - a. Welded Joints: Welded on back side wherever possible.
 - b. Welds Exposed to Touch: Ground smooth.
 - c. Bolts Exposed to Touch in Travel Area: No nuts or screw threads exposed to touch.
- C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
- D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH GRATING TREADS

- A. Jointing and Finish Quality Level: Industrial, as defined above.
- B. Risers: Open.
- C. Treads: Steel bar grating.
1. Grating Type: Welded.
 2. Bearing Bar Depth: 1 inch, minimum.
 3. Top Surface: Serrated.
 4. Nosing: Checkered plate.
 5. Nosing Width: 1-1/4 inch, minimum.
 6. Anchorage to Stringers: End plates welded to grating, bolted to stringers.
- D. Stringers: Rolled steel channels.
1. Stringer Depth: 12 inches.
 2. End Closure: Steel plate, 1/4 inch minimum; welded across ends.
- E. Railings: Steel pipe railings.
- F. Finish: Galvanized after fabrication.

2.03 HANDRAILS AND GUARDS

- A. Guards:
1. Top Rails: Round pipe or tube rails unless otherwise indicated.
 - a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
 2. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair.
 - a. Outside Diameter: 1 inch.
 - b. Material: Steel pipe or tube, round.
 - c. Vertical Spacing: Maximum 4 inches on center.
 - d. Jointing: Welded and ground smooth and flush.
 3. End and Intermediate Posts: Same material and size as top rails.
 - a. Horizontal Spacing: As indicated on drawings.
 - b. Mounting: Welded to top surface of stringer.

2.04 MATERIALS

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

- C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
- E. Gratings: Bar gratings that comply with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.

2.05 ACCESSORIES

- A. Steel Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- B. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
- C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, and comply with VOC limitations of authorities having jurisdiction.

2.06 SHOP FINISHING

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.
 - 1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. When field welding is required, clean and strip primed steel items to bare metal.

3.03 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.
- C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
- F. Obtain approval prior to site cutting or creating adjustments not scheduled.
- G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

**SECTION 210500
COMMON WORK RESULTS FOR FIRE SUPPRESSION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Above ground piping.
- B. Escutcheons.
- C. Mechanical couplings.
- D. Pipe hangers and supports.
- E. Pipe sleeves.
- F. Pipe sleeve-seal systems.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

- A. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- B. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2020.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2016.
- F. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard 2017.
- G. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- I. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe 2020.
- J. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).
- K. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use 2013 (Reapproved 2020).
- L. AWWA C606 - Grooved and Shouldered Joints 2015.
- M. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.
- F. Project Record Documents: Record actual locations of components and tag numbering.
- G. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section.
 - 1. Minimum three years experience.
- C. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.07 WARRANTY

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

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Sprinkler-based System:
 - 1. Comply with NFPA 13.
 - 2. See Section 211300.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.02 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A795 Schedule 10, ASTM A53 Schedule 40, ASTM A135/A135M Schedule 10, or ASTM A795 Schedule 40, black.
 - 1. Steel Fittings: ASME B16.5 steel flanges and fittings.
 - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
 - 3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
 - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - 5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

2.03 ESCUTCHEONS

- A. Manufacturers:
 - 1. Fire Protection Products, Inc; [____]: www.fppi.com/#sle.com/#sle.
 - 2. Tyco Fire Protection Products; [____]: www.tyco-fire.com/#sle.
 - 3. Viking Group Inc; [____]: www.vikinggroupinc.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Material:
 - 1. Metals and Finish: Comply with ASME A112.18.1.
- C. Construction:
 - 1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
 - 2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.04 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

2.05 MECHANICAL COUPLINGS

- A. Manufacturers:
 - 1. Anvil International; []: www.anvilintl.com/#sle.
 - 2. Shurjoint Piping Products, Inc; []: www.shurjoint.com/#sle.
 - 3. Tyco Fire Protection Products; []: www.tyco-fire.com/#sle.
 - 4. Victaulic Company; FireLock Style 009H: www.victaulic.com/#sle.
- B. Rigid Mechanical Couplings for Grooved Joints:
 - 1. Dimensions and Testing: Comply with AWWA C606.
 - 2. Minimum Working Pressure: 300 psig.
 - 3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
 - 4. Housing Coating: Factory applied orange enamel.
 - 5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
 - 6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
 - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 2. Place hangers within 12 inches of each horizontal elbow.
 - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- H. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- I. Structural Considerations:
 - 1. Do not penetrate building structural members unless indicated.
- J. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- K. Escutcheons:
 - 1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
 - 2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
 - 3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

- L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.
- C. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

END OF SECTION

SECTION 210553
IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Stencil paint.

1.02 REFERENCE STANDARDS

- A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature for each product required.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Piping: Tags.
- B. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.02 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Height: 1/4 inch.
 - 2. Background Color: Black.
 - 3. Thickness: 1/8 inch.
 - 4. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- B. Color code as follows:
 - 1. Fire Quenching Fluids: Red with white letters.

2.05 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 099123 for stencil painting.

3.02 INSTALLATION

- A. Install tags with corrosion resistant chain.
- B. Install plastic pipe markers in accordance with manufacturer's instructions.
- C. Use tags on piping 3/4 inch diameter and smaller.
- D. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

**SECTION 211300
FIRE-SUPPRESSION SPRINKLER SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.

1.02 REFERENCE STANDARDS

- A. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL (DIR) - Online Certifications Directory Current Edition.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
 - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
 - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
 - 3. Submit shop drawings, product data, and hydraulic calculations to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.
- D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements for additional provisions.
 - 2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
 - 3. Sprinkler Wrenches: For each sprinkler type.
- I. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard on site.
- B. Comply with FM (AG) requirements.
- C. Designer Qualifications: Design system under direct supervision of a Professional experienced in design of this type of work and licensed in the State in which the Project is located.
- D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience and approved by manufacturer.
- F. Equipment and Components: Provide products that bear FM (AG) label or marking.

- G. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
1. Anvil International; [____]: www.anvilintl.com/#sle.
 2. Tyco Fire Protection Products; [____]: www.tyco-fire.com/#sle.
 3. Viking Corporation; [____]: www.vikinggroupinc.com/#sle.
 4. Reliable.
 5. Substitutions: See Section 016000 - Product Requirements.

2.02 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for building areas noted.
- B. Occupancy: Light hazard; comply with NFPA 13. See drawings for design criteria.
- C. Water Supply: Determine volume and pressure from water flow test data. Contractor to perform new flow test prior to submitting hydraulic calculations.
- D. Interface system with building fire and smoke alarm system.
- E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.
- F. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 2. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 3. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

2.03 SPRINKLERS

- A. Suspended Ceiling Type: Concealed pendant type with matching push on escutcheon plate. See drawings for sprinkler head description.
1. Response Type: Quick.
 2. Coverage Type: Standard.
 3. Finish: Enamel, color White .
 4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- B. Flexible Drop System: Stainless steel, multiple use, open gate type.
1. Application: Use to properly locate sprinkler heads.
 2. Include all supports and bracing.
 3. Provide braided type tube as required for the application.
 4. Manufacturers:
 - a. FlexHead Industries, a brand of Anvil International; [____]: www.anvilintl.com/#sle.
 - b. Victaulic Company; Vic-Flex: www.victaulic.com/#sle.

2.04 PIPING SPECIALTIES

- A. Test Connections:
1. Inspector's Test Connection:
 - a. Route test connection to an janitor sink, accepting full flow without negative consequences.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Place pipe runs to minimize obstruction to other work.
- D. Place piping in concealed spaces above finished ceilings.

- E. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
- F. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- G. Flush entire piping system of foreign matter.
- H. Hydrostatically test entire system.
- I. Require test be witnessed by Fire Marshal.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

3.03 SCHEDULES

- A. System Hazard Areas:
 - 1. Offices: Light Hazard.
 - 2. Warehouse, Mechanical, Storage rooms: Ordinary Hazard, Group 2.

END OF SECTION

**SECTION 220001
GENERAL PROVISIONS FOR PLUMBING WORK**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Requirements of this Section apply to work in every Section of Division 22 equally as if incorporated therein.

1.02 WORK INCLUDED

- A. Work included in Division 22 - PLUMBING: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for Plumbing Work covered by all sections within this Division.

1.03 SCOPE

- A. Division of the Specification into sections is for the purpose of simplification alone. Responsibility for the work of various trades shall rest with the Contractor. Various sections of this Division are related to each other as well as the plumbing drawings. Examine all drawings and read all applicable parts of the project manual in order to ensure complete execution of all work in this Division, coordinating where required with other trades in order to avoid conflicts.
- B. These specifications and accompanying drawings are intended to cover the furnishing of all labor, materials, equipment and services necessary for the complete installation and acceptable performance of the plumbing systems. Small items of material, equipment and appurtenances not mentioned in detail or shown on the drawings, but necessary for complete and operating systems shall be provided by this contractor without additional charge to the Owner and shall be included under this contract.
- C. In general, specifications establish the quality of material, equipment and workmanship. The contract documents are intended to secure for the Owner, a first-class installation in every respect. Labor shall be performed by skilled mechanics, and the entire facility, when delivered to the Owner, shall be ready for satisfactory and efficient operation.
- D. The Contractor shall carefully examine the drawings and specifications before accepting the contract. He shall call attention to any changes or additions which, in his opinion, are necessary to make possible the fulfillment of any guarantee called for by these specifications; failing which, it shall be deemed that he has accepted full responsibility for all such guarantees.
- E. The contractor shall put his work in place as fast as is reasonably possible. He shall, at all times, keep a competent foreman in charge of the work, to make decisions necessary for the diligent advancement of the work. The Contractor shall facilitate the inspection of the work by the Engineer, Architect, or Owner's representative.
- F. The Contractor shall coordinate all work in the building in order to facilitate intelligent execution of the work. He shall also remove any rubbish as expeditiously as possible.
- G. Materials or products specified herein and/or indicated on the drawings by trade's names, manufacturer's names, model number or catalog numbers establish the quality of materials or products to be furnished. Model numbers are to be confirmed by the manufacturer to provide required capacities and material to meet the specifications and design intent. In no instance shall an obsolete, incomplete or inaccurate trade name, manufacturer name, model number or catalog number indicated on the drawings, result in additional charges to the owner.
- H. Points of connection or continuation of work under this contract are so marked on drawings or herein specified. In case of any doubt as to the required exact location of such points, the Owner's Representative shall decide and direct.
- I. The plumbing contractor shall provide water services to within two (2) feet of HVAC equipment requiring same, and shall terminate service with a shutoff valve. The mechanical contractor shall make the final connection to the equipment.

1.04 REFERENCE STANDARDS, CODES AND REGULATIONS

- A. Requirements of Regulatory Agencies:
 - 1. Nothing contained in these specifications or shown on the drawings shall be construed to conflict with any State or local laws, ordinances, rules and regulations, the UL and NFPA regulations. The Contractor shall make all changes required by the enforcing authorities. Where alterations to and / or deviations from the Contract Documents are required by the authorities having jurisdiction, report the requirements to the Engineer and secure acceptance before work is started. All such changes shall be made in a manner acceptable to the Engineer and shall be made without cost to the Owner.
 - 2. When drawings or specifications exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement. All work shall be done in full conformity with the requirements of all authorities having jurisdiction. Installation shall be made in compliance with all applicable regulations, and utility company rules, all of which shall be considered a part of this specification and shall take precedence in the order of listing.
 - 3. It is not the intent of drawings or specifications to repeat requirements of codes except where necessary for completeness in individual sections.
- B. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in this Division, in addition to other standards which may be specified in individual sections:
 - 1. {RS#10000010} American Gas Association
 - 2. {RS#10000011} American National Standards Institute
 - 3. {RS#10000009} American Society of Plumbing Engineers
 - 4. {RS#10000012} American Society for Testing and Materials
 - 5. {RS#10000013} Cast Iron Soil Pipe Institute
 - 6. ETL Testing Laboratories
 - 7. Factory Mutual Engineering and Research Corporation
 - 8. National Standard Plumbing Code
 - 9. National Electrical Manufacturer's Association
 - 10. NFPA 13-2016 National Fire Protection Association
 - 11. National Board of Fire Underwriters
 - 12. National Electric Code
 - 13. Occupational Safety and Health Administration
 - 14. Plumbing Drainage Institute
 - 15. Underwriters Laboratories, Inc.
- C. Furnish and file with the proper authorities, all drawings required by them in connection with the work. Contractor shall secure and obtain all approvals, permits, licenses and inspections and pay all legal and proper fees and charges in this connection, before commencing work in order to avoid delays during construction. He shall deliver the official records of the granting of the permits, etc., to the Owner's Representative.

1.05 QUALITY ASSURANCE

- A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply all equipment and accessories new and free from defects.
- C. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.4 of this section with all applicable national, state and local codes.

All items of a given type shall be the product of same manufacturer.

1.06 DESCRIPTION OF BID DOCUMENTS

- A. Specifications:
 - 1. Specifications, in general, describe quality and character of materials and equipment.
 - 2. Specifications are of simplified form and include incomplete sentences.
 - 3. Words or phrases such as "The Contractor shall", "shall be", "furnish", "provide", "a", "an", "the", and "all" may have been omitted for brevity.
- B. Drawings: Plumbing drawings under this contract are made a part of these specifications. Deviations from these specifications as noted below must have the approval of the Engineer or Construction Manager without an increase in contract price.

1. The drawings shall be considered as being diagrammatic and for bidding purposes only. Intention is to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement. The attention of the contractor is called to the fact that while these drawings are generally to scale and are made as accurately as the scale will permit, all critical dimensions shall be determined in the field. They are not to be considered as erection drawings.
 2. The drawings do not indicate every fitting, elbow, offset, valve, etc. which is required to complete the job. Contractor shall prepare field erection drawings as required for the use of his mechanics to insure proper installation.
 3. Scaled and figured dimensions are approximate and are for estimating purposes only. Indicated dimensions are limiting dimensions.
 4. Before proceeding with work check and verify all dimensions in field.
 5. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
 6. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
 7. For exact locations of building elements, refer to dimensional Architectural/Structural drawings.
- C. Description of systems: Provide all materials to provide functioning systems in compliance with performance requirements specified, and any modifications resulting from reviewed shop drawings and field coordinated drawings.
1. Installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.
- D. Do not use equipment exceeding dimensions indicated or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.
- E. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect for his interpretation and decision as early as possible, including during bidding period.
1. Do not proceed with work without Engineer's decision.

1.07 EQUIPMENT MANUFACTURERS

- A. The first named manufacturer is used as the basis of design. Other named manufacturers are identified as equivalent manufacturers, not equivalent products. Naming other manufacturers does not necessarily imply conformance of any specific product with the written specifications.
- B. The contractor is required to verify that equipment and material to be used on the project meets the requirements of the specifications and will physically fit the available space, clearance and service requirements of the particular piece of equipment and include all pertinent information when he submits material for acceptance. Contractor shall also be responsible for and bear the cost of any modifications to openings available or anticipated as being available for rigging equipment to its final installation place. This shall include openings in exterior envelope, walls and roofs, interior walls, corridors, passage ways or door openings. Any on site dismantling and any reassembly of equipment made necessary by impediment to the rigging of said equipment shall be the sole responsibility of the contractor.
- C. Contract document indicates power and physical requirements based on the equipment manufacturer's data as first named. If equipment requiring more system capacity is furnished, the contractor shall be responsible for the cost associated with modifying the design and installation of associated services, including any redesign costs associated with the engineer's review.

1.08 DEFINITIONS

- A. "Provide": To supply, furnish, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.
- B. "Install": To erect, mount and connect complete with related accessories.
- C. "Supply", "Furnish": To purchase, procure, acquire and deliver complete with related accessories.
- D. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

- E. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.
- F. "Wiring": Raceway, fittings, wire, boxes and related items.
- G. "Concealed": Items referred to as hidden from normal sight, embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.
- H. "Exposed": Not installed underground or "concealed" as defined above.
- I. "Indicated", "Shown", or "Noted": As indicated, shown or noted on drawings or specifications.
- J. "Directed": Directed by Engineer.
- K. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified product.
- L. "Reviewed", "Satisfactory", or "Directed": As reviewed, satisfactory, or directed by or to Engineer.
- M. "Motor Controllers": Manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.
- N. "Control or Actuating Devices": Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.
- O. "Remove": Dismantle, demolish and take away from the site and dispose of in accordance with all applicable rules and regulations or, should the Owner so require, deliver to a location as designated by the Owner for the use of the Owner, at no additional cost to the Owner.
- P. "Replace": Remove existing and provide an equivalent product or material as specified.
- Q. "Extract (and Reinstall) ": Carefully disassemble, dismantle existing, save or store where directed by the Owner, in such a manner as to preserve the existing condition and reinstall as indicated on the drawings or as described in the specifications.
- R. Where any device or piece of equipment is referred to in the singular number, such reference shall be deemed to apply to as many devices as are required to complete the installation.

1.09 JOB CONDITIONS

- A. This contractor shall investigate all conditions affecting his work and shall provide such offsets, fittings, valves, and piping, etc., as may be required to meet conditions at the building.
- B. The contractor shall verify all measurements at the building site and shall be responsible for the correctness of same before ordering materials or before starting work of any Section.
 - 1. Report to Architect, in writing, conditions which will prevent proper provision of this work.
 - 2. Beginning work of any Section without reporting unsuitable conditions to Architect constitutes acceptance of conditions by Contractor.
 - 3. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to Owner.
- C. Piping shall be concealed or run behind furring in finished spaces unless otherwise noted to be run exposed.
- D. Horizontal piping not run below slabs on grade shall be run as close as possible to underside of roof or floor slab above and parallel to building lines. Maintain maximum headroom in all areas.
- E. Determine possible interference between trades before the work is fabricated or installed. The contractor must coordinate his work to insure that erection will proceed without such interference. Coordination is of paramount importance and no request for additional payment will be considered where such request is based upon interference between trades.
- F. Connections to Existing Work:

1. Install new work and connect to existing work with minimum of interference to existing facilities.
 2. Temporary shutdowns of existing services:
 - a. At no additional charges
 - b. At times not to interfere with normal operation of existing facilities.
 - c. Only with written consent of Owner.
 3. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.
 4. Restore existing disturbed work to original condition.
- G. Removal, extraction and relocation of existing work.
1. The work includes demolition or removal of all construction indicated or specified. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the site. Rubbish and debris shall be removed from the site daily unless otherwise directed so as to not allow accumulation inside or outside the building. Materials that cannot be removed daily shall be stored in areas specified by the Owner.
 2. Title to all materials and equipment to be demolished, excepting Owner salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Owner will not be responsible for the condition, loss or damage to such property after notice to proceed.
 3. The Owner reserves the "Right of First Refusal" on all material for salvage. Material for salvage shall be stored as approved by the Owner. Salvage materials shall be removed from the site before completion of the Contract. Material for salvage shall not be sold on the site.
 4. Property of the Owner: Salvaged items remaining the property of the Owner shall be removed in a manner to prevent damage and packed or crated to protect the items from damage while in storage or during shipment and relocated by the contractor at no cost, to the Owners designated storage facility on the site. Containers shall be properly identified as to contents.
 5. Damaged Items: Items damaged during removal or storage shall be repaired or replaced to match existing.
 6. Disconnect, remove or relocate material, equipment, plumbing fixtures, piping and other work noted and required by removal or changes in existing conditions.
 7. Where existing pipes, conduits and/or ducts which are to remain prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits, and/or ducts.
 8. Provide new material and equipment required for relocated equipment.
 9. Plug or cap active piping or below finish.
 10. Do not leave long dead-end branches.
 11. Cap or plug as close as possible to active line.
 12. Remove unused piping and equipment.
- H. Dispose of unusable piping and material.

1.10 CLEARANCE FROM ELECTRICAL EQUIPMENT

- A. Piping:
1. Prohibited, except as noted, in:
 - a. Electric rooms and closets.
 - b. Telephone rooms and closets.
 - c. Elevator machine rooms.
 - d. Electric switchboard room.
 2. Prohibited, except as noted, over or within 5 ft. of:
 - a. Transformers.
 - b. Substations.
 - c. Switchboards.
 - d. Motor control centers.
 - e. Standby power plant.
 - f. Bus ducts.
 - g. Electrical panels.
 3. Drip pans under piping:

- a. Only where unavoidable and approved.
 - 1) 18 gauge galvanized steel.
- b. With bituminous paint coating.
- c. Reinforced and supported.
- d. Watertight.
- e. With 1-1/4 inch drain outlet piped to floor drain or service sink.

1.11 TEMPORARY FACILITIES

- A. Temporary facilities are not included within this Section.

1.12 SPECIAL TOOLS

- A. Furnish to Owner at completion of work:
 - 1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of the Division.
 - 2. "Special tools": those not normally found in possession of mechanics or maintenance personnel.
 - 3. One pressure grease gun for each type of grease required.
 - a. With adapters to fit all lubricating fittings on equipment.
 - b. Include lubricant for lubricated plug valves.

1.13 PRODUCT DELIVERY, HANDING AND STORAGE

- A. Provide adequate and secure storage facilities for materials and equipment during the progress of the work.
- B. Contractor shall be responsible for the condition of all materials and equipment employed in the plumbing installation until final acceptance by the Owner. Protect same from any cause whatsoever.
- C. Where necessary, ship in crated sections of size to permit passing through available space.
- D. Ship equipment in original packages, to prevent damaging or entrance of foreign matter.
- E. Handle and ship in accordance with manufacturer's recommendations.
- F. Provide protective coverings during construction.
- G. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by Engineer.
- H. Tag all items with weatherproof tag, identifying equipment by name and purchase order number.
- I. Include packing and shipping lists.
- J. Adhere to special requirements as specified in individual sections.

1.14 PROTECTION OF MATERIALS

- A. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed.
- B. Provide temporary storage facilities for materials and equipment.
- C. Material, equipment or apparatus damaged because of improper storage or protection will be rejected.
- D. apparatus in replacement of that rejected.
- E. Cover motors and other moving machinery to protect from dirt and water during construction. Rotate moving equipment, shafts, bearings, motors etc. to prevent corrosion and to circulate lubricants.
- F. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.
- G. Contractor shall be responsible for the replacement of all damaged or defective work, materials or equipment. Do not install sensitive or delicate equipment until major construction work is completed.
- H. Remove replaced parts from premises.
- I. Make good any damage to the work caused by floods, storms, accidents, acts of God, acts of negligence, strikes, violence or theft up to time of final acceptance by the Owner.

- J. Do not leave any plumbing work in a hazardous condition, even temporarily.

1.15 REVIEW OF CONSTRUCTION

- A. Work may be reviewed at any time by representative of the Engineer.
- B. Advise Architect and Engineer that work is ready for review at following times:
 - 1. Prior to backfilling buried work.
 - 2. Prior to concealment of work in walls and above ceilings.
 - 3. When all requirements of Contract have been completed.
- C. Neither backfill nor conceal work without Engineer's consent.
- D. Maintain on job a set of Specifications and Drawings for use by Engineer's representatives.

1.16 SCHEDULE OF WORK

- A. Arrange work to conform to schedule of construction established or required to comply with Contract Documents.
- B. In scheduling, anticipate means of installing equipment through available openings in structure.
- C. Confirm in writing to Architect and Engineer, within 30 days of signing of contract, anticipated number of days required to perform test, balance, and acceptance testing of plumbing systems.
 - 1. This phase must occur after completion of plumbing systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.
 - 2. Submit for approval at this time, names and qualifications of test and balancing agencies to be used.
- D. Arrange with Owner schedule for work in each area.
- E. Unless otherwise directed by Owner, perform work during normal working hours.
- F. Work delays:
 - 1. In case noisy work interferes with Owner's operations, Owner may require work to be stopped and performed at some other time, or after normal working hours.

1.17 ACCESS TO PLUMBING WORK

- A. Access doors in walls and ceilings.
- B. Access Units Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by access units, provide UL listed-and-labeled units, except for units which are smaller than minimum size requiring ratings as recognized by governing authority.
- C. Product Data, Access Units: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.
- D. Furnish to the general contractor all access doors necessary for access through inaccessible wall or ceiling construction, for installation by the general contractor. Information on the size and location of the subject access doors is to be communicated in writing to the general contractors during the bidding period.

1.18 CONCRETE FOR PLUMBING WORK

- A. Concrete for plumbing Work
 - 1. Basins and curbs for plumbing equipment.
 - 2. Plumbing equipment foundations and housekeeping pads.
 - 3. Inertia bases for isolation of plumbing work.
 - 4. Rough grouting in and around plumbing work.
 - 5. Patching concrete cut to accommodate plumbing work.
- B. Quality control testing for concrete is required as work of this section.
- C. Concrete Work Codes and Standards:
 - 1. Comply with governing regulations and, where not otherwise indicated, comply with the following industry standards; whichever is the most stringent in its application to work in each instance.

2. "Specifications for Structural Concrete for Buildings"
 3. "Recommended Practice for Concrete Inspection"
 4. "Building Code Requirements for Reinforced Concrete"
 5. "Recommended Practice for Concrete Form work"
 6. "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"
 7. Concrete Reinforcing Steel Institute's, "Manual of Standard Practice"
- D. Submittals: Shop Drawings, Plumbing Concrete Work: Submit shop drawings for structural type concrete work, showing dimensions of formed shapes of concrete; bending, placement, sizes and spacing of reinforcing steel; location of anchors, isolation units, hangers and similar devices to be integrated with concrete work; and piping penetrations, access openings, inlets and other accessories and work to be accommodated by concrete work.
- E. Laboratory Test Reports, Plumbing Concrete Work: Submit laboratory test reports for concrete work materials, and for tested samples of placed concrete (where required as work of this section).

1.19 NOISE REDUCTION

- A. Cooperate in reducing objectionable noise or vibration caused by plumbing systems.
1. To extent of adjustments to specified and installed equipment and appurtenances.
- B. Correct noise problems caused by failure to install work in accordance with Contract Documents.
1. Include labor and materials required as result of such failure.

1.20 CUTTING AND PATCHING

- A. Provide all carpentry, cutting and patching required for proper installation of material and equipment specified.
- B. Do not cut or drill structural members without consent of Architect.

1.21 COORDINATION DRAWINGS

- A. Layout Shop Drawings Required:
1. Prepare layout shop drawings for all areas; minimum 1/8 inch scale.
 2. Individual coordinated trade layout drawings are to be prepared for all areas.
 3. General Contractor is to assure that each trade has coordinated work with other trades, prior to submittal where submittal is required.
 - a. Include stamp on each submittal indicating that layout shop drawing has been coordinated.
 4. No layout shop drawing will be reviewed without stamped and signed coordinated assurance by General Contractor.
 5. All changes shall be clearly marked on each submitted layout drawing.
 6. Drawings shall show work of all trades including but not limited to'
 - a. Piping: All Trades.
 - b. Plumbing Equipment.
 - c. Electrical Equipment.
 - d. Main Electrical conduits and bus ducts.
 - e. Equipment supports and suspension devices.
 - f. Structural and architectural constraints.
 - g. Show location of:
 - 1) Valves
 - 2) Piping specialties
 - 3) Access Doors
 - 4) Control and electrical panels
 - 5) Disconnect switches
 7. Drawings shall indicate coordination with work in other Divisions that must be incorporated in plumbing spaces, including, but not limited to:
 - a. Elevator equipment.
 - b. Cable trays not furnished under Division 16.
 - c. Computer equipment.
 8. Submission of drawings:
 - a. Prepare reproducible drawings.

- b. Submit to other trades for review of space allocated to all trades.
 - c. Revise drawings to compensate for requirements of existing conditions and conditions created by other trades.
 - d. Review revisions and other trades.
 - e. Submit one reproducible and one blue-line print to Engineer for review.
 9. Final prepared drawings shall show that other trades affected have made reviews and signed, by each trade, at completions of coordination.
 - a. General Contractor
 - b. Include stamp on each submittal indicating that layout shop drawing has been coordinated.
 10. No layout shop drawing will be reviewed without stamped and signed coordination assurance by General Contractor.
- B. Shop Drawings:
 1. Layout drawings of mechanical equipment rooms and penthouses showing all related equipment and equipment clearances required by other trades.
 2. Layout drawings of areas in which it may be necessary to deviate substantially from layout shown on the drawings. Minor transitions in piping, if required due to job conditions, need not be submitted as long as the pipe area is maintained. Show major relocation of piping and major changes in size of pipes. Coordinate shop drawings with all trades prior to piping fabrication.
 3. Details of intermediate structural steel members required to span main structural steel for the support of piping.
 4. Method of attachment of pipe hangers to building construction.

1.22 GUARANTEE

- A. Furnish guarantee covering all work in accordance with general requirements of the contract for minimum period of one year. This personal guarantee shall exist for a period of one (1) year from the date of final acceptance of the work and shall apply to defects in materials and to defective workmanship of any kind.
- B. For factory-assembled equipment and devices on which the manufacturers furnish standard published guarantees as regular trade practice, obtain such guarantees and replace any such equipment that proves defective during the life of these guarantees.
- C. Guarantee all work for which materials are furnished, fabricated or field erected by the contractor, all factory-assembled equipment for which no specific manufacturer's guarantee is furnished, and all work in connection with installing manufacturer's guarantee is furnished, and all work in connection with installing manufacturer's guaranteed equipment.
- D. In the event of failure of any work, equipment or device during the life of the guarantee, repair or replace the equipment or defective work. Remove, replace or restore, at no cost to the Owner, any part of the structure or building which may be damaged either as the direct result of the defective work or in the course of the contractor's making replacement of the defective work or materials. Work shall be done at a time and in a manner as to cause no undue inconvenience to the Owner. Provide new materials, equipment, apparatus and labor to replace that determined by Engineer to be defective or faulty.
- E. This guarantee also applies to services including Instructions, Adjusting, Testing, Noise, Balancing, etc.
- F. Additional equipment and material guarantees and warranties may be indicated in other sections. In all cases, the more stringent guarantee or warranty shall be provided.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT QUALITY

- A. Material and equipment furnished under this Division of specification shall be new. Defective or inferior materials must be replaced by contractor at no cost to Owner regardless of the stage of construction. Inferior material shall be defined as material or equipment of a quality or performance less than that specified as determined by the Owner's Representative.
- B. Provide each item of equipment with manufacturer's identification tag which is readily accessible and clearly shows model and size.

2.02 ACCESS TO PLUMBING WORK

- A. Access Doors:
 - 1. General: Where walls and ceilings must be penetrated for access to mechanical work, access doors shall be provided. Furnish adequate size for intended and necessary access. Furnish doors with UL Fire Rating to match wall or ceiling construction. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.
- B. Access Door Construction: Refer to Section 083113 – ACCESS DOORS AND FRAMES

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Perform as specified in individual sections, and as required by authorities having jurisdiction.
 - 2. Duration as noted.
- B. Provide required labor, material, equipment, and connections.
- C. Furnish written report and certification those tests have been satisfactorily completed.
- D. Repair or replace defective work, as directed.
- E. Pay for restoring or replacing damaged work due to tests as directed.
- F. Pay for restoring or replacing damaged work of others, due to tests, as directed.

3.02 ACCESS TO PLUMBING WORK

- A. Coordinate installation and placement of access doors and panels with contractor for general construction.
- B. Remove or replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION

**SECTION 220517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Pipe sleeves.
- B. Stack-Sleeve fittings.
- C. Sleeve-Seal Fittings
- D. Grout

1.03 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 099123 - Interior Painting: Preparation and painting of interior piping systems.
- C. Section 220523 - General-Duty Valves for Plumbing Piping.
- D. Section 220553 - Identification for Plumbing Piping and Equipment: Piping identification.
- E. Section 220719 - Plumbing Piping Insulation.

1.04 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2016.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified this section.
 - 1. Minimum three years experience.
 - 2. Approved by manufacturer.
- C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.08 WARRANTY

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

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Manufacturers:
 - 1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/#sle.
 - 2. Smith, Jay R. Mfg. Co..

3. Zurn Specification Drainage Operation; Zurn Plumbing Products Group..
4. Presealed Systems.
5. Substitutions: See Section 016000 - Product Requirements.
- B. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water stop unless otherwise indicated.
- C. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.Pipe
- D. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- E. Passing Through Below Grade Exterior Walls:
 1. Zinc coated or cast iron pipe.
 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- F. Clearances:
 1. Provide allowance for insulated piping.
 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
 3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 STACK-SLEEVE FITTINGS

- A. Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping rings with setscrews.

2.03 SLEEVE-SEAL SYSTEMS

- A. Manufactured plastic, sleeve-type, water stop assemblies made for imbedding in concrete slab or wall. Unit has plastic or rubber water stop collar with center opening to match piping OD.

2.04 GROUT

- A. Standard: ASTM C 1107/C1107M Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28 day compressive strength.
- D. Packaging: Premix and factory packaged.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Provide sleeves when penetrating footings, floors, walls, partitions, and [_____]. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- E. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.

- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.
- C. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

**SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Ball valves.
- B. Butterfly valves.
- C. Check valves.
- D. Plug valves.

1.03 RELATED REQUIREMENTS

- A. Section 220553 - Identification for Plumbing Piping and Equipment.
- B. Section 220719 - Plumbing Piping Insulation.
- C. Section 221005 - Plumbing Piping.

1.04 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.

1.05 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch) 2013 (Reaffirmed 2018).
- B. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2017.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- D. ASME B31.9 - Building Services Piping 2020.
- E. AWWA C606 - Grooved and Shouldered Joints 2015.
- F. MSS SP-67 - Butterfly Valves 2017.
- G. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends 2018.
- H. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
- I. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
- J. NSF 61 - Drinking Water System Components - Health Effects 2020.
- K. NSF 372 - Drinking Water System Components - Lead Content 2020.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
 - 4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
 - 5. Secure check valves in either the closed position or open position.
 - 6. Adjust butterfly valves to closed or partially closed position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.
 - 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.
 - b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.09 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

- A. Handle large valves with sling, modified to avoid damage to exposed parts.
- B. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
 - 1. Conbraco Industries Inc.; Apollo Valves.
 - 2. Crane Co.; Crane Valve Group; Crane Valves.
 - 3. Hammond Valve
 - 4. Milwaukee Valve Company
 - 5. NIBCO INC.
 - 6. Red-White Valve Corporation
 - 7. Watts Regulator Co.; a division of Watts Water Technologies. Inc.

2.02 APPLICATIONS

- A. Provide the following valves for the applications if not indicated on drawings:
 - 1. Shutoff: Ball, butterfly, [_____].
 - 2. Dead-End: Leave no dead end piping. Cap at
 - 3. Throttling: Provide ball or butterfly.
- B. Required Valve End Connections for Non-Wafer Types:
 - 1. Copper Tube:
 - a. 2 NPS and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
- C. Domestic, Hot and Cold Water Valves:
 - 1. 2 NPS and Smaller:
 - a. Ball: Two piece, full port, brass with stainless-steel trim.
 - 2. 2-1/2 NPS and Larger:
 - a. Iron Grooved-End Butterfly: 175 CWP.

2.03 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:

1. Hand Lever: Quarter-turn valves 6 NPS and smaller except plug valves.
- D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
 1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- E. Valve-End Connections:
 1. Threaded End Valves: ASME B1.20.1.
 2. Solder Joint Connections: ASME B16.18.
 3. Grooved End Connections: AWWA C606.
- F. General ASME Compliance:
 1. Solder-joint Connections: ASME B16.18.
 2. Building Services Piping Valves: ASME B31.9.
- G. Potable Water Use:
 1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.
- H. Source Limitations: Obtain each valve type from a single manufacturer.

2.04 BRONZE, BALL VALVES

- A. General:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Two Piece, Full Port with Bronze Trim:
 1. Comply with MSS SP-110.
 2. SWP Rating: 150 psig.
 3. CWP Rating: 600 psig.
 4. Body: Forged bronze or dezincified-brass alloy.
 5. Ends: Threaded.
 6. Seats: PTFE.
 7. Stem: Stainless steel.
 8. Ball: Stainless steel, vented.

2.05 IRON, GROOVED-END BUTTERFLY VALVES

- A. CWP Rating: 175 psig (1200 kPa).
 1. Comply with MSS SP-67, Type I.
 2. Body: Coated ductile iron.
 3. Stem: Two-piece stainless steel.
 4. Disc: Coated ductile iron.
 5. Disc Seal: EPDM.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

- D. Install check valves where necessary to maintain direction of flow as follows:
1. Lift Check: Install with stem plumb and vertical.
 2. Swing Check: Install horizontal maintaining hinge pin level.
 3. Orient plate-type into horizontal or vertical position, between flanges.

END OF SECTION

**SECTION 220529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Support and attachment components for equipment, piping, and other plumbing work.

1.03 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.04 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- E. MFMA-4 - Metal Framing Standards Publication 2004.
- F. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.06 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of the Valve and Fitting Industry Inc.

1.07 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ACSE/SEI7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, systems contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.08 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.09 QUALITY ASSURANCE

- A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of [____]. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Metal Channel (Strut) Framing Systems:
 - 1. Comply with MFMA-4.
- C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- D. Thermal Insulated Pipe Supports:
 - 1. General Construction and Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
 - d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
- E. Pipe Supports:
 - 1. Liquid Temperatures Up To 122 degrees F:
 - a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
 - b. Support From Below: MSS SP-58 Types 35 through 38.
- F. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- G. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Secure fasteners according to manufacturer's recommended torque settings.
- I. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.

1.03 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Identification painting.

1.04 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Piping: Tags.
- B. Pumps: Nameplates.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Brimar Industries, Inc; []: www.pipemarker.com/#sle.
 - 2. Kolbi Pipe Marker Co; []: www.kolbipipemarkers.com/#sle.
 - 3. Seton Identification Products; []: www.seton.com/#sle.
- B. Description: Laminated three-layer plastic with engraved letters.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.
 - 4. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Manufacturers:
 - 1. Brimar Industries, Inc; []: www.pipemarker.com/#sle.
 - 2. Kolbi Pipe Marker Co; []: www.kolbipipemarkers.com/#sle.
 - 3. Seton Identification Products; []: www.seton.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Manufacturers:
 - 1. Brimar Industries, Inc; []: www.pipemarker.com/#sle.
 - 2. Kolbi Pipe Marker Co; []: www.kolbipipemarkers.com/#sle.
 - 3. Seton Identification Products; []: www.seton.com/#sle.
- B. Comply with ASME A13.1.

- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Color code as follows:
 - 1. Domestic Water, Storm Drainage, Waste & Vent: Green with white letters.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 099123 for stencil painting.

3.02 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 099123.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- G. Use tags on piping 3/4 inch diameter and smaller.
 - 1. Identify service, flow direction, and pressure.
 - 2. Install in clear view and align with axis of piping.
 - 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

**SECTION 220719
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Supplies and drains for handicap-accessible lavatories and sinks.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Detail application of protective sheilds or saddles at hangers for each type of insulation and hang
- D. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
- E. Detail application of field-applied jackets.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to {RS#10000008} by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
- B. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- C. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- D. Comply with the following applicable standards and other requirements specified for miscellaneous components:
- E. Supply and Drain Protective Shielding Guards: ICC A117.1

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.08 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to **ASTM C 871**.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials.
- G. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Aeroflex USA, Inc.; Aerocel.
 - 2. Armacell LLC; AP Armaflex.
 - 3. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.02 MINERAL-FIBER, PREFORMED PIPE INSULATION:

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Fibrex Insulations Inc.; Coreplus 1200.
 - 2. Johns Manville; Micro-Lok.
 - 3. Knauf Insulation; 1000-Degree Pipe Insulation.
 - 4. Manson Insulation Inc.; Alley-K.
 - 5. Owens Corning; Fiberglas Pipe Insulation.
- B. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.03 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ramco Insulation, Inc.; Super-Stik.

2.04 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- C. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Aeroflex USA, Inc.; AeroSeal.
 - 2. Armacell LLC; Armaflex 520 Adhesive.
 - 3. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - 4. K-Flex USA; R-373 Contact Adhesive.

- D. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- G. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - 2. Eagle Bridges - Marathon Industries; 225.
 - 3. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - 4. Mon-Eco Industries, Inc.; 22-25.
- H. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- I. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.05 PVC JACKET ADHESIVE: COMPATIBLE WITH PVC JACKET.

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Dow Corning Corporation; 739, Dow Silicone.
 - 2. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - 3. I.C. Plastics, Inc.; Welding Adhesive.
 - 4. Speedline Corporation; Polyco VP Adhesive.
- B. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.06 SEALANTS

- A. Joint Sealants:
 - 1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
- B. Materials shall be compatible with insulation materials, jackets, and substrates.
- C. Permanently flexible, elastomeric sealant.
- D. Service Temperature Range: Minus 100 to plus 300 deg F.
- E. Color: White or gray.
- F. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.07 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2.08 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
- C. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Johns Manville; Zeston.
 - 2. I.C. Plastics, Inc.; FG Series.
 - 3. Proto Corporation; LoSmoke.
 - 4. Speedline Corporation; SmokeSafe.
- D. Adhesive: As recommended by jacket material manufacturer.
- E. Color: White.
- F. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - 1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.09 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers at ADA Lavatories :
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Engineered Brass Company.
 - 3. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
 - 4. McGuire Manufacturing.
 - 5. Plumberex.
 - 6. Truebro; a brand of IPS Corporation.
 - 7. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
 - 8. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

- C. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- D. Install multiple layers of insulation with longitudinal and end seams staggered.
- E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
- L. Draw jacket tight and smooth.
 - 1. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 2. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - 3. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.

3.04 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 7. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.07 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, locations of threaded valves, and locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.09 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. **Domestic Cold Water:**
 - 1. NPS 1 and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch Insert dimension thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. **Domestic Hot Water (105-140 F):**
 - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
 - 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
- D. Piping, Exposed:
 - 1. PVC: 20 mils thick.

END OF SECTION

**SECTION 221005
PLUMBING PIPING**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
 - 1. Sanitary sewer.
 - 2. Domestic water.
 - 3. Flanges, unions, and couplings.

1.03 RELATED REQUIREMENTS

- A. Section []: Roof penetrations.
- B. Section 078400 - Firestopping.
- C. Section 083100 - Access Doors and Panels.
- D. Section 099123 - Interior Painting.
- E. Section 220553 - Identification for Plumbing Piping and Equipment.
- F. Section 220719 - Plumbing Piping Insulation.
- G. Section 312316 - Excavation.
- H. Section 312323 - Fill.

1.04 REFERENCE STANDARDS

- A. ANSI Z223.1 - National Fuel Gas Code 2016.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- C. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2016.
- D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
- F. ASME B31.9 - Building Services Piping 2020.
- G. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2020.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- I. ASTM B32 - Standard Specification for Solder Metal 2020.
- J. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- K. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- L. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- M. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings 2020a.
- N. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.
- O. AWWA C651 - Disinfecting Water Mains 2014.
- P. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications 2017 (Revised 2018).
- Q. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2012 (Revised 2018).
- R. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.

- S. NSF 61 - Drinking Water System Components - Health Effects 2020.
- T. NSF 372 - Drinking Water System Components - Lead Content 2020.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.
- D. Project Record Documents: Record actual locations of valves.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper tubing shall meet the requirements of Federal Specification W-W-T 7996 and shall conform to ASTM specifications B-75, B-88 and B68 as they apply to Type K copper tubing.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
 - 1. Fittings: Ductile or gray iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.

2.06 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 - 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
- B. No-Hub Couplings:
 - 1. Gasket Material: Neoprene complying with ASTM C564.
 - 2. Band Material: Stainless steel.
 - 3. Eyelet Material: Stainless steel.

2.07 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.
 - 5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
 - 6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
 - a. Bases: High-density polypropylene.
 - b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - c. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
 - d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material.
 - e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
- B. Plumbing Piping - Drain, Waste, and Vent:
 - 1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
 - 2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
- C. Plumbing Piping - Water:
 - 1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
 - 2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

2.08 MANUFACTURED SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 - 1. The Metraflex Company; MetraSeal: www.metraflex.com/#sle.
- B. Modular/Mechanical Seal:
 - 1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
 - 2. Provide watertight seal between pipe and wall/casing opening.
 - 3. Elastomer element size and material in accordance with manufacturer's recommendations.
 - 4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Drawing plans, schematics and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service area at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Make changes in direction using appropriate branches, bends, and long sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of a drainage piping in direction of flow is prohibited.
- E. Lay buried drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturers' written instructions for use of lubricants, cements, and other installation requirements.
- F. Install drainage piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Storm or Sewer: 2 percent downward in direction of flow for piping 2-1/2" or smaller; 1 percent downward in direction of flow for piping 3" and larger.
- G. Install cast-iron soil piping accordance to CISPI "Cast Iron Soil Pipe and Fitting Handbook," Chapter IV, Installation of Cast Iron Soil Pipe and Fittings."
- H. Install in accordance with manufacturer's instructions.
- I. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- J. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- K. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- L. Group piping whenever practical at common elevations.
- M. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
 - 1. See Section 220719.
- N. Provide access where valves and fittings are not exposed.
 - 1. Coordinate size and location of access doors with Section 083100.
- O. Provide support for utility meters in accordance with requirements of utility companies.
- P. Excavate in accordance with Section 312316.
- Q. Backfill in accordance with Section 312323.
- R. Install bell and spigot pipe with bell end upstream.
- S. Install valves with stems upright or horizontal, not inverted. See Section 220523.
- T. Install water piping to ASME B31.9.
- U. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- V. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- W. Sleeve pipes passing through partitions, walls, and floors.
- X. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

- Y. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping.
 - 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - a. Painting of interior plumbing systems and components is specified in Section 099123.
 - 10. Support cast iron drainage piping at every joint.
- Z. Manufactured Sleeve-Seal Systems:
 - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 - 3. Locate piping in center of sleeve or penetration.
 - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 - 5. Tighten bolting for a watertight seal.
 - 6. Install in accordance with manufacturer's recommendations.
- AA. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install globe valves for throttling, bypass, or manual flow control services.
- F. Provide spring-loaded check valves on discharge of water pumps.
- G. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.

- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

- A. Provide new sanitary and storm sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, [_____].
 - 1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
 - 2. Provide 18 gauge, 0.0478-inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

END OF SECTION

**SECTION 221006
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Cleanouts.
- B. Floor Drains
- C. Water hammer arrestors.
- D. Vacuum Breakers
- E. Hose Bibbs
- F. Escutcheons
- G. Floor Plates

1.03 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Manhole bottoms.
- B. Section 221005 - Plumbing Piping.
- C. Section 223000 - Plumbing Equipment.
- D. Section 224000 - Plumbing Fixtures.

1.04 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASME A112.6.3 - Floor and Trench Drains 2019.
- C. ASME A112.6.4 - Roof, Deck, and Balcony Drains 2008 (Reaffirmed 2012).
- D. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers 2017.
- E. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers 2011.
- F. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).
- G. NSF 61 - Drinking Water System Components - Health Effects 2020.
- H. NSF 372 - Drinking Water System Components - Lead Content 2020.
- I. PDI-WH 201 - Water Hammer Arresters 2017.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- F. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors, [_____].

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 ESCUTCHEONS

- A. One-piece, Cast-brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-piece, Deep-Pattern Type: Deep-drawn, box-shaped with chrome-plated finish and spring-clip fasteners.
- C. One-piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated finish and with the concealed hinge and setscrew.

2.03 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Castbrass with concealed hinge.

2.04 FLOOR DRAINS (FD-1)

- A. Manufacturers: Subject to compliance with requirements, available manufacturers product offering that may be incorporated into the work include, but are not limited to, the following:
 - 1. Jay R. Smith Manufacturing Company; [____]: www.jrsmith.com/#sle.
 - 2. MIFAB, Inc; [____]: www.mifab.com/#sle.
 - 3. Watts Equal to **FD-100-A**
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.05 FLOOR DRAIN (FD-1):

- A. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.06 CLEANOUTS (FCO & WCO)

- A. Manufacturers: Subject to compliance with requirements, available manufacturers product offering that maybe incorporated into the work include, but are not limited to, the following:
- B. Manufacturers
 - 1. Jay R. Smith Manufacturing Company; [____]: www.jayrsmith.com/#sle.
 - 2. Josam Company; [____]: www.josam.com/#sle.
 - 3. MIFAB, Inc; [____]: www.mifab.com/#sle.
 - 4. Zurn Industries, LLC; [____]: www.zurn.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- C. Cleanouts at Interior Finished Floor Areas (**FCO**):
 - 1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.
- D. Cleanouts at Interior Finished Wall Areas (**WCO**):
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
- E. Cleanouts at Interior Unfinished Accessible Areas (**CO**): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.07 HOSE BIBBS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers product offering that maybe incorporated into the work include, but are not limited to, the following:
- B. Hose Bibb Manufacturers:
 - 1. Jay R. Smith Manufacturing Company; [____]: www.jayrsmith.com/#sle.
 - 2. Murdock Manufacturing, Inc; [____]: www.murdockmfg.com/#sle.
 - 3. Watts Regulator Company; [____]: www.wattsregulator.com/#sle.

4. Zurn Industries, LLC; []: www.zurn.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

2.08 WATER HAMMER ARRESTORS (HA-1)

- A. Manufacturers: Subject to compliance with requirements, available manufacturers product offering that maybe incorporated into the work include, but are not limited to, the following:
 1. Jay R. Smith Manufacturing Company; []: www.jayrsmith.com/#sle.
 2. Watts Regulator Company, a part of Watts Water Technologies; []: www.wattsregulator.com/#sle. **Equal to LF15M2-DR**
 3. Zurn Industries, LLC; []: www.zurn.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Water Hammer Arrestors:
 1. Stainless steel construction, piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install escutcheons for piping penetration of walls, ceilings, and finished floors.
- C. Install escutcheons with ID to closely fit around the pipe, tube, and insulation and with OD that completely covers the opening.
 1. Escutcheons for New Piping:
 - a. Piping with Fittings or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plating Piping: One-piece, cast-brass type with polished, chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass, cast-brass type with polished, chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
 2. Escutheons for Existing Pipe:
 - a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
 - c. Bare Piping at Wall or Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished chrome-plate finish.
 - e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
 - f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.
- D. Install floor plates for piping penetrations of equipment-room floors.
- E. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping with OD that completely covers opening.
 1. New Piping: One-piece, floor plate type.
 2. Existing Piping: Split-casting, floor-plate type.
- F. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- G. Encase exterior cleanouts in concrete flush with grade.

- H. Install floor cleanouts at elevation to accommodate finished floor.
- I. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks or Sinks.

END OF SECTION

**SECTION 224000
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water closets.
- B. Lavatories.
- C. Sinks.
- D. Mop sinks.

1.02 RELATED REQUIREMENTS

- A. Section 064100 - Architectural Wood Casework: Preparation of counters for sinks and lavatories.
- B. Section 079200 - Joint Sealants: Sealing joints between fixtures and walls and floors.
- C. Section 221005 - Plumbing Piping.
- D. Section 221006 - Plumbing Piping Specialties.
- E. Section 223000 - Plumbing Equipment.
- F. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration. 2013.
- C. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use 1997 (Reaffirmed 2017).
- D. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- E. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2017).
- F. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures 2018.
- G. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018.
- H. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures 1994 (R2009).
- I. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks 2017.
- J. ASME A112.19.15 - Bathtub/Whirlpool Bathtubs with Pressure Sealed Doors 2012.
- K. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers 2005.
- L. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices 2015.
- M. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping 2015.
- N. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- O. NSF 61 - Drinking Water System Components - Health Effects 2020.
- P. NSF 372 - Drinking Water System Components - Lead Content 2020.
- Q. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Sustainable Design Documentation: Submit appropriate evidence that materials used in potable water systems comply with the specified requirements.

- E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Provide Plumbing Fixtures and all accessories as indicated on the plumbing fixture schedule on the drawings. Acceptable manufacturer are indicated below.
- B. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- C. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for installation of plumbing systems.
- B. Comply with UL (DIR) requirements.
- C. Perform work in accordance with local health department regulations.
- D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.03 PLUMBING FIXTURES

- A. See Plumbing Plans for Plumbing Fixture Schedule

2.04 FLUSH VALVE WATER CLOSETS

- A. Water Closet: See Plumbing Plans for Plumbing Fixture Schedule
- B. Water Closets: Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.
 - 1. Bowl: ASME A112.19.2; 16.5 inches high with elongated rim.
 - 2. Flush Valve: Exposed (top spud).
 - 3. Flush Operation: Manual metering valve.
 - 4. Handle Height: 44 inches or less.
 - 5. Supply Size: 1-1/2 inches.
 - 6. Outlet Size: 3 or 4 inches.
 - 7. Color: White.
 - 8. Manufacturers:
 - a. American Standard, Inc; []: www.americanstandard-us.com/#sle.
- C. Flush Valves: See Plumbing Plans for Plumbing Fixture Schedule.
- D. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
- E. Seats: See Plumbing Plans for Plumbing Fixture Schedule.
 - 1. Manufacturers: Subject to compliance with requirements, available manufactures product offering that maybe incorporated into the work include, but are not limited to the following:
 - 2. Seat Manufacturers:

- a. Bemis Manufacturing Company; [____]: www.bemismfg.com/#sle.
 - b. Church Seat Company; [____]: www.churchseats.com/#sle.
 - c. Olsonite; [____]: www.olsonite.com/#sle.
3. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, with cover.
- F. Water Closet Carriers:
1. Manufacturers: Subject to compliance with requirements, available manufactures product offering that maybe incorporated into the work include, but are not limited to the following:
 2. Carrier Manufacturers:
 - a. Jay R. Smith MFG. Co; [____]: www.jrsmith.com/#sle.
 - b. JOSAM Company; [____]: www.josam.com/#sle.
 - c. Zurn Industries, Inc; [____]: www.zurn.com/#sle.
 3. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.05 LAVATORIES

- A. Manufacturers: Subject to compliance with requirements, available manufactures product offering that maybe incorporated into the work include, but are not limited to the following:
- B. Lavatory Manufacturers:
1. American Standard, Inc; [____]: www.americanstandard-us.com/#sle.
- C. See Plumbing Plans for Plumbing Fixture Schedule.
- D. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, [____] by [____] inch minimum, with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.

2.06 SINKS

- A. Manufacturers: Subject to compliance with requirements, available manufactures product offering that maybe incorporated into the work include, but are not limited to the following:
- B. Sink Manufacturers:
1. American Standard, Inc; [____]: www.americanstandard-us.com/#sle.
- C. See Plumbing Plans for Plumbing Fixture Schedule.

2.07 UNDER-LAVATORY PIPE SUPPLY COVERS

- A. General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
 2. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
 3. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
 - a. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
 - b. Comply with ICC A117.1.
 4. Color: High gloss white.

2.08 BI-LEVEL, ELECTRIC WATER COOLERS

- A. Bi-level, Electric Water Cooler Manufacturers:
1. Elkay Manufacturing Company; [____]: www.elkay.com/#sle.
- B. Water Cooler: Bi-level, electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
 2. Electrical: 115 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.
- C. Bottle Filler: Materials to match fountain.

2.09 MOP SINKS

- A. Manufacturers: Subject to compliance with requirements, available manufactures product offering that maybe incorporated into the work include, but are not limited to the following:
- B. See Plumbing Plans for Plumbing Fixture Schedule.
- C. Terrazzo Mop Sink Manufacturers:
 - 1. Acorn Engineering Company; []: www.americanstandard-us.com/#sle.
 - 2. Fiat.
- D. Material: Precast terrazzo composed of marble chips cast in Portland cement.
- E. Accessories:
 - 1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
 - 2. Hose clamp hanger.
 - 3. Mop hanger.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports and bolts.
- E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment.
- B. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

3.08 SCHEDULES

- A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
 - 1. Water Closet:
 - a. Accessible: 18 inches to top of seat.
 - 2. Water Closet Flush Valves:
 - a. Standard: 11 inches min. above bowl rim.

3. Lavatory:
 - a. Accessible: 34 inches to top of basin rim.
 4. Drinking Fountain:
 - a. Standard Adult: 40 inches to top of basin rim.
 - b. Accessible: 36 inches to top of spout.
- B. Fixture Rough-In
1. Water Closet (Flush Valve Type):
 - a. Cold Water: 1 Inch.
 - b. Waste: 4 Inch.
 - c. Vent: 2 Inch.
 2. Lavatory:
 - a. Hot Water: 1/2 Inch.
 - b. Cold Water: 1/2 Inch.
 - c. Waste: 1-1/2 Inch.
 - d. Vent: 1-1/4 Inch.
 3. Sink:
 - a. Hot Water: 1/2 Inch.
 - b. Cold Water: 1/2 Inch.
 - c. Waste: 1-1/2 Inch.
 - d. Vent: 1-1/4 Inch.
 4. Service Sink:
 - a. Hot Water: 1/2 Inch.
 - b. Cold Water: 1/2 Inch.
 - c. Waste: 3 Inch.
 - d. Vent: 1-1/2 Inch.
 5. Drinking Fountain:
 - a. Cold Water: 1/2 Inch.
 - b. Waste: 1-1/4 Inch.
 - c. Vent: 1-1/4 Inch.

END OF SECTION

**SECTION 224300
HEALTHCARE PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work includes providing new hospital plumbing fixtures and related work.
- B. Fixtures include:
 - 1. Flushing rim disposal service sinks, wall-mounted type. (CS-1)
- C. Providing rough-in and making final plumbing connections to equipment furnished under other specification sections.

1.02 REFERENCE STANDARDS

- A. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use 1997 (Reaffirmed 2017).
- B. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NSF 61 - Drinking Water System Components - Health Effects 2020.
- D. NSF 372 - Drinking Water System Components - Lead Content 2020.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog sheets for fixtures, fittings, and accessories.

PART 2 PRODUCTS

2.01 GENERAL

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 ELECTRICAL MOTORS, CONTROLLERS, CONTACTORS, AND DISCONNECTS

- A. Furnish motors, controllers, contactors, and disconnects with their respective pieces of equipment.
- B. Controllers and contractors shall have a maximum of 120-volt control circuits, and auxiliary contacts for use with the controls furnished.

2.03 PLUMBING FIXTURES, FITTINGS, ACCESSORIES, AND SUPPLIES

- A. Manufacturers:
 - 1. Acorn Engineering Company; []: www.acorneng.com/#sle.
 - 2. American Standard, Inc; []: www.americanstandard-us.com/#sle.
 - 3. Sloan Valve Company; []: www.sloan.com/#sle.
- B. General Requirements:
 - 1. Provide control stop valves on each supply to each fixture.
 - 2. Provide chromium-plated finish on fittings and accessories exposed to view.
 - 3. Fixture dimensions specified are nominal.
- C. Sink, Service, Disposal, Flushing Rim:
 - 1. Vitreous china, wall mounted, service sink with flushing rim and blowout flushing action.
 - 2. Dimensions: 22 inches wide, 26 inches long, 10-1/2 inches deep, and integral 4-3/4 inches high, with elongated open-front seat.
 - 3. Provide ANSI large diaphragm (not less than 2.625 inches upper chamber inside diameter at the point where the diaphragm is sealed between the upper and lower chambers), nonhold-open flush valve of chrome plated copper alloy, including vacuum breaker and angle (control-stop) valve with back check.
 - 4. Provide wall mounted combination faucet with renewable seats, 6 inch brass handles, plain end spout with bucket hook, screwdriver stops, fork brace, and stainless steel rim guards on front and both sides.

2.04 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fixtures and accessories are of the correct type and size prior to installation.
- B. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- C. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Install fixtures and fittings in accordance with the manufacturer's instructions and in accordance with the applicable codes.
- C. When fixtures require both hot water and cold water supplies, provide the hot water supply to the left of the cold water supply.
- D. Install off-the-floor supports to comply with ASME A112.6.1M.
- E. Adjust water flow rates to comply with manufacturer's rating of the fixture.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. General Requirements:
 - 1. Before final acceptance of the work, test each fixture as in service to demonstrate compliance with the contract requirements. Perform the following tests in addition to the tests specified in the applicable codes.
 - 2. Correct all defects in the work provided by the Contractor, and repeat the tests until the work is in compliance with contract requirements.
 - 3. Furnish equipment, instruments, connecting devices, and personnel for the tests.

3.05 CLEANING

- A. Thoroughly clean plumbing fixtures and equipment.
- B. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

3.06 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 226005
MEDICAL AIR, GAS, AND VACUUM SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Medical oxygen gas system.
- B. Medical compressed air system.
- C. Medical vacuum system.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 220553 - Identification for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
- C. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.
- D. ASTM B32 - Standard Specification for Solder Metal 2020.
- E. ASTM B819 - Standard Specification for Seamless Copper Tube for Medical Gas Systems 2019.
- F. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2011 (Amended 2012).
- G. CGA V-5 - Diameter Index Safety System (Noninterchangeable Low Pressure Connections for Medical Gas Applications) 2008 (Reaffirmed 2013).
- H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
- I. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
- J. NFPA 99 - Health Care Facilities Code 2018.
- K. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers literature and illustrations for all components indicating size, dimensions and configuration.
- C. Certificates: Certify that products meet or exceed specified requirements.
- D. Independent Testing Agency Reports: Indicate systems are complete, zone valves installed, alarm systems functional, and pressure and cross connections tests performed. Document tests.
- E. Manufacturer's Instructions: Indicate installation requirements for equipment and systems.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Valves: One of each type and size.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 99.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- D. Testing Laboratory: Company specializing in performing testing of the type specified in this section, with minimum 5 years of documented experience.

- E. Comply with applicable codes for medical gas systems.
- F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept material on site in factory containers and packing. Inspect for damage.
- B. Protect from damage and contamination by maintaining factory packaging and caps in place until installation.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for [_____].

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. BeaconMedaes; [_____]: www.beaconmedaes.com/#sle.

2.02 PIPE AND FITTINGS

- A. Factory Preparation: Wash inside of copper pipe and copper fitting with hot solution of sodium carbonate or trisodium phosphate mixed 1 lb to 3 gal of water; rinse with water, and blow dry with oil-free dry nitrogen or compressed air.
- B. Oxygen, Compressed Air, Nitrous Oxide, Nitrogen Systems, Aboveground:
 - 1. Copper Tube: ASTM B819, Type K, H58 (drawn general purpose) temper.
 - 2. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper.
 - 3. Joints: AWS A5.8M/A5.8 Classification BCuP-3 or BCuP-4 silver braze.
- C. Vacuum and Anesthesia Gas Evacuation Systems, Aboveground:
 - 1. Copper Tube: ASTM B819, Type K, H58 (drawn, general purpose) temper.
 - 2. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper.
 - 3. Joints: AWS A5.8M/A5.8 Classification BCuP-3 or BCuP-4 silver braze or ASTM B32 solder, Grade Sn95.

2.03 VALVES

- A. Factory Preparation for Oxygen Service: Disassemble, clean, degrease, seal, and pack for shipping.
- B. Ball Valves:
 - 1. Requirements: Comply with MSS SP-110; bronze body, three piece, double-seal ball valves with replaceable neoprene or teflon seat and stem seals, for minimum 600 psi cold working pressure, flange or union mounting, labeled for intended service.

2.04 PIPING ACCESSORIES

- A. Hangers and Supports: MSS SP-58 with types as required.
- B. Pressure Gauges:
 - 1. ASME B40.100, white dials and black lettering with restrictor.
 - 2. Oxygen and nitrous oxide systems: Manufactured and labeled expressly for intended service; UL labeled.
- C. Vacuum Bottle Brackets: Stainless steel, chrome-plated metal, or aluminum with finish matching adjacent outlet.
- D. Flexible Connectors: Corrugated flexible, single ply, seamless or seam-welded tubing of stainless steel or bronze or reinforced teflon bellows or hose.
- E. Valve Cabinets:
 - 1. Manufacturers:
 - 2. Extruded aluminum, flush-mounted and rigidly assembled to accommodate valves and fittings, punched or drilled sides to receive tubing, anchors to secure to wall construction.
 - 3. Cover Plates: Extruded aluminum, with replaceable plastic windows with pull ring to remove window.
 - 4. Cabinet Labels: labeled and color coded for intended service and area served.
 - 5. Valves: Pre-assemble and mount chrome plated valves and tubing extensions.

6. Gauges: Provide where indicated and in operating rooms areas downstream of isolating valves.

- F. Piping Identification: Pressure sensitive adhesive tape and decals, color and labeling to comply with Section 220553.

2.05 OUTLETS

- A. Outlet Units:
 1. Manufacturers:
 - a. BeaconMedaes; Series B - quick connect for all wall outlets - match existing Hospital key index: www.beaconmedaes.com/#sle.
 2. CGA V-5 Diameter-Index Safety System (DISS) non-interchangeable connectors, automatic valves, secondary check valves (except vacuum and evacuation outlets), and capped 3/8 inch tubing stubs for supply connections, color coded and labeled for intended service. - Use for ceiling - gas column outlets only
- B. Faceplates:
 1. Surface Outlets: Surface mount with color coded plastic cover and stainless steel faceplate with Lexan cover, color coded with embossed labeling.

2.06 ALARM SYSTEM

- A. Manufacturers:
 1. BeaconMedaes; Total Alert Infinity: www.beaconmedical.com/#sle.
- B. Multi-Signal Alarm Panel: **AAP**
 1. Closed circuit, self-monitoring type, to monitor oxygen, vacuum, compressed air, nitrous oxide, and nitrogen piping systems pressure or liquid level.
 2. Green light for systems normal.
 3. For abnormal condition:
 - a. Red light energizes.
 4. Monitor following abnormal conditions:
 - a. Oxygen line pressure high.
 - b. Oxygen line pressure low.
 - c. Air line pressure high.
 - d. Air line pressure low.
 - e. Vacuum line pressure above normal.
 - f. Vacuum line pressure below normal.
 5. High-Low Pressure Switch: Dual circuit with two single pole, double throw, snap action switches, tested at 180 psi with adjustable range of 4 psi, preset at 40 psi and 60 psi.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with NFPA 99.
- B. Pre-Installation Cleaning: Disassemble positive pressure gas systems pipe, fittings, valves, and components, except those supplied cleaned and prepared for intended service, and thoroughly wash in hot solution of sodium carbonate or trisodium phosphate mixed 1 lb to 3 gal of water. After washing, rinse with water, dry and cap until installation.
- C. Braze joints in pipe and tubing. Avoid leaving excess flux inside of pipe and fittings. During brazing of pipe connections, purge interior of pipe continuously with nitrogen.
- D. Effect changes in size with reducing fittings. Make changes in direction of required turns or offsets with fittings or tubing shaped by bending tools. Make bends free of flattening, buckling or thinning of tube wall.
- E. Cut pipe and tubing accurately and install without springing or forcing.
- F. Identify piping with tape and decals. Provide piping identification code and schematic for installation under provisions of Section 220553. Install labeling on pipe at intervals of not more than 20 feet and at least once in each room and each story traversed by pipeline.
- G. Support gas piping with pipe hooks or hangers suitable for size of pipe, spaced:
 1. 1/2 inch pipe or tubing: 72 inches.
 2. 3/4 inch or one inch pipe or tubing: 96 inches.

3. 1-1/4 inches or larger (horizontal): 120 inches.

- H. Except where indicated or in flush wall mounted cabinets, install manual shut off valves with stem vertical and accessible for operation and maintenance.

3.02 PIPING SYSTEMS CLEANING AND PRESSURE TESTING

- A. After erection of pipe and tubing but prior to installation of service outlet valves, blow systems clear of free moisture and foreign matter with nitrogen gas.
- B. Install service outlet valves, subject system to test pressure of 150 psi with nitrogen or dry compressed air. Check with soapy water. Provide 24-hour standing pressure test.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Independent testing agency to certify system is complete, zone valves installed, alarm systems functional, and tests performed. Document tests and submit.
- C. Test system with dry compressed air or dry nitrogen with test pressure in piping system at 50 psi.
- D. Check each station outlet of every piping system to determine test gas is dispensed only from outlet of system under investigation. Measure pressure with gauge attached to specific adaptor. Do not use universal adaptors.
- E. Disconnect test gas and connect proper gas to each system. Purge entire system to remove test gas. Check with analyzer suitable for gas installed.

END OF SECTION

SECTION 230000
GENERAL PROVISIONS FOR MECHANICAL WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Requirements of this Section apply to work in every Section of Division 23 equally as if incorporated therein.

1.02 WORK INCLUDED

- A. Work included in Division 23 - Mechanical: Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for Mechanical Work covered by all sections within this Division.

1.03 SCOPE

- A. Division of the Specification into sections is for the purpose of simplification alone. Responsibility for the work of various trades shall rest with the Contractor. Various sections of this Division are related to each other as well as the mechanical drawings. Examine all drawings and read all applicable parts of the project manual in order to ensure complete execution of all work in this Division, coordinating where required with other trades in order to avoid conflicts.
- B. These specifications and accompanying drawings are intended to cover the furnishing of all labor, materials, equipment and services necessary for the complete installation and acceptable performance of the mechanical systems. Small items of material, equipment and appurtenances not mentioned in detail or shown on the drawings, but necessary for complete and operating systems shall be provided by this contractor without additional charge to the Owner and shall be included under this contract.
- C. In general, specifications establish the quality of material, equipment and workmanship. The contract documents are intended to secure for the Owner, a first-class installation in every respect. Labor shall be performed by skilled mechanics, and the entire facility, when delivered to the Owner, shall be ready for satisfactory and efficient operation.
- D. The Contractor shall carefully examine the drawings and specifications before accepting the contract. He shall call attention to any changes or additions which, in his opinion, are necessary to make possible the fulfillment of any guarantee called for by these specifications; failing which, it shall be deemed that he has accepted full responsibility for all such guarantees.
- E. The contractor shall put his work in place as fast as is reasonably possible. He shall, at all times, keep a competent foreman in charge of the work, to make decisions necessary for the diligent advancement of the work. The Contractor shall facilitate the inspection of the work by the Owner's Representative.
- F. The Contractor shall coordinate all work in the building in order to facilitate intelligent execution of the work. He shall also remove any rubbish as expeditiously as possible.
- G. Materials or products specified herein and/or indicated on the drawings by trade's names, manufacturer's names, model number or catalog numbers establish the quality of materials or products to be furnished. Model numbers are to be confirmed by the manufacturer to provide required capacities and material to meet the specifications and design intent. In no instance shall an obsolete, incomplete or inaccurate trade name, manufacturer name, model number or catalog number indicated on the drawings, result in additional charges to the owner.
- H. Points of connection or continuation of work under this contract are so marked on drawings or herein specified. In case of any doubt as to the required exact location of such points, the Owner's Representative shall decide and direct.
- I. The plumbing contractor shall provide water services to within two (2) feet of HVAC equipment requiring same, and shall terminate service with a shutoff valve. The mechanical contractor shall make the final connection to the equipment.

1.04 REFERENCE STANDARDS, CODES AND REGULATIONS

- A. Requirements of Regulatory Agencies:
 - 1. Nothing contained in these specifications or shown on the drawings shall be construed to conflict with any State or local laws, ordinances, rules and regulations, the UL and NFPA regulations. The Contractor shall make all changes required by the enforcing authorities. Where alterations to and / or deviations from the Contract Documents are required by the authorities having jurisdiction, report the requirements to the Engineer and secure acceptance before work is started. All such changes shall be made in a manner acceptable to the Engineer and shall be made without cost to the Owner.
 - 2. When drawings or specifications exceed requirements of applicable laws, ordinances, rules and regulations, comply with documents establishing the more stringent requirement. All work shall be done in full conformity with the requirements of all authorities having jurisdiction. Installation shall be made in compliance with all applicable regulations, and utility company rules, all of which shall be considered a part of this specification and shall take precedence in the order of listing.
 - 3. It is not the intent of drawings or specifications to repeat requirements of codes except where necessary for completeness in individual sections.
- B. Published specifications, standards, tests or recommended method of trade, industry or governmental organizations as listed below apply to all work in this Division, in addition to other standards which may be specified in individual sections:
 - 1. Associated Air Balance Council
 - 2. Air Diffuser Balance Council
 - 3. Air Moving and Conditioning Association
 - 4. American Gas Association
 - 5. American National Standards Institute
 - 6. Air Conditioning and Refrigeration Institute
 - 7. American Society of Heating, Refrigeration and Air Conditioning Engineers
 - 8. American Society of Mechanical Engineers
 - 9. American Society for Testing and Materials
 - 10. Cast Iron Soil Pipe Institute
 - 11. ETL Testing Laboratories
 - 12. Factory Mutual Engineering and Research Corporation
 - 13. National Standard Plumbing Code
 - 14. National Electrical Manufacturer's Association
 - 15. National Fire Protection Association
 - 16. National Board of Fire Underwriters
 - 17. National Electric Code
 - 18. Occupational Safety and Health Administration
 - 19. Plumbing Drainage Institute
 - 20. Sheet Metal & Air Conditioning Contractors National Association
 - 21. Underwriters Laboratories, Inc.
- C. Furnish and file with the proper authorities, all drawings required by them in connection with the work. Contractor shall secure and obtain all approvals, permits, licenses and inspections and pay all legal and proper fees and charges in this connection, before commencing work in order to avoid delays during construction. He shall deliver the official records of the granting of the permits, etc., to the Owner's Representative.

1.05 QUALITY ASSURANCE

- A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply all equipment and accessories new and free from defects.
- C. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.4 of this section with all applicable national, state and local codes.
- D. All items of a given type shall be the product of same manufacturer.

1.06 DESCRIPTION OF BID DOCUMENTS

- A. Specifications:
 - 1. Specifications, in general, describe quality and character of materials and equipment.

2. Specifications are of simplified form and include incomplete sentences.
 3. Words or phrases such as "The Contractor shall", "shall be", "furnish", "provide", "a", "an", "the", and "all" may have been omitted for brevity.
- B. Drawings: Mechanical drawings under this contract are made a part of these specifications. Deviations from these specifications as noted below must have the approval of the Engineer or Construction Manager without an increase in contract price.
1. The drawings shall be considered as being diagrammatic and for bidding purposes only. Intention is to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement. The attention of the contractor is called to the fact that while these drawings are generally to scale and are made as accurately as the scale will permit, all critical dimensions shall be determined in the field. They are not to be considered as erection drawings.
 2. The drawings do not indicate every fitting, elbow, offset, valve, etc. which is required to complete the job. Contractor shall prepare field erection drawings as required for the use of his mechanics to insure proper installation.
 3. Scaled and figured dimensions are approximate and are for estimating purposes only. Indicated dimensions are limiting dimensions.
 4. Before proceeding with work check and verify all dimensions in field.
 5. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
 6. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
 7. For exact locations of building elements, refer to dimensional Architectural/Structural drawings.
- C. Description of systems: Provide all materials to provide functioning systems in compliance with performance requirements specified, and any modifications resulting from reviewed shop drawings and field coordinated drawings.
1. Installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.
- D. Do not use equipment exceeding dimensions indicated or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions.
- E. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect for his interpretation and decision as early as possible, including during bidding period.
1. Do not proceed with work without Engineer's decision.

1.07 EQUIPMENT MANUFACTURERS

- A. The first named manufacturer is used as the basis of design. Other named manufacturers are identified as equivalent manufacturers, not equivalent products. Naming other manufacturers does not necessarily imply conformance of any specific product with the written specifications.
- B. The contractor is required to verify that equipment and material to be used on the project meets the requirements of the specifications and will physically fit the available space, clearance and service requirements of the particular piece of equipment and include all pertinent information when he submits material for acceptance. Contractor shall also be responsible for and bear the cost of any modifications to openings available or anticipated as being available for rigging equipment to its final installation place. This shall include openings in exterior envelope, walls and roofs, interior walls, corridors, passage ways or door openings. Any on site dismantling and any reassembly of equipment made necessary by impediment to the rigging of said equipment shall be the sole responsibility of the contractor.
- C. Contract document indicates power and physical requirements based on the equipment manufacturer's data as first named. If equipment requiring more system capacity is furnished, the contractor shall be responsible for the cost associated with modifying the design and installation of associated services, including any redesign costs associated with the engineer's review.

1.08 DEFINITIONS

- A. "Provide": To supply, furnish, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.
- B. "Install": To erect, mount and connect complete with related accessories.
- C. "Supply", "Furnish": To purchase, procure, acquire and deliver complete with related accessories.
- D. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.
- E. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.
- F. "Wiring": Raceway, fittings, wire, boxes and related items.
- G. "Concealed": Items referred to as hidden from normal sight, embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures.
- H. "Exposed": Not installed underground or "concealed" as defined above.
- I. "Indicated", "Shown", or "Noted": As indicated, shown or noted on drawings or specifications.
- J. "Directed": Directed by Engineer.
- K. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified product.
- L. "Reviewed", "Satisfactory", or "Directed": As reviewed, satisfactory, or directed by or to Engineer.
- M. "Motor Controllers": Manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of motors.
- N. "Control or Actuating Devices": Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.
- O. "Remove": Dismantle, demolish and take away from the site and dispose of in accordance with all applicable rules and regulations or, should the Owner so require, deliver to a location as designated by the Owner for the use of the Owner, at no additional cost to the Owner.
- P. "Replace": Remove existing and provide an equivalent product or material as specified.
- Q. "Extract (and Reinstall) ": Carefully disassemble, dismantle existing, save or store where directed by the Owner, in such a manner as to preserve the existing condition and reinstall as indicated on the drawings or as described in the specifications.
- R. Where any device or piece of equipment is referred to in the singular number, such reference shall be deemed to apply to as many devices as are required to complete the installation.

1.09 JOB CONDITIONS

- A. This contractor shall investigate all conditions affecting his work and shall provide such offsets, fittings, valves, sheet metal work, etc., as may be required to meet conditions at the building.
- B. The contractor shall verify all measurements at the building site and shall be responsible for the correctness of same before ordering materials or before starting work of any Section.
 - 1. Report to Architect, in writing, conditions which will prevent proper provision of this work.
 - 2. Beginning work of any Section without reporting unsuitable conditions to Architect constitutes acceptance of conditions by Contractor.
 - 3. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to Owner.
- C. Piping and ductwork shall be concealed or run behind furring in finished spaces unless otherwise noted to be run exposed.

- D. Horizontal piping and ductwork not run below slabs on grade shall be run as close as possible to underside of roof or floor slab above and parallel to building lines. Maintain maximum headroom in all areas.
- E. Determine possible interference between trades before the work is fabricated or installed. The contractor must coordinate his work to insure that erection will proceed without such interference. Coordination is of paramount importance and no request for additional payment will be considered where such request is based upon interference between trades.
- F. Connections to Existing Work:
 - 1. Install new work and connect to existing work with minimum of interference to existing facilities.
 - 2. Temporary shutdowns of existing services:
 - 3. At no additional charges
 - a. At times not to interfere with normal operation of existing facilities.
 - b. Only with written consent of Owner.
 - 4. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.
 - 5. Restore existing disturbed work to original condition.
- G. Removal, extraction and relocation of existing work.
 - 1. The work includes demolition or removal of all construction indicated or specified. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the site. Rubbish and debris shall be removed from the site daily unless otherwise directed so as to not allow accumulation inside or outside the building. Materials that cannot be removed daily shall be stored in areas specified by the Owner.
 - 2. Title to all materials and equipment to be demolished, excepting Owner salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Owner will not be responsible for the condition, loss or damage to such property after notice to proceed.
 - 3. The Owner reserves the "Right of First Refusal" on all material for salvage. Material for salvage shall be stored as approved by the Owner. Salvage materials shall be removed from the site before completion of the Contract. Material for salvage shall not be sold on the site.
 - 4. Property of the Owner: Salvaged items remaining the property of the Owner shall be removed in a manner to prevent damage and packed or crated to protect the items from damage while in storage or during shipment and relocated by the contractor at no cost, to the Owners designated storage facility on the site. Containers shall be properly identified as to contents.
 - 5. Damaged Items: Items damaged during removal or storage shall be repaired or replaced to match existing.
 - 6. Disconnect, remove or relocate material, equipment, plumbing fixtures, piping and other work noted and required by removal or changes in existing conditions.
 - 7. Where existing pipes, conduits and/or ducts which are to remain prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits, and/or ducts.
 - 8. Provide new material and equipment required for relocated equipment.
 - 9. Plug or cap active piping or ductwork behind or below finish.
 - 10. Do not leave long dead-end branches.
 - a. Cap or plug as close as possible to active line.
 - 11. Remove unused piping, ductwork and equipment.
 - 12. Dispose of unusable piping, ductwork and material.

1.10 CLEARANCE FROM ELECTRICAL EQUIPMENT

- A. Piping or ductwork:
 - 1. Prohibited, except as noted, in:
 - a. Electric rooms and closets.
 - b. Telephone rooms and closets.
 - c. Elevator machine rooms.
 - d. Electric switchboard room.
 - 2. Prohibited, except as noted, over or within 5 ft. of:

- a. Transformers.
- b. Substations.
- c. Switchboards.
- d. Motor control centers.
- e. Standby power plant.
- f. Bus ducts.
- g. Electrical panels.
- 3. Drip pans under piping:
 - a. Only where unavoidable and approved.
 - b. 18 gauge galvanized steel.
 - 1) With bituminous paint coating.
 - c. Reinforced and supported.
 - d. Watertight.
 - e. With 1-1/4 inch drain outlet piped to floor drain or service sink.

1.11 TEMPORARY FACILITIES

- A. Temporary facilities are not included within this Section.

1.12 SPECIAL TOOLS

- A. Furnish to Owner at completion of work:
 - 1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of the Division.
 - 2. "Special tools": those not normally found in possession of mechanics or maintenance personnel.
 - 3. One pressure grease gun for each type of grease required.
 - a. With adapters to fit all lubricating fittings on equipment.
 - b. Include lubricant for lubricated plug valves.

1.13 PRODUCT DELIVERY, HANDING AND STORAGE

- A. Provide adequate and secure storage facilities for materials and equipment during the progress of the work.
- B. Contractor shall be responsible for the condition of all materials and equipment employed in the mechanical installation until final acceptance by the Owner. Protect same from any cause whatsoever.
- C. Where necessary, ship in crated sections of size to permit passing through available space.
- D. Ship equipment in original packages, to prevent damaging or entrance of foreign matter.
- E. Handle and ship in accordance with manufacturer's recommendations.
- F. Provide protective coverings during construction.
- G. Replace at no expense to Owner, equipment or material damaged during storage or handling, as directed by Engineer.
- H. Tag all items with weatherproof tag, identifying equipment by name and purchase order number.
- I. Include packing and shipping lists.
- J. Adhere to special requirements as specified in individual sections.

1.14 PROTECTION OF MATERIALS

- A. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed.
- B. Provide temporary storage facilities for materials and equipment.
- C. Material, equipment or apparatus damaged because of improper storage or protection will be rejected.
 - 1. Remove from site and provide new, duplicate, material, equipment, or apparatus in replacement of that rejected.
- D. Cover motors and other moving machinery to protect from dirt and water during construction. Rotate moving equipment, shafts, bearings, motors etc. to prevent corrosion and to circulate lubricants.

- E. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.
 - 1. Contractor shall be responsible for the replacement of all damaged or defective work, materials or equipment. Do not install sensitive or delicate equipment until major construction work is completed.
 - 2. Remove replaced parts from premises.
- F. Make good any damage to the work caused by floods, storms, accidents, acts of God, acts of negligence, strikes, violence or theft up to time of final acceptance by the Owner.
- G. Do not leave any mechanical work in a hazardous condition, even temporarily.

1.15 REVIEW OF CONSTRUCTION

- A. Work may be reviewed at any time by representative of the Engineer.
- B. Advise Architect and Engineer that work is ready for review at following times:
 - 1. Prior to backfilling buried work.
 - 2. Prior to concealment of work in walls and above ceilings.
 - 3. When all requirements of Contract have been completed.
- C. Neither backfill nor conceal work without Engineer's consent.
- D. Maintain on job a set of Specifications and Drawings for use by Engineer's representatives.

1.16 SCHEDULE OF WORK

- A. Arrange work to conform to schedule of construction established or required to comply with Contract Documents.
- B. In scheduling, anticipate means of installing equipment through available openings in structure.
- C. Confirm in writing to Architect and Engineer, within 30 days of signing of contract, anticipated number of days required to perform test, balance, and acceptance testing of mechanical systems.
 - 1. This phase must occur after completion of mechanical systems, including all control calibration and adjustment, and requires substantial completion of the building, including closure, ceilings, lighting, partitioning, etc.
 - 2. Submit for approval at this time, names and qualifications of test and balancing agencies to be used.
- D. Arrange with Owner schedule for work in each area.
- E. Unless otherwise directed by Owner, perform work during normal working hours.
- F. Work delays:
 - 1. In case noisy work interferes with Owner's operations, Owner may require work to be stopped and performed at some other time, or after normal working hours.

1.17 ACCESS TO MECHANICAL WORK

- A. Access doors in walls and ceilings.
- B. Access Units Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by access units, provide UL listed-and-labeled units, except for units which are smaller than minimum size requiring ratings as recognized by governing authority.
- C. Product Data, Access Units: Submit manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.
- D. Furnish to the general contractor all access doors necessary for access through inaccessible wall or ceiling construction, for installation by the general contractor. Information on the size and location of the subject access doors is to be communicated in writing to the general contractors during the bidding period.

1.18 CONCRETE FOR MECHANICAL WORK

- A. Concrete for Mechanical Work
 - 1. Basins and curbs for mechanical equipment.
 - 2. Mechanical equipment foundations and housekeeping pads.

3. Inertia bases for isolation of mechanical work.
 4. Rough grouting in and around mechanical work.
 5. Patching concrete cut to accommodate mechanical work.
- B. Quality control testing for concrete is required as work of this section.
- C. Concrete Work Codes and Standards:
1. Comply with governing regulations and, where not otherwise indicated, comply with the following industry standards; whichever is the most stringent in its application to work in each instance.
 - a. ACI 301: "Specifications for Structural Concrete for Buildings"
 - b. ACI 311: "Recommended Practice for Concrete Inspection"
 - c. ACI 318: "Building Code Requirements for Reinforced Concrete"
 - d. ACI 347R: "Recommended Practice for Concrete Form work"
 - e. ACI 304R: "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"
 - f. Concrete Reinforcing Steel Institute's, "Manual of Standard Practice"
- D. Submittals: Shop Drawings, Mechanical Concrete Work: Submit shop drawings for structural type concrete work, showing dimensions of formed shapes of concrete; bending, placement, sizes and spacing of reinforcing steel; location of anchors, isolation units, hangers and similar devices to be integrated with concrete work; and piping penetrations, access openings, inlets and other accessories and work to be accommodated by concrete work.
- E. Laboratory Test Reports, Mechanical Concrete Work: Submit laboratory test reports for concrete work materials, and for tested samples of placed concrete (where required as work of this section).

1.19 NOISE REDUCTION

- A. Cooperate in reducing objectionable noise or vibration caused by mechanical systems.
1. To extent of adjustments to specified and installed equipment and appurtenances.
- B. Correct noise problems caused by failure to install work in accordance with Contract Documents.
1. Include labor and materials required as result of such failure.

1.20 CUTTING AND PATCHING

- A. Provide all carpentry, cutting and patching required for proper installation of material and equipment specified.
- B. Do not cut or drill structural members without consent of Architect.

1.21 COORDINATION DRAWINGS

- A. Layout Shop Drawings Required:
1. Prepare layout shop drawings for all areas; minimum 3/8 inch scale.
 2. Individual coordinated trade layout drawings are to be prepared for all areas.
 3. General Contractor is to assure that each trade has coordinated work with other trades, prior to submittal where submittal is required.
 - a. Include stamp on each submittal indicating that layout shop drawing has been coordinated.
 4. No layout shop drawing will be reviewed without stamped and signed coordinated assurance by General Contractor.
 5. All changes shall be clearly marked on each submitted layout drawing.
 6. Drawings shall show work of all trades including but not limited to'
 - a. Ductwork.
 - b. Piping: All Trades.
 - c. Mechanical Equipment.
 - d. Electrical Equipment.
 - e. Main Electrical conduits and bus ducts.
 - f. Equipment supports and suspension devices.
 - g. Structural and architectural constraints.
 - h. Show location of:
 - 1) Valves

- 2) Piping specialties
 - 3) Dampers
 - 4) Access Doors
 - 5) Control and electrical panels
 - 6) Disconnect switches
7. Drawings shall indicate coordination with work in other Divisions that must be incorporated in mechanical spaces, including, but not limited to:
 - a. Elevator equipment.
 - b. Cable trays not furnished under Division 16.
 - c. Computer equipment.
 8. Submission of drawings:
 - a. Prepare reproducible drawings.
 - b. Submit to other trades for review of space allocated to all trades.
 - c. Revise drawings to compensate for requirements of existing conditions and conditions created by other trades.
 - d. Review revisions and other trades.
 - e. Submit one reproducible and one blueline print to Engineer for review.
 9. Final prepared drawings shall show that other trades affected have made reviews and signed, by each trade, at completions of coordination.
 - a. General Contractor
 - b. Include stamp on each submittal indicating that layout shop drawing has been coordinated.
 10. No layout shop drawing will be reviewed without stamped and signed coordination assurance by General Contractor.
- B. Shop Drawings:
1. Layout drawings of mechanical equipment rooms and penthouses showing all related equipment and equipment clearances required by other trades.
 2. Layout drawings of areas in which it may be necessary to deviate substantially from layout shown on the drawings. Minor transitions in ductwork, if required due to job conditions, need not be submitted as long as the duct area is maintained. Show major relocation of ductwork and major changes in size of ducts. Coordinate shop drawings with all trades prior to ductwork fabrication.
 3. Details of intermediate structural steel members required to span main structural steel for the support of ductwork.
 4. Method of attachment of duct hangers to building construction.
 5. Duct material, gage, type of joints and duct reinforcing for each size range, including sketches or SMACNA plate numbers for joints, method of fabrication and reinforcing.

1.22 GUARANTEE

- A. Furnish guarantee covering all work in accordance with general requirements of the contract for minimum period of one year. This personal guarantee shall exist for a period of one (1) year from the date of final acceptance of the work and shall apply to defects in materials and to defective workmanship of any kind.
- B. For factory-assembled equipment and devices on which the manufacturers furnish standard published guarantees as regular trade practice, obtain such guarantees and replace any such equipment that proves defective during the life of these guarantees.
- C. Guarantee all work for which materials are furnished, fabricated or field erected by the contractor, all factory-assembled equipment for which no specific manufacturer's guarantee is furnished, and all work in connection with installing manufacturer's guarantee is furnished, and all work in connection with installing manufacturer's guaranteed equipment.
- D. In the event of failure of any work, equipment or device during the life of the guarantee, repair or replace the equipment or defective work. Remove, replace or restore, at no cost to the Owner, any part of the structure or building which may be damaged either as the direct result of the defective work or in the course of the contractor's making replacement of the defective work or materials. Work shall be done at a time and in a manner as to cause no undue inconvenience to the Owner. Provide new materials, equipment, apparatus and labor to replace that determined by Engineer to be defective or faulty.

- E. This guarantee also applies to services including Instructions, Adjusting, Testing, Noise, Balancing, etc.
- F. Additional equipment and material guarantees and warranties may be indicated in other sections. In all cases, the more stringent guarantee or warranty shall be provided.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT QUALITY

- A. Material and equipment furnished under this Division of specification shall be new. Defective or inferior materials must be replaced by contractor at no cost to Owner regardless of the stage of construction. Inferior material shall be defined as material or equipment of a quality or performance less than that specified as determined by the Owner's Representative.
- B. Provide each item of equipment with manufacturer's identification tag which is readily accessible and clearly shows model and size.

2.02 ACCESS TO MECHANICAL WORK

- A. Access Doors:
 - 1. General: Where walls and ceilings must be penetrated for access to mechanical work, access doors shall be provided. Furnish adequate size for intended and necessary access. Furnish doors with UL Fire Rating to match wall or ceiling construction. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.
- B. Access Door Construction: Refer to Section 083113 – ACCESS DOORS AND FRAMES

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Perform as specified in individual sections, and as required by authorities having jurisdiction.
 - 2. Duration as noted.
- B. Provide required labor, material, equipment, and connections.
- C. Furnish written report and certification those tests have been satisfactorily completed.
- D. Repair or replace defective work, as directed.
- E. Pay for restoring or replacing damaged work due to tests as directed.
- F. Pay for restoring or replacing damaged work of others, due to tests, as directed.

3.02 ACCESS TO MECHANICAL WORK

- A. Coordinate installation and placement of access doors and panels with contractor for general construction.
- B. Remove or replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION

**SECTION 230002
MECHANICAL AND ELECTRICAL COORDINATION**

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Work Included in This Section: Materials, equipment, fabrication, installation, and tests in conformity with applicable codes and authorities having jurisdiction for the following:
 - 1. Motors.
 - 2. Factory-wired equipment (FWE).
 - 3. Factory-wired control panels (FWCP).
 - 4. Motor controllers where provided as part of mechanical equipment.
 - 5. Motor controllers where supplied under Division 23 - Mechanical Work.
 - 6. Disconnects and safety switches for mechanical equipment.
 - 7. Fuses for equipment provided, and starters and disconnect switches.
 - 8. Emergency Pushbutton Operator Station.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 23 - HVAC Instrumentation and Controls, Motors.
- B. Installation and Power Wiring of Motor Controllers.

1.03 REFERENCE STANDARDS

- A. Published specifications standards, tests, or recommended methods of trade, industry or governmental organization as apply to work in this section where cited below:
 - 1. ANSI - American National Standards Institute.
 - 2. NEMA - National Electrical Manufacturer's Association.
 - 3. IEEE - Institute of Electrical and Electronic Engineers.

1.04 QUALITY ASSURANCE

- A. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- B. Supply all equipment and accessories new and free from defects.
- C. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.03 of this Section and with all applicable National, State and local codes.
- D. All items of a given-type shall be the products of the same manufacturer.

1.05 DIVISION OF WORK

- A. This section delineates the work required to be performed by Contractors under Division 23 and Division 26.

1.06 WORK REQUIRED UNDER DIVISION 23

- A. Furnish motors, manual and combination starters, pushbutton devices, contactors, disconnect switches, electric thermostats, low voltage transformers, Emergency Break Glass Stations and other electrical devices required for equipment furnished.
- B. Install all items in piping and ductwork such as control valves, aquastats, ductstats, etc.
- C. All external wiring of equipment, all temperature control wiring, external wiring of control circuits of magnetic starters, interlocking wiring, boiler wiring, Emergency Break Glass Stations, and mounting of control devices, etc., shall be included under Division 23. All external wiring shall be in conduit. (Unless specifically shown to be provided by the Electrical Contractor)
- D. The Electrical Contractor, under Division 26, shall furnish and install all power wiring and conduit to junction box, to disconnect switch on unit, to motor starters and contactors, and between motor starters and contactors to motor or other load. Electrical Contractor shall be responsible for proper direction of rotation for all three phase equipment. The Electrical Contractor shall mount all starters, disconnects.
- E. Wiring required under Division 23 shall comply with the specifications as described in Division 26.

- F. The Plumbing Contractor, under Division 22, shall provide water and natural gas services to within two (2) feet of HVAC equipment requiring same and terminating with shut-off valves. The HVAC Contractor, under Division 23, shall make final connections to equipment.
- G. Provide disconnect switches or safety switches for equipment. (Unless specifically shown to be provided by the Electrical Contractor, starters and disconnects shown on the electrical drawings are for installation and do not require the Electrical Contractor to furnish units)
- H. Emergency Generator - Exhaust muffler and flexible exhaust connection shall be furnished by the generator manufacturer under Division 26. Installation of the exhaust system including providing piping, insulation and accessories shall be included under Division 23.

1.07 SUBMITTALS

- A. Shop Drawings: Complete wiring diagrams of all power and control connections (standard diagrams will not be accepted). Deliver 2 copies of approved wiring diagrams to the Electric Contractor for installation of wiring and connections required under the Electric Contract.
- B. Product Data for Motor Controllers and Disconnect Switches: Manufacturer's catalog sheets, specifications and installation instructions. Submit enclosure type coordinated for service and location. Submit simultaneously with product data required for motors. Identify each controller for use with corresponding motor. Submit shop drawings and product data in accordance with project requirements.
- C. All warranties shall be delivered as part of the close-out submission.
- D. A receipt shall be delivered as part of the close-out submission that states all required spare parts have been delivered to the owner. This receipt must be signed and dated by the owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Motor Controllers and Disconnects
 - 1. Square D
 - 2. Allen-Bradley
 - 3. General Electric
 - 4. Cutler-Hammer

2.02 MOTOR CONTROLLERS

- A. General: All starters shall be correctly sized to motor connected thereto. Provide one (1) additional auxiliary contact over and above that normally furnished, at least two (2) required. Provide overload heaters for each phase. Coordinate starters and controllers with the temperature control Contractor and sequence of operations.
- B. Minimum Size: The minimum allowable size of single or three phase magnetic motor controller is NEMA size 0.
- C. Enclosures: Unless otherwise indicated furnish NEMA 1 enclosures, except where installed outdoors furnish NEMA 3R enclosures.
- D. Control Power: Furnish control power transformer (maximum control voltage 120 volts) mounted within each magnetic motor controller enclosure.
- E. Pilot Lights: Furnish pilot lights of the neon lamp type mounted in the controller enclosure, green for running, red for not running.

2.03 MOTOR CONTROLLER TYPES:

- A. Type A (Full Voltage, Manual, Non-Magnetic):
 - 1. Allen-Bradley Co. Bulletin 609 (or Bulletin 600 - single phase, 1 HP or less only).
 - 2. General Electric Co. CR-1062 (or CR-101 - single phase, 1 HP or less only).
 - 3. Cutler-Hammer. B100 (or MS - single phase, 1 HP or less only).
- B. Type A2 (2 Speed, 2 Winding, Full Voltage, Manual, Non-Magnetic):
 - 1. Allen-Bradley Co. Bulletin 609TS (or Bulletin 600 - single phase, 1 HP or less only).
 - 2. General Electric Co. CR-1062 (or CR-101 - single phase, 1 HP or less only).

3. Square D Co. Class 2512, Type M (or Class 2512, Type F - single phase, 1 HP or less only).
- C. Type B (Full Voltage Magnetic):
 1. Allen-Bradley Co. Bulletin 709.
 2. General Electric Co. CR-206.
 3. Square D Co. Class 8536.
 4. Cutler-Hammer. ECN05.
- D. Type B-COM (Combination Full Voltage Magnetic/Safety Switch):
 1. Allen-Bradley Co. Bulletin 712.
 2. General Electric Co. CR-208.
 3. Square D Co. Class 8538.
 4. Cutler-Hammer. ECN16.
- E. Type B2 (2 Speed, 2 Winding, Full Voltage, Magnetic):
 1. Allen-Bradley Co. Bulletin 715.
 2. General Electric Co. CR209.
 3. Square D Co. Class 8810.
 4. Cutler-Hammer. ECN33.
- F. Type C (Automatic, Reduced Voltage, Magnetic):
 1. Allen-Bradley Co. Bulletin 746.
 2. General Electric Co. CR-231.
 3. Square D Co. Class 8606.
 4. Cutler-Hammer. ECA42.
- G. Type C-COM (Combination Automatic, Reduced Voltage, Magnetic/ Safety Switch):
 1. Allen-Bradley Co. Bulletin 746C.
 2. Square D Co. Class 8606.
 3. Cutler-Hammer. ECA43.
- H. Type D (Part Winding, Magnetic):
 1. Allen-Bradley Co. Bulletin 736.
 2. General Electric Co. CR-230.
 3. Square D Co. Class 8640.
 4. Cutler-Hammer. ECA45.

2.04 REMOTE PUSH BUTTON STATIONS

- A. Start-Stop with pilot light in NEMA 1 enclosure unless otherwise indicated.
 1. Allen-Bradley Co. Bulletin 800S.
 2. General Electric Co. CR-2943.
 3. Square D Co. Class 9001.
 4. Cutler-Hammer. Class 10250.

2.05 SAFETY SWITCHES

- A. General Electric Co. Type TH; Square D Co. Heavy Duty Series; Cutler-Hammer HD Series; with the following:
 1. Fused switches equipped with fuseholders to accept only the fuses specified in Section 16181 (U.L. Class RK-1, RK-5, L).
 2. NEMA 1 enclosure unless otherwise indicated on drawing or required. 3R for devices installed outdoors.
 3. Switch rated 240V for 120V, 208V, 240V, circuits; 600 V for 277V, 480V circuits.
 4. Switch rated 600V for 277V, 480V circuits.
 5. Solid neutral bus when neutral or grounding conductor is included with circuit.
 6. Current rating and number of poles as indicated on drawings.

2.06 NAMEPLATES

- A. Phenolic Type: Standard phenolic nameplates with 3/8" minimum size lettering engraved thereon.

- B. Embossed Aluminum: Standard stamped or embossed aluminum tags: Tech Products, Inc., Seton Name Plate Corp.

2.07 EMERGENCY PUSHBUTTON OPERATOR STATION

- A. Acceptable Manufacturer: Square D or equal.
- B. Switch Style: Class 9001, NEMA 4 rated emergency mushroom head pushbutton.
- C. Voltage: 120VAC, 60Hz as required.
- D. Contacts: 20A, 2-NO/2-NC contact.
- E. Operation: Manual.
- F. Normal position: Operator out.
- G. Activated position: Operator in.
- H. Reset: Manual, turn to release.
- I. Enclosure: NEMA 4.

2.08 CUSTOM LEGEND PLATE

- A. "EMERGENCY BOILER SHUTOFF"

PART 3 - EXECUTION

3.01 GENERAL

- A. Equipment shall be connected in a neat and skillful manner. Equipment deliver with terminal boxes that are inadequate shall be equipped with special boxes that suit the conditions by the Mechanical Contractor furnishing the equipment.
- B. In general, rigid conduit or tubing shall be used, but equipment that requires movement or that would transmit vibration to conduit shall be wired with flexible (liquid tight) steel conduit not over 18" long.
- C. All equipment shall be grounded with a green-covered ground wire run inside the conduit and connected to equipment frame on one end and to grounding system on the other end.
- D. All electrical work required in the Mechanical Contract shall conform to the applicable requirements of Division 26 of these Specifications.
- E. The Heating, Ventilating, and Air Conditioning Contractor shall assign all Electrical Work required under his contract to the approved Automatic Temperature Control Contractor, who shall perform this work with qualified electricians employed by that Contractor.
- F. The Mechanical Contractors shall cooperate with the Contractor for Electrical Work in making all necessary tests and in receiving, storing, and setting all motor-driven equipment, electrical devices, and controls furnished and/or installed under these contracts.
- G. Install heaters correlated with full load current of motors provided.
- H. Set overload devices to suit motors provided.

3.02 INSTALLATION

- A. Control Wiring:
 - 1. Provide control wiring and connections.
 - 2. Where control circuit interlocking is required between individually mounted motor controllers, provide a single pole on-off switch in a threaded type box mounted adjacent to motor safety switches which are remote from the control transformer (to enable interlock circuit to be opened when the motor safety switch is opened).
- B. Nameplates: Rivet or bolt the nameplate on the cover of NEMA 1 enclosures. Rivet or bolt and gasket the nameplate on cover of NEMA 3R or NEMA 12 enclosures. Provide phenolic or embossed aluminum nameplates as follows:
 - 1. On each remote control station, indicating motor controlled.
 - 2. On each interlock circuit switch, indicating purpose of switch.
- C. Emergency Pushbutton Operator Station: Wire all switches in series with boiler control branch circuits.

3.03 TYPES OF MOTOR CONTROLLERS REQUIRED FOR SINGLE SPEED MOTORS (SYSTEMS UNDER 250 VOLTS)

- A. Single Phase Motors Less than 5 HP - Manually Operated: Type A.
- B. Single Phase Motors Less than 1/2 HP - Automatically Operated: Type A.
- C. Single Phase Motors 1/2 to 5 HP - Automatically Operated: Type B.
- D. Three Phase Squirrel Cage Motors Less than 7-1/2 HP: Type B (B-COM when indicated on drawings).
- E. Three Phase Squirrel Cage Motors 7-1/2 HP and Larger: Type C (C-COM when indicated on drawings).
- F. Three Phase Hermetically Sealed Compressor Motors Less than 7-1/2 HP: Type B.
- G. Three Phase Hermetically Sealed Compressor Motors 7-1/2 HP and Larger: Type D.

3.04 TYPES OF MOTOR CONTROLLERS REQUIRED FOR SINGLE SPEED MOTORS (277/480 VOLT SYSTEM)

- A. Single Phase Motors Less than 5 HP - Manually Operated: Type A.
- B. Single Phase Motors Less than 1 HP - Automatically Operated: Type A.
- C. Single Phase Motors 1 to 5 HP - Automatically Operated: Type B.
- D. Three Phase Squirrel Cage Motors Less than 15 HP: Type B (B-COM when indicated on drawings).
- E. Three Phase Squirrel Cage Motors 15 HP and Larger: Type C (C-COM when indicated on drawings).
- F. Three Phase Hermetically Sealed Compressor Motors Less than 15 HP: Type B.
- G. Three Phase Hermetically Sealed Compressor Motors 15 HP and Larger: Type D.

3.05 TYPES OF MOTOR CONTROLLERS REQUIRED FOR 2 SPEED MOTORS (SYSTEMS UNDER 250 VOLTS)

- A. Single Phase Motors Less than 5 HP - Manually Operated: Type A2.
- B. Single Phase Motors Less than 1/2 HP - Automatically Operated: Type A2.
- C. Single Phase Motors 1/2 to 5 HP - Automatically Operated: Type B2.
- D. Three Phase Squirrel Cage Motors Less than 7-1/2 HP: Type B2.

3.06 TYPES OF MOTOR CONTROLLERS REQUIRED FOR 2 SPEED MOTORS (277/480 VOLT SYSTEM)

- A. Single Phase Motors Less than 5 HP - Manually Operated: Type A2.
- B. Single Phase Motors Less than 1 HP - Automatically Operated: Type A2.
- C. Single Phase Motors 1 to 5 HP - Automatically Operated: Type B2.
- D. Three Phase Squirrel Cage Motors Less than 15 HP: Type B2.

3.07 DISCONNECTS

- A. Motor Controllers: Provide safety switch for all motor controllers. Provide combination type starter-disconnect unless otherwise noted on drawings.
- B. Motors: Provide a disconnect switch for all motors. Provide a separate safety switch for motors which are not within sight of the starter.
- C. Provide safety switches for all factory packaged equipment.
- D. Provide NEMA 3R safety switch for all rooftop and outdoor equipment.
- E. Provide unit mounted disconnect switches for all equipment such as unit heaters, fans, unit ventilators, incremental units, etc

3.08 EMERGENCY PUSHBUTTON OPERATOR STATION

- A. Provide Emergency Pushbutton Operator Station at each boiler room exit to de-energize the primary control circuit and to close the main fuel valves to stop the flow of fuel to the burner during an emergency.
- B. Review plans for locations.
- C. Provide all conduit and wiring for interlock of each boiler.

END OF SECTION

**SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General construction and requirements.
- B. Applications.
- C. Single phase electric motors.
- D. Three phase electric motors.
- E. Electronically Commutated Motors (ECM).

1.02 RELATED REQUIREMENTS

- A. Section 262913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings 2015.
- B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators 2017.
- C. NEMA MG 1 - Motors and Generators 2018.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.
- D. Operation Data: Include instructions for safe operating procedures.
- E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer warranty for motors larger than 20 horsepower.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Baldor Electric Company/ABB Group: www.baldor.com/#sle.
- B. Leeson Electric Corporation: www.leeson.com/#sle.
- C. Regal-Beloit Corporation (Century): www.centuryelectricmotor.com/#sle.
- D. Substitutions: See Section 016000 - Product Requirements.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Construction:
 - 1. Open drip-proof type except where specifically noted otherwise.
 - 2. Design for continuous operation in 104 degrees F environment.
 - 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

- B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- C. Wiring Terminations:
 - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 - 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

- A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.
- B. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.
- C. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.

2.04 SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque.
- B. Starting Current: Less than five times full load current.
- C. Pull-up Torque: Up to 350 percent of full load torque.
- D. Breakdown Torque: Approximately 250 percent of full load torque.
- E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
- F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.
- G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS

- A. Starting Torque: Between 1 and 1-1/2 times full load torque.
- B. Starting Current: Six times full load current.
- C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
- D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.
- E. Insulation System: NEMA Class B or better.
- F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
- G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 262913.
- I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- J. Sound Power Levels: To NEMA MG 1.
- K. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

- L. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.
- M. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

2.06 ELECTRONICALLY COMMUTATED MOTORS (ECM)

- A. Applications:
 - 1. Commercial:
 - a. Roof Top Unit:
 - 1) Operating Mode: Constant speed.
 - 2) Input: Motor manufacturer to coordinate control requirements with the control board of the roof top unit and/or specified sequence of operation.
 - 3) Shaft Extension: Single.
 - b. Power Roof Ventilator (PRV):
 - 1) Operating Mode: Constant cfm.
 - 2) Input: Motor manufacturer to coordinate control requirements with the control board of the PRV and/or specified sequence of operation.
 - 3) Shaft Extension: Single.
 - c. Hydronic Pump:
 - 1) Operating Mode: Constant speed.
 - 2) Input: Motor manufacturer to coordinate control requirements with the control board of the hydronic pump and/or specified sequence of operation.
 - 3) Flange Configuration: "C".

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

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**SECTION 230517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe sleeves.
- B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 230719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2016.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
 - 4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
- B. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- C. Pipe Passing Through Below Grade Exterior Walls:
 - 1. Zinc coated or cast iron pipe.
 - 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- D. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
 - 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 - 2. Connect sleeve with floor plate except in mechanical rooms.
- E. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
 - 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 - 2. Connect sleeve with floor plate except in mechanical rooms.
- F. Clearances:

1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

- A. Modular/Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
 2. Provide watertight seal between pipe and wall/casing opening.
 3. Elastomer element size and material in accordance with manufacturer's recommendations.
 4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Inserts:
1. Provide inserts for placement in concrete formwork.
 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- E. Structural Considerations:
1. Do not penetrate building structural members unless indicated.
- F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
 2. Aboveground Piping:
 - a. Pack solid using mineral fiber in compliance with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
 3. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
 4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- G. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 3. Locate piping in center of sleeve or penetration.
 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.

- 5. Tighten bolting for a water-tight seal.
- 6. Install in accordance with manufacturer's recommendations.
- H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

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**SECTION 230519
METERS AND GAUGES FOR HVAC PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells.
- C. Filter gauges.

1.02 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.04 FIELD CONDITIONS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc; []: www.dwyer-inst.com/#sle.
 - 2. Moeller Instrument Company, Inc; []: www.moellerinstrument.com/#sle.
 - 3. Omega Engineering, Inc; []: www.omega.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
 - 1. Case: Steel with brass bourdon tube.
 - 2. Size: 4-1/2 inch diameter.
 - 3. Mid-Scale Accuracy: One percent.
 - 4. Scale: Psi.

2.02 PRESSURE GAUGE TAPPINGS

- A. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.
- B. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.
- C. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.03 STEM TYPE THERMOMETERS

- A. Manufacturers:
 - 1. Dwyer Instruments, Inc; []: www.dwyer-inst.com/#sle.
 - 2. Omega Engineering, Inc; []: www.omega.com/#sle.
 - 3. Weksler Glass Thermometer Corp; []: www.wekslerglass.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
 - 1. Size: 9 inch scale.
 - 2. Window: Clear Lexan.
 - 3. Stem: 3/4 inch NPT brass.
 - 4. Accuracy: 2 percent, per ASTM E77.
 - 5. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
- B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.05 TEST PLUGS

- A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge with needle valves for isolation suction and discharge pressure.
- C. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Provide siphon on gauges in steam systems. Extend nipples and siphons to allow clearance from insulation.
- D. Install pressure gauges on the inlet and outlet piping of all hydronic zones, hydronic coils, and heat transfer equipment.
- E. Install pressure gauges upstream and downstream of all pressure reducing valves.
- F. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- G. Install thermometers in air duct systems on flanges.
- H. Install thermometers in the return duct, outside air duct, inlet duct, and supply duct of all air handling systems and terminal units.
- I. Install thermometers on the inlet and outlet piping of all hydronic zones, hydronic coils, and heat transfer equipment.
- J. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.
- K. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- L. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- M. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- N. Locate test plugs adjacent to pressure gauges and pressure gauge taps.

END OF SECTION

SECTION 230523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Applications.
- B. Globe valves.
- C. Ball valves.
- D. Butterfly valves.
- E. Check valves.
- F. Gate valves.
- G. Chainwheels.

1.02 RELATED REQUIREMENTS

- A. Section 230553 - Identification for HVAC Piping and Equipment.
- B. Section 230719 - HVAC Piping Insulation.
- C. Section 232113 - Hydronic Piping.
- D. Section 232213 - Steam and Condensate Heating Piping.

1.03 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. SWP: Steam working pressure.
- I. TFE: Tetrafluoroethylene.
- J. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch) 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2020.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard 2017.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2017.
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- F. ASME B16.34 - Valves - Flanged, Threaded and Welding End 2017.
- G. ASME B31.9 - Building Services Piping 2020.
- H. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).
- I. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2018).
- J. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).
- K. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
- L. AWWA C606 - Grooved and Shouldered Joints 2015.
- M. MSS SP-45 - Bypass and Drain Connections 2003 (Reaffirmed 2008).
- N. MSS SP-67 - Butterfly Valves 2017.

- O. MSS SP-68 - High Pressure Butterfly Valves with Offset Design 2017.
- P. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends 2011.
- Q. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends 2018.
- R. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves 2013.
- S. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends 2011.
- T. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.06 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
 - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
 - 4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
 - 5. Secure check valves in either the closed position or open position.
 - 6. Adjust butterfly valves to closed or partially closed position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.
 - 2. Store valves in shipping containers and maintain in place until installation.
 - a. Store valves indoors in dry environment.
- C. Exercise the following precautions for handling:
 - 1. Handle large valves with sling, modified to avoid damage to exposed parts.
 - 2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Provide the following valves for the applications if not indicated on drawings:
 - 1. Throttling (Hydronic): Butterfly, Ball, and Globe.
 - 2. Throttling (Steam): Gate.
 - 3. Isolation (Shutoff): Butterfly and Ball.
 - 4. Swing Check (Pump Outlet):
 - a. 2 NPS and Smaller: Bronze with bronze disc.
 - b. 2-1/2 NPS and Larger: Iron with lever and weight, lever and spring, center-guided metal, or center-guided with resilient seat.
 - 5. Dead-End: Butterfly, single-flange (lug) type.
- B. Required Valve End Connections for Non-Wafer Types:

1. Steel Pipe:
 - a. 2 NPS and Smaller: Threaded ends.
 - b. 2-1/2 NPS and Larger: Grooved ends or flanged.
 2. Copper Tube:
 - a. 2 NPS and Smaller: Threaded ends (Exception: Solder-joint valve-ends).
 3. Steam and Steam Condensate Pipe: Grooved ends not acceptable.
- C. Chilled Water Valves:
1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Threaded ends.
 - b. Ball: Full port, two piece, stainless steel trim.
 - c. Swing Check: Bronze disc, Class.
 - d. Globe: Bronze disc, Class 125.
 2. 2-1/2 NPS and Larger, Iron Valves:
 - a. Single-Flange Butterfly: 2-1/2 NPS to 12 NPS, aluminum-bronze disc, EPDM seat, 200 CWP.
 - b. Grooved-End Butterfly: 2-1/2 NPS to 12 NPS, 175 CWP.
 - c. Swing Check: Metal seats, Class 125.
 - d. Grooved-End Check: 3 NPS to 12 NPS, 300 CWP.
- D. Heating Hot Water Valves:
1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Threaded ends.
 - b. Ball: Full port, two piece, stainless steel trim.
 - c. Swing Check: Bronze disc, Class 125.
 - d. Globe: Bronze disc, Class 125.
 2. 2-1/2 NPS and Larger, Iron Valves:
 - a. Single-Flange Butterfly: 2-1/2 NPS to 12 NPS, aluminum-bronze disc, EPDM seat, 200 CWP.
 - b. Grooved-End Butterfly: 2-1/2 NPS to 12 NPS, 175 CWP.
 - c. Swing Check: Metal seats, Class 125.
 - d. Grooved-End Swing Check: 3 NPS to 12 NPS, 300 CWP.
- E. Low Pressure Steam Valves (15 PSIG or Less):
1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Gate: NRS, Class 125.
 - b. Globe: Bronze disc, Class 125.
 2. 2-1/2 NPS and Larger, Iron Valves:
 - a. Gate: NRS, Class 125.
- F. High Pressure Steam Valves (Greater than 15 PSIG):
1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Gate: NRS, Class 125.
 - b. Globe: Bronze disc, Class 125.
 2. 2-1/2 NPS and Larger, Iron Valves:
 - a. Gate: NRS, Class 125.
- G. Steam-Condensate Valves:
1. 2 NPS and Smaller, Brass and Bronze Valves:
 - a. Gate: NRS, Class 125.
 - b. Swing Check: Metal seats, Class 125.
 2. 2-1/2 NPS and Larger, Iron Valves:
 - a. Swing Check: Metal seats, Class 125.
 - b. Gate: NRS, Class 125.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
 1. Gear Actuator: Quarter-turn valves 8 NPS and larger.
 2. Handwheel: Valves other than quarter-turn types.

3. Hand Lever: Quarter-turn valves 6 NPS and smaller.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- D. Valves in Insulated Piping: Provide 2 NPS stem extensions and the following features:
 1. Gate Valves: Rising stem.
 2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 3. Butterfly Valves: Extended neck.
 4. Memory Stops: Fully adjustable after insulation is installed.
- E. Memory Stops: Fully adjustable after insulation is installed.
- F. Valve-End Connections:
 1. Threaded End Valves: ASME B1.20.1.
 2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
 3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
 4. Solder Joint Connections: ASME B16.18.
 5. Grooved End Connections: AWWA C606.
- G. General ASME Compliance:
 1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
 2. Building Services Piping Valves: ASME B31.9.
- H. Bronze Valves:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- I. Valve Bypass and Drain Connections: MSS SP-45.
- J. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE, GLOBE VALVES

- A. Class 125: CWP Rating: 200 psig:
 1. Comply with MSS SP-80, Type 1.
 2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
 3. Ends: Threaded or solder joint.
 4. Stem and Disc: Bronze or PTFE.
 5. Packing: Asbestos free.
 - a. Handwheel: Malleable iron.

2.04 IRON, GLOBE VALVES

- A. Class 125: CWP Rating: 200 psig; and Class 250: CWP Rating: 500 psig:
 1. Comply with MSS SP-85, Type I.
 2. Body: Gray iron; ASTM A126, with bolted bonnet.
 3. Ends: Flanged.
 4. Trim: Bronze.
 5. Packing and Gasket: Asbestos free.
 6. Operator: Handwheel or chainwheel.

2.05 BRONZE, BALL VALVES

- A. General:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Two Piece, Full Port with Stainless Steel Trim:
 1. Comply with MSS SP-110.
 2. SWP Rating: 150 psig.
 3. CWP Rating: 600 psig.
 4. Body: Forged bronze or dezincified-brass alloy.
 5. Ends: Threaded.
 6. Seats: PTFE.
 7. Stem: Stainless steel.
 8. Ball: Stainless steel, vented.

2.06 IRON, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug Style: Bi-directional dead-end service without use of downstream flange.
 - 1. Comply with MSS SP-67, Type I.
 - 2. CWP Rating: 150 psig and 200 psig.
 - 3. Body Material: ASTM A126 cast iron or ASTM A536 ductile iron.
 - 4. Stem: One or two-piece stainless steel.
 - 5. Seat: NBR.
 - 6. Disc: Coated ductile iron.

2.07 IRON, GROOVED-END BUTTERFLY VALVES

- A. CWP Rating: 175 psig (1200 kPa), 300 psig (2070 kPa): 8 NPS (50 DN) or smaller, and 200 psig (1389 kPa): 10 NPS (250 DN) or larger.
 - 1. Comply with MSS SP-67, Type I.
 - 2. Body: Coated ductile iron.
 - 3. Stem: Stainless steel.
 - 4. Disc: Coated ductile iron.
 - 5. Disc Seal: EPDM.

2.08 HIGH-PERFORMANCE, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug type: Bi-directional dead end service without downstream flange.
 - 1. Comply with MSS SP-68.
 - 2. Class 150: CWP Rating: 285 psig and Class 300: CWP Rating: 720 psig at 100 degrees F.
 - 3. Body: Provide carbon steel, cast iron, ductile Iron, or stainless steel.
 - 4. Seat: Metal or reinforced PTFE.
 - 5. Offset stem: Stainless steel.
 - 6. Disc: Carbon steel.

2.09 BRONZE, SWING CHECK VALVES

- A. Class 125: CWP Rating: 200 psig (1380 kPa) and Class 150: CWP Rating: 300 psig (2070 kPa).
 - 1. Comply with MSS SP-80, Type 3.
 - 2. Body Design: Horizontal flow.
 - 3. Body Material: Bronze, ASTM B62.
 - 4. Ends: Threaded.
 - 5. Disc: Bronze.

2.10 IRON, FLANGED END SWING CHECK VALVES

- A. Class 125: CWP Rating: 200 psig (1380 kPa) with Metal Seats.
 - 1. Comply with MSS SP-71, Type I.
 - 2. Design: Clear or full waterway with flanged ends.
 - 3. Body: Gray iron with bolted bonnet in accordance with ASTM A126.
 - 4. Trim: Bronze.
 - 5. Gasket: Asbestos free.

2.11 IRON, GROOVED-END SWING CHECK VALVES

- A. 300 CWP:
 - 1. 2 NPS to 8 NPS.
 - 2. CWP Rating: 300 psig.
 - 3. Body Material: ASTM A536, Grade 65-45-12 ductile iron.
 - 4. Seal: EPDM or Nitrile.
 - 5. Disc: Ductile iron.
 - 6. Coating: Black, non-lead paint.

2.12 BRONZE, GATE VALVES

- A. Non-Rising Stem (NRS) or Rising Stem (RS):
 - 1. Comply with MSS SP-80, Type I.
 - 2. Class 150: CWP Rating: 300 psig.
 - 3. Body Material: Bronze with integral seat and union-ring bonnet.
 - 4. Ends: Threaded.

5. Stem: Bronze.
6. Disc: Solid wedge; bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.

2.13 IRON, GATE VALVES

- A. NRS or OS&Y:
 1. Comply with MSS SP-70, Type I.
 2. Body Material: Gray iron with bolted bonnet.
 3. Ends: Flanged.
 4. Trim: Bronze.
 5. Disc: Solid wedge.
 6. Packing and Gasket: Asbestos free.

2.14 CHAINWHEELS

- A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 2. Attachment: For connection to ball, butterfly, and plug valve stems.
 3. Sprocket Rim with Chain Guides: Ductile iron include zinc coating.
 4. Chain: Hot-dip galvanized steel. Sized to fit sprocket rim.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Install check valves where necessary to maintain direction of flow as follows:
 1. Swing Check: Install horizontal maintaining hinge pin level.
- D. Provide chainwheels on operators for valves 4 NPS and larger where located 96 NPS or more above finished floor, terminating 60 NPS above finished floor.

END OF SECTION

**SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components for equipment, piping, and other HVAC/hydraulic work.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping 2014 (Reapproved 2020).
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- I. MFMA-4 - Metal Framing Standards Publication 2004.
- J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Installer Qualifications for Field-Welding: As specified in Section 055000.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 1. Comply with MSS SP-58.
 2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 4.0. Include consideration for vibration, equipment operation, and shock loads where applicable.
 5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Materials for Metal Fabricated Supports: Comply with Section 055000.
- C. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 1. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Ferguson Enterprises Inc: www.fnw.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
 2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 3. Comply with MFMA-4.
 4. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
 6. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
- D. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
 - c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
 - d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.
- E. Thermal Insulated Pipe Supports:
 1. Manufacturers:
 - a. Buckaroos, Inc: www.buckaroos.com/#sle.
 - b. KB Enterprises: www.snappitz.com/#sle.
 2. General Construction and Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
 - d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
 3. PVC Jacket:
 - a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
 - b. Minimum Service Temperature: Minus 40 degrees F.
 - c. Maximum Service Temperature: 180 degrees F.
 - d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
 - e. Thickness: 60 mil.
 - f. Connections: Brush on welding adhesive.
 4. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
 5. Products:
 - a. Buckaroos, Inc; CoolDry: www.buckaroos.com/#sle.
- F. Pipe Supports:
 1. Liquid Temperatures Up To 122 degrees F:
 - a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
 - b. Support From Below: MSS SP-58 Types 35 through 38.
 2. Operating Temperatures from 122 to 446 degrees F:
 - a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
 - b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.
 - c. Sliding Support: MSS SP-58 Types 35 through 38.
- G. Pipe Stanchions: For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
 1. Manufacturers:
 - a. Anvil International; H-Block: www.anvilintl.com/#sle.
 2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 3. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
- H. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
 1. Manufacturers:
 - a. Ferguson Enterprises Inc: www.fnw.com/#sle.
 2. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
 3. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- I. Riser Clamps:
 1. Manufacturers:
 - a. Ferguson Enterprises Inc; []: www.fnw.com/#sle.

2. Provide copper plated clamps for copper tubing support.
 3. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
- J. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
- K. Strut Clamps: Two-piece pipe clamp.
- L. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.
- M. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
 2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
- N. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
1. Pipe Diameter 6 inches and Smaller: Provide minimum clearance of 0.16 inch.
 2. Pipe Diameter 8 inches: Provide U-bolts with double nuts providing minimum clearance of 0.28 inch.
 3. Pipe Diameter 8 inches: 0.625 inch U-bolt.
 4. Pipe Diameter 10 inches: 0.75 inch U-bolt.
 5. Pipe Diameter 12 to 16 inches: 0.875 inch U-bolt.
 6. Pipe Diameter 18 to 30 inches: 1 inch U-bolt.
- O. Pipe Alignment Guides: Galvanized steel.
1. Pipe Diameter 8 inches and Smaller: Spider or sleeve type.
 2. Pipe Diameter 10 inches and Larger: Roller type.
- P. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- Q. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Manufacturers:
 - a. Anvil International; H-Block: www.anvilintl.com/#sle.
 - b. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - c. Erico International Corporation, a brand of Pentair: www.erico.com/#sle.
 - d. Ferguson Enterprises Inc: www.fnw.com/#sle.
 - e. PHP Systems/Design: www.phpsd.com/#sle.
 - f. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
 2. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
 3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- R. Pipe Shields for Insulated Piping:
1. Manufacturers:
 - a. Anvil International: www.anvilintl.com/#sle.
 2. General Construction and Requirements:
 - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
 - b. Shields Material: UV-resistant polypropylene with glass fill.
 - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
 - d. Minimum Service Temperature: Minus 40 degrees F.
 - e. Maximum Service Temperature: 178 degrees F.
 - f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
- S. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
 - a. Hilti, Inc: www.us.hilti.com/#sle.

- b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
- c. Powers Fasteners, Inc: www.powers.com/#sle.
- d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
2. Manufacturers - Powder-Actuated Fastening Systems:
 - a. Hilti, Inc: www.us.hilti.com/#sle.
 - b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
 - c. Powers Fasteners, Inc: www.powers.com/#sle.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.
12. Hammer-driven anchors and fasteners are not permitted.
13. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
 - d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
14. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
- T. Pipe Installation Accessories:
 1. Copper Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
 2. Thermal Insulated Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
 3. Overhead Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
 4. Plenum Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
 5. Telescoping Pipe Supports:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
 6. Inserts and Clamps:
 - a. Manufacturers:
 - 1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.

2.02 RETROFIT PIPING COVER SYSTEM

- A. Manufacturers:
 1. DecoShield Systems, Inc: www.decoshield.com/#sle.
- B. General Requirements:

1. Surface Burning Characteristics: Flame spread index/smoke developed index of 20/250, maximum, when tested in accordance with ASTM E84 or UL 723.
- C. Materials:
 1. Piping Cover System: Removal-resistant, modular, snap-fit cover units, clips, and anchors for use with CPVC, steel, and copper piping systems.
 2. Cover Units: L-shaped and U-shaped cross-section units of flame retardant resin material, paintable finish.
 3. Unit Length: 7.5 feet.
 4. Provide coupling fittings for joining units end to end and prefabricated inside and outside corner fittings and end caps as required.
 5. Provide mounting clips to secure covers to wall-ceiling per manufacturer requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Field-Welding (where approved by Architect): Comply with Section 055000.
- H. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- I. Equipment Support and Attachment:
 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- J. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- K. Secure fasteners according to manufacturer's recommended torque settings.
- L. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

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- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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**SECTION 230550
WIND RESTRAINT FOR HVAC SYSTEMS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

- A. Support and brace mechanical and electrical systems, as called for, to resist directional wind forces (lateral, longitudinal and vertical).

1.03 APPLICABLE CODES AND STANDARDS

- A. Provide work in compliance with the following codes and standards:
- B. 2015 International Building Code (Section 1609).
- C. 2015 International Mechanical Code (Section 301, Item 301.15).
- D. American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures with Supplement No. 1 - Standard ASCE/SEI 7-10.

1.04 QUALITY ASSURANCE

- A. General:
 - 1. The contractor shall provide professional engineer stamped and signed calculations, and details of wind restraint systems to meet total design lateral force requirements for support and restraint of mechanical and electrical systems.
 - 2. Systems requiring wind restraint including, but not limited to:
 - a. Exhaust fans.
 - b. Hooded intake or relief ventilators.
 - c. Ductwork.
 - d. Rooftop air handling equipment.
 - e. Condensing units.
 - f. Miscellaneous HVAC equipment.
 - g. Roof curbs and pipe/duct/equipment supports associated with any of the equipment listed above.

1.05 SUBMITTALS

- A. Submit wind force level (Fp) calculations from applicable building code. Submit pre-approved restraint selections, installation details, and plans indicating locations of restraints.
- B. Calculations, plans, restraint selection, and installation details shall be stamped and signed by a professionally licensed engineer experienced in wind restraint design.
- C. Submit manufacturer's product data.
- D. For each piece of equipment that requires wind restraint as outlined in this section, include the following:
 - 1. Dimensioned Outline Drawings of Equipment Unit: Identify the center of gravity and locate and describe mounting and anchoring provisions.
 - 2. Anchorage: Provide detailed description of equipment anchorage devices on which the calculations are based and their installation requirements. Identify anchor bolts, studs and other mounting devices. Provide information on the size, type and spacing of mounting brackets, holes and other provisions.

PART 1 PRODUCTS

2.01 CODE INFORMATION

- A. This project is subject to the wind bracing requirements of the 2015 International Building Code (Section 1609) and American Society of Civil Engineers ASCE/SEI 7-10. The following criteria are applicable to this project:
 - 1. Nominal Design Wind Speed (V) (Per ASCE 7-10): 120 mph.
 - 2. Risk Category (Per ASCE 7-10): III
 - 3. Exposure Category (Per ASCE 7-10): C
 - 4. Height and Exposure Adjustment Coefficient (Per ASCE 7-10): 1.21

2.02 WIND BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

- A. General:
 - 1. Design analysis shall include calculated dead loads, wind loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
 - 2. Analysis shall detail anchoring methods, bolt diameter, and embedment depth.
 - 3. All wind restraint devices shall be designed to accept without failure the forces calculated per the applicable building code and as summarized in Section 2.1.
- B. Friction from gravity loads shall not be considered resistance to wind forces.

PART 1 EXECUTION

3.01 INSTALLATION

- A. Wind Restraint of Ductwork and Equipment:
 - 1. All restraint systems shall be installed in strict accordance with the manufacturer's restraint guidelines and all certified submittal data.
 - 2. The interaction between mechanical and electrical equipment and the supporting structures shall be designed into the restraint systems.
 - 3. Friction clips shall not be used for anchorage attachments.
 - 4. Expansion anchors shall not be used for non-vibration isolated equipment rated over 10 HP.
 - 5. Components mounted on vibration isolation systems shall have a bumper restraint or snubber in each horizontal direction and vertical restraints shall be provided to resist overturning.
 - 6. Installation of restraints shall not cause any change in position of equipment or ductwork, resulting in stresses or misalignment.
 - 7. Exhaust fans with hinge kits shall have wind restraint fasteners installed on the hinged side, same as the three (3) non-hinged sides.
 - 8. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.
 - 9. Do not install any equipment or duct that makes rigid connections with the building unless isolation is not specified.
 - 10. Prior to installation, bring to the Architect's/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.
 - 11. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult Structural Engineer of record.
 - 12. Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The Contractor shall submit loads to the Structural Engineer of record for approval in this event.
 - 13. Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.
 - 14. Provide reinforced clevis bolts where required.
 - 15. Do not brace a system to two independent structures such as a roof and wall.

END OF SECTION

SECTION 230553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Adhesive-backed duct markers.
- D. Stencils.
- E. Pipe markers.
- F. Ceiling tacks.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

- A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Tags.
- C. Automatic Controls: Tags. Key to control schematic.
- D. Control Panels: Nameplates.
- E. Dampers: Ceiling tacks, where located above lay-in ceiling.
- F. Ductwork: Adhesive-backed duct markers or stencils.
- G. Heat Transfer Equipment: Nameplates.
- H. Instrumentation: Tags.
- I. Major Control Components: Nameplates.
- J. Piping: Pipe markers.
- K. Pumps: Nameplates.
- L. Relays: Tags.
- M. Small-sized Equipment: Tags.
- N. Tanks: Nameplates.
- O. Thermostats: Nameplates.
- P. Valves: Tags and ceiling tacks where located above lay-in ceiling.
- Q. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

- A. Manufacturers:
 - 1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
 - 2. Brimar Industries, Inc: www.pipemarker.com/#sle.

3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.
- B. Letter Color: White.
- C. Letter Height: 1/4 inch.
- D. Background Color: Black.
- E. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Manufacturers:
1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
 2. Brady Corporation: www.bradycorp.com/#sle.
 3. Brimar Industries, Inc: www.pipemarkers.com/#sle.
 4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 6. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 ADHESIVE-BACKED DUCT MARKERS

- A. Manufacturers:
1. Brimar Industries, Inc: www.pipemarkers.com/#sle.
 2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 3. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
- B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.
- C. Style: Individual Label.
- D. Color: Green/White Green/White.

2.05 STENCILS

- A. Manufacturers:
1. Brady Corporation: www.bradycorp.com/#sle.
 2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
 3. Insite Solutions, LLC: www.stop-painting.com/#sle.
 4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
 5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.
- B. Stencils: With clean cut symbols and letters of following size:
1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
 2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
 3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
 4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
 5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
 6. Ductwork and Equipment: 2-1/2 inch high letters.
- C. Stencil Paint: As specified in Section 099123, semi-gloss enamel, colors complying with ASME A13.1.

2.06 PIPE MARKERS

- A. Manufacturers:
1. Brady Corporation; []: www.bradycorp.com/#sle.

2. Brimar Industries, Inc; []: www.pipemarker.com/#sle.
 3. Craftmark Pipe Markers; []: www.craftmarkid.com/#sle.
 4. Kolbi Pipe Marker Co; []: www.kolbipipemarkers.com/#sle.
 5. Seton Identification Products, a Tricor Company; []: www.seton.com/#sle.
- B. Color: Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- E. Color code as follows:
1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

2.07 CEILING TACKS

- A. Manufacturers:
1. Craftmark Pipe Markers; []: www.craftmarkid.com/#sle.
- B. Description: Steel with 3/4 inch diameter color coded head.
- C. Color code as follows:
1. HVAC Equipment: Yellow.
 2. Fire Dampers and Smoke Dampers: Red.
 3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 099123 for stencil painting.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 099123.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Use tags on piping 3/4 inch diameter and smaller.
1. Identify service, flow direction, and pressure.
 2. Install in clear view and align with axis of piping.
 3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- G. Install ductwork with adhesive-backed duct markers. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- H. Locate ceiling tacks to locate dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

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SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic systems.
- C. Measurement of final operating condition of HVAC systems.

1.02 RELATED REQUIREMENTS

- A. Section 230800 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008 (Reaffirmed 2017).
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems 2015, with Errata (2017).
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to Architect.
 - 2. Include at least the following in the plan:
 - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Identification and types of measurement instruments to be used and their most recent calibration date.
 - d. Final test report forms to be used.
 - e. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
 - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 5. Units of Measure: Report data in I-P (inch-pound) units only.
 - 6. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Architect.
 - g. Project Contractor.
 - h. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. SMACNA (TAB).
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Provide testing, adjusting, and balancing services for each project phase. Provide a final TAB report at the completion of all project work that includes all phases. The final TAB services shall include re-verifying 10% of the work for each phase to confirm that subsequent work did not impact the previous TAB information.
- D. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- E. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
 - c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.
- F. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.
 - 12. Hydronic systems are flushed, filled, and vented.
 - 13. Pumps are rotating correctly.
 - 14. Proper strainer baskets are clean and in place.
 - 15. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations.
- B. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- E. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- I. Where modulating dampers are provided, take measurements and balance at extreme conditions.

3.07 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

3.08 SCOPE

- A. Test, adjust, and balance the following:
 - 1. HVAC Pumps.
 - 2. Air Cooled Refrigerant Condensers.
 - 3. Custom Roof Top Heating/Dehumidification Units.
 - 4. Computer Room Air Conditioning Units.
 - 5. Air Coils.
 - 6. Fans.
 - 7. Air Terminal Units.
 - 8. Air Inlets and Outlets.

3.09 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
 - 1. Manufacturer.
 - 2. Model/Frame.
 - 3. HP/BHP.
 - 4. Phase, voltage, amperage; nameplate, actual, no load.
 - 5. RPM.
 - 6. Service factor.
 - 7. Starter size, rating, heater elements.
 - 8. Sheave Make/Size/Bore.
- B. Pumps:
 - 1. Identification/number.
 - 2. Manufacturer.
 - 3. Size/model.
 - 4. Impeller.
 - 5. Service.
 - 6. Design flow rate, pressure drop, BHP.
 - 7. Actual flow rate, pressure drop, BHP.
 - 8. Discharge pressure.
 - 9. Suction pressure.
 - 10. Total operating head pressure.
 - 11. Shut off, discharge and suction pressures.
 - 12. Shut off, total head pressure.
- C. Air Cooled Condensers:
 - 1. Identification/number.
 - 2. Location.
 - 3. Manufacturer.
 - 4. Model number.
 - 5. Serial number.
 - 6. Entering DB air temperature, design and actual.
 - 7. Leaving DB air temperature, design and actual.
 - 8. Number of compressors.
- D. Heat Exchangers:
 - 1. Identification/number.
 - 2. Location.
 - 3. Service.
 - 4. Manufacturer.
 - 5. Model number.
 - 6. Serial number.
 - 7. Steam pressure, design and actual.
 - 8. Primary water entering temperature, design and actual.
 - 9. Primary water leaving temperature, design and actual.
 - 10. Primary water flow, design and actual.
 - 11. Primary water pressure drop, design and actual.
 - 12. Secondary water leaving temperature, design and actual.
 - 13. Secondary water flow, design and actual.
 - 14. Secondary water pressure drop, design and actual.
- E. Cooling Coils:
 - 1. Identification/number.
 - 2. Location.
 - 3. Service.
 - 4. Manufacturer.
 - 5. Air flow, design and actual.
 - 6. Entering air DB temperature, design and actual.
 - 7. Entering air WB temperature, design and actual.
 - 8. Leaving air DB temperature, design and actual.

9. Leaving air WB temperature, design and actual.
 10. Water flow, design and actual.
 11. Water pressure drop, design and actual.
 12. Entering water temperature, design and actual.
 13. Leaving water temperature, design and actual.
 14. Saturated suction temperature, design and actual.
 15. Air pressure drop, design and actual.
- F. Heating Coils:
1. Identification/number.
 2. Location.
 3. Service.
 4. Manufacturer.
 5. Air flow, design and actual.
 6. Water flow, design and actual.
 7. Water pressure drop, design and actual.
 8. Entering water temperature, design and actual.
 9. Leaving water temperature, design and actual.
 10. Entering air temperature, design and actual.
 11. Leaving air temperature, design and actual.
 12. Air pressure drop, design and actual.
- G. Air Moving Equipment:
1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Air flow, specified and actual.
 6. Return air flow, specified and actual.
 7. Outside air flow, specified and actual.
 8. Total static pressure (total external), specified and actual.
 9. Inlet pressure.
 10. Discharge pressure.
 11. Sheave Make/Size/Bore.
 12. Fan RPM.
- H. Return Air/Outside Air:
1. Design air flow.
 2. Actual air flow.
 3. Design return air flow.
 4. Actual return air flow.
 5. Design outside air flow.
 6. Actual outside air flow.
 7. Return air temperature.
 8. Outside air temperature.
 9. Required mixed air temperature.
 10. Actual mixed air temperature.
 11. Design outside/return air ratio.
 12. Actual outside/return air ratio.
- I. Exhaust Fans:
1. Location.
 2. Manufacturer.
 3. Model number.
 4. Serial number.
 5. Air flow, specified and actual.
 6. Total static pressure (total external), specified and actual.
 7. Inlet pressure.
 8. Discharge pressure.
 9. Sheave Make/Size/Bore.
 10. Number of Belts/Make/Size.

11. Fan RPM.
- J. Flow Measuring Stations:
 1. Identification/number.
 2. Location.
 3. Size.
 4. Manufacturer.
 5. Model number.
 6. Serial number.
 7. Design Flow rate.
 8. Design pressure drop.
 9. Actual/final pressure drop.
 10. Actual/final flow rate.
 11. Station calibrated setting.
- K. Terminal Unit Data:
 1. Manufacturer.
 2. Type, constant, variable, single, dual duct.
 3. Identification/number.
 4. Location.
 5. Model number.
 6. Size.
 7. Minimum static pressure.
 8. Minimum design air flow.
 9. Maximum design air flow.
 10. Maximum actual air flow.
 11. Inlet static pressure.
- L. Air Distribution Tests:
 1. Air terminal number.
 2. Room number/location.
 3. Terminal type.
 4. Terminal size.
 5. Area factor.
 6. Design velocity.
 7. Design air flow.
 8. Test (final) velocity.
 9. Test (final) air flow.
 10. Percent of design air flow.

END OF SECTION

SECTION 230713 DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Insulation jackets.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 230553 - Identification for HVAC Piping and Equipment.
- C. Section 233100 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.
- D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- G. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation 2020.
- H. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.
- I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.
- K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
1. CertainTeed Corporation: www.certainteed.com/#sle.
 2. Johns Manville: www.jm.com/#sle.
 3. JP Lamborn Co; Thermal Sleeve MT: www.jpflex.com/#sle.
 4. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com/#sle.
 5. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 6. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
 2. Maximum Service Temperature: 1200 degrees F.
 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Indoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- F. Outdoor Vapor Barrier Mastic:
1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- G. Tie Wire: Annealed steel, 16 gauge, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

- A. Manufacturer:
1. CertainTeed Corporation: www.certainteed.com/#sle.
 2. Johns Manville: www.jm.com/#sle.
 3. Knauf Insulation: www.knaufinsulation.com/#sle.
 4. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
 2. Maximum Service Temperature: 450 degrees F.
 3. Maximum Water Vapor Absorption: 5.0 percent.
 4. Maximum Density: 8.0 lb/cu ft.
- C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.

2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

- A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
 1. Lagging Adhesive:
 - a. Manufacturers:
 - 1) Design Polymeric; DP 3050 Water Based, Zero VOC, Premium Quality, Lagging Adhesive, and Vapor Retarder: www.designpoly.com/#sle.
 - 2) Substitutions: See Section 016000 - Product Requirements
 - b. Compatible with insulation.
- B. Aluminum Jacket: ASTM B209 (ASTM B209M).
 1. Thickness: 0.016 inch sheet.
 2. Finish: Smooth.
 3. Joining: Longitudinal slip joints and 2 inch laps.
 4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated Ducts Conveying Air Below Ambient Temperature:
 1. Provide insulation with vapor barrier jackets.
 2. Finish with tape and vapor barrier jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Insulated Ducts Conveying Air Above Ambient Temperature:
 1. Provide with standard vapor barrier jacket.
 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.
- F. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.
- G. Slope exterior ductwork to shed water.
- H. External Duct Insulation Application:
 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
 2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
 3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

3.03 SCHEDULES

- A. Exhaust Ducts Within 10 ft of Exterior Openings:
 1. Flexible Glass Fiber Duct Insulation: 1-1/2 inches thick.
 2. Rigid Glass Fiber Duct Insulation: 1-1/2 inches thick.
- B. Outside Air Intake Ducts:
 1. Insulation:
 - a. Flexible Glass Fiber Duct Insulation:
 - 1) Thickness required to provide an R value not less than R-12.

- b. Rigid Glass Fiber Duct Insulation:
 - 1) Thickness required to provide an R value not less than R-12.
- C. Supply Ducts:
 - 1. Continuous from unit supply connections.
 - a. Flexible Glass Fiber Duct Insulation:
 - 1) Thickness required to provide an R value not less than R-6.
 - b. Rigid Glass Fiber Duct Insulation:
 - 1) Thickness required to provide an R value not less than R-6.
- D. Ducts Exposed to Outdoors:
 - 1. Insulation:
 - a. Flexible Glass Fiber Duct Insulation:
 - 1) Thickness required to provide an R value not less than R-12.
 - b. Rigid Glass Fiber Duct Insulation:
 - 1) Thickness required to provide an R value not less than R-12.
 - 2. Jacket:
 - a. Aluminum Jacket or Flexible Weather-Proofing Outdoor Jacket

END OF SECTION

**SECTION 230716
HVAC EQUIPMENT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Equipment insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Covering.

1.02 RELATED REQUIREMENTS

- A. Section 230553 - Identification for HVAC Piping and Equipment.
- B. Section 232114 - Hydronic Specialties.

1.03 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2013).
- E. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.
- F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- G. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2017, with Editorial Revision (2018).
- H. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- I. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- J. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service 2020.
- K. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturers:
1. Johns Manville Corporation; []: www.jm.com/#sle.
 2. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com/#sle.
 3. Owens Corning Corporation; []: www.ocbuildingspec.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C553; flexible, noncombustible.
1. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 2. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 2. Secure with self-sealing longitudinal laps and butt strips.
 3. Secure with outward clinch expanding staples and vapor barrier mastic.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

- A. Manufacturers:
1. Auburn Manufacturing Inc; Ever Green Cut 'n Wrap: www.auburnmfg.com/#sle.
 2. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C553 Type V; flexible, noncombustible.
1. Comply with ASTM C1695.
 2. K Value: 0.37 at 100 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 3. Minimum Service Temperature: 32 degrees F.
 4. Maximum Service Temperature: 500 degrees F.
 5. Maximum Water Vapor Absorption: Less than 5.0 percent by weight.
 6. Color: Green.
 7. Weight: 7.65 oz per sq ft.
 8. Effective Thickness: 1.25 plus/minus 0.25 inch.

2.04 GLASS FIBER, RIGID

- A. Manufacturer:
1. CertainTeed Corporation; []: www.certainteed.com/#sle.
 2. Johns Manville Corporation; []: www.jm.com/#sle.
 3. Knauf Insulation; Earthwool Insulation Board: www.knaufinsulation.com/#sle.
 4. Owens Corning Corporation; []: www.ocbuildingspec.com/#sle.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.
1. K Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 2. Maximum Service Temperature: 850 degrees F.
 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
 4. Maximum Density: 8.0 lb/cu ft.
- C. Vapor Barrier Jacket:
1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

2. Secure with self-sealing longitudinal laps and butt strips.
3. Secure with outward clinch expanding staples and vapor barrier mastic.
- D. Facing: 1 inch galvanized steel hexagonal wire mesh stitched on one face of insulation.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.05 CELLULAR GLASS

- A. Manufacturer:
 1. Owens Corning Corporation; []: www.ocbuildingspec.com/#sle.
 2. Substitutions: See Section 016000 - Product Requirements.
- B. Pipe and Tubing Insulation: ASTM C552, Type II, Grade 6.
 1. K Value: 0.35 at 100 degrees F.
 2. Service Temperature Range: From 250 degrees F to 800 degrees F.
 3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
 4. Water Absorption: 0.5 percent by volume, maximum.
 5. Density: At least 6.12 lb/cu ft.
- C. Block Insulation: ASTM C552, Type I, Grade 6.
 1. K Value: 0.35 at 100 degrees F.
 2. Service Temperature: 800 degrees F, maximum.
 3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
 4. Water Absorption: 0.5 percent by volume, maximum.
 5. Density: At least 6.12 lb/cu ft.

2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
 1. Aeroflex USA, Inc; Aerocel AC Sheet and Roll: www.aeroflexusa.com/#sle.
 2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
 3. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
 1. Minimum Service Temperature: Minus 40 degrees F.
 2. Maximum Service Temperature: 220 degrees F.
 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.07 JACKETS

- A. PVC Plastic:
 1. Jacket: Sheet material, off-white color.
 - a. Minimum Service Temperature: Minus 40 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.
 2. Covering Adhesive Mastic: Compatible with insulation.
- B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 1. Thickness: 0.016 inch sheet.
 2. Finish: Smooth.
 3. Joining: Longitudinal slip joints and 2 inch laps.
 4. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Factory Insulated Equipment: Do not insulate.
- C. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation 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 cement.
- F. Insulated equipment containing fluids below ambient temperature; insulate entire system.
- G. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.
- H. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
- I. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
- J. Fiber glass insulated equipment containing fluids above ambient temperature; provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.
- K. Inserts and Shields:
 - 1. Application: Equipment 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between hangers and inserts.
 - 3. Insert Location: Between support shield and equipment and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- L. Finish insulation at supports, protrusions, and interruptions.
- M. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting or PVC jacket and fitting covers.
- N. Exterior Applications:
 - 1. Provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement.
 - 2. Cover with aluminum.
- O. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.
- P. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- Q. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULE

- A. Heating Systems:
 - 1. Heat Exchangers/Converters.
 - 2. Air Separators.
- B. Cooling Systems:
 - 1. Pump Bodies.
 - 2. Air Separators.
 - 3. Expansion Tanks.

END OF SECTION

**SECTION 230719
HVAC PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Jackets and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 232113 - Hydronic Piping: Placement of hangers and hanger inserts.
- C. Section 232213 - Steam and Condensate Heating Piping: Placement of hangers and hanger inserts.
- D. Section 232300 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

- A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2019.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2013).
- F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement 2007 (Reapproved 2013).
- G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.
- H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation 2017.
- I. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.
- J. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2019.
- K. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.
- L. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing 2010 (Reapproved 2016).
- M. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation 2020.
- N. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- O. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation 2017a.
- P. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces 2008 (Reapproved 2019).
- Q. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.
- R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- S. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

- A. Manufacturers:
 - 1. CertainTeed Corporation; []: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation; []: www.jm.com/#sle.
 - 3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
 - 5. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com/#sle.
 - 6. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
 - 1. K Value: ASTM C177, 0.23 at 75 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- D. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- F. Vapor Barrier Lap Adhesive: Compatible with insulation.
- G. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- H. Fibrous Glass Fabric:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Blanket: 1.0 lb/cu ft density.
 - 3. Weave: 5 by 5.

- I. Indoor Vapor Barrier Finish:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, black color.
- J. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- K. Insulating Cement: ASTM C449.

2.03 HYDROUS CALCIUM SILICATE

- A. Manufacturers:
 - 1. Johns Manville Corporation; [____]: www.jm.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.
 - 1. K Value: 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 - 2. Maximum Service Temperature: 1200 degrees F.
 - 3. Density: 15 lb/cu ft.
- C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- D. Insulating Cement: ASTM C449.

2.04 POLYISOCYANURATE CELLULAR PLASTIC

- A. Insulation Material: ASTM C591, rigid molded modified polyisocyanurate cellular plastic.
 - 1. Dimension: Comply with requirements of ASTM C585.
 - 2. K Value: 0.18 at 75 degrees F, when tested in accordance with ASTM C518.
 - 3. Minimum Service Temperature: Minus 70 degrees F.
 - 4. Maximum Service Temperature: 300 degrees F.
 - 5. Water Absorption: 0.5 percent by volume, maximum, when tested in accordance with ASTM D2842.
 - 6. Moisture Vapor Transmission: 4.0 perm inch.
 - 7. Connection: Waterproof vapor barrier adhesive.

2.05 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 - 1. Aeroflex USA, Inc; Aerocel Stay-Seal with Protape (SSPT): www.aeroflexusa.com/#sle.
 - 2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
 - 3. K-Flex USA LLC; K-Flex Titan: www.kflexusa.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 - 1. Minimum Service Temperature: Minus 40 degrees F.
 - 2. Maximum Service Temperature: 180 degrees F.
 - 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
- D. Comply with ASTM E84.
- E. Insulation: ASTM C578; rigid closed cell.
 - 1. K Value: 0.23 at 75 degrees F.
 - 2. Maximum Service Temperature: 165 degrees F.
 - 3. Maximum Water Vapor Permeance: 5.0 perms.
- F. Billet Dimensions: 7 inches by 14 inches by 108 inches.
- G. Density: Type X, 1.30 pcf (21 kg/cu m), minimum.
- H. Water Absorption: Type X, 0.3 percent by volume, maximum, by total immersion.

2.06 JACKETS

- A. PVC Plastic.
 - 1. Manufacturers:
 - a. Johns Manville Corporation; [____]: www.jm.com/#sle.

- b. Substitutions: See Section 016000 - Product Requirements.
 - 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.
 - 3. Covering Adhesive Mastic: Compatible with insulation.
- B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
 - 1. Thickness: 0.016 inch sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch laps.
 - 4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
 - 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
- C. Vapor Barrier Membranes: ASTM C1136, Type IX.
 - 1. Multilayer Laminate Vapor Barrier:
 - a. Thickness: 2.4 mil.
 - b. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.
 - c. Manufacturers:
 - 1) Polyguard Products; ZERO-PERM: www.polyguardproducts.com/#sle.
 - 2) Substitutions: See Section 016000 - Product Requirements.

2.07 ACCESSORIES

- A. General Requirements:
 - 1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
 - 2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
 - 3. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
 - 4. Supply materials that are asbestos free.
- B. Corrosion Inhibitors:
 - 1. Corrosion Control Gel:
 - a. Manufacturers:
 - 1) Polyguard Products; RG2400LT: www.polyguardproducts.com/#sle.
 - 2) Substitutions: See Section 016000 - Product Requirements.
 - b. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward

- clinch expanding staples and vapor barrier mastic.
- 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- H. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- I. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.
- K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.
- L. Concealed Piping: Finish with fitting covers on flanges, fittings, valves, and specialties.
- M. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

3.03 SCHEDULE

- A. Heating Systems:
 - 1. Heating Water Supply and Return:
 - a. NPS 1-1/4 and Smaller: 1-1/2 inch thick Rigid Glass Fiber.
 - b. NPS 1-1/2 and Larger: 2 inch thick Rigid Glass Fiber.
 - 2. Low Pressure Steam Piping (250 deg. F and Below):
 - a. NPS 3-1/2 and Smaller: 2-1/2 inch thick Rigid Glass Fiber.
 - b. NPS 4 and Larger: 3 inch thick Rigid Glass Fiber.
 - 3. Low Pressure, Gravity, and Pumped Steam Condensate:
 - a. NPS 3-1/2 and Smaller: 2-1/2 inch thick Rigid Glass Fiber.
 - b. NPS 4 and Larger: 3 inch thick Rigid Glass Fiber.
 - 4. High Pressure Steam Piping:
 - a. Less than NPS 1: 3 inch thick Rigid Glass Fiber.
 - b. NPS 1 to NPS 1-1/4: 4 inch thick Rigid Glass Fiber.
 - c. NPS 1-1/2 to NPS 3-1/2: 4-1/2 inch thick Rigid Glass Fiber.
 - 5. High Pressure Steam Condensate:
 - a. Less than NPS 1: 3 inch thick Rigid Glass Fiber.
 - b. NPS 1 to NPS 1-1/4: 4 inch thick Rigid Glass Fiber.
 - c. NPS 1-1/2 to NPS 3-1/2: 4-1/2 inch thick Rigid Glass Fiber.
- B. Cooling Systems:
 - 1. Chilled Water:
 - a. NPS 3 and Smaller: 1-1/2 inch thick Rigid Glass Fiber with Vapor Barrier.
 - b. NPS 4 to NPS 12: 2 inch thick Rigid Glass Fiber with Vapor Barrier.
 - 2. Cold Condensate Drains:

- a. All Sizes: 1/2 inch thick Rigid Glass Fiber with Vapor Barrier.
- b. All Sizes: 3/4 inch thick Flexible Elastomeric Cellular with Vapor Barrier.
- 3. Condensate Drains from Cooling Coils:
 - a. All Sizes: 1/2 inch thick Rigid Glass Fiber with Vapor Barrier.
 - b. All Sizes: 3/4 inch thick Flexible Elastomeric Cellular with Vapor Barrier.
- 4. Refrigerant Suction:
 - a. All Sizes: 1-1/2 inch thick Flexible Elastomeric Cellular with Vapor Barrier.
- 5. Refrigerant Hot Gas:
 - a. All Sizes: 1-1/2 inch thick Flexible Elastomeric Cellular with Vapor Barrier.

END OF SECTION

SECTION 230800 COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

- A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.
- B. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.
- C. The following HVAC equipment is to be commissioned, including commissioning activities for the following specific items:
 - 1. Control system.
 - 2. Major and minor equipment items.
 - 3. Terminal units.
 - 4. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
- D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 REFERENCE STANDARDS

- A. ASHRAE Guideline 1.1 - The HVAC&R Technical Requirements for the Commissioning Process 2007, with Errata (2012).

1.03 SUBMITTALS

- A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.
- B. Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
 - 1. System name.
 - 2. List of devices.
 - 3. Step-by-step procedures for testing each controller after installation, including:
 - a. Process of verifying proper hardware and wiring installation.
 - b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
 - c. Process of performing operational checks of each controlled component.
 - d. Plan and process for calibrating valve and damper actuators and all sensors.
 - e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
 - 4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has "passed" and is operating within the contract parameters.
 - 5. Description of the instrumentation required for testing.
 - 6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.
- C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.
- D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
 - 1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and

- algorithms.
- 2. Full as-built set of control drawings.
- 3. Full as-built sequence of operations for each piece of equipment.
- 4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
 - a. Floor.
 - b. Room number.
 - c. Room name.
 - d. Air handler unit ID.
 - e. Reference drawing number.
 - f. Air terminal unit tag ID.
 - g. Heating and/or cooling valve tag ID.
 - h. Minimum air flow rate.
 - i. Maximum air flow rate.
- 5. Full print out of all schedules and set points after testing and acceptance of the system.
- 6. Full as-built print out of software program.
- 7. Electronic copy on disk of the entire program for this facility.
- 8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
- 9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
- 10. Control equipment component submittals, parts lists, etc.
- 11. Warranty requirements.
- 12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
- 13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
 - a. Sequences of operation.
 - b. Control drawings.
 - c. Points lists.
 - d. Controller and/or module data.
 - e. Thermostats and timers.
 - f. Sensors and DP switches.
 - g. Valves and valve actuators.
 - h. Dampers and damper actuators.
 - i. Program setups (software program printouts).
- E. Project Record Documents: See Section 017800 for additional requirements.
 - 1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
 - 2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.
- F. Draft Training Plan: In addition to requirements specified in Section 017900, include:
 - 1. Follow the recommendations of ASHRAE Guideline 1.1.
 - 2. Control system manufacturer's recommended training.
 - 3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.
- G. Training Manuals: See Section 017900 for additional requirements.
 - 1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in

order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

- A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.
- B. Furnish additional information requested by the Commissioning Authority.
- C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.
- D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.
- E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
- F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.
- G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

- A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
- B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.
- C. Valve/Damper Stroke Setup and Check:
 - 1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
 - 2. Set pump/fan to normal operating mode.
 - 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 - 4. Command valve/damper open; verify position is full open and adjust output signal as required.
 - 5. Command valve/damper to a few intermediate positions.
 - 6. If actual valve/damper position does not reasonably correspond, replace actuator.
 - 7. Closure for Heating Coil Valves - Normally Open:
 - a. Set heating setpoint 20 degrees F above room temperature.
 - b. Observe valve open.
 - c. Remove control air or power from the valve and verify that the valve stem and actuator position do not change.
 - d. Restore to normal.
 - e. Set heating setpoint to 20 degrees F below room temperature.
 - f. Observe the valve close.
 - g. Restore to normal.
 - 8. Closure for Cooling Coil Valves - Normally Closed:
 - a. Set cooling setpoint 20 degrees F above room temperature.
 - b. Observe the valve close.
 - c. Remove control air or power from the valve and verify that the valve stem and actuator position do not change.
 - d. Restore to normal.
 - e. Set cooling setpoint to 20 degrees F below room temperature.
 - f. Observe valve open.
 - g. Restore to normal.
- D. Isolation Valve or System Valve Leak Check: For valves not by coils.

1. With full pressure in the system, command valve closed.
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

- A. TAB: Testing, adjusting, and balancing of HVAC.
- B. Coordinate commissioning schedule with TAB schedule.
- C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.
- D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.
- E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.
- F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

- A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.
- B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.
- C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.
- D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
 1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
 2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.
- E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.
- F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
 1. Setpoint changing features and functions.
 2. Sensor calibrations.
- G. Demonstrate to the Commissioning Authority:
 1. That all specified functions and features are set up, debugged and fully operable.
 2. That scheduling features are fully functional and setup, including holidays.
 3. That all graphic screens and value readouts are completed.
 4. Correct date and time setting in central computer.
 5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
 6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
 7. Power failure and battery backup and power-up restart functions.
 8. Global commands features.
 9. Security and access codes.
 10. Occupant over-rides (manual, telephone, key, keypad, etc.).

- 11. O&M schedules and alarms.
 - 12. Occupancy sensors and controls.
 - 13. All control strategies and sequences not tested during controlled equipment testing.
- H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. See Section 017800 for additional requirements.
- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

- A. See Section 017900 for additional requirements.
- B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
- C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.
- D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned.
- E. Provide the services of manufacturer representatives to assist instructors where necessary.
- F. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

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SECTION 230913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Control panels.
- B. Control Valves:
 - 1. Ball valves and actuators.
 - 2. Globe pattern.
 - 3. Electronic operators.
- C. Dampers.
- D. Damper Operators:
 - 1. Electric operators.
- E. Input/Output Sensors:
 - 1. Temperature sensors.
 - 2. Humidity sensors.
 - 3. Static pressure (air pressure) sensors.
 - 4. Equipment operation (current) sensors.
 - 5. Damper position indicators.

1.02 RELATED REQUIREMENTS

- A. Section 230519 - Meters and Gauges for HVAC Piping: Thermometer sockets and gauge taps.
- B. Section 230923 - Direct-Digital Control System for HVAC.
- C. Section 230993 - Sequence of Operations for HVAC Controls.
- D. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.
- E. Section 262726 - Wiring Devices: Elevation of exposed components.

1.03 REFERENCE STANDARDS

- A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.
- B. ANSI/FCI 70-2 - Control Valve Seat Leakage 2013.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Manufacturer's Instructions: Provide for all manufactured components.
- E. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience approved by manufacturer.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Substantial Completion.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
- B. NEMA 250, general purpose utility enclosures with enameled finished face panel.
- C. Provide common keying for all panels.

2.03 CONTROL VALVES

- A. Ball Valves and Actuators:
 - 1. Service: Use for chilled water, hot water, or steam at 15 to 25 psig (104.4 to 172.4).
 - 2. Flow Characteristic: Include 2-way, 3-way diverting, and 3-way mixing operation.
 - a. Heating Hot Water: Configure to fail normally open.
 - b. Chilled Water: Configure to fail normally closed.
 - 3. Provide pressure-independent type.
 - 4. Rangeability: 500 to 1.
 - 5. ANSI Rating: Class 150.
 - 6. Leakage: Class IV (0.1 percent of rated capacity) per ANSI/FCI 70-2.
 - 7. Body Size:
 - a. Under 2-1/2 inches:
 - 1) Connection: NPT.
 - 2) Materials:
 - (a) Body: Brass.
 - (b) Flanges: Ductile iron.
 - (c) Ball: 300 series stainless steel.
 - (d) Stem: 300 series stainless steel.
 - (e) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.
 - (f) Stem Seal: EPDM O-Rings.
 - (g) Flow Control Disk: Thermoplastic synthetic-resin.
 - b. 2-1/2 inches and Above:
 - 1) Connection Type: Flanged.
 - 2) Materials:
 - (a) Body: Brass.
 - (b) Flanges: Ductile iron.
 - (c) Ball: 300 series stainless steel.
 - (d) Stem: 300 series stainless steel.
 - (e) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.
 - (f) Stem Seal: EPDM O-Rings.
 - (g) Flow Control Disk: Thermoplastic synthetic-resin.
 - c. Service Temperature:
 - 1) Fluid Side: 0 to 284 degrees F liquid or 25 psig steam.
 - 2) Ambient Side: From minus 4 to 122 degrees F.
 - 8. Actuator Requirements:
 - a. Assembly: Factory-mounted.
 - b. Input: 0 to 5 VDC configured for proportional control.
 - c. Accessories: Provide with valve position indicator and manual override.
- B. Globe Pattern:
 - 1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.

2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
3. Steam Systems:
 - a. Rate for service pressure of 125 psig at 250 degrees F.
 - b. Replaceable plugs and seats of stainless steel. Pressure drop across any steam valve at maximum flow; as indicated on drawings.
 - c. Size for 10 psig inlet pressure and 5 psig pressure drop.
 - d. Valves shall have modified linear characteristics.
- C. Electronic Operators:
 1. Select operator for full shut off at maximum pump differential pressure.

2.04 DAMPERS

- A. Performance: Test in accordance with AMCA 500-D.
- B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gauge, 0.1046 inch.
- C. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gauge, 0.0299 inch, attached to minimum 1/2 inch shafts with set screws.
- D. Blade Seals: Synthetic elastomeric, inflatable, mechanically attached, field replaceable.
- E. Shaft Bearings: Oil impregnated sintered bronze.
- F. Linkage Bearings: Oil impregnated sintered bronze.
- G. Leakage: Less than one percent based on approach velocity of 2000 ft per min and 4 inches wg.
- H. Maximum Pressure Differential: 6 inches wg.
- I. Temperature Limits: Minus 40 to 200 degrees F.

2.05 DAMPER OPERATORS

- A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
 1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
 2. Provide one operator for maximum 36 sq ft damper section.
- B. Electric Operators:
 1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

2.06 INPUT/OUTPUT SENSORS

- A. Temperature Sensors:
 1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
 2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
 3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
 4. Temperature Sensing Device: Compatible with project DDC controllers.
 5. Performance Characteristics:
 - a. RTD:
 - 1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
 - 2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
 - 3) Chilled Water Accuracy: Plus/minus 0.50 degrees F minimum.
 - 4) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
 - 5) Range: Minus 40 degrees F through 220 degrees F minimum.
 - b. Thermistor:
 - 1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
 - 2) Range: Minus 25 degrees F through 122 degrees F minimum.
 - 3) Heat Dissipation Constant: 2.7 mW per degree C.
 - c. Room Sensors: Locking cover.

- d. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
 - e. Room Temperature Sensors with Integral Digital Display:
 - 1) Construct for wall box.
 - f. Temperature Averaging Elements:
 - 1) Use on duct sensors for ductwork 10 sq ft or larger.
 - 2) Provide for all mixed air and heating coil discharge sensors regardless of duct size.
 - g. Insertion Elements:
 - 1) Provide dry type, insertion elements for liquids, installed in immersion wells, with minimum insertion length of 2.5 inches.
- B. Humidity Sensors:
- 1. Duct Mounted Sensor: Voltage type encased in a die-cast metal, weather-proof housing.
 - a. Input Power, Voltage Type: Class 2; 12-30 VDC/24 VAC, 15mA max.
 - b. Input Power, mA Type: Class 2; Loop powered 12-30 VDC only, 30 mA max.
 - c. Output Voltage Type: 3-wire observed polarity.
 - d. Output mA Type: 2-wire, not polarity sensitive (clipped and capped).
 - e. Humidity:
 - 1) HS Element: Digitally profiled thin-film capacitive.
 - 2) Accuracy 1 percent at 10 to 80 percent relative humidity at 77 degrees F, multi-point calibration, NIST traceable.
 - (a) Plus/minus 1 percent at 20 to 40 percent RH in mA output mode; (multi-point calibration, NIST traceable).
 - 3) Scaling: 0 to 100 percent RH.
 - f. Temperature Effect:
 - 1) Duct Mounted: Plus/minus 0.18 percent per degree F.
 - 2) Outdoor Mounted: 4 to 20mA version: $(0.0013 \times \%RH \times (T_{\text{degreeC}} - 25))$.
 - g. Hysteresis: 1.5 percent typical.
 - h. Linearity: Included in accuracy specification.
 - i. Reset Rate: 24 hours.
 - j. Stability: Plus/minus 1 percent at 68 degrees F (20 degrees C) annually, for two years.
 - k. Temperature Monitoring:
 - 1) Temperature Transmitter Output: Digital, 4 to 20mA (clipped and capped) or 0-5V/0-10V output.
 - (a) HO Transmitter Accuracy: Plus/minus 2.3 degrees F.
 - (b) HD Transmitter Accuracy: Plus/minus 1.0 degree F.
 - l. Operating Environment:
 - 1) Operating Humidity Range: 0 to 100 percent RH noncondensing.
 - 2) Operating Temperature Range: Minus 40 degrees F to 122 degrees F.
- C. Static Pressure (Air Pressure) Sensors:
- 1. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
 - 2. Accuracy: One percent of full scale with repeatability 0.3 percent.
 - 3. Output: 0 to 5 vdc with power at 12 to 28 vdc.
- D. Equipment Operation (Current) Sensors:
- 1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
 - 2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
 - 3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.

- C. Beginning of installation means installer accepts existing conditions.
- D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- F. Ensure installation of components is complementary to installation of similar components.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of exposed control sensors with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches. Refer to Section 262726.
- C. Mount freeze protection thermostats using flanges and element holders.
- D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
- E. Provide separable sockets for liquids and flanges for air bulb elements.
- F. Provide valves with position indicators and with pilot positioners where sequenced with other controls.
- G. Provide separate steam valves for each bank of coils. Provide two valves in parallel where steam load exceeds 1500 lb per hr with 1/3 to 2/3 load capacities sequenced with smaller valve opening first.
- H. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors. [] .
- I. Provide isolation (two position) dampers of parallel blade construction.
- J. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
- K. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- L. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
- M. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 MAINTENANCE

- A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide service and maintenance of control system for one year from Date of Substantial Completion.
- C. Provide complete service of controls systems, including call backs, and submit written report of each service call.
- D. In addition to normal service calls, make minimum of 4 complete normal inspections of approximately 4 hours duration to inspect, calibrate, and adjust controls.

END OF SECTION

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SECTION 230914 FLOW INSTRUMENTS

PART 1 GENERAL

1.01 REFERENCES

- A. UL-873, Temperature Reading and Indicating Equipment
- B. UL 60730-1, 60730-2-9, Automated Electrical Controls
- C. FCC Part 15

1.02 SUBMITTALS

- A. Submit under the provisions of Section 013000
- B. Product Data: Manufacturer's data sheets on each product being used, including:
 - 1. Equipment schedule.
 - 2. Product overview and technical specifications.
 - 3. Operations and maintenance manual.
 - 4. Wiring diagrams.
 - 5. Product placement guide.
 - 6. Sensor density table.
- C. Independent Test Reports: Provide a copy of each of the following test reports:
 - 1. NIST Report of Airflow Calibration
 - 2. CHEMIR Test Report on Sensor Exposure to Salts and Acids.
 - 3. UL Certificate Report
 - 4. CE Certification form (European shipments)
 - 5. FCC Part 15 compliance report.
 - 6. BTL Certification Report.
- D. Quality Assurance
 - 1. Manufacturer Qualifications: Company specializing in manufacturing thermal dispersion airflow measurement devices with minimum ten years documented experience.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products in an environment that is protected from rain, snow and/or condensing moisture.
- C. Handle with care during installation.
- D. Protect sensors from construction debris and remove all debris that may enter the air distribution system prior to system startup.

1.04 SYSTEM STARTUP AND VERIFICATION

- A. Startup and verify products in accordance with manufacturers procedures in the operations and maintenance manual.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS AND EXCLUSIONS

- A. Provide one thermal airflow measuring device (AMD) for each location indicated on plans, schedules and/or control diagrams. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
- B. Each AMD shall use the principle of thermal dispersion to determine the actual or mass airflow rate of the airstream. Differential pressure-based devices, including pitot tubes, pitot arrays, piezo-rings and devices measuring the pressure drop across a louver, damper or obstruction are not acceptable.
- C. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. The airflow of each sensor node shall be determined using one self-heated and ambient temperature sensing thermistor. Devices using indirectly heated thermistors to determine the airflow rate are not acceptable. Devices using chip thermistors of any type or packaging are not acceptable. Devices using platinum wire RTDs or similar "hot wire" devices are not acceptable.

- D. All internal wiring in the probe tube shall be chemical and abrasion resistant Kynar® coated copper.
- E. All connections to internal wires in the probe tube shall be solder joints or welds. Connectors of any type in the probe tube are not acceptable.
- F. Each thermistor shall be independently calibrated to NIST traceable temperature standards to establish the resistance-temperature characteristics for the determination of airflow and temperature. Devices using interchangeable, curve-matched, thermistors are not acceptable.
- G. The airflow sensing thermistor of each sensor node shall be self-heated. Devices using Indirectly heated thermistors are not acceptable.
- H. Remote transmitters shall be mounted in a location protected from moisture, rain and snow with an ambient temperature between -20 and 120 °F [-28.9 to 48.9 °C] and a humidity range between 5 and 95% RH (non-condensing). Provide a weatherproof enclosure and mount away from direct sunlight when outdoor mounting is required.
- I. Probes with remote transmitters shall be “plug and play”, not require matching to the transmitter, and be provided with a UL listed, FEP jacketed, plenum rated cable and connector plug. Devices using PVC jacketed cables to connect sensor probes to the transmitter are not acceptable.
- J. Each AMD shall be UL/cUL listed as a final assembly and FCC-Part 15 compliant. Compliance shall be demonstrated by an independent test laboratory.

2.02 HARDWARE

- A. Basis of Design: EBTRON models GTx116-P+, GTx-108FI and GTx116e-PC. Approved equal: Sierra and Kurz.
- B. Each AMD shall utilize thermal dispersion technology to measure velocity. Pressure differential systems, including piezo rings and pitot tubes, shall not be acceptable.
- C. Probes shall be suitable for installation in ducts, plenums, air handling equipment and outdoor air intakes to determine the airflow rate and velocity weighted temperature of the airstream.
- D. Provide one to four gold anodized 6063 aluminum probes and one remote transmitter.
- E. Each sensor node shall be individually wind-tunnel calibrated at 16 points to NIST traceable airflow standards and have an accuracy of $\pm 2\%$ of reading over the entire operating range. Provide a copy of the NIST calibration report for the reference standard used to calibrate the production tunnels used to calibrate individual sensor nodes. Reference standards calibrated to third-party NIST traceable labs are not acceptable. Devices claiming AMCA certification are not acceptable.
- F. Provide up to 16 sensing nodes per measurement location as required for the opening size and published sensor density tables to achieve an installed airflow accuracy of $\pm 3\%$ ($\pm 5\%$ of reading on close coupled outdoor air intakes) between 0 and 5,000 fpm [0 to 25.4 m/s] over a temperature range of -20 to 160 °F [-28.9 to 71.1 °C] and a humidity range between 0 and 100% RH (non-condensing).
- G. Provide the velocity weighted temperature of the airstream with an accuracy of ± 0.15 °F [0.08 °C].
- H. Provide low and high airflow alarms with a user defined setpoint and tolerance.
- I. Transmitter interface shall be two isolated, field selectable (4-20mA, 0-5/0-10 VDC) analog output signals (flow plus temperature, humidity, enthalpy, dewpoint or alarm) and one isolated RS-485, field selectable (BACnet MS/TP or Modbus RTU) network connection.
- J. Provide a Bluetooth, low-energy interface and free Android® or iOS® software that allows real-time airflow and temperature monitoring and airflow and temperature traverses. Software shall capture, save and/or e-mail airflow/temperature data, transmitter settings and diagnostics information.
- K. Fan Array and Single Fan Measurement.
 - 1. Each AMD shall be suitable for installation in fan inlets to determine the airflow rate and velocity weighted temperature of the airstream. Piezo rings are not acceptable.

2. Provide face, forward mount adjustable brackets for each sensor node. Mount styles shall not affect the airflow or sound performance of plenum fans.
3. Provide the following number of sensor nodes based on fan type. All sensors shall be connected to a single, remote transmitter. Fan array models shall calculate the airflow of each fan individually prior to outputting the total airflow rate and have a built-in alarm capable of removing a failed fan from the total airflow calculation.

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SECTION 230923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. System description.
- B. Controllers.
- C. Power supplies and line filtering.
- D. System software.
- E. Controller software.

1.02 RELATED REQUIREMENTS

- A. Section 230913 - Instrumentation and Control Devices for HVAC.
- B. Section 230993 - Sequence of Operations for HVAC Controls.
- C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests 2019h.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for each system component and software module.
- C. Shop Drawings:
 - 1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
 - 2. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.
 - 3. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
 - 4. Indicate description and sequence of operation of operating, user, and application software.
- D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.
- E. Operation and Maintenance Data:
 - 1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
 - 2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
 - 3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 5 years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum 5 years of documented experience.
- D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Substantial Completion.
- C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Siemens AG, Building Technologies Division; [____]: www.siemens.com/#sle.

2.02 SYSTEM DESCRIPTION

- A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.
- B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.
- C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 230913.
- E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.
- F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 CONTROLLERS

- A. Building Controllers:
 - 1. General:
 - a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
 - b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
 - c. Share data between networked controllers.
 - d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
 - e. Utilize real-time clock for scheduling.
 - f. Continuously check processor status and memory circuits for abnormal operation.
 - g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
 - h. Communication with other network devices to be based on assigned protocol.
 - 2. Communication:
 - a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
 - b. Perform routing when connected to a network of custom application and application specific controllers.
 - c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
 - 3. Anticipated Environmental Ambient Conditions:
 - a. Outdoors and/or in Wet Ambient Conditions:
 - 1) Mount within waterproof enclosures.
 - 2) Rated for operation at 40 to 150 degrees F.
 - b. Conditioned Space:
 - 1) Mount within dustproof enclosures.
 - 2) Rated for operation at 32 to 120 degrees F.

4. Provisions for Serviceability:
 - a. Diagnostic LEDs for power, communication, and processor.
 - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
 5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
 6. Power and Noise Immunity:
 - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
 - b. Perform orderly shutdown below 80 percent of nominal voltage.
 - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.
- B. Custom Application Controller:
1. General:
 - a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
 - b. Share data between networked, microprocessor based controllers.
 - c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
 - d. Utilize real-time clock for scheduling.
 - e. Continuously check processor status and memory circuits for abnormal operation.
 - f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
 - g. Communication with other network devices to be based on assigned protocol.
 2. Communication:
 - a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
 - b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
 3. Anticipated Environmental Ambient Conditions:
 - a. Outdoors and/or in Wet Ambient Conditions:
 - 1) Mount within waterproof enclosures.
 - 2) Rated for operation at 40 to 150 degrees F.
 - b. Conditioned Space:
 - 1) Mount within dustproof enclosures.
 - 2) Rated for operation at 32 to 120 degrees F.
 4. Provisions for Serviceability:
 - a. Diagnostic LED's for power, communication, and processor.
 - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
 5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
 6. Power and Noise Immunity:
 - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
 - b. Perform orderly shutdown below 80 percent of nominal voltage.
 - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.
- C. Application Specific Controllers:
1. General:
 - a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
 - b. Customized for operation within the confines of equipment served.
 - c. Communication with other network devices to be based on assigned protocol.
 2. Communication:
 - a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
 - b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:
 - a. Outdoors and/or in Wet Ambient Conditions:
 - 1) Mount within waterproof enclosures.
 - 2) Rated for operation at 40 to 150 degrees F.
 - b. Conditioned Space:
 - 1) Mount within dustproof enclosures.
 - 2) Rated for operation at 32 to 120 degrees F.
 4. Provisions for Serviceability:
 - a. Diagnostic LEDs for power, communication, and processor.
 - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
 5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
 6. Power and Noise Immunity:
 - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
 - b. Perform orderly shutdown below 80 percent of nominal voltage.
 - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.
- D. Input/Output Interface:
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
 2. All Input/Output Points:
 - a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
 - b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
 3. Binary Inputs:
 - a. Allow monitoring of On/Off signals from remote devices.
 - b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
 - c. Sense dry contact closure with power provided only by the controller.
 4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.
 5. Analog Inputs:
 - a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
 - b. Compatible with and field configurable to commonly available sensing devices.
 6. Binary Outputs:
 - a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
 - b. Outputs provided with three position (On/Off/Auto) override switches.
 - c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
 7. Analog Outputs:
 - a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
 - b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
 - c. Drift to not exceed 0.4 percent of range per year.
 8. Tri State Outputs:
 - a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
 - b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
 - c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
 9. System Object Capacity:

- a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
- b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.04 POWER SUPPLIES AND LINE FILTERING

- A. Power Supplies:
 1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
 2. Limit connected loads to 80 percent of rated capacity.
 3. Match DC power supply to current output and voltage requirements.
 4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
 5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
 6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
 7. Operational Ambient Conditions: 32 to 120 degrees F.
 8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
 9. Line voltage units UL recognized and CSA approved.
- B. Power Line Filtering:
 1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
 2. Minimum surge protection attributes:
 - a. Dielectric strength of 1000 volts minimum.
 - b. Response time of 10 nanoseconds or less.
 - c. Transverse mode noise attenuation of 65 dB or greater.
 - d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.05 SYSTEM SOFTWARE

- A. Operating System:
 1. Concurrent, multi-tasking capability.
 - a. Common Software Applications Supported: Microsoft Excel.
 - b. Acceptable Operating Systems: [_____].
 2. System Graphics:
 - a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.
 - b. Animation displayed by shifting image files based on object status.
 - c. Provide method for operator with password to perform the following:
 - 1) Move between, change size, and change location of graphic displays.
 - 2) Modify on-line.
 - 3) Add, delete, or change dynamic objects consisting of:
 - (a) Analog and binary values.
 - (b) Dynamic text.
 - (c) Static text.
 - (d) Animation files.
 3. Custom Graphics Generation Package:
 - a. Create, modify, and save graphic files and visio format graphics in PCX formats.
 - b. HTML graphics to support web browser compatible formats.
 - c. Capture or convert graphics from AutoCAD.
 4. Standard HVAC Graphics Library:
 - a. HVAC Equipment:
 - 1) Air Handlers.
 - 2) Terminal HVAC Units.
 - b. Ancillary Equipment:
 - 1) Fans.
 - 2) Pumps.

- 3) Coils.
- 4) Valves.
- 5) Piping.
- 6) Dampers.
- 7) Ductwork.

B. Workstation System Applications:

1. Automatic System Database Save and Restore Functions:
 - a. Current database copy of each Building Controller is automatically stored on hard disk.
 - b. Automatic update occurs upon change in any system panel.
 - c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.
2. Manual System Database Save and Restore Functions by Operator with Password Clearance:
 - a. Save database from any system panel.
 - b. Clear a panel database.
 - c. Initiate a download of a specified database to any system panel.
3. Software provided allows system configuration and future changes or additions by operators under proper password protection.
4. On-line Help:
 - a. Context-sensitive system assists operator in operation and editing.
 - b. Available for all applications.
 - c. Relevant screen data provided for particular screen display.
 - d. Additional help available via hypertext.
5. Security:
 - a. Operator log-on requires user name and password to view, edit, add, or delete data.
 - b. System security selectable for each operator.
 - c. System supervisor sets passwords and security levels for all other operators.
 - d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.
 - e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.
 - f. All system security data stored in encrypted format.
6. System Diagnostics:
 - a. Operations Automatically Monitored:
 - 1) Workstations.
 - 2) Printers.
 - 3) Modems.
 - 4) Network connections.
 - 5) Building management panels.
 - 6) Controllers.
 - b. Device failure is annunciated to the operator.
7. Alarm Processing:
 - a. All system objects are configurable to "alarm in" and "alarm out" of normal state.
 - b. Configurable Objects:
 - 1) Alarm limits.
 - 2) Alarm limit differentials.
 - 3) States.
 - 4) Reactions for each object.
8. Alarm Messages:
 - a. Descriptor: English language.
 - b. Recognizable Features:
 - 1) Source.
 - 2) Location.
 - 3) Nature.
9. Configurable Alarm Reactions by Workstation and Time of Day:

- a. Logging.
 - b. Printing.
 - c. Starting programs.
 - d. Displaying messages.
 - e. Dialing out to remote locations.
 - f. Paging.
 - g. Providing audible annunciation.
 - h. Displaying specific system graphics.
10. Custom Trend Logs:
- a. Definable for any data object in the system including interval, start time, and stop time.
 - b. Trend Data:
 - 1) Sampled and stored on the building controller panel.
 - 2) Archivable on hard disk.
 - 3) Retrievable for use in reports, spreadsheets and standard database programs.
 - 4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.
 - 5) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.
11. Alarm and Event Log:
- a. View all system alarms and change of states from any system location.
 - b. Events listed chronologically.
 - c. Operator with proper security acknowledges and clears alarms.
 - d. Alarms not cleared by operator are archived to the workstation hard disk.
12. Object, Property Status and Control:
- a. Provide a method to view, edit if applicable, the status of any object and property in the system.
 - b. Status Available by the Following Methods:
 - 1) Menu.
 - 2) Graphics.
 - 3) Custom Programs.
13. Reports and Logs:
- a. Reporting Package:
 - 1) Allows operator to select, modify, or create reports.
 - 2) Definable as to data content, format, interval, and date.
 - 3) Archivable to hard disk.
 - b. Real-time logs available by type or status such as alarm, lockout, normal, etc.
 - c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.
 - d. Set to be printed on operator command or specific time(s).
14. Reports:
- a. Standard:
 - 1) Objects with current values.
 - 2) Current alarms not locked out.
 - 3) Disabled and overridden objects, points and SNVTs.
 - 4) Objects in manual or automatic alarm lockout.
 - 5) Objects in alarm lockout currently in alarm.
 - 6) Logs:
 - (a) Alarm History.
 - (b) System messages.
 - (c) System events.
 - (d) Trends.
 - b. Custom:
 - 1) Daily.
 - 2) Weekly.
 - 3) Monthly.
 - 4) Annual.
 - 5) Time and date stamped.

- 6) Title.
- 7) Facility name.
- c. Tenant Override:
 - 1) Monthly report showing total, requested, after-hours HVAC and lighting services on a daily basis for each tenant.
 - 2) Annual report showing override usage on a monthly basis.
- d. Electrical, Fuel, and Weather:
 - 1) Electrical Meter(s):
 - (a) Monthly showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.
 - (b) Annual summary showing monthly electrical consumption and peak demand with time and date stamp for each meter.
 - 2) Fuel Meter(s):
 - (a) Monthly showing daily natural gas consumption for each meter.
 - (b) Annual summary showing monthly consumption for each meter.
 - 3) Weather:
 - (a) Monthly showing minimum, maximum, average outdoor air temperature and heating/cooling degree-days for the month.
- C. Workstation Applications Editors:
 - 1. Provide editing software for each system application at PC workstation.
 - 2. Downloaded application is executed at controller panel.
 - 3. Full screen editor for each application allows operator to view and change:
 - a. Configuration.
 - b. Name.
 - c. Control parameters.
 - d. Set-points.
 - 4. Scheduling:
 - a. Monthly calendar indicates schedules, holidays, and exceptions.
 - b. Allows several related objects to be scheduled and copied to other objects or dates.
 - c. Start and stop times adjustable from master schedule.
 - 5. Custom Application Programming:
 - a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.
 - b. Programming Features:
 - 1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.
 - 2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.
 - 3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.
 - 4) Allows the development of independently, executing, program modules designed to enable and disable other modules.
 - 5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.
 - 6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
 - 7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.
 - 8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes, hours, and days where the variable values can be used in IF/THEN comparisons, calculations, programming statement logic, etc.
 - 9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the

controller software.

2.06 CONTROLLER SOFTWARE

- A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.
- B. System Security:
 - 1. User access secured via user passwords and user names.
 - 2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
 - 3. User Log On/Log Off attempts are recorded.
 - 4. Automatic Log Off occurs following the last keystroke after a user defined delay time.
- C. Object or Object Group Scheduling:
 - 1. Weekly Schedules Based on Separate, Daily Schedules:
 - a. Include start, stop, optimal stop, and night economizer.
 - b. 10 events maximum per schedule.
 - c. Start/stop times adjustable for each group object.
- D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.
- E. Alarms:
 - 1. Binary object is set to alarm based on the operator specified state.
 - 2. Analog object to have high/low alarm limits.
 - 3. All alarming is capable of being automatically and manually disabled.
 - 4. Alarm Reporting:
 - a. Operator determines action to be taken for alarm event.
 - b. Alarms to be routed to appropriate workstation.
- F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.
- G. Sequencing: Application software based upon specified sequences of operation in Section 230993.
- H. PID Control Characteristics:
 - 1. Direct or reverse action.
 - 2. Anti-windup.
 - 3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
 - 4. User selectable controlled variable, set-point, and PED gains.
- I. Staggered Start Application:
 - 1. Prevents all controlled equipment from simultaneously restarting after power outage.
 - 2. Order of equipment startup is user selectable.
- J. Energy Calculations:
 - 1. Accumulated instantaneous power or flow rates are converted to energy use data.
 - 2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
 - 3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.
- K. Anti-Short Cycling:
 - 1. All binary output objects protected from short-cycling.
 - 2. Allows minimum on-time and off-time to be selected.
- L. On-Off Control with Differential:
 - 1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
 - 2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.
- M. Run-Time Totalization:
 - 1. Totalize run-times for all binary input objects.
 - 2. Provides operator with capability to assign high run-time alarm.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 230993.
- C. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
- B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.
- C. Provide basic operator training for 4 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 40 hours dedicated instructor time. Provide training on site.

3.04 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate complete and operating system to Owner.

3.05 MAINTENANCE

- A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.
- C. Provide four complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.
- D. Provide complete service of systems, including call backs. Make minimum of 4 complete normal inspections of approximately 4 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

END OF SECTION

SECTION 230934
VARIABLE-FREQUENCY MOTOR CONTROLLERS-CPL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.
- B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 RELATED REQUIREMENTS

- A. Section 230529 - Hangers and Supports for HVAC Piping and Equipment.
- B. Section 230553 - Identification for HVAC Piping and Equipment: Identification products and requirements.
- C. Section 260526 - Grounding and Bonding for Electrical Systems.
- D. Section 260573 - Power System Studies: Additional criteria for selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

- A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2000, with Errata (2008).
- D. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices 2017.
- E. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
- F. NEMA ICS 7 - Standard for Industrial Control and Systems: Adjustable-Speed Drives 2020.
- G. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems 2014.
- H. NEMA ICS 7.2 - Application Guide for AC Adjustable Speed Drive Systems 2015.
- I. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems 2005.
- J. NEMA MG 1 - Motors and Generators 2018.
- K. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 508A - UL Standard for Safety Industrial Control Panels 2018.
- N. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work to provide motor controllers suitable for use with actual motors to be installed.
 - 2. Coordinate work to provide controllers and associated wiring suitable for interface with control devices to be installed.
 - 3. Coordinate arrangement with dimensions and clearance requirements of actual equipment to be installed.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with conductors to be installed.
 - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include wiring diagrams showing factory and field connections.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity providing contract maintenance and trouble call-back service.
- F. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Air Filters: Two of each different type.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
 - 1. Authorized service facilities located within 200 miles of project site.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum 18 month manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB: www.abb.com/#sle.
- B. Square D.
- C. Yaskawa Electric Corp.
- D. Substitutions: See Section 016000 - Product Requirements.
- E. Source Limitations: Furnish variable-frequency motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

2.02 VARIABLE-FREQUENCY MOTOR CONTROLLERS

- A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

- B. Provide products listed, classified, and labeled as suitable for purpose intended.
- C. Variable-Frequency Motor Controller:
 - 1. Configuration: Packaged controller with across-the-line bypass.
 - 2. Rectifier/Converter: Diode-based, 6-pulse type.
 - 3. Control Method: Vector; closed-loop, with feedback.
 - 4. Filtering: Provide input/line reactor and output/load reactor.
- D. Controller Assemblies: Comply with NEMA ICS 7, NEMA ICS 7.1, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.
- E. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA ICS 7.2, NEMA MG 1 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:
 - 1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 1 design letter or inverter duty rating for induction motors.
 - 2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
 - 3. Motor nameplate data.
 - 4. Requirements for speed control range, speed regulation, and braking.
 - 5. Motor suitability for bypass starting method, where applicable.
- F. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.
- G. Operating Requirements:
 - 1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
 - 2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
 - 3. Efficiency: Minimum of 96 percent at full speed and load.
 - 4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
 - 5. Overload Rating:
 - a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.
 - b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.
- H. Power Conversion System: Microprocessor-based, pulse width modulation type consisting of rectifier/converter, DC bus/link, and inverter.
 - 1. Rectifier/Converter: Diode-based, 6-pulse type unless otherwise indicated.
- I. Control System:
 - 1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
 - 2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
 - 3. Control Functions:
 - a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
 - 1) Scalar/Volts per Hertz Control: Provide IR compensation for improved low-speed torque.
 - 2) Vector Control: Provide selectable autotuning function.
 - b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
 - c. Selectable braking control; DC injection or flux braking.
 - d. Adjustable minimum/maximum speed limits.
 - e. Adjustable pulse width modulation switching carrier frequency.
 - f. Adjustable motor slip compensation.
 - g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
 - 4. Status Indications:
 - a. Motor run/stop status.
 - b. Motor forward/reverse status.

- c. Local/remote control status.
 - d. Output voltage.
 - e. Output current.
 - f. Output frequency.
 - g. DC bus voltage.
 - h. Motor speed.
 - i. Elapsed run time.
 - j. Discrete input/output status.
 - k. Analog input/output values.
- 5. Protective Functions/Alarm Indications:
 - a. Overcurrent.
 - b. Motor overload.
 - c. Undervoltage.
 - d. Overvoltage.
 - e. Controller overtemperature.
 - f. Input/output phase loss.
 - g. Output short circuit protection.
 - h. Output ground fault protection.
- 6. Inputs:
 - a. Digital Input(s): Three.
 - b. Analog Input(s): Two.
- 7. Outputs:
 - a. Analog Output(s): One.
 - b. Relay Output(s): Two.
- 8. Communications: Compatible with connected systems. Provide accessories necessary for proper interface.
 - a. Serial Communications: RS-485; support for Modbus RTU protocol.
 - b. Ethernet Communications: Support for Modbus TCP protocol.
- 9. Features:
 - a. Password-protected security access.
 - b. Event log.
- J. Power Conditioning/Filtering:
 - 1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated or required.
 - 2. Reactor Impedance: 3 percent, unless otherwise indicated or required.
- K. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
 - 1. Disconnects: Circuit breaker or disconnect switch type.
 - a. Disconnect Switches: Fusible type or nonfusible type with separate input fuses.
 - b. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
 - c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
 - 2. Provide door-mounted remote operator interface.
 - 3. Packaged Controllers with Bypass: Provide contactors and controls to enable removal of variable-frequency controller from circuit.
 - a. Bypass Method: Manual, unless otherwise indicated.
 - b. Bypass Configuration: 3-contactor type, with contactors for bypass, drive output, and drive input.
 - c. Bypass Motor Starting Method: Full-voltage (across-the-line) with overload relay, unless otherwise indicated or required.
 - d. Overload Relays: Solid state or bimetallic thermal type.
 - 4. Pilot Devices Required:
 - a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings, except where equivalent function is provided by remote operator interface.
 - b. Packaged Controllers with Bypass:

- 1) Bypass Mode Selector Switch: DRIVE/OFF/BYPASS.
 - 2) Motor Control Selector Switch: HAND/OFF/AUTO.
 - 3) Indicating Lights: For drive/bypass mode status, drive/bypass run status, and drive/bypass fault status.
- L. Service Conditions:
1. Provide controllers and associated components suitable for operation under following service conditions without derating:
 - a. Altitude: Less than 3,300 feet.
 - b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
 2. Provide controllers and associated components suitable for operation at indicated ratings under service conditions at installed location.
- M. Short Circuit Current Rating:
1. Provide controllers with listed short circuit current rating not less than available fault current at installed location as determined by short circuit study performed in accordance with Section 260573.
 2. Provide line/input reactors where specified by manufacturer for required short circuit current rating.
- N. Conductor Terminations: Suitable for use with conductors to be installed.
- O. Enclosures:
1. Comply with NEMA ICS 6.
 2. NEMA 250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:
 - a. Outdoor Locations: Type 3R or Type 4.
 3. Finish: Manufacturer's standard unless otherwise indicated.
 4. Cooling: Forced air or natural convection as determined by manufacturer.
 5. Enclosure Space Heaters:
 - a. Provide in each controller enclosure installed outdoors and in unconditioned indoor spaces.
 - b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
 - c. Heater Control: Thermostat.
 - d. Heater Power Source: Provide connection to transformer factory-installed in enclosure or suitable external branch circuit as indicated or as required.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Overload Relays:
1. Provide overload relays and, where applicable, associated current elements/heaters selected for actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
 2. Comply with NEMA ICS 2.
 3. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
 4. Trip-free operation.
 5. Visible trip indication.
 6. Resettable:
 - a. Employ manual reset unless otherwise indicated.
 - b. Do not employ automatic reset with two-wire control.

2.04 ACCESSORIES

- A. Auxiliary Contacts:
1. Comply with NEMA ICS 5.
 2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each bypass motor starter, minimum.
- B. Pilot Devices:
1. Comply with NEMA ICS 5; heavy-duty type.

2. Pushbuttons: Unless otherwise indicated, provide momentary, nonilluminated type with flush button operator; normally open or normally closed as indicated or as required.
 3. Selector Switches: Unless otherwise indicated, provide maintained, nonilluminated type with knob operator; number of switch positions as indicated or as required.
 4. Indicating Lights: Push-to-test type unless otherwise indicated.
 5. Provide LED lamp source for indicating lights and illuminated devices.
- C. Control and Timing Relays:
1. Comply with NEMA ICS 5.
 2. Provide number and type of relays indicated or required to perform necessary functions.
- D. Control Power Transformers:
1. Size to accommodate burden of contactor coil(s) and connected auxiliary devices.
 2. Include primary and secondary fuses.

2.05 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Factory test controllers in accordance with NEMA ICS 61800-2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings of controllers are consistent with indicated requirements.
- C. Verify that mounting surfaces are ready to accept controllers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.
- C. Do not exceed manufacturer's recommended maximum cable length between controller and motor.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 230529.
- F. Install controllers plumb and level.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Install field-installed devices, components, and accessories.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- J. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.17. Insulation-resistance test on control wiring listed as optional is not required.
- D. Packaged Controllers with Bypass: Test for proper operation in both drive and bypass modes.
- E. Test for proper interface with other systems.
- F. Correct deficiencies and replace damaged or defective controllers or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. See Section 017900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of controllers and associated devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Location: At project site.

3.07 PROTECTION

- A. Protect installed controllers from subsequent construction operations.

3.08 MAINTENANCE

- A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

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SECTION 230993
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes control sequences for DDC for HVAC systems, subsystems, and equipment.

1.02 DEFINITIONS

- A. Analog Output: Proportional output signal (zero- to 10-V dc, 4 to 20 mA).
- B. Binary Output: On/off output signal or contact closure.
- C. BMS: Building management system.
- D. DDC: Direct digital control.
- E. Digital Output: Data output that must be interpreted digitally.

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. An instrumentation list for each controlled system. Label each element of the controlled system in table format. Show, in the table element name, type of device, manufacturer, model number, and control device product data sheet number.
 - 2. A complete description of the operation of the control system, including sequences of operation. Include and reference a schematic diagram of the controlled system.
- B. Shop Drawings:
 - 1. Riser diagrams showing control network layout, communication protocol, and wire types.
 - 2. Schematic diagram of each controlled system. Include all control points labeled with point names shown or listed. Show the location of control elements in the system.
 - 3. Wiring diagram for each controlled system. Show all control elements labels. Where a control element is the same as that shown on the control system schematic, label with the same name. Label all terminals.

1.04 HVAC CONTROL SEQUENCES

- A. General
 - 1. All set points, changeover points and reset schedules shall be user adjustable.
 - 2. Control algorithms shall utilize tuned PID loops to maintain set points and minimum/maximum leaving air temperatures optimally.
 - 3. Coordinate individual alarm notifications with Owner.

1.05 AIR HANDLING UNIT AHU-19

- A. Provide BACnet interface necessary to have BMS control of RTU as specified below.
- B. Occupied Modes:
 - 1. Supply Fan Array:
 - a. Run continuously. Modulate via VFDs to maintain static pressure set point as determined by the balancer. Provide supply airflow measuring station.
 - b. All fans shall operate at the same speed.
 - 2. Return Fan Array:
 - a. Run continuously. Modulate via VFDs to maintain this relationship, and as measured by a return airflow measuring station. $RA\ CFM = SA\ CFM - EA\ CFM$. The exhaust airflow rate is the sum of the two independent exhaust fans as measured by their respective airflow measuring stations.
 - b. All fans shall operate at the same speed.
 - 3. Outside Air Damper:
 - a. Open to maintain scheduled outside air quantity as measured by the airflow measuring station. Outside air damper shall never be positioned below this minimum except in case of emergency.
 - b. Modulate outside air damper beyond scheduled minimum as required for economizer cooling (see cooling mode below).
 - c. In shoulder seasons (heating or cooling) modulate outside damper to allow for the maximum outside air possible while still maintaining required discharge air

- temperature from the unit. Modulate heating and cooling coils to accommodate for the increase in outside air.
4. Return Air Damper:
 - a. Modulate inversely with outdoor air damper.
 5. Occupied Heating Mode (OAT is below 55°F and space temperature below set point)
 - a. Modulate hot water coil control valve to maintain discharge air temperature set point of 55°F (adjustable).
 - b. Enable energy recovery wheel. Close ERW bypass dampers.
 - c. Closed chilled water coil control valve.
 - d. Disable DX cooling.
 6. Occupied Cooling Mode (OAT is above 55°F and space temperature is above set point)
 - a. Unless in economizer mode, enable energy recovery wheel. Close ERW bypass dampers.
 - b. Modulate the chilled water coil control valve (if chilled water is available) to maintain discharge air temperature set point of 55°F (adjustable).
 - c. If chilled water coil control valve is fully open and the discharge air temperature set point remains above 55°F (adjustable), enable and modulate DX cooling.
 - d. If chilled water is not available, enable and modulate DX cooling to maintain discharge air temperature set point of 55°F (adjustable).
 - e. Occupied Economizer Cooling Mode – when there is call for cooling and the outdoor air enthalpy is below the return air enthalpy.
 - 1) Modulate outdoor air damper inversely with return damper to maintain discharge air temperature set point.
 - 2) Disable energy recovery wheel.
 - 3) Fully open energy recovery wheel bypass dampers.
 - 4) Modulate chilled water coil control valve or enable DX cooling only after the economizer is at its fully open position.
 7. Relative Humidity Control
 - a. Continuously monitor the return air relative humidity. The acceptable RH range shall be 40% - 60%.
 - b. Humidification: Upon a decrease in return air RH below setpoint, enable the remote humidifier and modulate the humidifier output as necessary to stay within RH limits.
 - c. Dehumidification: Upon an increase in return air RH above setpoint, lower the discharge air temperature setpoint incrementally. Utilize the VAV reheat coils for zone temperature control per the VAV sequence described below.
- C. Alarms – Provide an alarm for each of the following:
1. Fan motor failures – each fan.
 2. Low/high discharge air temperature, +/-3°F.
 3. VFD fault – each fan.
 4. High filter static – pre-filters and final filters.
 5. Energy recovery wheel failure.
 6. Low mixed air temperature.
 7. Low off-coil (heating coil) temperature.
 8. High water level in drain pan.

1.06 VAV BOXES WITH HOT WATER REHEAT

- A. Air Flow Control:
1. Refer to the VAV schedule for maximum and minimum airflow setpoints.
 2. During occupied mode:
 - a. In the heating mode, the VAV shall modulate to minimum air flow unless the space temperature is not satisfied and discharge air temperature is at 90 deg. F then the damper shall modulate as necessary to maintain space temperature subject to the maximum air flow.
 - b. In the cooling mode, the VAV shall modulate to maintain air flow set point. The airflow set point shall increase from minimum air flow to maximum airflow as the space temperature rises from 1 Deg. F below cooling set point to 1 Deg. F above cooling set point.

- c. When the space temperature is satisfied the VAV shall modulate to minimum air flow.
- B. Reheat Coil Control:
 - 1. During occupied mode, the reheat coil control valve shall modulate to maintain space temperature set point subject to a maximum discharge air temperature of 95 Deg. F.
- C. Alarms:
 - 1. High/low space temperature.

1.07 EQUIPMENT ROOM AC UNIT AC-1,3,4

- A. Cooling Mode
 - 1. The BMS shall enable the split system when the space temperature exceeds setpoint.
 - 2. The split system controller shall control the unit operation.
- B. Alarms
 - 1. Equipment failure
 - 2. High/low space temperature
 - 3. Condensate pump failure. Disable the associated split system and send an alarm to the BMS.

1.08 EQUIPMENT ROOM AC UNIT AC-2

- A. Cooling Mode
 - 1. VAV box shall be set for minimum CFM shown on plan and shall modulate open when there is a call for cooling.
 - 2. AC-2 shall be enabled by the BMS when there is a call for cooling and the VAV box is open to its maximum setpoint. AC-2 shall control room humidity and temperature setpoint based on the unit controller.
- B. Heating Mode
 - 1. AC-2 shall be disabled upon call for heat. VAV airflow and reheat valve shall be controlled by the standard VAV sequence above.
- C. Alarms
 - 1. Equipment failure
 - 2. High/low space temperature
 - 3. Condensate pump failure. Disable the associated split system and send an alarm to the BMS.

1.09 HEAT TRANSFER PACKAGE

- A. Steam Control Valve
 - 1. Operate the 1/3-2/3 control valve arrangement such that the 1/3 control valve is used for initial heating.
 - 2. Modulate the control valve(s) to maintain the heating hot water supply setpoint.
 - 3. Provide an outside air reset for the heating hot water supply temperature setpoint.
- B. Heating Hot Water Pumps
 - 1. Enable lead/standby sequence at all times in heating modes.
 - 2. The DDC system shall totalize runtimes of the lead and standby pumps. If the lead pump runtime exceeds set point or pump failure occurs, the standby pump shall start and be designated as the lead pump. Alarms shall be recorded at the operator's workstation for pump failure or exceeding runtime limits.
 - 3. Modulate the lead pump to maintain the pressure differential set point as determined by the balancer.
 - 4. If lead pump reaches 90% pumping capacity, engage lag pump and adjust pump speeds to operate at the same speed.
 - 5. If any associated control valve opens to 90%, modulate the pump speed to exceed the differential pressure setpoint.
 - 6. Alarms
 - a. Pump failure.
 - b. VFD Alarm.

1.10 EXHAUST FANS

- A. Exhaust fans shall run continuously.

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PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 232113 HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Hydronic system requirements.
- B. Heating water and glycol piping, above grade.
- C. Chilled water piping, above grade.
- D. Equipment drains and overflows.
- E. Pipe hangers and supports.
- F. Unions, flanges, mechanical couplings, and dielectric connections.

1.02 RELATED REQUIREMENTS

- A. Section 230516 - Expansion Fittings and Loops for HVAC Piping.
- B. Section 230719 - HVAC Piping Insulation.
- C. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

- A. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
- E. ASME B31.9 - Building Services Piping 2020.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- G. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service 2019a.
- H. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts 2014 (Reapproved 2020).
- I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- J. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).
- K. ASTM B32 - Standard Specification for Solder Metal 2020.
- L. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.
- M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- N. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications 2018.
- O. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers 1992, with Editorial Revision (2018).
- P. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications 2007 (Reapproved 2019).
- Q. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- R. AWWA C606 - Grooved and Shouldered Joints 2015.
- S. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Include data on pipe materials, pipe fittings, valves, and accessories.

2. Provide manufacturers catalog information.

1.05 QUALITY ASSURANCE

- A. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:
 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
 2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
 3. Grooved mechanical joints may be used in accessible locations only.
 - a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
 - b. Grooved mechanical connections and joints comply with AWWA C606.
 - 1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
 - 2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
 - c. Use rigid joints unless otherwise indicated.
 - d. Use gaskets of molded synthetic rubber with central cavity, pressure-responsive configuration, and complying with ASTM D2000, Grade 2CA615A15B44F17Z for circulating medium up to maximum 230 degrees F or Grade M3BA610A15B44Z for circulating medium up to maximum 200 degrees F.
 - e. Provide steel coupling nuts and bolts complying with ASTM A183.
 4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
 1. Where grooved joints are used in piping, provide grooved valve/equipment connections if available; if not available, provide flanged ends and grooved flange adapters.
- D. Valves: Provide valves where indicated:
 1. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.
 2. For throttling service, use plug cocks. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.
- E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 HEATING WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
 1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
 2. Threaded Joints: ASME B16.3, malleable iron fittings.
 3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn, using one of the following joint types:
 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.

- a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
2. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

2.03 CHILLED WATER PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:
 1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
 2. Threaded Joints: ASME B16.3, malleable iron fittings.
 3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), hard drawn; using one of the following joint types:
 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22, solder wrought copper fittings.
 - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
 2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
 3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

2.04 EQUIPMENT DRAINS AND OVERFLOWS

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
 1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2.05 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
 5. Hangers for Hot Pipe Sizes 6 Inches and Greater: Adjustable steel yoke, cast iron roll, double hanger.
 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.
 8. Vertical Support: Steel riser clamp.
 9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 10. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 12. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
 13. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
- B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.06 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

- A. Unions for Pipe 2 Inches and Less:
 - 1. Ferrous Piping: 150 psig malleable iron, threaded.
 - 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe 2 Inches and Greater:
 - 1. Ferrous Piping: 150 psig forged steel, slip-on.
 - 2. Gaskets: 1/16 inch thick, preformed neoprene.
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
 - 1. Dimensions and Testing: In accordance with AWWA C606.
 - 2. Mechanical Couplings: Comply with ASTM F1476.
 - 3. Housing Material: Ductile iron, galvanized complying with ASTM A536.
 - 4. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
 - 5. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
 - 6. When pipe is field grooved, provide coupling manufacturer's grooving tools.
 - 7. Manufacturers:
 - a. Apollo Valves; []: www.apollovalves.com/#sle.
 - b. Grinnell Products; []: www.grinnell.com/#sle.
 - c. Victaulic Company; []: www.victaulic.com/#sle.
- D. Dielectric Connections:
 - 1. Waterways:
 - a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
 - b. Dry insulation barrier able to withstand 600-volt breakdown test.
 - c. Construct of galvanized steel with threaded end connections to match connecting piping.
 - d. Suitable for the required operating pressures and temperatures.
 - 2. Flanges:
 - a. Dielectric flanges with same pressure ratings as standard flanges.
 - b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
 - c. Dry insulation barrier able to withstand 600-volt breakdown test.
 - d. Construct of galvanized steel with threaded end connections to match connecting piping.
 - e. Suitable for the required operating pressures and temperatures.
 - 3. Unions:
 - a. 1/2 to 1 Inches: Brass solder to galvanized FPT.
 - b. 1/2 to 2 Inches: Brass solder to galvanized FPT.
 - c. 1/2 to 1 Inches: Brass to galvanized FPT or FIP (Female Iron Pipe).
 - d. 3/4 to 1/2 Inch Reducer: Brass solder to galvanized FPT.
 - e. Service: 250 psi, minus 20 to 180 deg F.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare piping connections to equipment using jointing system specified.
- E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- F. After completion, fill, clean, and treat systems. See Section 232500 for additional requirements.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and to avoid interference with use of space.
- D. Group piping whenever practical at common elevations.
- E. Sleeve pipe passing through partitions, walls, and floors.
- F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified [_____].
- G. Slope piping and arrange to drain at low points.
- H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 230516.
- I. Grooved Joints:
 - 1. Install in accordance with the manufacturer's latest published installation instructions.
 - 2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.
- J. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
 - 2. Support horizontal piping as scheduled.
 - 3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping.
- K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 230719.
- L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welds.
- M. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
 - 1. 1/2 Inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 2. 1 Inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 3. 1-1/2 Inches and 2 Inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
- B. Hanger Spacing for Steel Piping.
 - 1. 2-1/2 Inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
 - 2. 3 Inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
 - 3. 4 Inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
 - 4. 6 Inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
 - 5. 8 Inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.

END OF SECTION

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**SECTION 232114
HYDRONIC SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Expansion tanks.
- B. Air vents.
- C. Air separators.
- D. Strainers.
- E. Suction diffusers.
- F. Pump connectors.
- G. Pressure-temperature test plugs.
- H. Balancing valves.
- I. Relief valves.
- J. Pressure reducing valves.

1.02 RELATED REQUIREMENTS

- A. Section 232113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

- A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2019.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 EXPANSION TANKS

- A. Manufacturers:
 - 1. Amtrol Inc; []: www.amtrol.com/#sle.
 - 2. ITT Bell & Gossett; []: www.bellgossett.com/#sle.
 - 3. Taco, Inc; []: www.taco-hvac.com/#sle.
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psi, with flexible EPDM diaphragm or bladder sealed into tank, and steel support stand.
- C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psi.
- D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check backflow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.02 AIR VENTS

- A. Manual Type: Short vertical sections of 2-inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- B. Float Type:
 - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
- C. Washer Type:
 - 1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring-loaded ball check valve.

2.03 AIR SEPARATORS

- A. Centrifugal Air Separators/Strainers:
 - 1. Manufacturers:
 - a. Armstrong International, Inc; [____]: www.armstronginternational.com/#sle.
 - b. ITT Bell & Gossett; [____]: www.bellgossett.com/#sle.
 - c. Taco, Inc; [____]: www.taco-hvac.com/#sle.
 - 2. Steel, tested and stamped in accordance with ASME BPVC-VIII-1; for 125 psi operating pressure, with integral bronze strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.04 STRAINERS

- A. Manufacturers:
 - 1. Armstrong International, Inc: www.armstronginternational.com/#sle.
 - 2. Flexicraft Industries: www.flexicraft.com/#sle.
 - 3. Grinnell Products: www.grinnell.com/#sle.
- B. Size 2 inch and Under:
 - 1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- C. Size 2-1/2 inch to 4 inch:
 - 1. Provide flanged or grooved iron body for 175 psi working pressure, Y pattern with 1/16 inch or 3/64 inch stainless steel perforated screen.
- D. Size 5 inch and Larger:
 - 1. Provide flanged or grooved iron body for 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.05 SUCTION DIFFUSERS

- A. Manufacturers:
 - 1. Anvil International: www.anvilintl.com/#sle.
 - 2. Grinnell Products: www.grinnell.com/#sle.
 - 3. ITT Bell & Gossett: www.bellgossett.com/#sle.
 - 4. Shurjoint Piping Products, Inc: www.shurjoint.com/#sle.
 - 5. Victaulic Company of America: www.victaulic.com/#sle.
- B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable 5/32 inch mesh strainer to fit over cylinder strainer, 20 mesh startup screen, and permanent magnet located in flow stream and removable for cleaning.
- C. Accessories: Adjustable foot support, blowdown tapping in bottom, gauge tapping in side.

2.06 PUMP CONNECTORS

- A. Manufacturers:
 - 1. Anvil International; AnviFlex: www.anvilintl.com/#sle.
 - 2. Ferguson Enterprises Inc; [____]: www.fnw.com/#sle.
 - 3. The Metraflex Company; Vane Flex: www.metraflex.com/#sle.
- B. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
 - 1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.

2. Accommodate the Following:
 - a. Axial Deflection in Compression and Expansion: [] inch.
 - b. Lateral Movement: [] inch.
 - c. Angular Rotation: 15 degrees.
 - d. Force developed by 1.5 times specified maximum allowable operating pressure.
3. End Connections: Same as specified for pipe jointing.
4. Provide necessary accessories including, but not limited to, swivel joints.

2.07 PRESSURE-TEMPERATURE TEST PLUGS

- A. Manufacturers:
 1. Ferguson Enterprises Inc: www.fnw.com/#sle.
 2. Peterson Equipment Company Inc: www.petesplug.com/#sle.
 3. Sisco Manufacturing Company Inc: www.siscomfg.com/#sle.
- B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.
- C. Application: Use extended length plugs to clear insulated piping.

2.08 BALANCING VALVES

- A. Manufacturers:
 1. Armstrong International, Inc: www.armstronginternational.com/#sle.
 2. Ferguson Enterprises Inc: www.fnw.com/#sle.
 3. Hays Fluid Controls: www.haysfluidcontrols.com/#sle.
 4. ITT Bell & Gossett: www.bellgossett.com/#sle.
 5. Taco, Inc: www.taco-hvac.com/#sle.
- B. Size 2 inch and Smaller:
 1. Provide ball or globe style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
 2. Metal construction materials consist of bronze or brass.
 3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.
- C. Size 2.5 inch and Larger:
 1. Provide ball, globe, or butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
 2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
 3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

2.09 RELIEF VALVES

- A. Manufacturers:
 1. Apollo Valves; []: www.apollovalves.com/#sle.
 2. Armstrong International, Inc; []: www.armstronginternational.com/#sle.
 3. ITT Bell & Gossett; []: www.bellgossett.com/#sle.
- B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.10 PRESSURE REDUCING VALVES

- A. Manufacturers:
 1. Apollo Valves; []: www.apollovalves.com/#sle.
 2. Armstrong International, Inc; []: www.armstronginternational.com/#sle.
 3. ITT Bell & Gossett; []: www.bellgossett.com/#sle.
 4. Taco, Inc; []: www.taco-hvac.com/#sle.
- B. Operation: Automatically feeds make-up water to the hydronic system whenever pressure in the system drops below the pressure setting of the valve. Refer to Section 232113.
- C. Materials of Construction:
 1. Valve Body: Constructed of bronze, cast iron, brass, or iron.
 2. Internal Components: Construct of stainless steel or brass and composition material.
- D. Connections:

1. NPT threaded: 0.50 inch or 0.75 inch.
 2. Soldered: 0.50 inch.
- E. Provide integral check valve and strainer.
 - F. Maximum Inlet Pressure: 100 psi.
 - G. Maximum Fluid Temperature: 180 degrees F.
 - H. Operating Pressure Range: Between 10 psi and 25 psi.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Provide manual air vents at system high points and as indicated.
- C. Provide manual air vents in ceiling spaces and other concealed location
- D. Provide automatic air vents in exposed locations and in mechanical rooms.
- E. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- F. Provide valved drain and hose connection on strainer blowdown connection.
- G. Provide pump suction fitting on suction side of base-mounted centrifugal pumps. Remove temporary strainers after cleaning systems.
- H. Support pump fittings with floor-mounted pipe and flange supports.
- I. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- J. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- K. Pipe relief valve outlet to nearest floor drain.

END OF SECTION

SECTION 232123 HYDRONIC PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Base-mounted pumps.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete.
- B. Section 230513 - Common Motor Requirements for HVAC Equipment.
- C. Section 230548 - Vibration and Seismic Controls for HVAC.
- D. Section 230716 - HVAC Equipment Insulation.
- E. Section 230719 - HVAC Piping Insulation.
- F. Section 232113 - Hydronic Piping.
- G. Section 232114 - Hydronic Specialties.
- H. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. UL 778 - Standard for Motor-Operated Water Pumps Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Taco, Inc: www.TacoComfort.com.
- B. Armstrong Fluid Technology, Inc: www.armstrongfluidtechnology.com/#sle.
- C. Bell & Gossett, a Xylem Inc. brand: www.bellgossett.com/#sle.
- D. SIHI Group: www.sterlingsihi.com/#sle.
- E. Substitutions: See Section 016000 - Product Requirements.

2.02 HVAC PUMPS - GENERAL

- A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- B. Minimum Quality Standard: UL 778.
- C. Base Mounted Pumps: Aligned by qualified millwright.
- D. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

2.03 BASE-MOUNTED FLEX COUPLED PUMPS

- A. Pump casing shall be constructed of ASTM A48 class 30 cast iron. The pump casing/volute shall be rated for 250 psi working pressure for all jobs. The pump flanges shall be matched to suit the working pressure of the piping components on the job, with either ANSI Class 125 flanges or ANSI class 250 flanges. The pump casing shall be drilled and tapped for

gauge ports on both the suction and discharge connections and for a drain port at the bottom of the casing. The casing shall have an additional tapping on the discharge connection to allow for the installation of a seal flush line. The pump cover shall be drilled and tapped to accommodate a seal flush line which can be connected to the corresponding tapping on the discharge connection, or to an external source to facilitate cooling and flushing of the seal faces.

- B. All casings shall be flanged. Threaded casings not allowed unless extra unions and fittings are provided with that pump to allow servicing.
- C. Pump volute shall be foot mounted. Overhung cantilevered design not allowable.
- D. The pump shall be center line discharge for both positive air venting and allowance for better load distribution.
- E. The pump casing inlet shall have an integrally cast anti-rotational vane.
- F. The impeller shall be ASTM B584-836/875 bronze ASTM A351/A351M-08 stainless steel and hydraulically balanced. The impeller shall be dynamically balanced to ANSI Grade G6.3 and shall be fitted to the shaft with a key. The impeller shall be cast by the hydraulically efficient lost foam technique to ensure repeatability of high quality.
- G. The pump shall incorporate a dry shaft design to prevent the circulating fluid from contacting the shaft. The pump shaft shall be of ASTM A582 Type 416T or ASTM A582 Type 410T stainless steel with field replaceable bronze SAE 660 shaft sleeve. In order to improve serviceability and reduce the cost of ownership the shaft sleeve must be slip on (press on not allowable) and must be easily replaced in the field.
- H. The pump shall be fitted with a single mechanical seal, with EPT elastomers and Carbon/Ceramic faces, rated up to 250°F. This seal must be capable of being flushed externally via a tapping in the pump cover adjacent to the seal cavity. Any pump used on an open system shall be furnished with a seal flush line and a Cuno / Kynar / Purocell #900 replaceable cartridge filter or separator with shut-off isolation valve installed in the seal flushing line. The filter shall have the ability to remove particles down to five microns in size. The entire pump line shall use no more than three different sizes of seals.
- I. All pumps to be provided with a fully welded, rigid structural steel base. The base shall include closed ends and top openings to allow for grouting. The base shall include an integral drain pan fabricated from steel with a minimum thickness of 0.1875" and shall contain an integral 3/4" drain connection.
- J. The pump bearing frame shall incorporate maintenance free permanently lubricated and sealed bearings with an L10 life of 60,000 hours. Bearing frame shall be equipped with Forsheda seals to protect bearings from moisture and airborne contaminants. The entire line of pumps shall use no more than four different sizes of bearing frames.
- K. The pump shall be flexibly coupled to a NEMA standard T frame motor. The coupler shall be suitable for across the line starting as well as variable speed conditions associated with variable frequency drives. The coupling shall be equal to a Woods Dura-Flex coupler. Any pump manufacturer providing a mechanically inferior coupler design, especially in variable torque applications, shall extend the warranty of the coupler for an additional two years in addition to their own standard warranty. The coupling and shafts shall be covered by a metal guard. Pump shall be aligned upon receipt at job, during installation, and after system fill by contractor.
- L. In order to both simplify and reduce the total cost of ownership, the manufacturer shall standardize on no more than three sizes of mechanical seals and four sizes of bearing frames through out the entire range of the family of pumps. The manufacturer shall not use multiple part numbers for the same part.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.
- C. All pumps shall be fitted with a discharge multi-purpose balancing valve or other means of providing system balance, isolation, and check feature for reverse flow. The valve shall be straight or angle pattern and shall be field convertible between the two. The valve shall be

ductile iron and rated for 250 psi working pressure for all jobs. The valve flanges shall be matched to suit the working pressure of the piping components on the job; with either ANSI class 125 flanges or ANSI class 250 flanges. The valve shall include the following components; non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation. Valve shall be serviceable under full system pressure. The valve shall be a Taco model MPV Plus Two multi-purpose valve or equivalent.

- D. All pump suctions to be fitted with a multifunction inlet suction diffuser equal to that as manufactured by Taco, Inc. The suction diffuser body and cover plate shall be ductile iron and be rated for 250 psi for all jobs. The guide flanges shall be matched to suit the working pressure of the piping components on the job; with either ANSI class 125 flanges or ANSI class 250 flanges. The suction guide shall include the following components; full length S.S. straightening vanes, permanent S.S. strainer, disposable 16 mesh bronze start up strainer, blow down ports, and metering ports. For those pumps where an inlet guide fitting is not installed, there should be five pipe diameters of straight undisturbed flow going into the pump suction. The fitting shall be a Taco model SD inlet suction elbow or equivalent.
- E. All pumps shall be fitted with one 4 ½" dial pressure gauge piped to the inlet and outlet pump flanges. The gauge is to be isolated from each flange via ¼" ball valve. This gauge is to be used to take the differential across the pump unless otherwise indicated.
- F. Contractor shall install pump in accordance with the manufacturer's instructions. All base mounted pumps to be aligned upon receipt at jobsite, during installation, and after system fill. Contractor shall level and grout each pump according to the manufacturer recommendations to insure proper alignment prior to operation.
- G. Pipe connections to pumps shall be made in such a manner so as not to exert any stress on pump housings. If necessary to meet this requirement, provide additional pipe supports and flex connectors.
- H. Pumps shall **NOT** be run dry to check rotation.
- I. Change start-up strainers to permanent strainer upon acceptance of the job. Provide a blowdown valve on each strainer and terminate with hose thread or extend blowdown line to nearest floor drain.
- J. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close-coupled or base-mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
- K. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.
- L. Check, align, and certify alignment of base-mounted pumps prior to start-up.
- M. Install close-coupled and base-mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 033000.
- N. Lubricate pumps before start-up.

END OF SECTION

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**SECTION 232130
HEAT TRANSFER PACKAGE**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Refer to Division 1 for all requirements pertaining to General Provisions.

1.02 SECTION INCLUDES

- A. Variable Speed Heat Transfer Package.
- B. Products furnished but not installed under this Section.
 - 1. Differential Pressure Transmitter(s)

1.03 REFERENCES

- A. Hydraulic Institute Standards
- B. ANSI - American National Standards Institute
- C. NEMA - National Electrical Manufacturers Association
- D. L. 508 - Electric Industrial Control Equipment
- E. E.C. Handbook N.F.P.A. 70
- F. AISC Manual of Steel Construction

1.04 SYSTEM DESCRIPTION

- A. Furnish and install a factory assembled variable speed packaged heat transfer system equal to Canariis Corporation Model No. D-95-55-EC-1HX. The system shall be a pre-assembled and pre-tested unit and shall require only suction and discharge pipe connections, electrical power connection(s) and necessary connections to the various field mounted transmitters and the building automation system.

1.05 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 1. The following information shall be provided:
 - 1. System design information sheet.
 - 2. Description of system operation.
 - 3. System Energy Analysis showing the overall system efficiency and input kW in 5% increments throughout the complete range of system operation.
 - 4. Packaged system dimension and general arrangement drawing.
 - 5. System Flow Diagram and Piping Schematic showing the overall system piping arrangement including remote mounted sensors and transmitters.
 - 6. Pump materials of construction and engineering data.
 - 7. Pump curve showing design point.
 - 8. Motor materials of construction and engineering data.
 - 9. Catalog information on valves, strainers and control components.
 - 10. Electrical power and control wiring diagram.
 - 11. Detailed analog and digital point list.
 - 12. Catalog data on BAS Controller.
 - 13. Proof of UL listings.
 - 14. Complete description of Flow Test Procedures including performance data on all NIST Traceable instrumentation used during the test.
- B. Submit manufacturer's installation instructions under provisions of Division 1

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 1. The following information shall be provided:
 - 1. System design information sheet.
 - 2. Description of system operation.
 - 3. Packaged system dimension and general arrangement drawing.
 - 4. Electrical power and control wiring diagram.

5. Pump operation and maintenance instructions.
6. Special electrical component operation instructions.

1.07 QUALITY ASSURANCE

- A. The manufacturer of the package must be listed by Underwriters Laboratories as an approved manufacturer of UL Packaged Pumping Systems. The complete Packaged Pumping System, including pumps, motors, control equipment, hydronic specialties, valves, fittings and manifolds must be UL Listed under Category QCZJ (Packaged Pumping Systems). In addition to the UL Listing for the complete system, the control panel assembly must be separately listed under UL 508A (Industrial Control Panels). The manufacturer shall furnish proof of the two listings as part of the submittal data.
- B. The packaged pumping system manufacturer shall provide published catalog data clearly indicating that HVAC Packaged Pumping Systems are one of their standard product lines. Upon request, the packaged pumping system manufacturer shall also provide a copy of a valid Insurance Certificate providing a minimum of \$5,000,000.00 Liability Insurance.
- C. The packaged pumping system manufacturer shall have in place an ISO 9001 compliant Quality Assurance Program to assure the quality of engineering design, components, materials and workmanship provided in the packaged pumping system. Upon request, this procedure shall be submitted to the engineer.
- D. The system manufacturer shall have a minimum of ten years manufacturing and application experience and shall be responsible for the proper pressure and flow in the system.
- E. The packaged pumping system manufacturer must have experience with the programming, wiring and testing of controllers of the same manufacture as the BAS. Proof of this experience, including a list of similar installations, shall be provided to the engineer upon request.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site under provisions of Division 1.
- B. Store and protect products under provisions of Division 1.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Canariis Corporation

2.02 MANUFACTURED UNIT – HEAT TRANSFER PACKAGE

- A. General: The packaged system shall consist of a system base, pumps, motors, valves, heat-exchangers, manifolds, intermediate piping, piping supports, controls and other components as listed in this specification for a complete system.
- B. Components
 1. All components shall be mounted on a structural steel base. The base shall be large enough to support the packaged pumping system's pumps, piping, control panel and variable frequency drive's (VFD's). The top of the structural base shall be covered with painted diamond plate steel. The plate shall cover the total base and be welded to the substructure. Any seams shall be continuously welded. The plate shall be primed and then painted the same as the package. Both the base and supports shall consist of structural steel components, all welded per the AISC Manual of Steel Construction, Part 4, "Welded Joints".
 2. Pump design shall be as indicated on the drawings. Pumps shall be end-suction type with ANSI flanged connections, cast iron casing, bronze impeller, and mechanical seal. Pumps shall be mounted on a structural steel base and shall be free of distortion caused by flexing of the system base or system piping.
 3. Motors shall be of the premium-efficiency type, ODP with a minimum 1.15 service factor. Motor manufacturer's stated efficiencies shall be derived from tests conducted in accordance with NEMA Standard MG1-12.53a, which is based upon IEEE Standard 112, Method B. Refer to Section 23 05 13.
 4. The pump design conditions and motor horsepower requirements shall be as described on the pump schedule. The pump shall not overload the motor at any point on the pump curve.
 5. The package piping shall consist of fabricated welded steel headers with steel and/or cast iron fittings in and out of pumps. All piping for the system shall be as indicated on

- the drawings. Branch piping to the pumps shall be sized for the design capacity of the pump. Supports shall be provided for the suction and discharge headers. Piping supports shall include insulation protection saddles. The branch suction and discharge piping on each pump shall be supported independently of pump connections. Drain plugs shall be provided at all low points in the system piping where water can be trapped. Manual air vents shall be provided at all high points in the system piping where air can be trapped.
6. Butterfly valves shall be furnished on the suction and discharge of each pump. Valves shall be constructed with a ductile iron lug style body, EPDM seat, aluminum bronze disc and stainless steel shaft. Valves 6" and smaller shall be provided with lever operators and valves 8" and larger shall be provided with hand wheel and gear operator.
 7. A suction strainer shall be installed on the suction of each pump. The strainer shall be of the diffuser type or inline "Y" type. The strainer shall be constructed with a cast iron body and perforated 304 stainless steel screen. Disposable fine mesh screens shall be included for initial startup. The strainer shall include a mounted blow-down valve. Blow-down valve shall be piped to drain by contractor.
 8. A wafer style, center guided, silent check valve shall be installed on the discharge of each pump. The valve shall be cast iron body with a pressure rating exceeding the pump shut-off head plus maximum suction pressure. Valve shall have a SS disc, shaft and spring and a resilient seat.
 9. Flexible connectors shall be furnished for the system suction and discharge connections. The connectors shall be constructed with steel flanges and a neoprene and nylon body. Connectors shall have a pressure rating that is suitable for the maximum working pressure of the system. Flexes shall include controls rods.
 10. Grade 2A pressure gauges, 4½" diameter, shall be furnished mounted on the control cubicle for indication of all individual pump suction/discharge pressures and all common suction and discharge pressures. All control sensing lines and gauge connections shall be piped with shut-off valves. Gauges shall be mounted such that they can be viewed from the front of the control enclosure.
 11. Adjustable angle thermometers shall be furnished where indicated on drawings. Thermometers shall be 9", V-shaped charcoal gray case or die cast black aluminum V-shaped case, glass front, white aluminum scale with bold black graduations and figures, mercury free blue liquid in glass with magnifying lens for easy readability, accuracy of ± 1% of full scale, easy adjustment to permit case and stem to be rotated 360°.
 12. A bladder type expansion tank shall be provided on the pump skid as indicated on the drawings. The expansion tank shall have a carbon steel shell and a replaceable heavy-duty butyl bladder. The tank must be constructed in accordance with Section VIII of the ASME Code for Boilers and Pressure Vessels and stamped for 125 PSI working pressure. The tank volume shall be as indicated on the drawings.
 13. A vortex type air & dirt separator shall be provided on the pump skid as indicated on the drawings. The air & dirt separator shall have a carbon steel shell and must be constructed in accordance with Section VIII of the ASME Code for Boilers and Pressure Vessels and stamped for 125 PSI working pressure. A blow-down connection shall be provided to facilitate routine cleaning of the air separator. An automatic air release valve shall be provided at the high-point of the air separator complete with isolation valve.
 14. A 5 gallon chemical filter feeder shall be provided for the chilled water system. The shot feeder shall be piped across the system and shall include shut-off valves, gauges, fill funnel with valve, manual air release valve and drain connection with valve.
 15. The packaged pumping system shall include all controls necessary to operate the system. The microprocessor based Direct Digital Controller (DDC) shall be of the same manufacture as the Building Automation System (BAS) and shall have "stand alone" capability, including on-board software necessary to operate the pumping system should the signal from the BAS be temporarily lost. The controller must be fully wired, programmed and tested by the packaged pumping system manufacturer before shipment from the factory.
 16. The control system shall be designed to start and stop the pumps and modulate their speed as required by system demands. The pumping system controller shall provide

for Direct Digital Control with discrete signal selection. The DDC algorithm will include a factory tuned proportional, integral and derivative (PID) control action. Use of any or all of these terms as well as changing their constants shall be user on-line programmable. The 4-20mA DC signal(s) from the remote mounted differential pressure transmitter(s) shall be transmitted over a No. 22 gauge or larger shielded cable or broadcast over the BAS communication trunk to the pumping system controller located in the logic section of control enclosure. The pumping system controller shall have field-programmable independent set points, the value of which shall be the optimum differential pressure as designed for each remote location or zone. The zone that deviates farthest from its independent set point shall be the controlling input to insure that the pumps run at the minimum speed necessary to satisfy demand in all zones.

17. The pumping system controller shall have loop alarms for all analog inputs. Failure of any remote transmitter shall remove that transmitter signal from the remaining control functions. Failure of all remote transmitters shall activate a pre-set speed control output that will run all pumps at an adjustable set speed. The controller shall be housed in a metal enclosure designed for EMI and RFI rejection.
18. The pumping system controller shall add standby pumps on excessive deviation from set point and in accordance with a Best-Efficiency Control program to insure that the system operates at maximum efficiency throughout the range of operation. The Best-Efficiency Control program shall evaluate system flow, system TDH and input kW to operate only the most efficient combinations of pumps.
19. The pumping system controls shall include semi-automatic and manual modes of operation. The operator shall be capable of starting each pump manually while allowing the automatic controls to adjust the pump speed to maintain system differential pressure. This shall be accomplished by utilizing the pump Hand-Off-Auto switch on the system control panel. The operator shall also have the option of starting each pump and controlling its speed manually. This shall be accomplished by utilizing the pump Hand-Off-Auto switch and the manual speed adjustment on each variable frequency drive control panel.
20. The control system shall include a failure alarm for each pump. Each alarm shall include a current switch, adjustable time delay, alarm light and manual reset. Upon a pump failure alarm, the pump shall be stopped and locked-out of service until the alarm is manually reset via a panel mounted reset push button. A pump failure alarm shall automatically replace the failed pump with the next pump in the sequence.
21. The power distribution panel shall be 1, single door design with single-point input power connection.
 - a. Power distribution panel shall include:
 - 1) Main input terminal block
 - 2) Control circuit transformer
 - 3) Power distribution equipment for each pump
 - 4) Disconnect switch with thru-the-door handle for each pump
22. The control logic panel shall be NEMA 1, single door design with single-point input power connection. Controls shall be Siemens.
 - a. Control logic panel shall include:
 - 1) Door mounted Control Power On/Off switch and light
 - 2) System Local-Off-Remote switch (remote provides for remote system start/stop from BAS)
 - 3) System Initialized light
 - 4) Hand-Off-Auto switch for each pump
 - 5) Run Light for each pump
 - 6) Pump Failure alarm light and reset
 - 7) Pump sequencing logic
 - 8) Elapsed Time Meter for each pump
 - 9) All control panel indicating lights shall be a million hour average life, LED type.
 - 10) System BAS Controller
 - 11) Local Display or Human Machine Interface (HMI)
 - 12) Interface controls for variable frequency drives
 - 13) Provisions for single communication cable connection to BAS.

- b. All communication between the pumping system controller and the BAS shall be via BAS communications. Separate data gathering panels and protocol converters used for communication with the BAS shall not be acceptable.
 - c. Door handles shall be provided for each panel disconnect switch so that power circuits are turned off before the door can be opened. All electric wiring between the control panel, variable frequency drives, electric motors and system mounted controls shall be completed per N.E.C. standards.
23. The following pre-programmed standard functions for the controller shall be provided.
- a. Time-of-Day Scheduling
 - b. Daylight Saving Time Adjustments
 - c. Holiday Scheduling
 - d. Maintenance Messages
 - e. Direct Digital Control - PID
 - f. Power Failure/Auto Restart
 - g. User Defined Programming
 - h. Data Logging
 - i. Self-Diagnostics with Service Alarm Buffer
24. The local user interface or Human Machine Interface (HMI) unit shall be mounted in the door of the system control enclosure. It shall be microcomputer based and hold its firmware in EPROM memory. The system interface shall be of the same manufacture as the BAS. On-line programmable data entries such as set points, calculated results and totalization shall be stored in non-volatile memory. All data entry shall be modifiable by system mounted keypad or HMI using engineering units such as GPM, PSI and feet of head. The unit shall be programmable and modifiable from the BAS central computer.
25. VFD's shall be supplied with the package. To insure safety of the equipment the VFD shall include these protective features and options:
- a. Static instantaneous over current and over voltage trip.
 - b. Power unit over temperature protection
 - c. Motor inverse time overload protection
 - d. Motor amperage/load display
 - e. Speed display
 - f. Automatic restart after power failure or drive fault. The drive shall attempt a minimum of two restarts before a complete drive shut-down.
 - g. Power On indication
 - h. Manual speed adjustment
 - i. Hand-Off-Automatic switch or Manual-Automatic switch with Start-Stop push-button.
 - j. VFD Fault indication.
 - k. The drive shall include built-in diagnostics. Diagnostics shall be in the form of built-in LED indicating lights, LED readout or a Fault Diagnostic test card. If a test card is utilized, it shall be interchangeable between drives. The drive shall be listed by UL, ETL and/or CSA.
26. The packaged pumping system manufacturer shall provide as many as required per the drawings and specifications complete, self-contained, variable capacitance type, differential pressure transmitter(s). The transmitter(s) shall be installed by the contractor where indicated on the drawings. Wiring terminals and electronics shall be in separate compartments so that the electronics remain sealed during installation. Reverse polarity protection shall be included to keep wiring mishaps from damaging the transmitter. The 4-20mA DC signal(s) shall be transmitted over a No. 22 gauge or larger shielded cable (supplied by the contractor) directly to the control panel terminal strip or to the nearest BAS control enclosure for broadcast back to the pumping system.
- a. Design range shall be as required for the system. Transmitter shall have external zero and span adjustments. Over-pressure limits of 0 to 2,000 PSI on either side without damage to the transmitter. Minimum accuracy shall be $\pm 0.15\%$ of calibrated span, includes combined effects of linearity, hysteresis and repeatability. Stability shall be $\pm 0.25\%$ of upper range limit for six months. No internal mechanical linkages shall be used in the transmitter.

27. The packaged pumping system manufacturer shall provide self-contained RTD type temperature transmitters. The temperature transmitters shall each receive its power input and send its current output (4-20mA) over the same pair of low voltage wires. Each transmitter head shall be explosion proof. The temperature probe shall use a platinum, wire wound, sensing element in a 316SS sheath, spring loaded, and inserted into a ¾" NPT stainless steel thermowell with explosion proof process fittings and connection head. The thermowell shall penetrate one half the pipe diameter. The total system accuracy of the temperature transmitter/probe assembly shall be +/0.001% of span; the sensing element and the transmitter shall be individually calibrated and traceable to NIST.
28. Shell-and-Tube, U-Tube Heat Exchanger:
 - a. A steam to water removable U-Tube type heat exchanger of the sizes and capacities noted on the schedule. The heat exchanger shall consist of ¾" OD copper tubes, cast iron head of either two or four pass configuration, steel shell, tubesheet and supports. Unit's shell and tubes shall be specifically designed for 150 PSIG working pressure at 375°F.
 - b. Tubes shall be of ¾" O.D. 20 gauge copper and shall be secured to a steel tubesheet via rolled joints.
 - c. Heat exchanger shall be constructed of a cast iron or fabricated steel head, steel shell, and steel baffles, tie rods, and spacers. Unit shall have a compressed fiber gasket to seal the shell at the tubesheet.
 - d. Heat exchanger design shall allow for a maximum tubeside velocity no greater than 7.5 feet/ second and a shell side velocity no greater than 4.0 feet/second. Unit shall be constructed with a fouling factor equal too or greater than that scheduled. Unit diameter shall be no less than 12 inches and the bundle length shall be no greater than that scheduled.
 - e. Heat exchanger shall be provided with the scheduled square footage of heat transfer area.
 - f. Where indicated heat exchanger shall be provided with alternate materials of construction as noted on schedule and installation drawings

2.03 FABRICATION

- A. The packaged pumping system manufacturer shall provide a completely assembled and tested water circulating system that is fabricated using all new components. Fabrication shall incorporate sound engineering design, proven manufacturing techniques and the latest proven technology available.

2.04 FINISHING

- A. The manufacturer shall operate and maintain a paint spraying facility that conforms to EPA, OSHA and local codes requirements.
- B. All steel components shall be cleaned, degreased and painted with a rust-preventive, self-etching primer.
- C. The complete packaged pumping system shall be factory painted with lead-free, high-gloss enamel prior to shipment.
- D. Nameplates for each major component including pumps, motors, variable frequency drives, and electrical control panels shall be masked prior to painting and all shall be clean and legible prior to shipment.

2.05 SOURCE QUALITY CONTROL

- A. Testing Facility
 1. The packaged pumping system manufacturer shall maintain an operating test facility at the point of manufacture and shall performance test each component and feature of the assembled water circulating system with its remote transmitters and controls. The testing facility shall include Flow Meters, Test Gauges, Watt Meter, Digital Multi-Meter, Tachometer and Differential Pressure Transmitters for measuring system performance, which are traceable to the National Institute of Standards and Technology (NIST).
- B. Factory Tests
 1. After factory assembly, the packaged pumping system shall be hydrostatically tested at 50 PSIG over maximum system working pressure or to 150 PSIG (whichever is

- higher) for a minimum of one hour.
2. Each pump shall be individually tested for performance while at full speed. Pump performance measurements shall include shut-off pressure and pump TDH and motor full load amps at 25%, 50%, 75% and 100% of pump design capacity.
 3. During the variable speed wire-to-water efficiency test each pump and combination of pumps shall be operated according to multiple system curves in increments of 5% from 25% to 100% of design flow. The system is adjusted to operate the pump(s) at each design point where system/pump flow, system/pump head, pump speed, amperage, input kW and supply voltage are recorded. This test provides actual system wire-to-water efficiency based on the selected set points.
 4. Each Control panel must be designed, built and tested per UL508A prior to integrating with the pumping system. The testing includes verification of wiring, component operation, programming and sequence testing.
 5. The pumping system must be connected to a test tank with the actual components, valves and sensors specific for this project. Any calibrations or adjustments that are required for proper system operation will be performed. All sequencing controls, alarms and system operation must be tested and verified to be functional prior to removal from the test tank. These tests may be witnessed by the engineer, owner or a representative if required.
 6. All testing must be performed with NIST Traceable instrumentation. The NIST Traceable instrumentation must be independently calibrated in accordance with NIST and Hydraulic Institute Standards.
- C. Inspections
1. The manufacturer shall provide access to the owner or his representative to the fabrication facilities at any time during the construction of the packaged pumping system. All testing may be witnessed by a representative of the owner, contractor and/or consulting engineer.
- D. Verification of Performance
1. A written report certified by an officer of manufacturing company shall be provided to the owner's representative on request.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The contractor shall off-load, store, locate, level, anchor, pipe and wire the system and the remote components in accordance with manufacturer's instructions.
- B. Alignment: Base mounted pumps shall be aligned by the contractor after installation using a qualified millwright and the alignment shall be certified in writing.
- C. The contractor shall confirm that all components necessary for a complete and proper startup are installed, wired and operational prior to scheduling startup. A system startup request form shall be filled out and signed by the contractor and returned to the factory to certify readiness.

3.02 CLEANING

- A. All piping in the building heating water system shall be thoroughly cleaned and free of debris, dirt, sand and other impurities. After flushing the system, start-up of the pumping system can commence.

3.03 ADJUSTING

- A. During initial start up, the mechanical contractor shall, under the supervision and assistance of the manufacturer or his representative, adjust all mechanical and electrical components to actual job conditions.

3.04 DEMONSTRATION

- A. After all adjustments have been completed, the owner and/or his representatives will receive a thorough demonstration of the system operation and will receive training in the operation and adjustment of all components.
- B. System manufacturer or his representative shall provide up to two (2) 8 hour days, during not more than one (1) trip to the jobsite for startup, adjustment and training of owner's personnel on the operation and maintenance of the packaged pumping system.

END OF SECTION

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**SECTION 232213
STEAM AND CONDENSATE HEATING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and pipe fittings.
- B. Pipe hangers and supports.
- C. Steam piping system.
- D. Steam condensate piping system.

1.02 RELATED REQUIREMENTS

- A. Section 230523 - General-Duty Valves for HVAC Piping.
- B. Section 230553 - Identification for HVAC Piping and Equipment.
- C. Section 232214 - Steam and Condensate Heating Specialties.
- D. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- B. ASME B31.9 - Building Services Piping 2020.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- D. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- F. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.

1.04 SYSTEM DESCRIPTION

- A. Use unions and flanges downstream of valves and at equipment or apparatus connections. Use dielectric unions where joining dissimilar materials. Do not use direct welded or threaded connections.
- B. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
- C. Use gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Use gate valves for throttling, bypass, or manual flow control services.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labelling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with ASME B31.9 [] code for installation of piping system.

2.02 MEDIUM AND HIGH PRESSURE STEAM PIPING (150 PSIG MAXIMUM)

- A. Steel Pipe: ASTM A53/A53M, Schedule 80, black.
 - 1. Fittings: ASME B16.3 malleable iron Class 150, or ASTM A234/A234M wrought steel welding type.

2. Joints: Threaded, or AWS D1.1/D1.1M welded.

2.03 LOW PRESSURE STEAM PIPING (15 PSIG MAXIMUM)

- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
 1. Fittings: ASME B16.3 malleable iron Class 150, or ASTM A234/A234M wrought steel.
 2. Joints: Threaded, or AWS D1.1/D1.1M welded.

2.04 MEDIUM AND HIGH PRESSURE STEAM CONDENSATE PIPING

- A. Steel Pipe: ASTM A53/A53M, Schedule 80, black.
 1. Fittings: ASME B16.3 malleable iron Class 150 or ASTM A234/A234M wrought steel.
 2. Joints: Threaded, or AWS D1.1/D1.1M welded.

2.05 LOW PRESSURE STEAM CONDENSATE PIPING

- A. Steel Pipe: ASTM A53/A53M, Schedule 80, black.
 1. Fittings: ASME B16.3 malleable iron Class 150, or ASTM A234/A234M wrought steel.
 2. Joints: Threaded, or AWS D1.1/D1.1M welded.

2.06 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
- D. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
- E. Multiple or Trapeze Hangers for Pipe Sizes to 4 inches: Steel channels with welded spacers and hanger rods.
- F. Multiple or Trapeze Hangers for Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods; cast iron roll and stand.
- G. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- H. Wall Support for Pipe Sizes 4 to 5 Inches: Welded steel bracket and wrought steel clamp.
- I. Wall Support for Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll.
- J. Vertical Support: Steel riser clamp.
- K. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- L. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- M. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.07 UNIONS, FLANGES, AND COUPLINGS

- A. Unions for Pipe 2 Inches and Under:
 1. Ferrous Piping: 150 psig galvanized malleable iron, threaded.
- B. Flanges for Pipe Over 2 Inches:
 1. Ferrous Piping: 150 psig forged steel, slip-on.
 2. Gaskets: 1/16 inch thick preformed non-asbestos graphite fiber.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.
- E. After completion, fill, clean, and treat systems. Refer to Section 232500.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Sleeve pipe passing through partitions, walls, and floors.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Place hangers within 12 inches of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Slope steam piping one inch in 40 feet in direction of flow. Use eccentric reducers to maintain bottom of pipe level.
- I. Slope steam condensate piping one inch in 40 feet. Provide drip trap assembly at low points and before control valves. Run condensate lines from trap to nearest condensate receiver. Provide loop vents over trapped sections.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- K. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

- A. Hanger Spacing for Steel Steam Piping.
 - 1. 1/2 inch: Maximum span, 8 feet; minimum rod size, 1/4 inch.
 - 2. 3/4 inch and 1 inch: Maximum span, 9 feet; minimum rod size, 1/4 inch.
 - 3. 1-1/4 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
 - 4. 1-1/2 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
 - 5. 2 inches: Maximum span, 13 feet; minimum rod size, 3/8 inch.
 - 6. 2-1/2 inches: Maximum span, 14 feet; minimum rod size, 3/8 inch.
 - 7. 3 inches: Maximum span, 15 feet; minimum rod size, 3/8 inch.
 - 8. 4 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
- B. Hanger Spacing for Steel Steam Condensate Piping.
 - 1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
 - 2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - 4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.

END OF SECTION

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SECTION 232214
STEAM AND CONDENSATE HEATING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steam traps.
- B. Steam air vents.
- C. Pressure reducing valves.
- D. Steam safety valves.

1.02 RELATED REQUIREMENTS

- A. Section 230716 - HVAC Equipment Insulation.
- B. Section 230719 - HVAC Piping Insulation.
- C. Section 232213 - Steam and Condensate Heating Piping.

1.03 REFERENCE STANDARDS

- A. ASME B31.9 - Building Services Piping 2020.
- B. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Provide for manufactured products and assemblies required for this project.
 - 2. Include product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
 - 3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each specialty.
 - 4. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate application, selection, and hookup configuration. Include pipe and accessory elevations.
- D. Operation and Maintenance Data: Include installation instructions, servicing requirements, and recommended spare parts lists.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 STEAM TRAPS

- A. Manufacturers:
 - 1. Armstrong International, Inc; [____]: www.armstronginternational.com/#sle.
 - 2. Marshall Engineered Products Company; [____]: www.mepcollc.com/#sle.
 - 3. Spirax-Sarco; [____]: www.spiraxsarco.com/us/#sle.
- B. Inverted Bucket Traps: ASTM A126 cast iron or semi-steel body with bolted cover, brass bucket, stainless steel seats and plungers, and stainless steel lever mechanism with knife edge operating surfaces.
 - 1. Rating: 60 psi WSP.
 - 2. Features: Access to internal parts without disturbing piping, top test plug, bottom drain plugs.
 - 3. Accessories:
 - a. Integral inlet strainer of brass.
 - b. Integral inlet check valve.
 - c. Integral bimetal air vent.

- C. Float and Thermostatic Traps: ASTM A126 cast iron or semi-steel body and bolted cover, stainless steel or bronze bellows type air vent, stainless steel or copper float, stainless steel lever and valve assembly.
 - 1. Rating: 15 psi WSP.
 - 2. Features: Access to internal parts without disturbing piping, bottom drain plug.
 - 3. Accessories: Gauge glass with shut-off cocks.

2.02 STEAM AIR VENTS

- A. Manufacturers:
 - 1. Armstrong International, Inc; []: www.armstronginternational.com/#sle.
 - 2. Bell and Gossett, a xylem brand; []: www.bellgossett.com/#sle.
 - 3. Spirax-Sarco; []: www.spiraxsarco.com/us/#sle.
- B. 125 psi WSP: Balanced pressure type; cast brass body and cover; access to internal parts without disturbing piping; stainless steel bellows, stainless steel valve and seat.

2.03 PRESSURE REDUCING VALVES

- A. Manufacturers:
 - 1. Armstrong International, Inc; GP 2000 PRV: www.armstronginternational.com/#sle.
 - 2. McDonnell & Miller, a xylem brand; []: www.mcdonnellmiller.com/#sle.
 - 3. Spirax-Sarco; []: www.spiraxsarco.com/us/#sle.
- B. Bronze or cast iron body, stainless or chrome steel valve spring, stem, and trim, phosphor bronze diaphragm, direct acting, threaded up to 2 inches, flanged over 2 inches.

2.04 SAFETY RELIEF VALVES

- A. Manufacturers:
 - 1. Armstrong International, Inc; []: www.armstronginternational.com/#sle.
 - 2. ITT McDonnell & Miller, a xylem brand; []: www.mcdonnellmiller.com/#sle.
 - 3. Spirax-Sarco; []: www.spiraxsarco.com/us/#sle.
- B. Valve: Bronze body, stainless steel valve spring, stem, and trim, direct pressure actuated, capacities ASME certified and labelled.
- C. Accessories: Drip pan elbow.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install steam and steam condensate piping and specialties in accordance with ASME B31.9.
- B. Install specialties in accordance with manufacturer's instructions.
- C. Steam Traps:
 - 1. Provide minimum 3/4 inch size on steam mains and branches.
 - 2. Install with union or flanged connections at both ends.
 - 3. Provide gate valve and strainer at inlet, and gate valve and check valve at discharge.
 - 4. Provide minimum 10 inch long, line size dirt pocket between apparatus and trap.
- D. Provide pressure reducing stations with pressure reducing valve, valved bypass, strainer and pressure gauge on upstream side, relief valve and pressure gauge on downstream side of pressure reducing valve.
 - 1. Pressure reducing station shall be one or two stages as required, to produce flat reduced pressure curve over range of capacity.
 - 2. Locate pilot operator control minimum 6 feet downstream of valve.
- E. Rate relief valves for pressure upstream of pressure reducing station, for full operating capacity. Set relief at maximum 20 percent above reduced pressure.

END OF SECTION

**SECTION 232300
REFRIGERANT PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Strainers.
- F. Check valves.
- G. Filter-driers.
- H. Solenoid valves.
- I. Expansion valves.
- J. Flexible connections.

1.02 REFERENCE STANDARDS

- A. AHRI 710 - Performance Rating of Liquid-Line Driers 2009.
- B. AHRI 750 - Thermostatic Refrigerant Expansion Valves 2007.
- C. AHRI 760 - Performance Rating of Solenoid Valves for Use With Volatile Refrigerants 2007.
- D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants 2019, with Errata (2020).
- E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
- F. ASME B31.5 - Refrigeration Piping and Heat Transfer Components 2020.
- G. ASME B31.9 - Building Services Piping 2020.
- H. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2020.
- I. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2011 (Amended 2012).
- J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
- K. UL 429 - Electrically Operated Valves Current Edition, Including All Revisions.

1.03 SYSTEM DESCRIPTION

- A. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
- B. Liquid Indicators:
 - 1. Use line size liquid indicators in main liquid line leaving condenser.
 - 2. If receiver is provided, install in liquid line leaving receiver.
 - 3. Use line size on leaving side of liquid solenoid valves.
- C. Valves:
 - 1. Use service valves on suction and discharge of compressors.
 - 2. Use gauge taps at compressor inlet and outlet.
 - 3. Use check valves on compressor discharge.
 - 4. Use check valves on condenser liquid lines on multiple condenser systems.
- D. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.
- E. Strainers:
 - 1. Use line size strainer upstream of each automatic valve.
 - 2. Use shut-off valve on each side of strainer.
- F. Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
- G. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.
- C. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.
- D. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with ASME B31.9 for installation of piping system.

2.02 PIPING

- A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
 1. Fittings: ASME B16.22 wrought copper.
 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- B. Pipe Supports and Anchors:
 1. Provide hangers and supports that comply with MSS SP-58.
 - a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
 5. Vertical Support: Steel riser clamp.
 6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
 8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.03 REFRIGERANT

- A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.04 MOISTURE AND LIQUID INDICATORS

- A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.05 VALVES

- A. Diaphragm Packless Valves:
 1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

- B. Packed Angle Valves:
 - 1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
- C. Ball Valves:
 - 1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.
- D. Service Valves:
 - 1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.06 STRAINERS

- A. Straight Line or Angle Line Type:
 - 1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.07 CHECK VALVES

- A. Globe Type:
 - 1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.
- B. Straight Through Type:
 - 1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

2.08 FILTER-DRIERS

- A. Performance:
 - 1. Flow Capacity - Liquid Line: 5 ton, minimum, rated in accordance with AHRI 710.
 - 2. Flow Capacity - Suction Line: 5 ton, minimum, rated in accordance with AHRI 730 (I-P).
 - 3. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
 - 4. Design Working Pressure: 350 psi, minimum.
- B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.
- C. Construction: UL listed.
 - 1. Connections: As specified for applicable pipe type.

2.09 SOLENOID VALVES

- A. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.
- B. Coil Assembly: UL 429 UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

2.10 EXPANSION VALVES

- A. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.
- B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.11 FLEXIBLE CONNECTORS

- A. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.5.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- F. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Insulate piping and equipment; refer to Section and Section 230716.
- I. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.
- J. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.
- K. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
- L. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Test refrigeration system in accordance with ASME B31.5.
- C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

END OF SECTION

**SECTION 232500
HVAC WATER TREATMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Materials.
 - 1. System cleaner.
 - 2. Closed system treatment (water).
- B. By-pass (pot) feeder.

1.02 RELATED REQUIREMENTS

- A. Section 016000 - Product Requirements: Owner furnished treatment equipment.

1.03 REFERENCE STANDARDS

- A. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.
- D. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
- E. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Sufficient chemicals for treatment and testing during required maintenance period.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. AmSolv-Amrep, Inc; [____]: www.amsolv.com/#sle.
- B. GE Water & Process Technologies; [____]: www.gewater.com/#sle.
- C. Nalco, an Ecolab Company; [____]: www.nalco.com/#sle.
- D. Substitutions: See Section 016000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for addition of non-potable chemicals to building mechanical systems and to public sewage systems.
- B. Comply with UL (DIR) requirements.
- C. Perform work in accordance with local health department regulations.

2.03 MATERIALS

- A. System Cleaner:
 - 1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.
- B. Closed System Treatment (Water):

1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium tolyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
3. Conductivity enhancers; phosphates or phosphonates.

2.04 BY-PASS (POT) FEEDER

- A. Manufacturers:
 1. Griswold Controls; [____]: www.griswoldcontrols.com/#sle.
 2. J. L. Wingert Company; [____]: www.jlwingert.com/#sle.
 3. Neptune, a brand of the Dover Company; [____]: www.neptune1.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. 1.8 gal quick opening cap for working pressure of 175 psi.

PART 3 EXECUTION

3.01 PREPARATION

- A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

3.02 CLEANING SEQUENCE

- A. Concentration:
 1. As recommended by manufacturer.
- B. Hot Water Heating Systems:
 1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
 2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
 3. Circulate for 6 hours at design temperatures, then drain.
 4. Refill with clean water and repeat until system cleaner is removed.
- C. Remove, clean, and replace strainer screens.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.04 CLOSED SYSTEM TREATMENT

- A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.
- B. Introduce closed system treatment through bypass feeder when required or indicated by test.
- C. Provide 3/4 inch water coupon rack around circulating pumps with space for 4 test specimens.

3.05 CLOSEOUT ACTIVITIES

- A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.
 1. Provide minimum of two hours of instruction for two people.
 2. Have operation and maintenance data prepared and available for review during training.
 3. Conduct training using actual equipment after treated system has been put into full operation.

END OF SECTION

**SECTION 233100
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ductwork.
- B. Nonmetal ductwork.
- C. Duct cleaning.

1.02 RELATED REQUIREMENTS

- A. Section 230593 - Testing, Adjusting, and Balancing for HVAC.
- B. Section 230713 - Duct Insulation: External insulation and duct liner.
- C. Section 233300 - Air Duct Accessories.
- D. Section 233700 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

- A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- 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 E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- E. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements 2015.
- F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.
- G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
- H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- I. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual 2012.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for duct materials.
- C. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for low pressure class and higher systems.
- D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

1.06 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. Ducts: Galvanized steel, unless otherwise indicated.
- C. Low Pressure Supply (downstream of terminal unit): 2 inch wg pressure class, galvanized steel.

- D. Medium Pressure Supply (from air handling unit to terminal unit inlet): 3 inch w.g. pressure class, galvanized steel.
- E. Return and Relief: 2 inch wg pressure class, galvanized steel.
- F. General Exhaust: 1 inch wg pressure class, galvanized steel.
- G. Transfer Air and Sound Boots: 1/2 inch wg pressure class, fibrous glass.

2.02 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
 - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 - 2. VOC Content: Not more than 250 g/L, excluding water.
 - 3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
 - 4. For Use with Flexible Ducts: UL labeled.
 - 5. Manufacturers:
 - a. Carlisle HVAC Products; Hardcast Versa-Grip 181 Water Based Fiber Reinforced Duct Sealant: www.carlislehvac.com/#sle.
 - b. Design Polymeric; DP 1010 Water Based Smooth Duct Sealant, Zero VOC, Premium Quality: www.designpoly.com/#sle.
 - c. Ductmate Industries, Inc, a DMI Company; [_____]: www.ductmate.com/#sle.
- C. Gasket Tape: Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle rings connections.
- D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- E. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
 - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
 - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
 - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
 - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
 - 5. Other Types: As required.

2.03 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
- C. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- E. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
- F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.04 MANUFACTURED DUCTWORK AND FITTINGS

- A. Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.
 - 1. Manufacture in accordance with SMACNA (DCS).
- B. Round Ducts: Round lockseam duct with galvanized steel outer wall.

1. Manufacture in accordance with SMACNA (DCS).
- C. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
 1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
 2. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
 3. Maximum Velocity: 4000 fpm.
 4. Temperature Range: Minus 10 degrees F to 160 degrees F.
- D. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
 1. UL labeled.
 2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
 3. Pressure Rating: 4 inches wg positive and 0.5 inches wg negative.
 4. Maximum Velocity: 4000 fpm.
 5. Temperature Range: Minus 20 degrees F to 175 degrees F.
- E. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
- F. Round Duct Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Flexible Ducts: Connect to metal ducts with adhesive.
- E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- I. Use double nuts and lock washers on threaded rod supports.
- J. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.
- K. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

3.02 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

END OF SECTION

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**SECTION 233300
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Combination fire and smoke dampers.
- C. Duct access doors.
- D. Duct test holes.
- E. Fire dampers.
- F. Flexible duct connectors.
- G. Smoke dampers.
- H. Volume control dampers.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 233100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- B. NFPA 92 - Standard for Smoke Control Systems 2018.
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service Current Edition, Including All Revisions.
- E. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.
- F. UL 555S - Standard for Smoke Dampers Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Fusible Links: One of each type and size.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Manufacturers:
 - 1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com/#sle.
 - 2. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
 - 3. Krueger-HVAC, Division of Air System Components: www.krueger-hvac.com/#sle.
 - 4. Ruskin Company: www.ruskin.com/#sle.
 - 5. Titus HVAC, a brand of Johnson Controls: www.titus-hvac.com/#sle.
 - 6. Ward Industries, a brand of Hart and Cooley, Inc: www.wardind.com/#sle.

7. Substitutions: See Section 016000 - Product Requirements.

- B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com/#sle.
 2. Lloyd Industries, Inc: www.firedamper.com/#sle.
 3. Nailor Industries, Inc: www.nailor.com/#sle.
 4. Pottorff: www.pottorff.com/#sle.
 5. Ruskin Company: www.ruskin.com/#sle.
- B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- C. Provide factory sleeve and collar for each damper.
- D. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
- E. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

2.03 DUCT ACCESS DOORS

- A. Manufacturers:
1. Ductmate Industries, Inc, a DMI Company; [____]: www.ductmate.com/#sle.
 2. Elgen Manufacturing Company, Inc; [____]: www.elgenmfg.com/#sle.
 3. Nailor Industries, Inc; [____]: www.nailor.com/#sle.
 4. Ruskin Company; [____]: www.ruskin.com/#sle.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Access doors with sheet metal screw fasteners are not acceptable.

2.04 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.05 FIRE DAMPERS

- A. Manufacturers:
1. Lloyd Industries, Inc: www.firedamper.com/#sle.
 2. Nailor Industries, Inc: www.nailor.com/#sle.
 3. Ruskin Company: www.ruskin.com/#sle.
 4. United Enertech: www.unitedenertech.com/#sle.
 5. Ward Industries, a brand of Hart and Cooley, Inc; [____]: www.wardind.com/#sle.
 6. Substitutions: See Section 016000 - Product Requirements.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- C. Horizontal Dampers: Galvanized steel, 22 gauge, 0.0299 inch frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- D. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.06 FLEXIBLE DUCT CONNECTORS

- A. Manufacturers:
1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/#sle.
 2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
 3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Flexible Duct Connections: Fabric crimped into metal edging strip.

- D. Maximum Installed Length: 14 inch.

2.07 SMOKE DAMPERS

- A. Manufacturers:
1. AireTechnologies, Inc, a DMI Company: www.airetechnologies.com/#sle.
 2. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
 3. Nailor Industries, Inc: www.nailor.com/#sle.
 4. Ruskin Company: www.ruskin.com/#sle.
 5. United Enertech: www.unitedenertech.com/#sle.
 6. Substitutions: See Section 016000 - Product Requirements.
- B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.
- C. Dampers: UL Class 1 airfoil blade type smoke damper, normally closed automatically operated by electric actuator.

2.08 VOLUME CONTROL DAMPERS

- A. Manufacturers:
1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
 2. Nailor Industries, Inc: www.nailor.com/#sle.
 3. Ruskin Company: www.ruskin.com/#sle.
 4. United Enertech: www.unitedenertech.com/#sle.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Splitter Dampers:
- D. Single Blade Dampers:
1. Fabricate for duct sizes up to 6 by 30 inch.
 2. Blade: 24 gauge, 0.0239 inch, minimum.
- E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
1. Blade: 18 gauge, 0.0478 inch, minimum.
- F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 233100 for duct construction and pressure class.
- B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.
- C. Provide duct test holes where indicated and required for testing and balancing purposes.
- D. Provide fire dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- F. Demonstrate re-setting of fire dampers to Owner's representative.
- G. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

- H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- I. Use splitter dampers only where indicated.
- J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

**SECTION 233423
HVAC POWER VENTILATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof exhausters.

1.02 RELATED REQUIREMENTS

- A. Section 230513 - Common Motor Requirements for HVAC Equipment.
- B. Section 233300 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.
- B. AMCA 99 - Standards Handbook 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2005 (Reaffirmed 2012).
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Fan Belts: One set for each individual fan.

1.05 FIELD CONDITIONS

- A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carnes, a division of Carnes Company Inc; [____]: www.carnes.com/#sle.
- B. Greenheck Fan Corporation; [____]: www.greenheck.com/#sle.
- C. Loren Cook Company; [____]: www.lorencook.com/#sle.
- D. PennBarry, Division of Air System Components; [____]: www.pennbarry.com/#sle.
- E. Twin City Fan & Blower; [____]: www.tcf.com/#sle.
- F. Substitutions: See Section 016000 - Product Requirements.

2.02 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Comply with AMCA 99.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 ROOF EXHAUSTERS

- A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- B. Roof Curb: 16 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.
- C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.
- D. Backdraft Damper: Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.
- E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Install backdraft dampers on inlet to roof and wall exhausters.

END OF SECTION

**SECTION 233600
AIR TERMINAL UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single-duct terminal units.
 - 1. Single-duct, constant-volume units.
 - 2. Single-duct, variable-volume units.

1.02 RELATED REQUIREMENTS

- A. Section 230548 - Vibration and Seismic Controls for HVAC.
- B. Section 233100 - HVAC Ducts and Casings.
- C. Section 233300 - Air Duct Accessories.

1.03 REFERENCE STANDARDS

- A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addendum (2011).
- B. AHRI 880 (I-P) - Performance Rating of Air Terminals 2017.
- C. AHRI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets 2008 with Addendum 1.
- D. ASTM A492 - Standard Specification for Stainless Steel Rope Wire 1995 (Reapproved 2013).
- E. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope 2019.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.
- H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
- C. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.
- D. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME AND CONSTANT-VOLUME UNITS

- A. Manufacturers:
 - 1. Krueger-HVAC; []: www.krueger-hvac.com/#sle.
 - 2. Price Industries, Inc; []: www.priceindustries.com/#sle.
 - 3. Titus.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Acoustic Performance Requirements:
 - 1. Sound ratings of air distribution assemblies: Not to exceed 30 NC at a 0.75" w.c. static pressure drop across the unit, and the downstream static pressure of 0.25" w.c.
 - 2. Use attenuation values found in appendix E of AHRI 885.

- C. General:
 - 1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
 - 2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.
- D. Unit Casing:
 - 1. Minimum 22 gauge, 0.0299 inch galvanized steel.
 - 2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
 - 3. Unit Discharge: Rectangular, with slip-and-drive connections.
 - 4. Acceptable Liners:
 - a. 3/4 inch thick polyurethane foam adhesive complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke developed index of 50 for both insulation and adhesive, when tested in accordance with ASTM E84.
 - b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.
- E. Damper Assembly:
 - 1. Heavy-gauge, galvanized steel or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
 - 2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
 - 3. Incorporate low leak damper blades for tight airflow shutoff.
- F. Hot Water Heating Coil:
 - 1. Coil Casing: Minimum 22 gauge, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
 - 2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
 - 3. Coil leak tested to minimum 350 psig.
 - 4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.
- G. Control Transformers: Factory supplied and mounted for electric and electronic control applications.
- H. Controls:
 - 1. DDC (Direct-Digital Controls):
 - a. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
 - b. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFM's.
 - 1) Occupied and unoccupied operating mode.
 - 2) Remote reset of temperature or CFM set points.
 - 3) Proportional, plus integral control of room temperature.
 - 4) Monitoring and adjusting with portable terminal.
 - 2. Airflow Sensor: Differential pressure airflow device measuring total, static, and wake pressures.
 - a. Provides accuracy within 5 percent with a 90 degree sheet metal elbow directly at the inlet of the assembly.
 - b. Control tubing is protected by grommets at the wall of the air flow sensor's housing.
 - c. Furnished with twelve total pressure sensing ports and a center averaging chamber that amplifies the sensed air flow signal.
 - d. Provide sensor with a pressure transducer to interface with a DDC system.
 - e. Provide velocity pressure sensor with a removable access section for maintenance.
 - f. Signal accuracy: Plus/minus five percent throughout terminal operating range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are suitable for installation.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
- C. See drawings for the size(s) and duct location(s) of the air terminal units.
- D. Provide ceiling access doors or locate units above easily removable ceiling components.
- E. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.
- F. Do not support from ductwork.
- G. Connect to ductwork in accordance with Section 233100.

3.03 ADJUSTING

- A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Provide manufacturer's field representative to test, inspect, instruct, and observe field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.
 - 1. Leak Test:
 - a. After installation, fill water coils and test for leaks.
 - b. Repair leaks and retest until no leaks exist.
 - 2. Operational Test:
 - a. Test and adjust controls and safeties.
 - b. Replace damaged and malfunctioning controls and other equipment.
 - c. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

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**SECTION 233700
AIR OUTLETS AND INLETS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
 - 1. Rectangular ceiling diffusers.
- B. Registers/grilles:
 - 1. Ceiling-mounted, exhaust and return register/grilles.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

- A. AHRI 880 (I-P) - Performance Rating of Air Terminals 2017.
- B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets 2006 (Reaffirmed 2011).
- C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.05 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Carnes, a division of Carnes Company Inc; [____]: www.carnes.com/#sle.
- B. Hart & Cooley, Inc; [____]: www.hartandcooley.com/#sle.
- C. Krueger-HVAC; [____]: www.krueger-hvac.com/#sle.
- D. Price Industries; [____]: www.price-hvac.com/#sle.
- E. Ruskin Company; [____]: www.ruskin.com/#sle.
- F. Titus, a brand of Air Distribution Technologies; [____]: www.titus-hvac.com/#sle.
- G. Substitutions: See Section 016000 - Product Requirements.

2.02 RECTANGULAR CEILING DIFFUSERS

- A. Type: Provide square, stamped, multi-core diffuser to discharge air in four way pattern with sectorizing baffles where indicated.

2.03 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 1/2 inch maximum spacing, with blades set at 45 degrees, vertical face.
- B. Frame: 1-1/4 inch margin with countersunk screw mounting for surface mount.
- C. Frame: Provide inverted T-bar type.
- D. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.
- E. Color: As indicated.
- F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 099123.

END OF SECTION

SECTION 236213
PACKAGED AIR-COOLED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes air-cooled condensing units.

1.02 PERFORMANCE REQUIREMENTS

- A. Wind Requirements: Withstand the effects of wind forces.

1.03 SUBMITTALS

- A. General: Submit the following in accordance with Division 23 Section "Common Work Results for HVAC."

1.04 ACTION SUBMITTALS

- A. Product Data: For each condensing unit, include rated capacities, operating characteristics, furnished specialties, and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.
- B. Shop Drawings:
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members to which condensing units will be attached.
 - 2. Liquid and vapor pipe sizes.
 - 3. Refrigerant specialties.
 - 4. Piping including connections, oil traps, and double risers.
 - 5. Evaporators.

1.05 INFORMATIONAL SUBMITTALS

- A. Field Quality Control Test Reports.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For condensing units to include in emergency, operation, and maintenance manuals.
- B. Special Warranty Information: Special warranty specified in this Section.

1.07 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of condensing units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- D. ASME Compliance: Fabricate and label water-cooled condensing units to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

1.08 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."
- C. Coordinate location of piping and electrical rough-ins.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of condensing units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Compressor failure.
 - b. Condenser coil leak.

B. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 CONDENSING UNITS, AIR COOLED, 6 TO 120 TONS (21 TO 422 KW)

- A. Manufacturers:
1. York International Corp
 2. Or manufacturer approved by Owner
- B. Description: Factory assembled and tested, air cooled; consisting of casing, Scroll compressors, condenser coils, condenser fans and motors, and unit controls.
- C. Unit Casings: Factory assembled and mounted on a heavy-gauge steel channel base. Designed for outdoor installation and complete with weather protection for components and controls, and complete with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Unit base rails, supports and cabinetry shall be power-coat painted. The control panel shall have hinged and gasketed access doors.
- D. Refrigeration Circuit: Capped connections for field connections shall be provide for the suction line, liquid line. A pressure relief valve shall be factory installed on the high side and a charging valve shall factory installed on the liquid line. Rawal capacity control device shall be provided on lead circuit for maximum turndown. Hot gas bypass or digital scroll compressors shall not be allowed.
- E. Compressor: Sealed hermetic scroll type with crankcase oil heater and suction strainer. The compressors shall have forced-feed lubrication system with a reversible oil pump and oil charge. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two- pole, with inherent thermal protection on all three phases. Compressors shall be mounted on rubber in shear vibration isolators. Compressors shall have an acoustical blanket factory installed on each compressor.
- F. Compressor: Hermetic or semihermetic compressor designed for service with crankcase sight glass, crankcase heater, and service access valves on suction and discharge ports.
1. Capacity Control: RAWAL Factory installed capacity control.
 2. Refrigerant Charge: R-407C, R-410A, HFC-134a.
- G. Condenser Coil: Seamless copper-tube, aluminum-fin coil, including subcooling circuit and backseating liquid-line service access valve. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.
- H. Condenser Fans: Propeller-type vertical discharge; either directly or belt driven. Include the following:
1. Permanently lubricated ball-bearing motors.
 2. Separate motor for each fan.
 3. Dynamically and statically balanced fan assemblies.
- I. Controls: A DDC microprocessor unit controller with a 4-line by 20 character LCD display shall provide operating and protective functions. The controller shall take pre-emptive actions to protect the unit one of two ways: (1) by alarms that shut the unit down and require a manual reset or (2) by limit alarms that reduce the unit operation in response to an out of limit condition. The microprocessor shall interface with the Building Automation System via BACnet, Lonmark, or Modbus.
- J. Electrical: A centrally located weatherproof control panel with a single point non-fused disconnect switch with thru the door handle. Power and starting components shall include factory short circuit protection of fan motors and control circuits, individual contactors for each fan motor, solid state compressor three phase motor overload protection and inherent fan motor overload protection. Phase loss with under/over voltage protection and multiple

LED indication of fault shall be factory installed.

- K. Operating and safety controls include the following:
 - 1. High-pressure cutout switches.
 - 2. Low-pressure cutout switches.
 - 3. Compressor-winding thermostat cutout switch.
 - 4. Compressor-overload protection.
 - 5. Control transformer.
 - 6. Timer to prevent excessive compressor cycling.
- L. Accessories:
 - 1. Low Ambient Fan Control
 - 2. Include factory installed Rawal capacity control device, solenoid valve and manual shutoff valve
 - 3. Spring vibration isolators
 - 4. Condenser coil hail guard, grille to protect coil from physical damage
- M. Unit Casings: Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:
 - 1. Steel, galvanized, or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating.
 - 2. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.
 - 3. Gasketed control panel door.
 - 4. Nonfused disconnect switch, factory mounted and wired, for single external electrical power connection.

2.03 MOTORS

- A. General requirements for motors are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Electrical devices and connections are specified in Division 26 Sections.

2.04 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate condensing units according to the latest version of ARI 210/240 or ARI 340/360.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of condensing units.
- B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- C. Examine walls, floors, and roofs for suitable conditions where condensing units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.
- B. Install roof-mounting units on equipment supports specified in Division 07.
- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.

- C. Connect precharged refrigerant tubing to unit's quick-connect fittings. Install tubing so it does not interfere with access to unit. Install furnished accessories.
- D. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories. Refrigerant piping and specialties are specified in Division 23 Section "Refrigerant Piping."
- E. Ground equipment according to Division 26 Section "Grounding and Bonding."
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.04 FIELD QUALITY CONTROL

3.05 PERFORM THE FOLLOWING FIELD TESTS AND INSPECTIONS AND PREPARE TEST REPORTS:

- 1. Perform electrical test and visual and mechanical inspection.
- 2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
- 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
- 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- 5. Verify proper airflow over coils.
- B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
- C. Remove and replace malfunctioning condensing units and retest as specified above.

3.06 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - 1. Inspect for physical damage to unit casing.
 - 2. Verify that access doors move freely and are weathertight.
 - 3. Clean units and inspect for construction debris.
 - 4. Verify that all bolts and screws are tight.
 - 5. Adjust vibration isolation and flexible connections.
 - 6. Verify that controls are connected and operational.
- B. Lubricate bearings on fans.
- C. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
- D. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.
- E. Verify proper operation of condenser capacity control device.
- F. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.
- G. After startup and performance test, lubricate bearings and adjust belt tension.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 237413
PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
 - 1. Direct-expansion cooling.
 - 2. Hot water heating.
 - 3. Hot-gas reheat.
 - 4. Energy recovery.
 - 5. Economizer outdoor- and return-air damper section.
 - 6. Integral, space temperature controls.

1.03 DEFINITIONS

- A. DDC: Direct-digital control.
- B. ECM: Electrically commutated motor.
- C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
- E. RTU: Rooftop unit. As used in this Section, this abbreviation means outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
- F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
- G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

1.04 ACTION SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Structural members to which RTUs will be attached.
 - 2. Roof openings
- B. Field quality-control test reports.
- C. Warranty: Special warranty specified in this Section.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Filters: One set of filters for each unit.

1.08 QUALITY ASSURANCE

- A. ARI Compliance:
 - 1. Comply with ARI 203/110 and ARI 303/110 for testing and rating energy efficiencies for RTUs.
 - 2. Comply with ARI 270 for testing and rating sound performance for RTUs.
- B. ASHRAE Compliance:
 - 1. Comply with ASHRAE 15 for refrigeration system safety.
 - 2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
 - 3. Comply with applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- D. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.
- E. UL Compliance: Comply with UL 1995.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
 - 2. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, all air-handling units shall be manufactured by Ventrol. Other manufacturers offering similar products may be incorporated, they include and are limited to, the following:
 - 1. Ventrol
 - 2. Temtrol
 - 3. Governair
 - 4. Mammoth
 - 5. Huntair

2.02 MANUFACTURED UNITS

- A. General Description: Factory assembled, consisting of fans, motor and drive assembly, coils, dampers, plenums, filters, condensate pans, mixing dampers, and other accessories as indicated on drawings or schedules.

2.03 AIR HANDLING UNITS

- A. GENERAL: This specification covers the performance requirements and the material/construction requirements of custom-built outdoor air handling units. The detailed performance and data sheets and/or equipment schedule drawing(s) are considered part of this specification.
- B. Warranty: The manufacturer shall provide the parts warranty for equipment manufactured and all vendor supplied components. The said warranty shall cover replacement of all defective parts for a period of 12 months from equipment start up, not to exceed 18 months

from date of shipment.

- C. Submittal: The successful manufacturer shall provide Shop drawings and submittal data for review. The submittals and shop drawings shall be complete in all respects including the following information:
1. Overall unit dimensions and individual components and section dimensions.
 2. Sound analysis consisting of inlet, outlet and radiated sound power levels per unit performed by an AMCA 300 accredited lab.
 3. Shipping and operating weight of unit and/or sections.
 4. Materials of construction.
 5. Cross section details of typical wall, floor and roof construction.
 6. Component equipment data as detailed in component specification section.
 7. Unit performance data including sound data.
 8. Details of coil support in a coil bank.
 9. Piping connection sizes and approximate locations.
 10. Door and window sizes and elevations.
 11. Drain pan details.
 12. Operating and Maintenance Data
- D. Product Delivery, Storage, and Handling:
1. All equipment shall be delivered to the job site suitably packaged and protected for overland trucking using heavy-duty protective shrink-wrap plastic. Where multiple units are required, a schedule of priority will be furnished which shall determine the manufacturing and delivery sequence. In general, units shall be delivered in one piece unless indicated otherwise. Where building constraints, unit size or trucking limitations require that units ship in more than one piece, the manufacturer shall indicate all split points on the shop drawings. All items shipped loose such as filters, steam humidifier assemblies, caulking, etc. shall be itemized on the packing slip and be suitably secured in the unit or on a separate pallet.
- E. General Design Considerations:
1. Coils shall be arranged so that space between coils is a minimum of 24", unless specifically shown otherwise on drawings. Fan compartment shall be arranged such that the space between the fan inlet(s) and the housing is a minimum of 75% of fan diameter, unless noted or shown otherwise on the schedule or drawings. Coil assembly shall have provisions to facilitate total or partial removal from coil bank. Housing shall be designed and sealed to minimize air and water vapor leakage. Housing shall be designed and tested to meet maximum leakage of SMACNA class 3 when tested in accordance with the procedure outlined in the SMACNA HVAC Air Duct Leakage Manual.
- F. Factory Testing:
1. Factory testing shall be done on the assembled unit. An owner's representative shall witness the test. Manufacturer to provide for expenses of one owner representative to witness the test, with a two weeks' notice.
 2. Casing Leakage Test:
 - a. Housing shall be designed and tested to meet maximum leakage of SMACNA class 3, tested in accordance with the procedure outlined in the SMACNA HVAC Air Duct Leakage Manual. Leakage test will be conducted at 1.5 times the supply fan and/or return fan operating static pressure to a maximum of 12in.w.g. for 4-inch walls and 10in.w.c. for 2-inch walls, positive or negative depending on the unit configuration, and shall not leak more than 1% of the unit volumetric flow rate (cfm).
 - b. Leak testing is performed by measuring the airflow pumped in or out of the airside portion of the unit at various static pressures. An orifice tube with a variable supply system, as described in SMACNA Leakage Test Manual, is used as the airflow measurement system.
 - 1) POSITIVE PRESSURE Supply fan discharge opening and all supply air openings are sealed. The airflow measurement system is ducted to the unit and flow measured at specified static pressure.
 - 2) NEGATIVE PRESSURE Supply fan discharge opening and all return air and other openings are sealed. The airflow measurement system is ducted to the unit and flow measured at specified static pressure.

- c. The pressure drop across the orifice tube in the airflow measurement system is measured with a manometer. The airflow is then calculated using the SMACNA Leakage Test Manual equation 5-1. Leakage at the specified static pressure is then calculated from the data taken.
- G. Airflow and Static Capability Test:
 1. The unit is started-up and operated at full capacity. Fan system effects, which cannot be measured during the test but have been estimated, will be added to the actual static pressure measured when applicable. The total shall equal the total design static pressure. Static pressure is set by adjusting inlet and / or outlet dampers until the design pressure is achieved. Alternately, pre-filters or coils can be partially blocked.
 2. Supply airflow is measured with a set of Pitot Tubes and a Fluke - Airflow Meter. The set of Pitot Tubes covers an approximate 1 square foot area. There are a total of 4 Pitot Tubes. The velocity pressure applied via the 4 Pitot Tubes is mechanically averaged and presented to the meter as one single pressure. Flow rate is determined multiplying the average velocity by the area of an appropriate plane of the air handler. The measuring plane can be a surface inside the air handler, such as a bank of filters or coils.
 3. Current readings for each phase will be taken at the inlet to the control panel or starter panel when applicable.
- H. Panel Deflection Test:
 1. The panel deflection is measured on the cabinet exterior wall, typically in conjunction with an airflow or leakage test. Prior to pressurization of the unit, a measuring dial is placed on the seam between two panels and a first reading is taken. The unit is then pressurized to the specified static pressure. A second reading is taken on the dial and the deflection is calculated as the difference between the two measurements.
 2. Cabinet deflection shall not exceed 1/180 of the panel length on 2" wall units and 1/240 on 4" wall units. A written test report shall be prepared by the manufacturer and issued to the Owner's representative.
- I. AHU Factory Sound Pressure Test
 1. Site description:
 - a. Sound tests shall be conducted while the unit is running at design conditions. Sitting in the middle of an unobstructed bay (55 feet wide) in a large factory space (400 x 300 feet approximately) with a ceiling height of 28 feet. Floor is concrete, ceiling is steel deck over metal trusses, and walls are concrete blocks.
 2. Measurements conditions:
 - a. Tests shall be conducted while all work is stopped and all unnecessary noises eliminated, resulting in a background noise level lower than 50 dBA and unit noise measurements being at least 10 dB above.
 3. Description of measurements:
 - a. Sound pressure level (Lp) (in dB, ref. 20 µPa) readings in all nine octave bands (31.5 to 8000 Hz) at feet from designated openings and 5 feet adjacent to fan sections outside of the unit casing.
 - b. Calibration check of sound Level meter will be done before and after measurement test. Microphone shall be at 5 feet from floor or horizontal surface and away from direct air turbulence.
 - c. All measurements will be monitored to exclude any undesirable noises that are not from the unit. (Ex. Airplane, siren noise, etc.)
 4. Report:
 - a. Report shall show the measurements and a sketch showing the general arrangement of the test set up. (Points of measurement, distances, etc.)
 - b. Measurement parameters: (Produced by sound level meter application software) showing time, date and sound level meter setting.
- J. AHU Sound Analysis:
 1. Sound analysis consisting of inlet, outlet and radiated sound power levels performed by an AMCA 300 dual reverberant chamber accredited lab. Sound analysis from a non-AMCA accredited lab will not be accepted.

2.04 UNIT CONSTRUCTION

- A. Unit Base / Floor / Frame Work:

1. The unit base frame is manufactured with structural aluminum tubing. The completed unit base coating must be able to sustain salt spray testing of 1000 hours, per ASTM 117B. Sheet metal formed unit bases are not acceptable. The "Double Bottom" base features a 4.5" thick insulated walk-on floor as specified below. The base rails are fitted with Bolted removable lifting lugs at the unit or module (if demounted) corners. Sheet metal lifting lugs are not acceptable. Floor liner shall be 0.125" Aluminum treadplate. Floor seams shall be sealed to create leak free joints. The perimeter of the unit consists of a 1½" upturned perimeter lip to create a drainable floor. The entire unit base must be polyurethane foamed in place with a minimum thickness of 3" and a minimum R value of 20. Fiberglass insulated unit bases will not be acceptable. Maximum deflection of floor shall be L/360 at design loading (L=span in inches), the minimum floor design load is 150 lbs/sqft (distributed load), and the maximum point load on floor shall be 300 lbs (over 1 square foot).

Wall thickness	R-Value	Cabinet Insulation Options	Thermal Break Options
2"	13.2	Injected Foam	Gasket thermal break

- B. Panel Structural Strength:
 1. Maximum deflection of walls and roof shall be L/180 at +/- 8" w.c. for 2" construction (L= span in inches). Deflection is worst case at the center of wall span.
 - a. Minimum roof and wall load is 75 lbs /sqft (distributed load such as wind and snow)
 - b. Maximum point load on roof shall be 300 lbs (over 1 square foot)
- C. Cabinet Insulation: The polyurethane injected foam, 2.5 pcf with an effective thermal conductivity (C) of 0.154 BTU in/hr sq.ft°F) and an R-value of 13.2. The foam insulation has an ozone depletion potential of 0, a global warming potential of 0 and is VOC exempt. It is also rated UL94 HF-1.
- D. Cabinet – Embossed Aluminum Exterior Panels:
 1. Formed and reinforced wall panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. Outside Casing shall be solid 16-ga, Embossed Aluminum
 2. The unit construction needs to be thermal break PVC (poly-vinyl chloride) closed cell foam gasket meeting NFPA 90 A and B. The panel construction must meet a minimum R value of 8.3 in the walls and ceiling
 3. Interior walls shall be 0.063" aluminum. Inner liner shall be 0.080" thick aluminum. Walls shall use a gasketed thermal break.
 4. All aluminum construction shall be utilized. Units utilizing galvanized steel or other materials as part of construction shall not be acceptable.
- E. Triple Layer Roof:
 1. Each Roof Top Air Handling Unit shall incorporate a triple layer roof design. The first two layers shall seal the air tunnel to preserve performance integrity and shall be of the same construction as the rest of the casing. It shall consist of a 16 GA G-90 galvanized steel outer liner and a 20 GA G-90 galvanized steel interior liner filled. This casing shall then be completely covered with a third layer 3" deep lock formed standing seam roof. This top layer shall be single slope, ¼" per foot for units narrower than 144" wide and dual slope for units wider than 144", and create an air gap with the outer casing to guarantee no water penetration. Roof panels on units up to 400" wide shall be continuous, from one end of unit side to the other; split joints or any other method not using a single continuous panel will be rejected. Furnish with the manufacturer's standard powder coat finish.
 2. The construction shall use special brackets designed to hold the third layer to the outer casing while preventing any penetration through it and therefore eliminating any possibility of water leakage.
 3. All necessary hardware to seal module splits shall be provided by the manufacturer and installed by installing contractor or other. A special forming tool shall be supplied by the air handling unit manufacturer to provide the same lock formed standing seam as the other manufactured joints. This special locking tool shall be returned to the manufacturer within 2 weeks of units' successful rigging.
- F. Drain Pans and Cooling Coil Support Structure:

1. Condensate Drain Pans are IAQ design, 18-ga., 304 stainless steel and incorporate a double slope shape to eliminate standing water. All drain pans have a "Double Bottom" attached to welded structural steel base, with a minimum of 1.25" of polyurethane spray foam insulation under the drain pan under the lowest point. Drain connections are standard stainless steel 1-1/4" MPT connection. All coils are self-supported to reduce unit height to a minimum. All coils shall be mounted on raised supports above drain pan to facilitate cleaning and coil removal. Coils shall have independent removable access panels on both sides of the coil to allow for coil pull.

G. Access Doors and Panels:

1. Access doors are constructed with a double wall construction and an extruded aluminum frame. The door frame features a built-in no-through-metal high density resin barrier and a perimeter gasket. Door frames with no thermal break are not acceptable. The door gasket is seamed together at each corner to prevent leakage through the door. Door is attached to the unit with 3 axes adjustable stainless steel hinges. Doors shall open against higher pressure side. Where this is not feasible due to site constraints, an interlocking mechanism furnished on the fan section access door with a de-energizing switch complying with CAL-OSHA, ETL and the mechanical protection requirements of UL 1995 will be provided.
2. Inspection access panels and doors shall be sized and located to allow periodic maintenance and inspections. Provide access panels and doors in the following locations as shown on drawings
3. Dual-paned tempered glass with vacuum seal windows, molecular sieve sealant and thermally broken frames shall be supplied as shown on unit drawings. Singled paned windows are not acceptable.
4. All outward swinging doors must be equipped with a door chain to limit door swing.

2.05 FANWALL TECHNOLOGY®

A. Manufacturers

1. NAS, Nortek Air Solutions, including Governair, Huntair, Mammoth, Temtrol, Venmar, and Ventrol.
2. Approved Equal
 - a. Must be submitted per project specifications
 - b. Must guarantee submitted AHU performance for flow, pressure, and acoustics at the perimeter boundary of the unit.
 - c. Any corrective acoustical treatment, added airway tunnel lengths, increased electrical service, and any structural modifications necessary to meet specified and scheduled performance shall be provided at no additional cost to the owner to meet the specified performance criteria.

B. Fan Wheel HPF-A100

1. Fans shall be aluminum airfoil wheel, Class III, direct drive arrangement and shall be individually housed. Fans shall be certified by AMCA for performance. Fan shall be housed in a "cell".
2. Fan housing or "cell" shall be constructed of aluminum or stainless steel with perforated inner liner, melamine insulation, with either solid or perforated outer panels as required by application.
3. Fan/motor assembly shall be mounted within the housing on an adjustable slide rail base. Fan/motor assembly must be capable of either horizontal or vertical application.
4. Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204-96, for fan application class BV-5, to meet or exceed a rotational imbalance Grade G.55, producing a maximum rotational imbalance of 0.022 inches per second peak, filter in. "Filter in" measurement indicates that the specified balance grade must be achieved at the submitted design operating speed for the fan(s).
5. Fan and motor assemblies shall be designed for application in multiple fan arrays.
6. AC Motors:
 - a. All motors shall be standard foot mounted type, TEFC or TEAO motors selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere.
 - b. Motors shall meet the requirements of NEMA MG-1 Part 30 and 31, section 4.4.2.
 - c. Motors shall be as manufactured by Baldor, Siemens, or Toshiba. Motors shall be available in 1/2 HP increments at nameplate HP ratings from 1.5 HP through 12

HP.

- d. All motors shall include permanently sealed bearings and shaft grounding means to protect the motor bearings from electrical discharge machining due to stray shaft current. Motors provided with hybrid ceramic bearings, when specified, do not require shaft grounding devices.
- e. Steel cased motors and/or ODP motors are not acceptable.

C. Acoustical Performance

- 1. The AHU unit shall provide the specified acoustical performance as scheduled for the unit supply discharge opening(s), RA opening(s), and the Outside air and Exhaust air opening(s).
- 2. Coplanar silencer(s) and/or sound attenuator(s) shall be provided to meet specified acoustical requirements. Sound attenuator cross sectional area shall be selected to not exceed 500 fpm. Losses from sound attenuating devices must be included in the fan performance selection.
- 3. Listed or alternate manufacturers, other than the basis of design, providing fan arrays that incorporate fans which are not manufactured by the AHU manufacturer, must provide modeled acoustical performance of the AHU unit.
- 4. Sound and performance data for approval showing only single fan performance for multiple fan array application will be returned without review.
- 5. Any proposed remedy for deviations in submitted sound power levels shall be approved by a registered acoustical consultant as selected by the owner or architect. Costs for review of proposed changes shall be borne by the contractor.

D. Multiple Fan Arrays

- 1. The fan array shall consist of multiple housed fans or "cells", spaced in the air way tunnel cross section to provide a uniform air flow and velocity profile across the entire air tunnel cross section and components contained therein.
- 2. Each fan and motor assembly shall be removable through a 24" wide, free area, access door located on the discharge side of the fan wall array without removing the fan wheel from the motor.
- 3. All fans in the multiple fan arrays shall be AMCA certified for performance per AMCA arrangement "A" testing configuration. The submitted fan performance shall be inclusive of system effects attributed to the fan mounting arrangement, fan enclosures, back draft dampers, and other fan appurtenances not considered when AMCA certified performance per AMCA arr. "A" is determined. Submitted AHU/fan performance that does not indicate allowances for system effects for the back flow prevention device(s), wheel enclosures, safety screens, bearing pedestals, belt guards, or the fan and motor enclosure in which each fan is mounted, will be returned to the contractor disapproved and will need to be resubmitted with all of the requested information included for approval. Added system effects for acoustic attenuators, or other devices required to meet specified fan performance and sound levels must be indicated in the submitted fan selection data.
- 4. Fan system power requirements or sound power levels that fail to meet specified performance levels shall be corrected to meet specified performance levels at no additional cost to the owner. Any proposed corrections for power or sound deviations from specified values must be submitted to the engineer for approval prior to implementation of any proposed corrective procedure.
- 5. Submittals for units providing less than the scheduled quantity of fans and/or spacing of the fans for multiple fan arrays shall submit CFD modeling of the air flow profile for approval that indicates uniform velocity and flow across all internal components without increasing the length of the AHU unit or changing the aspect ratio of the unit casing as designed.
- 6. Manufacturers that do not manufacture their own fans for the specific purpose of use in multiple fan arrays, shall provide a letter guaranteeing submitted AHU performance for flow, pressure, and acoustics at the perimeter boundary of the unit signed by an officer of the OEM fan manufacturer being submitted. Any corrective acoustical treatment, added airway tunnel lengths, increased electrical service, and any structural modifications necessary to meet specified and scheduled performance shall be provided at no additional cost to the owner to meet the specified performance criteria. All proposed corrective actions, when required, must be submitted for approval and shall include a guarantee of performance, as listed above, at no additional cost to the

owner.

E. Backdraft dampers:

1. Each fan applied in multiple fan applications shall be provided with an integral back flow prevention device that prohibits recirculation of air in the event a fan, or multiple fans, becomes disabled. The system effect for the submitted back flow prevention device shall be included in the calculation to determine the fan TSP for fan selection purposes, and shall be indicated as a separate line item SP loss in the submitted fan selection data. Manufacturers other than the basis of design being submitted must provide independent lab certification of fan testing that indicates the system effects attributed to the submitted back flow prevention device in the submitted close coupled mounting arrangement at the inlet of the fan. Fans submitted with discharge dampers will not be approved.
2. Back Draft Damper performance data that is based on an AMCA ducted inlet and ducted discharge mounting configuration will not be accepted. Submitted Back flow prevention device data must be reflective of close coupled mounting at the intake of the fan(s) per the project design documents. Motorized dampers or other motorized devices submitted for back flow prevention are not acceptable.
3. AHU Manufacturers that do not manufacture the fans being submitted must provide tested and certified performance data for fans as installed in the AHU unit including the back draft damper system effects introduced by close coupled back draft dampers at the fan inlet.

F. Control Panel

1. Each fan motor shall be individually wired to a motor control panel containing motor overloads and VFD(s).
 - a. Each motor having its own VFD (Required for FANWALL® System Optimization Controls)
2. Each control panel shall have a single point electrical power connections. Therefore, units with supply and return fan wall would have two power connections.
3. Wire sizing shall be determined, and installed, in accordance with applicable NEC standards and local code requirements.

2.06 COILS

A. Heating Coils:

1. Hot Water coils: AHRI Certified Performance, Continuous circuit, Self-draining unless noted on performance output.
 - a. Piping connections: Same end of coil
 - b. Tube Material: Round Seamless Copper
 - 1) 5/8" od. x 0.035" tube wall [15.8 mm x .889 mm]
 - c. Fin Type: Corrugated plate with full drawn collar for accurate spacing.
 - d. Fin Thickness / material / tube size:
 - 1) 0.010" [.254 mm] Aluminum on 5/8" tube
 - e. Fin Spacing: FPI (fins per inch) / tube size
 - 1) 6 thru 14 FPI on 5/8" tube
 - f. Fin and Tube Joint: Tubes are mechanically expanded.
 - g. Coil Headers:
 - 1) Type L Seamless copper with 5% silver brazed joints
 - 2) Vent & Drain located at high and low point to provide gravity drain.
 - 3) Red Brass Male npt connections (std)
 - 4) Red Brass Grooved (Victaulic) connections
 - 5) Copper o.d. sweat connections
 - h. Coil Casing:
 - 1) 304 Stainless steel 16ga. or 14ga.
 - i. Leak testing:
 - 1) Entire coil assembly submerged in water and filled with Nitrogen at 315 psig.
 - j. Coil Working-Pressure Rating: 250 psig at 300 deg F

B. Cooling Coils:

1. Chilled Water coils: AHRI Certified Performance, Continuous circuit, Self-draining unless noted on performance output.
 - a. Piping connections: Same end of coil

- b. Tube Material: Round Seamless Copper
 - 1) 5/8" od. x 0.035" tube wall [15.8 mm x .889 mm]
 - c. Fin Type: Corrugated plate with full drawn collar for accurate spacing.
 - d. Fin Thickness / material / tube size:
 - 1) 0.010" [.254 mm] Aluminum on 5/8" tube
 - e. Fin Spacing: FPI (fins per inch) / tube size
 - 1) 6 thru 14 FPI on 5/8" tube
 - f. Fin and Tube Joint: Tubes are mechanically expanded.
 - g. Coil Headers:
 - 1) Type L Seamless copper with 5% silver brazed joints
 - 2) Vent & Drain located at high and low point to provide gravity drain.
 - 3) Red Brass Male npt connections (std)
 - 4) Red Brass Grooved (Victaulic) connections
 - 5) Copper o.d. sweat connections
 - h. Coil Casing:
 - 1) 304 Stainless steel 16ga. or 14ga.
 - i. Leak testing:
 - 1) Entire coil assembly submerged in water and filled with Nitrogen at 315 psig.
 - j. Coil Working-Pressure Rating: 250 psig at 300 deg F
2. DX Evaporator coil:
- a. Piping connections: Same end of coil
 - b. Tube Material: Round Seamless Copper
 - 1) 5/8" od. x 0.020" tube wall [15.8 mm x .508 mm]
 - c. Fin Type: Corrugated plate with full drawn collar for accurate spacing.
 - d. Fin Thickness / material / tube size:
 - 1) 0.008" [.203 mm] Aluminum on 5/8" tube
 - e. Fin Spacing: FPI (fins per inch) / tube size
 - 1) 6 thru 14 FPI on 5/8" tube
 - f. Fin and Tube Joint: Tubes are mechanically expanded.
 - g. Coil Headers:
 - 1) Type L Seamless copper with 5% silver brazed joints
 - 2) Copper o.d. sweat connections.
 - h. Coil Distributors:
 - 1) Interchangeable (removeable) nozzle type distributors
 - i. Coil Casing:
 - 1) 304 Stainless steel 16ga. or 14ga.
 - j. Leak testing:
 - 1) Entire coil assembly submerged in water and filled with Nitrogen at 315 psig.
 - k. Coil Working-Pressure Rating: 250 psig at 300 deg F

2.07 FILTERS, FILTER FRAMES, AND FILTER BANKS

- A. Pre-Filters:
- B. Final Filter - Rigid Type:
 - 1. The filter shall be a high performance, deep pleated, totally rigid type and shall consist of a glass fiber media, media support frame, contour stabilizers, and enclosing frame. The filter media shall be a high density microfine glass fiber laminated to a non-woven synthetic backing to form a lofted filter blanket. The media shall provide superior dust holding, moisture resistance and overall performance with an initial MERV 14 rating. The media support shall be a welded wire grid with an effective open area of not less than 96%. The grid shall be bonded to the filter media to eliminate media oscillation and pull-away. The grid shall support the media both vertically and horizontally. Contour stabilizers shall be permanently installed on both the air entering and exiting sides of the filter media pack to insure the pleat configuration is maintained throughout the life of the filter. The enclosing frame shall be constructed of galvanized steel. It shall be constructed and assembled to provide a rigid and durable enclosure for the filter pack. The frame shall be bonded to the filter pack. Standard filter sizes shall be 12" x 24" x 12" and 24" x 24" x 12". All filter holding frames must be caulked in between them to minimize bypass air through the frames. Filters shall be American Air Filter Rigidil, or equal by Cam-Farr, Eco-Air or Airguard. Provide Dwyer

Instruments Inc Series 2000 Magnehelic gauges across each filter bank.

C. Filter Frame Assemblies:

1. Constructed of galvanized steel, specifically designed and sized to have matching mounting holes such that frames may be riveted together. Frame comes with pre-installed gasket so as to provide a surface onto which the filter will self-seal. Filter frames come with stiffeners which are installed between each column of filter frame. All filter holding frames are caulked in between them to minimize bypass air through the frames. Proper structural support (every 5 frames wide) is provided when reinforcement is required for attachment of frame assembly to existing AHU casing / building structure as well as complete safing and proper air seal.

2.08 STEAM DISTRIBUTION SHORT ABSORPTION MANIFOLD (HUMIDIFIER GRID):

- A. All humidifier sections shall have a stainless steel drain pan as minimum 12" longer than scheduled absorption distance. Manufacturer to mount humidifier dispersion tube panel only. (See the unit drawing for location). All exterior piping shall be done in the field by OTHERS. Humidity controls and safeties such as air proving and high limit to be provided by OTHERS. See the air handling unit schedule for humidifier capacities.
- B. Pressurized Short Absorption Manifold (use when boiler steam is available):
 1. Steam Distribution : Short absorption manifold type humidifiers as manufactured by Vapac, or approved equal:
 - a. Manifold header: The manifold header shall be constructed of type 304 stainless steel and installed at the bottom of the duct or air handler for a horizontal airflow installation. The header shall be mounted on supplied support brackets, sloped to ensure efficient condensate removal through the steam inlet connection without the use of a separate condensate connection/leg.
 - b. Dispersion tubes: The dispersion tubes shall be constructed of type 304 stainless steel. They shall be welded to the header, closely spaced and spanning the width of the duct. The dispersion tubes spacing shall be optimized for every application to provide the best steam coverage, and the required absorption distance. Each tube shall contain a single row of integrally formed holes facing the airflow for shorter absorption distances. The dispersion tubes shall be supplied with a top support bracket adjustable in height for easy field installation. Manifolds supplied with all around frames will not be accepted because of their higher pressure drop.
 - c. Tube holes: Each hole shall be formed to extend the tube material internally in a cylindrical shape to get the driest steam from the center of the tube and prevent any condensation entrainment through the holes. Added plastic/resin or stainless steel nozzles are not acceptable. The spacing between holes shall be optimized, spanning the height of the tube and sized to ensure constant pressure inside every tube for even steam distribution.
 - d. Pressurized Manifold Steam Accessories:
 - 1) The appropriate steam valve, actuator, steam trap and strainer shall be shipped loose for field installation by OTHERS.
 - 2) The steam valve body should be made of bronze and the valve trim should be made of stainless steel for extended life.
 - 3) The valve actuator should be electrical (24 Vdc) or pneumatic. For electric valve actuators, the control signal should be 0-10 Vdc or 4-20 mA.
 - 4) The steam trap should be of the Float and Thermostatic (F&T) type with a cast iron body. When using treated water (DI or RO), the trap should be of the stainless steel Inverted Bucket type.
 - 5) The Y strainer should be made of cast iron, except when using treated water (DI or RO) where stainless steel Y strainer should be supplied.

2.09 DAMPERS

- A. Low leakage aluminum dampers as made by TAMCO. Dampers are made of extruded aluminum airfoil blades with extruded EPDM blade gaskets and extruded TPE frame seals, 7/16" aluminum hexagon shaft, aluminum linkage crankarm, aluminum pivot pin, acetal copolymer inner bearing and polycarbonate outer, and a 12-ga. aluminum frame.
- B. LOUVERS
 1. Furnish and install louvers as herein after specified where shown on plans. Louvers shall possess stationary vertical blades designed to prevent the penetration of wind

driven rain. Louver blades shall be contained within a 3" frame. Extended sill shall be provided to capture and drain water to exterior of air handling unit. Louver components shall be assembled by the louver manufacturer. Louver design shall limit single section sizes to 48" x 96" and shall withstand a wind load of 20 lbs/ft² (equivalent to a 90 mph wind). Manufacturer shall be Ruskin, Model # EME3625

2. Construction

- a. Frame
 - 1) Extruded aluminum alloy 6063-T5 with nominal wall thickness of 0.062" and 3" deep
- b. Blade
 - 1) Extruded aluminum alloy 6063-T5 vertically mounted with nominal wall Thickness of 0.040" spaced 0.75" center to center.
- c. Bird Screen
 - 1) Aluminum, 1/2 inch x 0.063 inch square mesh in a removable frame.
- d. Sill flashing is formed aluminum, 0.081" with end dams.
- e. All louver components shall be factory assembled.
- f. Louvers shall be tested in accordance with AMCA 500-L Wind Driven Rain Test.

2.10 HEAT WHEEL (INNERGY-TECH):

- A. Furnish and install the ERW3000 energy recovery wheel, to be manufactured by Innergy Tech Inc.
- B. The energy recovery wheel shall transfer both sensible and latent energies between outgoing and incoming air streams in a counter flow arrangement.
- C. The energy recovery wheel shall be labeled for direction of air flow, exhaust and supply inlets and outlets.
- D. The energy recovery wheel must be manufactured in North America.
- E. The energy recovery wheel manufacturer must have at least ten (10) years of experience in the manufacturing of energy recovery components.
- F. The rotor media shall be made of aluminum with a minimum thickness of 2 mil.
 - 1. All surfaces shall be coated with a non-migrating desiccant specifically developed for the water vapor transfer.
 - 2. Etched or oxidized surfaces are not acceptable.
 - 3. Desiccant must be a polymer hygroscopic coating.
 - 4. Desiccant shall be bactericide and non-corrosive.
 - 5. The rotor shall be constructed of equal width alternate layers of corrugated and flat aluminum sheet material to create a flat and smooth surface.
 - 6. Dry particles up to 800 microns shall freely pass through the wide angle media, minimizing air pressure drop and pre-filtering requirements.
 - 7. As specified in ASHRAE 52.2-1999, MERV 6 type filters shall be used on both faces of the wheel..
- G. Purge & Casing Assembly
 - 1. The unit shall be provided with a factory set, but field adjustable, purge section designed to limit cross contamination when operated under appropriate design conditions.
 - 2. The rotor shall be provided with a structural frame which limits the deflection of the rotor due to air pressure differential to less than 1/16 of an inch.
 - 3. The framing shall be made of heavy-duty welded tubular steel construction.
 - 4. Framing shall be painted with polyester based enamel.
 - 5. The cover panels shall be made of galvanized steel to prevent corrosion.
 - 6. The cassette shall be mounted with removable cover panels for service access to the motor and drive.
 - 7. The rotor shall be supported by two pillow block bearings which can be maintained or replaced without removal of the rotor from its casing or the media from its spoke system.
- H. Rotor Seals
 - 1. The rotor shall be supplied with non-contact labyrinth seals facing the media and with nylon contact seals on all other surfaces.
 - 2. The seals shall be specifically designed to compensate for pressure fluctuations.

3. The seals shall be adjustable to ensure proper sealing.
- I. Rotor frame system
 1. Rotor spoke system shall be a segmented design.
 2. The rotor spoke system shall be made of strong aluminum materials providing the structural integrity required at design pressure differentials.
- J. The rotor hub shall be made of extruded aluminum, without welding, for precision machining and stiffness.
- K. Drive system
 1. The rotor shall be driven by a high performance link belt made of polyurethane elastomer reinforced with polyester for easier installation and replacement.
 2. An A/C inverter duty motor shall drive the rotor.
 3. Wheel shall be perimeter driven.
 4. Speed reduction is available by pulley change out or by controlling the motor frequency.
 5. Speed reducer shall be permanently lubricated.
- L. Options
 1. VFD controllers.
- M. Quality Assurance Specifications
 1. The energy recovery wheel shall be a UL recognized component and bear the UL mark.
 2. The energy recovery wheel shall comply with the requirements of UL723.
 3. The manufacturer's quality procedures shall be ISO 9001-2000 certified.
 4. The manufacturer shall be a participant in the ARI Standard 1060-2005 certification program.
- N. Performance Specifications
 1. The energy recovery wheel shall bear the ARI 1060-2005 Standard Certified Product Seal.
 2. Sensible, latent and total effectiveness along with pressure drop, EATR and OACF ratings, shall be clearly documented in the ARI Certified Product Directory (Standard 1060-2005).
 3. Performance tests shall be conducted in accordance with AHSRAE Standard 84-91.

2.11 ELECTRICAL

- A. An interlocking mechanism is furnished on the fan section access door. The de-energizing switch is compliance with CAL-OSHA, ETL and the mechanical protection requirements of UL 1995.
- B. Motor starter panels with main disconnect.
- C. Each motor is wired to a junction box mounted on the unit exterior.
- D. Each motor is wired to a non-fused disconnect (with auxiliary switch).
- E. Units are equipped with two electrical cabinet unit heaters.
- F. Units are equipped with vapor proof light fixture(s) with guard. Unit drawing's fixture locations are approximate. Lights shall be controlled by one switch or each light will have its own switch. Refer to unit plans for details. Conduit for lights and outlets shall be electrical metallic tube (EMT). Flexible conduit connections shall be liquid tight. All junction boxes shall be gasketed.
- G. Units are equipped with vapor proof light fixture(s) with fluorescent bulbs (with guard). Unit drawing's fixture locations are approximate. Lights shall be controlled by one switch or each light will have its own switch. Refer to unit plans for details. Conduit for lights and outlets shall be electrical metallic tube (EMT). Flexible conduit connections shall be liquid tight. All junction boxes shall be gasketed.
- H. 120 Volt G.F.I convenience outlets provided. See drawings for quantity and locations
- I. Motor Wiring: Motor shall be wired to NEMA-1 enclosure located on the exterior of unit fan housing. Conduit shall be appropriately sized EMT with a 3 ft. section of Greenfield flex conduit at the motor to provide a vibration loop. EMT conduit used up to 100 HP, TEK wire used on 100 HP and up, when single point wiring is required.

- J. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 16.
- K. AHU tag must bear the ETL label.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.
- B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.
- C. Examine roofs for suitable conditions where RTUs will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install on structural steel support frame. Secure unit to frame per the manufacturer's recommendations.

3.03 CONNECTIONS

- A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- B. Install hot water heating piping up through the unit curb. Exposed, exterior piping is not acceptable.
- C. Duct installation requirements are specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination at top of roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
 - 4. Install return-air duct continuously through roof structure.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.
- C. Tests and Inspections:
 - 1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

3.05 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to compressor, coils, and fans.
 - 3. Inspect internal insulation.
 - 4. Verify that labels are clearly visible.
 - 5. Verify that clearances have been provided for servicing.

6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Clean condenser coil and inspect for construction debris.
9. Remove packing from vibration isolators.
10. Inspect operation of barometric relief dampers.
11. Verify lubrication on fan and motor bearings.
12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system.
 - b. Do not operate below recommended low-ambient temperature.
 - c. Complete startup sheets and attach copy with Contractor's startup report.
15. Inspect and record performance of interlocks and protective devices; verify sequences.
16. Operate unit for an initial period as recommended or required by manufacturer.
17. Calibrate thermostats.
18. Adjust and inspect high-temperature limits.
19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
20. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outdoor-air, dry-bulb temperature.
 - d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
21. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
22. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.
23. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
24. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
 - a. High-temperature limit on gas-fired heat exchanger.
 - b. Low-temperature safety operation.
 - c. Filter high-pressure differential alarm.
 - d. Economizer to minimum outdoor-air changeover.
 - e. Relief-air fan operation.
 - f. Smoke and firestat alarms.
25. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.06 CLEANING AND ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site during other-than-normal occupancy hours for this purpose.
- B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

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SECTION 238125
COMPUTER ROOM AIR CONDITIONERS - CEILING MOUNTED

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air conditioning units.
- B. Controls.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers literature and data indicating water, drain, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate procedures required for rigging and making service connections.
- D. Manufacturer's Field Reports: Indicate conditions at initial start-up including date, and initial set points.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Filters: One set for each individual unit.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide a five year warranty to include coverage for refrigeration compressor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. American Power Conversion Corporation, a brand of Schneider Electric: www.apcc.com/#sle.
- B. Compu-Aire, Inc: www.compu-aire.com/#sle.
- C. Liebert, a brand of Vertiv Co: www.vertivco.com/#sle.
- D. Substitutions: See Section 016000 - Product Requirements.

2.02 AIR CONDITIONING UNITS

- A. Description: Self contained air cooled, factory assembled, pre-wired and pre-piped unit, consisting of cabinet, fan, filters, humidifier, controls.
- B. Assembly: For horizontal ceiling mounting to fit 24 by 48 inches T-bar ceiling opening.
- C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
- D. Energy Efficiency:
 - 1. Air-Cooled Unit Capacity: Greater than or equal to 65 kBtu/h and less than 135 kBtu/h:
 - a. Energy Efficiency Ratio: 8.90.
 - b. Coefficient of Performance: 3.02.
- E. Cabinet: 10 gauge, 0.1345 inch welded steel with baked enamel finish, and lined with 1/2 inch thick acoustic duct liner.

- F. Evaporator Fan: Forward curved centrifugal, directly driven by two speed motor.
- G. Evaporator Coil: Direct expansion cooling coil of seamless copper tubes expanded into aluminum fins, with thermal expansion valve with external equalizer, liquid line filter-drier, service shut-off valves and charging valves. Mount coil assembly in stainless steel drain pan.
- H. Remote Air Cooled Condensing Unit:
 - 1. The condensing unit shall be designed for outdoor use with either roof or ground level mounting. The condensing unit is constructed of galvanized and galvanized painted steel for corrosion resistance. Removable exterior panels shall allow access to the electric panel or refrigeration components for service or maintenance. Both inlet and outlet air grilles shall be heavy duty steel with a durable polyester coating.
 - 2. Condensing unit components shall include a condenser coil, a direct-drive propeller-type fan, a scroll compressor with vibration-isolating grommets, high pressure switch and head pressure control valve, hot gas bypass system, pressure balancing valve and liquid line solenoid valve. The condenser coil shall be constructed of copper tubes and aluminum fins.
 - 3. A hot gas bypass system shall be provided to reduce compressor cycling and improve operation under low load conditions. The system shall be completely contained in the condensing unit. A field-installed third refrigerant line shall not be acceptable. Hot gas bypass shall be automatically deactivated upon a call for dehumidification.
 - 4. High pressure switch shall protect the unit from abnormal refrigerant pressure conditions and shall deactivate the compressor and annunciate an alarm at the wall controller. The blower shall continue to circulate air. The wall controller shall be used to manually restart the compressor function after the automatic pressure switch resets. Three high head pressure alarms in a rolling 12-hour period shall lock out the manual restart feature until power is cycled to the evaporator unit.
 - 5. A pressure balancing valve shall be factory installed to reduce the chance of high pressure cut-out due to excessive refrigerant migration to the receiver due to changing outdoor temperatures during off-cycles.
 - 6. The refrigerant piping shall be nitrogen holding charge. Field relief of the Schrader valves shall indicate a leak-free system. Evaporator and condensing unit shall be field piped using copper lines, brazed, evacuated and field charged with R-407C refrigerant. Condensing unit shall be designed for 95°F (35°C) ambient and be capable of operation to -30°F (-34.4°C).
- I. Filter: 1 inch thick disposable glass fiber media.
- J. Electrode Steam Type Humidifier: The system shall be equipped with a steam generating humidifier that is controlled by the microprocessor control system. It shall be complete with disposable canister, all supply and drain valves, 1" (25.4mm) air gap on fill line, inlet strainer, steam distributor and electronic controls. The need to change canister shall be annunciated on the wall controller. The humidifier shall have a capacity of 2.5 lb/hr (1.1 kg/h). An LED light on the humidifier assembly shall indicate cylinder full, overcurrent detection, fill system fault and end of cylinder life conditions. The canister flush water shall not drain into the coil drain pan, due to risk of aggressive corrosion of the evaporator coil. The humidifier wand shall be mounted over the coil drain pan.
- K. Factory Installed Sensors:
 - 1. Filter Clog Switch: The filter clog switch senses pressure drop across the filters and shall annunciate the wall controller upon reaching the adjustable setpoint. The filter clog switch shall be factory installed in every cooling unit.
 - 2. High-Temperature Sensor: The high-temperature sensor shall immediately shut down the system when high temperatures (125°F, 51.7°C) are detected. The high-temperature sensor shall be mounted with the sensing element in the return air of every cooling unit.

2.03 CONTROL SYSTEM

- A. Controls: Solid state wall mounted with start/stop switch, adjustable humidity setpoint, adjustable temperature setpoint.
- B. Alarms: The control system shall monitor unit operation and activate an audible and visual alarm in the event of the following factory preset alarm conditions:
 - 1. High Temperature

2. Low Temperature
 3. High Humidity
 4. Low Humidity
 5. High Water Alarm - Lockout Unit Operation
 6. High Head Pressure
 7. Loss of Power
 8. Compressor Short Cycle
- C. Custom Alarms:
1. Humidifier Problem.
 2. Filter Clog.
 3. Smoke Detected.
- D. Alarm Controls: Each alarm (unit and custom) shall be individually enabled or disabled (except for high head pressure and high water in condensate pan) and can be programmed for a time delay of 0 to 255 seconds of continuous alarm condition to be recognized as an alarm. Each alarm can also be enabled or disabled to activate the common alarm (except high head pressure and high water in condensate pan).
- E. Audible Alarm: The audible alarm shall annunciate at the wall-mounted controller any alarm that is enabled by the operator.
- F. Common Alarm: A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device. Alarms shall be enabled or disabled from reporting to the common alarm.

2.04 ACCESSORIES

- A. A factory-supplied supply and return grille kit shall be provided for supply and return air delivery through a 2' x 4' (0.6m x 0.6m) T-bar ceiling grid where indicated on schedule. Kit shall include an air baffle plate, supply grille, hinged return grille, 1" x 20 x 20" (25.4mm x 508mm x 508mm) MERV 8 (ASHRAE 52.2-2007) filter and mounting frame.
- B. Condensate Pump: The condensate pump shall be complete with integral float switch, discharge check valve, pump, motor assembly and reservoir. A secondary float switch on the condensate pump shall tie into the unit to provide an alarm on the wall-mounted controller and shut down the unit upon high water in the basin of the pump. Condensate pump shall be powered from the AC unit. A separate electrical feed is not acceptable.
- C. Remote Monitoring and Control - BMS Field-Installed Unit-Mount Kit
1. The Monitoring Solution shall provide SNMP v1/v2c/v3, BACnet IP, BACnet MSTP, Modbus TCP/IP, and Modbus RTU monitoring capability to the AC system. Card shall employ Ethernet and RS-485 networks to monitor and manage a wide range of operating parameters pertaining to the cooling system. The card shall provide access to the AC unit remotely via a web interface. The unit-mount external enclosure kit for field-installation shall include the IS-UNITY-DP card, power/communication interface card, galvanized steel enclosure, power and communication wire harnesses and full instructions. Field-supplied wiring for communication from the Liebert Mini-Mate2 to other systems shall be required to access features.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that ceiling system is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate installation of air conditioning unit with other ceiling-mounted components.

3.03 SYSTEM STARTUP

- A. Set initial temperature and humidity set points. Instruct operating personnel.

END OF SECTION

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SECTION 238413 HUMIDIFIERS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Boiler Steam Exchange - Nortec SETC Series Humidifier[s] as indicated on drawing[s] and as indicated on schedule[s].
- B. Complete and operable humidification system [which meets applicable building codes].
- C. Equipment start-up and project inspection by qualified factory trained representative.

1.02 QUALITY ASSURANCE

- A. Certifications, C-UL US Listed.
- B. ISO 9001-2004.
- C. ANSI/NFPA 70 - National Electrical Code.
- D. AHRI 640, "Standard for Commercial and Industrial Humidifiers.
- E. Products shall be supported with a warranty that ensures the product will be free from defects in materials and workmanship for a period of two years after installation or 30 months from manufacturer's ship date, whichever is earlier. The heat exchanger(s) will have an additional warranty that ensures the heat exchanger will be free from defects in materials and workmanship for an additional year, for a total period of 3 years from installation or 40 months from the manufacturer's ship date, whichever is earlier.

1.03 SUBMITTALS

- A. Submit product data under provisions of division 1. Include product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes. Include rated capacities, operating weights, furnished specialties, and accessories.
- B. Submit manufacturer's installation instructions.
- C. Submit operation and maintenance data.
- D. Submit coordination drawings. Detail fabrication and installation of humidifiers. Include piping details, plans, elevations, sections, details of components, and dispersion tubes.
- E. Detail humidifiers and adjacent equipment. Show support locations, type of support, weight on each support, and required clearances.
- F. Submit wiring diagrams including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- G. Submit minimum water quality requirements and water pressure requirements.

PART 2 - PRODUCTS

2.01 STEAM EXCHANGE HUMIDIFIER

- A. The NORTEC SETC steam exchange system uses all water types including, De-Ionized (DI), Reverse Osmosis (RO), potable and softened water.
- B. Packaged unit, wall mounted, steam exchange humidifier operating with boiler steam pressures between 5 psi to 15 psi, with output capacities up to 1050 lbs/hr (477 kg/hr).
- C. Unit to be complete with:
 - 1. Enclosed cabinet, powder painted steel construction and air gap between cabinet and insulated humidifier tank ensures safe surface temperature.
 - 2. All tank surfaces shall be insulated with minimum 1" (25 mm) thick insulation and enclosed within unit cabinetry to ensure safe surface temperature, high overall efficiency, and fast unit response time. Units with exposed insulation shall not be acceptable.
 - 3. Standard internal drain water cooler to ensure drain water tempering to 140° F [60° C]. If external drain water cooler required, provide factory cross-braced unit stand and factory supplied stainless steel water seal.
 - 4. Blow-down p-trap, factory installed, enclosed in cabinet, prevents steam leakage to drain. Field installation not acceptable.
 - 5. Humidifier to prevent "back-siphoning" using an internal air gap for supply water, to meet local plumbing codes.

6. Drain line to include a vacuum breaker to prevent siphon drainage of the tank.
 7. Stainless steel heat exchanger[s] shall have flat surfaces to retard scale build-up. Tubular heat exchangers are not acceptable.
 8. Stainless Steel heat exchanger(s) shall be heat treated to protect against possible stress corrosion cracking. Heat exchanger(s) that are not heat treated stainless steel are not acceptable.
 9. Stainless steel tank lid with gasket, easily removed for maintenance.
 10. Tank must have replaceable magnesium alloy sacrificial anode.
 11. Float and thermostatic (F & T) trap[s], must be included internal to the unit.
 12. Automatic water level control within a separate float chamber, isolated from the boiling action, to prevent false water level indication.
 13. Dual magnetic electronic float system, located outside of the boiling water to ensure accurate water level control and reduced maintenance. Cool fill water is to be supplied into the sensing chamber to keep the device cool. Systems using conductivity probes or floats located within hot reservoir water are not acceptable.
 14. Humidifier shall have a dual fill valve to feed water to the tank and float chamber, to reduce scaling and mineral build up on the magnetic floats.
 15. Float chamber to include LED indication of five possible water level indications.
 16. Pre-cleaning flushing feature shall be provided to reduce maintenance time.
 17. Must include end of season blow-down feature to evacuate contained water and minerals after 72 hours with no demand for humidification.
 18. Factory mounted, full size, backlit, Liquid Crystal Display provides full operational status. Display to include a keypad for user interface and adjustment of operational parameters.
- D. Steam Distribution - Nortec Short Absorption Manifold complete with:
1. Steam dispersion panel consisting of a (one) horizontal stainless steel header supplying steam to a bank of vertical tubes, spaced closely as necessary to meet absorption distance requirements, and to reduce condensation loss. Refer to schedule[s] for project specifics.
 2. Single horizontal stainless steel header to provide steam to vertical distributor tubes and to reduce condensation losses. Dual header systems creating unnecessary heat loss, or systems needing to be installed on a partition or requiring blank off plates are not acceptable.
 - a. Headers shall be welded stainless steel construction.
 - b. Header design is primarily round tube to minimize pressure drop. Square headers are not acceptable. (Full size SAM-e only).
 - c. Slim rectangular profile header design to minimize pressure drop. (Mini SAM-e only).
 - d. Steam inlet and condensate return located on same side of header to allow single point entry and floor mounting. Condensate return shall be located at lowest point of header.
 3. Vertical stainless steel distribution tube to promote condensation evacuation. Horizontal distributor tubes are not accepted.
 - a. Tubes shall be primarily stainless steel construction.
 - b. Distribution tubes shall include provisions for a top bracket. Factory supplied top bracket shall be provided to ensure adequate support of tubes in duct.
 - c. Stainless steel nozzle inserts ensure condensate free steam is discharged from the center of the distribution tubes. Tubes without nozzle inserts are not acceptable.
 - d. Stainless steel nozzles shall be made from similar material as the tubes to ensure similar expansion and contraction coefficients. Tubes with nozzles made from dissimilar metals or polymers are not acceptable.
 - e. Stainless steel nozzle inserts shall have metered orifices, sized to provide even distribution of the discharged steam, spaced for optimum steam absorption.
 4. Steam Inlet
 - a. Steam inlet configuration selection based on pressurized or atmospheric steam applications. Refer to schedule[s] for project specifics.
 - 1) For pressurized steam, inlet is determined by the size of the selected steam valve.
 - 2) For atmospheric steam, inlet is determined by the selected humidifier.

- E. Insulation
 - 1. Tubes and headers include insulation for increased energy efficiency. Uninsulated tubes and headers not acceptable.
 - 2. Tube and header insulation constructed from stainless steel shielding for increased energy efficiency and reduced airstream heat gain. Stainless steel shields to be isolated from distributor using plenum rated synthetic foam strips. Insulation to provide air-gap to minimize conduction and convection, as well provide reflective surface to minimize radiating heat transfer. Tubes and/or headers insulated with ceramic or foam wrap type insulations not acceptable.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install humidifiers per manufacturers' instructions.
- B. Install with required clearance for service and maintenance.
- C. Install accessories in accordance with manufacturer's recommendations.

3.02 START-UP

- A. Start-up of humidifier to be by factory trained technician.

END OF SECTION

**SECTION 260010
GENERAL PROVISIONS FOR ELECTRICAL WORK**

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The work included in this Contract is shown on the drawings and described in these specifications. It consists of furnishing all labor, material, services, supervision and connection of all systems shown and/or specified including the requirements of:
 - 1. DIVISION 00 - BIDDING AND CONTRACT REQUIREMENTS
 - 2. DIVISION 1 - GENERAL REQUIREMENT
 - 3. DIVISION 26,27,28 - GENERAL REQUIREMENT
- B. Contractor is responsible to review and understand all drawings and all work of all trades to ensure a complete and thorough project.
- C. Provide all labor, tools, materials, equipment, coordination, and plans necessary for installation and proper operation of the electrical systems.
- D. Contract drawings and specifications are complementary and must be so used to ascertain all requirements of the work.

1.02 DEFINITIONS

- A. Provide, furnish, install, and furnish and install shall have the same meaning. That is, the Contractor shall purchase, transport to the site and install all required components of the work unless specifically stated otherwise in the contract documents.
- B. Wiring pertains to raceway, fittings, conductors, terminations, hangers, supports, etc. as required to form a complete system.

1.03 DRAWINGS AND SPECIFICATIONS

- A. The plans are diagrammatic and indicate only the sizes and general arrangement of conduit, devices, and equipment; exact locations of all elements shall be determined as work progresses, in cooperation with the work of other trades. It is not intended to show every item of work or minor piece of equipment, but every item shall be furnished and installed without additional remuneration as necessary to complete the system in accordance with the best practice of the trade.
- B. As previously stated, the exact locations of electrical devices and equipment are diagrammatic. The owner may request for any devices or equipment to be installed at different locations than what is indicated on the drawings in a specific area or room. It is the responsibility of the Electrical Contractor to coordinate the locations of devices in all areas prior to installation.

1.04 PRODUCT EQUIVALENTS

- A. Where, in these specifications or on drawings, certain kinds, types, brands, or manufacturers of materials are named, they shall be regarded as required standard of quality. Where two or more are named these are presumed to be equal, and Contractor may select one of those items.
- B. If Contractor desires to use any kind, type, brand, or manufacturer of material other than those named in specification, he may submit the request for approval to the Architect well in advance of the bid date.
- C. Requests for approval of proposed equivalents will be received by Architect only from the Contractor.
- D. If the Architect approves a proposed equivalent prior to receipt of Bids, such approval will be set forth in an Addendum.
- E. After the bid opening the apparent low bidder or bidders will be notified by the Architect or Owner and shall submit to the Architect in writing, within ten (10) calendar days what equivalent kind, type, brand, or manufacture is included in bid in lieu of specified items. No equivalents will be considered after this submission.
- F. Contractor shall have burden of proving, at Contractor's own cost and expense, to satisfaction of Owner/Architect, that proposed product is similar and equal to named product. In making such determination Owner/Architect will be sole judge of objective and

appearance criteria that proposed product must meet in order for it to be approved.

1. Supporting data on equivalency is responsibility of bidder. For each equivalent to base specification, included in products list, submit information describing in specific detail:
 - a. Wherein it differs from quality and performance required by base specification.
 - b. Changes required in other elements of work because of equivalent.
 - c. Effect on construction schedule.
 - d. Any required license fees or royalties.
 - e. Availability of maintenance service, and source of replacement materials.
 - f. Such other information as may be required by Owner.
- G. Owner, through Architect, shall be judge of acceptability of proposed equivalents. Risk of whether bid equivalents will be accepted is borne by Contractor.
- H. Submission of an equivalent product and/or material constitutes a representation that Contractor:
 1. Has investigated proposed product and determined it is equal to or superior in all respects to that specified.
 2. Will provide same warranties or bonds for equivalent as for product specified.
 3. Will coordinate installation of an accepted equivalent into work and make such other changes as may be required to make work complete in all respects.
 4. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
 5. Will provide, at own cost and expense, any different quantity and/or arrangement of ductwork, piping, wiring, conduit or any part of work from that specified, detailed or indicated in Contract Documents if required for proper installation of an approved equivalent.
 6. Will provide, at own cost and expense, all such revision and redesign and all new drawings and details required by Architect for approval if proposed equivalent product requires a revision or redesign of any part of work covered by this contract.
- I. Contractor must sign the "Equivalent Certification" following this specification section and deliver it to the Architect along with a complete list of proposed equivalents within ten (10) calendar days after notification from the Architect or Owner. This is mandatory and must be done prior to award of contracts.

1.05 APPLICABLE STANDARDS

- A. All equipment shall bear the UL label.
- B. The latest edition of the following minimum standards shall apply wherever applicable:
 1. American Standards Association
 2. American Society for Testing Materials
 3. Electrical Testing Laboratories, Inc.
 4. Institute of Electrical and Electronic Engineers
 5. Insulated Power Cable for Engineers Association
 6. Occupational Safety and Health Act
 7. National Electric Code
 8. National Electrical Manufacturers Association
 9. National Electrical Safety Code
 10. National Fire Protection Association
 11. Underwriters Laboratories, Inc.
 12. Power company standards and regulations.
 13. Local and state codes.
- C. In the event there are conflicts between specifications and standards, standards shall govern unless specifications are in excess of standards.

1.06 PERMITS AND INSPECTIONS

- A. Permits: The Contractor shall apply for and pay the cost for any local permits necessary for the work of this contract.
- B. Inspections: The Contractor shall be responsible for obtaining a 3rd party electrical inspection of and the certificate by the approved inspection agency for the entire electrical system.

- C. The undertaking of periodic inspections by the Owner or Engineer shall not be construed as supervision of actual construction. The Owner or Engineer is not responsible for providing a safe place of work for the Contractor, Contractor's employees, suppliers or subcontractors for access, visits, use, work, travel or occupancy by any person.

1.07 CODES AND REGULATIONS

- A. Comply with all applicable rules and regulations of the municipal laws and ordinances and latest revisions thereof. All work shall be done in full conformity with the requirements of all authorities having jurisdiction. Modifications required by the above authorities will be made without additional charges to the Owner. Where alterations to and/or deviations from the Contract Documents are required by the authorities, report the requirements to the Engineer and secure approval before work is started.
- B. Furnish and file with the proper authorities, all drawings required by them in connection with the work. Obtain all permits, licenses, and inspections and pay all legal and proper fees and charges in this connection.
- C. Should any work shown or specified be of lighter or smaller material than Code requires, same shall be executed in strict accordance with the regulations.
- D. Heavier or larger size material than Code requires shall be furnished and installed, if required by the Plans and Specifications.
- E. This Contractor shall have the electrical work inspected from time to time by authorized inspectors and shall pay all expense incurred by same. At the completion of the work, the Contractor shall furnish a Certificate of Approval, in triplicate, indicating full approval of the work furnished and installed in this Contract from the local authority having jurisdiction.
- F. Equipment and components parts thereof shall bear manufacturer's name-plate, giving manufacturer's name, size, type and model number or serial number, electrical characteristic to facilitate maintenance and replacements. Name plates of distributors or contractors are not acceptable.
- G. Engineer will have privilege of stopping any work or use of any material that in his opinion is not being properly installed and each Contractor shall remove all materials delivered, or work erected, which does not comply with Contract Drawings and Specifications, and replace with proper materials, or correct such work as directed by the Engineer, at no additional cost to Owner.
- H. If equipment or materials are installed before proper approvals have been obtained, each Contractor shall be liable for their removal and replacement including work of other trades affected by such work, at no additional cost to Owner, if such items do not meet intent of the Drawings and Specifications.

1.08 RECORD DRAWINGS

- A. The Electrical Contractor shall keep an accurate location record of all underground and concealed piping, and of all changes from the original design. He is required to furnish this information to the Engineer prior to his application for final payment.
 - 1. Submit prior to final acceptance inspection, one complete marked-up set of reproducible engineering design drawings.
 - a. Fully illustrate all revisions made by all crafts in course of work.
 - b. Include all field changes, adjustments, variances, substitutions and deletions, including all Change Orders.
 - c. Exact location of raceways, equipment and devices.
 - d. Exact size and location of underground and under floor raceways, grounding conductors and duct banks.
 - e. These drawings shall be for record purposes for Owner's use and are not considered shop drawings.
- B. At completion of the project, all changes and deviations from the Contract Documents shall be recorded by the Contractor.
- C. Four (4) corrected sets of all operating and maintenance instructions and complete parts lists bound in hard covers shall be furnished to the Owner.

1.09 SLEEVES

- A. Sleeves: furnished, set in Electrical Work; built-in under General Construction Work.

- B. Sleeves shall be as follows:
 - 1. Sleeves in floors and partitions shall be galvanized steel with lock seam joints or a manufactured conduit floor seal.
 - 2. Sleeves of extra heavy cast iron pipe or galvanized steel pipe shall be used in outside walls, foundations, and footing or manufactured compression-type wall seal (waterproof).
 - 3. Conduit sleeves shall be two (2) sizes larger than the conduit passing through it.
 - 4. Terminate sleeves flush with walls, partitions, and ceilings. Sleeves in floor shall terminate 1/4" above floors.
 - 5. Fill space between sleeve and conduit in foundation walls with oakum and caulk with lead on both sides of wall. When using pipe sleeves, fill space between sleeve and pipe with fiberglass blanket insulation when sleeve does not occur in a foundation wall.
 - 6. An approved fire stop seal shall be used when conduits penetrate fire stopping walls and floors (between fire zone).
- C. Set sleeves, obtain review of their locations in ample time to permit pouring of concrete or progressing of other construction work as scheduled.

1.10 CLEANING CONDUIT, EQUIPMENT

- A. Conduit, equipment: thoroughly cleaned of dirt, cuttings, other foreign substances. Should any conduit, other part of systems be stopped by any foreign matter, disconnect, clean wherever necessary for purpose of locating, removing obstructions. Repair work damaged in course of removing obstructions.

1.11 VIBRATION ISOLATION

- A. Vibration isolators shall prevent, as far as practicable, transmission of vibration, noise or hum to any part of building.
- B. Design isolators to suit vibration frequency to be absorbed; provide isolator units of area, distribution to obtain proper resiliency under machinery load, impact.
- C. Wiring and other electrical connections to equipment mounted on vibration isolators; made flexible with minimum 180 degree loop of "greenfield" in order to avoid restraining equipment and short circuiting vibration isolator.

1.12 BALANCED LOAD

- A. It is intended that design and features of the work as indicated will provide balanced load on the feeders and main service. Contractor shall provide material and installation to provide this balance load insofar as possible.
- B. Contractor shall take current and voltage measurements at all panels of at least 1/2 hour. Reconnections of loads shall be made when deemed necessary by the Engineers.

1.13 JOB CONDITIONS

- A. Examine site related work and surfaces before starting work of any Section. Failure to do so shall in no way relieve the Contractor of the responsibility to properly install the new work.
 - 1. Report to the Engineer, in writing, conditions, which will prevent proper provision of this work ten (10) days prior to bid date, in time for an addendum to be issued.
 - 2. Beginning work of any Section without reporting unsuitable conditions to the Engineer constitutes acceptance of conditions by the Contractor.
 - 3. Perform any required removal, repair or replacement of this work caused by unsuitable conditions at no additional cost to Owner.
 - 4. The Contractor is responsible for performing routine maintenance and cleaning of any existing equipment where he is making connections to new work and to the building where his work adds debris.
- B. Connections to existing work:
 - 1. Install new work and connect to existing work with minimum interference to existing facilities.
 - 2. Provide temporary shutdowns of existing services only with written consent of Owner at no additional charges and at time not to interfere with normal operation of existing facilities.
 - 3. Maintain continuous operation of existing facilities as required with necessary temporary connections between new and existing work.

4. Do not interrupt alarm and emergency systems.
 5. Connect new work to existing work in neat and acceptable manner.
 6. Restore existing disturbed work to original condition including maintenance of wiring and continuity as required. Replace damaged or rusted conduit to which new equipment is being installed and connected.
- C. Removal and relocation of existing work.
1. Disconnect, remove or relocate electrical material, equipment and other work noted and required by removal or changes in existing construction.
 2. Provide new material and equipment required for relocated equipment.
 3. Disconnect load and line end of conductors feeding existing equipment.
 4. Remove conductors from existing raceways to be rewired.
 5. Remove conductors and cap outlets on raceways to be abandoned.
 6. Cut and cap abandoned floor raceways flush with concrete floor or behind walls and ceilings.
 7. Dispose of removed raceways and wire.
 8. Dispose of removed electrical equipment as directed by Owner. The Owner shall provide a list of equipment of the Contractor of equipment to be delivered to the Owner.

1.14 SPECIAL TOOLS AND LOOSE ITEMS

- A. Furnish to Owner at completion of work:
1. One set of any special tools required to operate, adjust, dismantle or repair equipment furnished under any section of this Division.
 2. "Special Tools": Those not normally found in possession of mechanics or maintenance personnel.
 3. Keys
 4. Redundant components and spare parts.
- B. Deliver items to Owner and obtain receipt prior to approval of final payment.

1.15 REVIEW OF CONSTRUCTION

- A. Work may be reviewed at any time by representative of the Engineer.
- B. Advise Architect and Engineer that work is ready for review at following times:
1. Prior to backfilling buried work.
 2. Prior to concealment of work in walls and above ceilings.
 3. When all requirements of contract have been completed.
- C. Neither backfill nor conceal work without Engineer's consent.

1.16 SHOP DRAWING SUBMITTALS

- A. Submit required shop drawings, samples and product information in accordance with Division 1, requirements and as required in the various sections of these specifications.
- B. Submittals shall show evidence of checking by the Contractor for accuracy. Product information (catalog sheets) shall indicate complete catalog number, color, accessories, etc., as well as, name of manufacturer and local distributor or manufacturer's representative.
- C. Submit for review detailed coordination drawings 3/8" or larger scale plans for all major electrical equipment and any areas of conflicts by drafting location of equipment, lighting fixtures, cable trays and conduits larger than 1-1/2" trade size. Contractor shall refer to Division 1 for preparing coordination drawings.
- D. Incomplete submittals will be rejected.
- E. Additionally, the Contractor will submit data on the following:
1. All electrical equipment including all panelboards and switching devices (disconnects, switches, occupancy sensors, etc.).
 2. Fire stop seals used for wall penetrations.
 3. Any proposed variation in specified wiring plans and circuitry.
 4. All special items and panels, made or constructed specifically for this project, including wiring diagrams, component layout and component data or materials list.
 5. All settings of installed equipment, such as overcurrent protection, overload settings, temperature settings, time settings, etc. This includes equipment provided by other

contractors or subcontractors and connected and tested by this Contractor.

- F. All submittals of NON SPECIFIED equipment and components will be reviewed. It is the submitting Contractor's responsibility to prove compliance and not the Architect/Engineer to prove non-compliance. The submitting Contractor will be charged the prevailing wage of the reviewing Engineer for all submittals requiring over one (1) hour to review that were not originally specified.
- G. It is the Contractor's responsibility to provide submittals in an organized and timely manner so as not to delay the project schedule and hamper the work of other trades.

1.17 OPERATING INSTRUCTIONS

- A. It shall be the Contractor's responsibility to insure that the Owner's representative is given adequate instruction on the operation of all equipment prior to final payment.

1.18 TEMPORARY POWER

- A. The Contractor shall provide all temporary power to all trades throughout all phases of construction throughout the duration of this project. This will include but not be limited to temporary lighting, power outlets, temporary elevator operation, controls for temporary heating, and job trailers. Contractor shall be responsible for providing temporary power via adjacent building(s) and/or a temporary diesel fired generator and associated fuel costs. Contractor shall coordinate temporary power source with project manager prior to demolition. Contractor is responsible for all costs associated with temporary power.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All materials and equipment shall be new and as specified or of equal or better quality.
- B. Basic hardware and miscellaneous items shall meet existing trade standards of quality and shall carry UL or FM listings where applicable.
- C. All equipment supplied shall be the standard equipment of the manufacturer.
- D. Multiple items such as panelboards, wiring devices, switches, breakers, raceways, etc., shall be from the same manufacturer.
- E. Drawings and specifications are based on specific manufacturer's equipment. Therefore, the Contractor shall assume all responsibility, cost and coordination involved in making any necessary revisions to apply another manufacturer's equipment, even though it may be approved as an "equal" item by the Engineer.

PART 3 EXECUTION

3.01 COORDINATION OF WORK

- A. All work shall be executed in accordance with recognized standards of workmanship. All work shall be installed in a neat and orderly manner.
- B. The Contractor shall exchange information with other Contractors and the Owner in order to insure orderly progress of the work.
- C. The Contractor must contact the Owner's representative and schedule all work ten (10) days prior to start.
- D. The Contractor shall check for possible interference before installing any items. If any work is installed, and later develops interference with other features of the design, the Contractor will be responsible to make such changes to eliminate the interference.

3.02 CEILING REMOVAL

- A. Existing ceilings which must be removed for the installation of new work or demolition of existing conditions shall be done by the Contractor. No ceiling shall be removed without prior approval of the Owner. Ceilings which must be removed shall be restored to their original condition as soon as practical and prior to final payment.
- B. The removed tile of lay-in type ceilings shall be stored either in the ceiling space or at a designated space in the building. No tiles shall be stored in the occupied space.
- C. The Contractor shall take all necessary precautions to prevent damage to the existing ceilings. All damaged ceilings shall be replaced with new ceiling construction to match the existing and to the Owner's satisfaction.

END OF SECTION

**SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Demolition drawings are based on casual field observation and existing record documents.
- C. Report discrepancies to Architect before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
 - 2. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Notify Owner before partially or completely disabling system.
 - 2. Make notifications at least 24 hours in advance.
 - 3. Make temporary connections to maintain service in areas adjacent to work area.
- F. Existing Nurse Call System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
 - 2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
 - 1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
 - 2. PCB- and DEHP-containing lighting ballasts.
 - 3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.

- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- F. Disconnect and remove abandoned panelboards and distribution equipment.
- G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- H. Repair adjacent construction and finishes damaged during demolition and extension work.
- I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

- A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.

END OF SECTION

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Wiring connectors.
- C. Electrical tape.
- D. Oxide inhibiting compound.
- E. Wire pulling lubricant.
- F. Cable ties.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2013.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2009.
- I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- L. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- M. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- N. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- O. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- P. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is not permitted.
- F. Armored cable is not permitted.
- G. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 260526.
- H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- I. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 3. Tinned Copper Conductors: Comply with ASTM B33.
- J. Minimum Conductor Size: 12 AWG.
1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 100 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 200 feet: 10 AWG, for voltage drop.
- K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- L. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. 240/120 V High-Leg Delta, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B (High-Leg): Orange.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - d. 240/120 V, 1 Phase, 3 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Neutral/Grounded: White.
 - e. Equipment Ground, All Systems: Green.
 - f. Isolated Ground, All Systems: Green with yellow stripe.
 - g. Travelers for 3-Way and 4-Way Switching: Pink.
 - h. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
 - i. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. Encore Wire Corporation: www.encorewire.com/#sle.
 - c. General Cable Technologies Corporation; []: www.generalcable.com/#sle.
 - d. Service Wire Co: www.servicewire.com/#sle.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
1. Feeders and Branch Circuits:

- 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

2.05 ACCESSORIES

- A. Electrical Tape:
 - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
 - 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
 - 3. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Burndy LLC: www.burndy.com/#sle.
- B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
 - 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. Ideal Industries, Inc: www.idealindustries.com/#sle.
 - c. IlSCO: www.ilsco.com/#sle.
- C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
 - 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. American Polywater Corporation: www.polywater.com/#sle.
 - c. Ideal Industries, Inc: www.idealindustries.com/#sle.
- D. Cable Ties: Material and tensile strength rating suitable for application.
 - 1. Manufacturers:
 - a. Burndy LLC: www.burndy.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 - 2. When circuit destination is indicated without specific routing, determine exact routing required.

3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
9. Provide oversized neutral/grounded conductors where indicated and as specified below.
 - a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
 - b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Installation in Raceway:
 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- E. Exposed Cable Installation (only where specifically permitted):
 1. Route cables parallel or perpendicular to building structural members and surfaces.
 2. Protect cables from physical damage.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- H. Install conductors with a minimum of 12 inches of slack at each outlet.
- I. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- L. Make wiring connections using specified wiring connectors.
 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

- 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
- M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
 - 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
- N. Insulate ends of spare conductors using vinyl insulating electrical tape.
- O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- P. Identify conductors and cables in accordance with Section 260553.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

**SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Ground access wells.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 260536 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 264113 - Lightning Protection for Structures.

1.03 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 99 - Health Care Facilities Code 2018.
- G. NFPA 780 - Standard for the Installation of Lightning Protection Systems 2020.
- H. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
 - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- F. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 - 3. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 - 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 - 5. Ground Ring:
 - a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
 - b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
 - c. Provide connection from ground ring conductor to:
 - 1) Perimeter columns of metal building frame.
 - 2) Ground rod electrodes located as indicated.
 - 6. Ground Rod Electrode(s):
 - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.

- b. Space electrodes not less than 10 feet from each other and any other ground electrode.
 - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
 - d. Provide ground access well for each electrode.
 7. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
 8. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
 - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
 9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.
- G. Service-Supplied System Grounding:
 1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
 1. Provide grounding electrode system for each separate building or structure.
 2. Provide equipment grounding conductor routed with supply conductors.
 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
 4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- I. Separately Derived System Grounding:
 1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 - b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
 - c. Generators, when neutral is switched in the transfer switch.
 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
 5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
 6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.

7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- J. Bonding and Equipment Grounding:
 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
 8. Provide bonding for interior metal air ducts.
 9. Provide bonding for metal building frame.
 10. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
 11. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.
- K. Isolated Ground System:
 1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
 2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
 3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.
- L. Communications Systems Grounding and Bonding:
 1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
 2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- M. Lightning Protection Systems, in Addition to Requirements of Section 264113:
 1. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.
 2. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.
- N. Cable Tray Systems: Also comply with Section 260536.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
 1. Provide products listed, classified, and labeled as suitable for the purpose intended.

2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
 1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 3. Unless otherwise indicated, use mechanical connectors or exothermic welded connections for accessible connections.
 - a. Exceptions:
 - 1) Use exothermic welded connections for connections to metal building frame.
 4. Manufacturers - Mechanical and Compression Connectors:
 - a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
 - b. Burndy LLC: www.burndy.com/#sle.
 - c. Harger Lightning & Grounding: www.harger.com/#sle.
 5. Manufacturers - Exothermic Welded Connections:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. Cadweld, a brand of Erico International Corporation: www.erico.com/#sle.
 - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
- D. Ground Bars:
 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: 9/32-inch holes spaced 1-1/8" apart..
 4. Manufacturers:
 - a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
 - b. Erico International Corporation: www.erico.com/#sle.
 - c. Harger Lightning & Grounding: www.harger.com/#sle.
 - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
- E. Ground Rod Electrodes:
 1. Comply with NEMA GR 1.
 2. Material: Copper-bonded (copper-clad) steel.
 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
 4. Manufacturers:
 - a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
 - b. Erico International Corporation: www.erico.com/#sle.
 - c. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
 - d. Harger Lightning & Grounding: www.harger.com/#sle.
- F. Ground Access Wells:
 1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
 2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
 4. Cover: Factory-identified by permanent means with word "GROUND".
 5. Manufacturers:
 - a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
 - b. Erico International Corporation: www.erico.com/#sle.
 - c. Harger Lightning & Grounding: www.harger.com/#sle.

- d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC;
[]: www.thermoweld.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70.
 - 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
- D. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

**SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- C. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- D. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- D. MFMA-4 - Metal Framing Standards Publication 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1.06 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported at 5 times the applied force. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
 - 1. Conduit Straps: One-hole or two-hole type; steel.
 - 2. Conduit Clamps: Bolted type unless otherwise indicated.
 - 3. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Erico International Corporation: www.erico.com/#sle.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
 - 1. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Erico International Corporation: www.erico.com/#sle.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 - 1. Comply with MFMA-4.
 - 2. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
 - d. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
 - 1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Busway Supports: 1/2 inch diameter.
 - c. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
 - d. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
 - e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
 - f. Outlet Boxes: 1/4 inch diameter.
 - g. Luminaires: 1/4 inch diameter.
- F. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2. Concrete: Use preset concrete inserts or expansion anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Plastic and lead anchors are not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.
 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Conduit Support and Attachment: Also comply with Section 260533.13.
- I. Box Support and Attachment: Also comply with Section 260533.16.
- J. Interior Luminaire Support and Attachment: Also comply with Section 265100.
- K. Secure fasteners according to manufacturer's recommended torque settings.
- L. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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**SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Flexible metal conduit (FMC).
- C. Liquidtight flexible metal conduit (LFMC).
- D. Electrical metallic tubing (EMT).
- E. Rigid polyvinyl chloride (PVC) conduit.
- F. Liquidtight flexible nonmetallic conduit (LFNC).
- G. Conduit fittings.
- H. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2015.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2015.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2013.
- E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2016.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- K. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- L. UL 360 - Liquid-Tight Flexible Steel Conduit Current Edition, Including All Revisions.
- M. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- N. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- O. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- P. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.
- Q. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Shop Drawings:
1. Include proposed locations of roof penetrations and proposed methods for sealing.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
1. Under Slab on Grade: Use rigid PVC conduit.
 2. Exterior, Direct-Buried: Use rigid PVC conduit.
 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit or rigid PVC conduit.
 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
- D. Embedded Within Concrete:
1. Within Slab on Grade: Not permitted.
 2. Within Slab Above Ground: Not permitted.
- E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).
- F. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).
- G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
- H. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).
- I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
- J. Exposed, Exterior: Use galvanized steel rigid metal conduit.
- K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

- L. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit.
- M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
 - 1. Maximum Length: 6 feet.
- N. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
- O. Fished in Existing Non-Accessible Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- B. Electrical Service Conduits: Also comply with Section 262100.
- C. Fittings for Grounding and Bonding: Also comply with Section 260526.
- D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for the purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
 - 3. Control Circuits: 1/2 inch (16 mm) trade size.
 - 4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
 - 5. Underground, Interior: 3/4 inch (21 mm) trade size.
 - 6. Underground, Exterior: 1 inch (27 mm) trade size.
- G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 - 1. Manufacturers:
 - a. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
 - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
 - 4. Material: Use steel.
 - 5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
 - 2. Electri-Flex Company: www.electriflex.com/#sle.

3. International Metal Hose: www.metalhose.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
1. Manufacturers:
 - a. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
 2. Electri-Flex Company: www.electriflex.com/#sle.
 3. International Metal Hose: www.metalhose.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
1. Manufacturers:
 - a. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.

2.06 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 2. Nucor Tubular Products: www.nucortubular/#sle.
 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
1. Manufacturers:
 - a. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel.
 4. Connectors and Couplings: Use set-screw type.
 - a. Do not use indenter type connectors and couplings.
 5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
 6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.07 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
1. Cantex Inc: www.cantexinc.com/#sle.
 2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
 3. JM Eagle: www.jmeagle.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors

rated 90 degrees C.

- C. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.08 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
 - 2. Electri-Flex Company: www.electriflex.com/#sle.
 - 3. International Metal Hose: www.metalhose.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.
- C. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.09 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.
- E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
- F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.
- G. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- H. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
- I. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- E. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
- F. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
 2. When conduit destination is indicated without specific routing, determine exact routing required.
 3. Conceal all conduits unless specifically indicated to be exposed.
 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 5. Unless otherwise approved or indicated on associated documents, do not route conduits exposed:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 7. Conduits run within slab on deck applications are NOT acceptable.
 8. Arrange conduit to maintain adequate headroom, clearances, and access.
 9. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
 10. Arrange conduit to provide no more than 150 feet between pull points.
 11. Route conduits above water and drain piping where possible.
 12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
 13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
- G. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.
 3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
 8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
 9. Use of spring steel conduit clips for support of conduits is not permitted.
 10. Use of wire for support of conduits is not permitted.
 11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.
- H. Connections and Terminations:
1. Use approved conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.

4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs for dry locations and raintight hubs for wet locations.
 6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
 8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- J. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 312316.13.
 2. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 3. Provide underground warning tape in accordance with Section 260553 along entire conduit length for service entrance where not concrete-encased.
- K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
- L. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- M. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- N. Provide grounding and bonding in accordance with Section 260526.
- O. Identify conduits in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

**SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Floor boxes.

1.02 RELATED REQUIREMENTS

- A. Section 260529 - Hangers and Supports for Electrical Systems.
- B. Section 260533.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 262726 - Wiring Devices:
 - 1. Wall plates.
 - 2. Floor box service fittings.
 - 3. Additional requirements for locating boxes for wiring devices.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- G. UL 508A - UL Standard for Safety Industrial Control Panels 2018.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.
 - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
- C. Samples:
 - 1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.
- D. Project Record Documents: Record actual locations for pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
 - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 - 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit is used.
 - 4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
 - 5. Use suitable concrete type boxes where flush-mounted in concrete.
 - 6. Use suitable masonry type boxes where flush-mounted in masonry walls.
 - 7. Use raised covers suitable for the type of wall construction and device configuration where required.
 - 8. Use shallow boxes where required by the type of wall construction.
 - 9. Do not use "through-wall" boxes designed for access from both sides of wall.
 - 10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 - 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 - 12. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch by 2-1/8 inches by 2-1/8 inches deep unless otherwise noted.
 - b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
 - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - 13. Wall Plates: Comply with Section 262726.

- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
 - 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 - 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.
 - 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 - b. Boxes 6 square feet and Larger: Provide hinged-cover enclosures.
 - 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
 - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
 - 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
- D. Floor Boxes:
 - 1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
 - 2. Use cast iron floor boxes within slab on grade.
 - 3. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
 - b. Communications Systems Outlets: Comply with Section 271000.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints.
 - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
 - 9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

- a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
- 10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
- I. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Floor-Mounted Cabinets: Mount on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.
- M. Install boxes as required to preserve insulation integrity.
- N. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.
- O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- Q. Close unused box openings.
- R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- S. Provide grounding and bonding in accordance with Section 260526.
- T. Identify boxes in accordance with Section 260553.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 260533.23
SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface raceway systems.
- B. Wireways.
- C. Wall duct.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260533.13 - Conduit for Electrical Systems.
- D. Section 260533.16 - Boxes for Electrical Systems.
- E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 262726 - Wiring Devices: Receptacles.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 111 - Outline of Investigation for Multioutlet Assemblies Current Edition, Including All Revisions.
- D. UL 870 - Wireways, Auxiliary Gutters, and Associated Fittings Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate rough-in locations of outlet boxes provided under Section 260533.16 and conduit provided under Section 260533.13 as required for installation of raceways provided under this section.
 - 3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
 - 4. Wall Duct: Coordinate the work with other trades to provide walls suitable for installation of flush-mounted wall duct where indicated.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install raceways until final surface finishes and painting are complete.
 - 2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.
 - 1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

- A. Provide all components, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

2.02 SURFACE RACEWAY SYSTEMS

- A. Manufacturers:
 - 1. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Multioutlet Assemblies: Listed and labeled as complying with UL 111.
- C. Surface Raceway System:
 - 1. Raceway Type: Two channel, aluminum.
 - 2. Length: As indicated on the drawings.
 - 3. Integrated Device Provisions:
 - a. Receptacles:
 - 1) Comply with Section 262726, except for finishes.
 - 2) Configuration: As indicated on the drawings.
 - 3) Spacing: As indicated on the drawings.
 - b. Communications Outlets:
 - 1) Voice and Data Jacks: Include provisions for jacks furnished by others.
 - 2) Configuration: As indicated on the drawings.
 - 3) Spacing: As indicated on the drawings.
 - 4. Products:
 - a. Wiremold AL5200 Series.

2.03 WIREWAYS

- A. Manufacturers:
 - 1. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- B. Description: Lay-in wireways and wiring troughs with removable covers; listed and labeled as complying with UL 870.
- C. Wireway Type, Unless Otherwise Indicated:
- D. Where wireway size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.04 WALL DUCT

- A. Manufacturers:
 - 1. Hubbell Incorporated: www.hubbell.com/#sle.
 - 2. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
 - 3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.
- B. Description: Metal raceways specifically designed for enclosure of wiring to X-ray machines and similar medical equipment; listed and labeled as complying with UL 870.
- C. Material: Steel, unless otherwise indicated.
- D. Mounting Provisions: Suitable for surface- or flush-mounting as indicated.
- E. Size: As indicated on the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

- C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install raceways plumb and level.
- D. Arrange wireways and associated raceway connections to comply with NFPA 70, including but not limited to requirements for deflected conductors and wireways used as pullboxes. Increase size of wireway where necessary.
- E. Secure and support raceways in accordance with Section 260529 at intervals complying with NFPA 70 and manufacturer's requirements.
- F. Close unused raceway openings.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Identify raceways in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect raceways for damage and defects.
- C. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.
- D. Correct wiring deficiencies and replace damaged or defective raceways.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

- A. Protect installed raceways from subsequent construction operations.

END OF SECTION

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**SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.

1.02 RELATED REQUIREMENTS

- A. Section 099113 - Exterior Painting.
- B. Section 099123 - Interior Painting.
- C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- D. Section 260536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
- E. Section 260573 - Power System Studies: Arc flash hazard warning labels.
- F. Section 262300 - Low-Voltage Switchgear: Factory-installed mimic bus.
- G. Section 262726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.
- H. Section 263100 - Photovoltaic Collectors: Additional identification requirements for photovoltaic systems.
- I. Section 271000 - Structured Cabling: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs 2011.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- D. Samples:

1. Identification Nameplates: One of each type and color specified.
2. Warning Signs and Labels: One of each type and legend specified.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Adhesive-attached labeling materials, including label stocks, laminating adhesive, and inks used by label printers, shall comply with UL 969.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchgear:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify main and tie devices.
 - 5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
 - 6) See Section 262300 for factory-installed mimic bus.
 - b. Switchboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify main overcurrent protective device.
 - 5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
 - c. Motor Control Centers:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify main overcurrent protective device.
 - 5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
 - d. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces.
 - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - e. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - f. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.

- 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - g. Busway:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Provide identification at maximum intervals of 40 feet.
 - 5) Use identification nameplate to identify load(s) served for each plug-in unit. Include location when not within sight of equipment.
 - h. Time Switches:
 - 1) Identify load(s) served and associated circuits controlled. Include location.
 - i. Enclosed Contactors:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
 - 4) Identify coil voltage.
 - 5) Identify load(s) and associated circuits controlled. Include location.
 - j. Transfer Switches:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - 4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
 - k. Electricity Meters:
 - 1) Identify load(s) metered.
2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
3. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
 - c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.
4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
6. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
7. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
8. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
9. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
10. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

11. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
 - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 099123 and 099113.
 12. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
 13. Arc Flash Hazard Warning Labels: Comply with Section 260573.
 14. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
 15. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
 16. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
 17. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
- B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
 2. Identification for Communications Conductors and Cables: Comply with Section 271000.
 3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
 4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes when more than one circuit is present.
 - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
 - d. In cable tray, at maximum intervals of 20 feet.
 5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
 6. Use underground warning tape to identify direct buried cables.
- C. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits 3" high at maximum intervals of 20 feet.
 2. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
 - a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
 - 1) Color Code:
 - (a) Emergency Power System: Red.
 - (b) Fire Alarm System: Red.

- 2) Field-Painting: Comply with Section 099123 and 099113.
- 3) Vinyl Color Coding Electrical Tape: Comply with Section 260519.
3. Use identification labels to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.
6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.
- D. Identification for Boxes:
 1. Use voltage markers to identify highest voltage present.
 2. Use voltage markers or color coded boxes to identify systems other than normal power system.
 - a. Color-Coded Boxes: Field-painted in accordance with Section 099123 and 099113 per the same color code used for raceways.
 - 1) Emergency Power System: Red.
 - b. For exposed boxes in public areas, do not color code.
 3. Use identification labels to identify circuits enclosed.
 - a. For exposed boxes in public areas, use only identification labels.
 4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
- E. Identification for Devices:
 1. Identification for Communications Devices: Comply with Section 271000.
 2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
 3. Factory Pre-Marked Wallplates: Comply with Section 262726.
 4. Use identification label to identify fire alarm system devices.
 - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
 5. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
- F. Identification for Luminaires:
 1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.
- G. Identification for Photovoltaic Systems: Comply with Section 263100

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
 1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - a. Use only for indoor locations.

2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
 1. Minimum Size: 1 inch by 2.5 inches.
 2. Legend:
 - a. System designation where applicable:
 - 1) Emergency Power System: Identify with text "EMERGENCY".
 - 2) Fire Alarm System: Identify with text "FIRE ALARM".
 - b. Equipment designation or other approved description.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height:
 - a. System Designation: 1 inch.
 - b. Equipment Designation: 1/2 inch.
 - c. Other Information: 1/4 inch.
 - d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
 5. Color:
 - a. Normal Power System: White text on black background.
 - b. Emergency Power System: White text on red background.
- D. Format for General Information and Operating Instructions:
 1. Minimum Size: 1 inch by 2.5 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/4 inch.
 5. Color: Black text on white background unless otherwise indicated.
- E. Format for Caution and Warning Messages:
 1. Minimum Size: 2 inches by 4 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/2 inch.
 5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Power source and circuit number or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Black text on white background.
- G. Format for Control Device Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Load controlled or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Black text on white background.
- H. Format for Fire Alarm Device Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Designation indicated and device zone or address.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
 - 1. Do not use handwritten text.
- E. Minimum Text Height: 1/8 inch.
- F. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

- A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
- B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- C. Minimum Size:
 - 1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
 - 2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
 - 3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
 - 4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- D. Legend:
 - 1. Markers for Voltage Identification: Highest voltage present.
 - 2. Markers for System Identification:
 - a. Emergency Power System: Text "EMERGENCY".
- E. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
 - 1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.
- B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- C. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- D. Legend: Type of service, continuously repeated over full length of tape.
- E. Color:
 - 1. Tape for Buried Power Lines: Black text on red background.
 - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 FLOOR MARKING TAPE

- A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes. Tape not to be installed in finished spaces open to general public and staff.

2.07 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 - 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
 - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 - 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - a. Do not use labels designed to be completed using handwritten text.
 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 3. Minimum Size: 2 by 4 inches unless otherwise indicated.
- D. Floor Signs:
1. Materials: Use factory preprinted, self-adhesive vinyl, polyester, or rubber labels with protective overlamine; removable.
 2. Minimum Size: 17-inch diameter unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
 2. Flush-Mounted Equipment: Enclosure front.
 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 4. Elevated Equipment: Legible from the floor or working platform.
 5. Branch Devices: Adjacent to device.
 6. Interior Components: Legible from the point of access.
 7. Conduits: Legible from the floor.
 8. Boxes: Outside face of cover.
 9. Conductors and Cables: Legible from the point of access.
 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 260943 NETWORK LIGHTING CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes a networked lighting control system comprised of the following components:
 - 1. System Backbone and Integration Equipment
 - a. System Controller
 - 2. Wired Networked Devices
 - a. Wall Stations
 - b. {nLGws} Graphic Wall Stations
 - c. Digital Key Switches
 - d. Auxiliary Input/Output Devices
 - e. Occupancy and Photocell Sensors
 - f. Wall Switch Sensors
 - g. Power Packs and Secondary Packs
 - h. Communication Bridge
- B. The networked lighting control system shall meet all the characteristics and performance requirements specified herein.
- C. The contractor shall provide, install and verify proper operation of all equipment necessary for proper operation of the system as specified herein and as shown on applicable drawings.

1.02 RELATED DOCUMENTS

- A. Section 26 27 26 Wiring Devices
- B. Section 26 51 13 Interior Lighting Fixtures

1.03 SUBMITTALS

- A. Submittal shall be provided including the following items.
 - 1. Bill of Materials necessary to install the networked lighting control system.
 - 2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.
 - 3. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.
 - 4. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.
 - 5. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
 - 6. Contractor Startup/Commissioning Worksheet (must be completed prior to factory start-up).
 - 7. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.
 - 8. Hardware and Software Operation Manuals.

1.04 APPROVALS

- A. Prior approval from owner's representative is required for products or systems manufactured by companies not specified in the Network Lighting Controls section of this specification.
- B. Any alternate product or system that has not received prior approval from the owner's representative at least 10 days prior to submission of a proposal package shall be rejected.
- C. Alternate products or systems require submission of catalog datasheets, system overview documents and installation manuals to owner's representative.
- D. For any alternate system that does not support any form of wireless communication to networked luminaires, networked control devices, networked sensors, or networked input devices, bidders shall provide a total installed cost including itemized labor costs for installing network wiring to luminaires, control devices, sensors, input devices and other required system peripherals.

1.05 QUALITY ASSURANCE

- A. Product Qualifications
 - 1. System electrical components shall be listed or recognized by a nationally recognized testing laboratory (e.g., UL, ETL, or CSA) and shall be labeled with required markings as applicable.
 - 2. System shall be listed as qualified under DesignLights Consortium Networked Lighting Control System Specification V2.0.
 - 3. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
 - 4. All components shall be subjected to 100% end of line testing prior to shipment to the project site to ensure proper device operation.
 - 5. All components and the manufacturing facility where product is manufactured must be RoHS compliant.
- B. Installation and Startup Qualifications
 - 1. System startup shall be performed by qualified personnel approved or certified by the manufacturer.
- C. Service and Support Requirements
 - 1. Phone Support: Toll free technical support shall be available.
 - 2. Remote Support: The bidder shall offer a remote support capability.
 - 3. Onsite Support: The bidder shall offer onsite support that is billable at whole day rates.
 - 4. Service Contract: The bidder shall offer a Service Contract that packages phone, remote, and onsite support calls for the project. Response times for each type of support call shall be indicated in the terms of the service contract included in the bid package.

1.06 PROJECT CONDITIONS

- A. Only install indoor equipment after the following site conditions are maintained:
 - 1. Ambient Temperature: 14 to 105 degrees F (-10 to 40 degrees C)
 - 2. Relative Humidity: less than 90% non-condensing
- B. Equipment shall not be subjected to dust, debris, moisture, or temperature and humidity conditions exceeding the requirements indicated above or as marked on the product, at any point prior to installation.
- C. Only properly rated equipment and enclosures, installed per the manufacturer's instructions, may be subjected to dust and moisture following installation.

1.07 WARRANTY

- A. The manufacturer shall provide a minimum five-year warranty on all hardware devices supplied and installed. Warranty coverage shall begin on the date of shipment.
- B. The hardware warranty shall cover repair or replacement any defective products within the warranty period.

1.08 MAINTENANCE & SUSTAINABILITY

- A. The manufacturer shall make available to the owner new parts, upgrades, and/or replacements available for a minimum of 5 years following installation.

PART 1 EQUIPMENT

2.01 MANUFACTURERS

- A. Basis of Design System: Acuity Controls nLight

2.02 SYSTEM COMPLIANCE

- A. System components shall comply with UL 916 and UL 924 standards where applicable.
- B. System components shall comply with CFR Title 47, Part 15 standards where applicable.
- C. All equipment shall be installed and connected in compliance with NFPA 70.

2.03 SYSTEM PERFORMANCE REQUIREMENTS

- A. System Architecture
 - 1. System shall have an architecture that is based upon three main concepts: (1) networkable intelligent lighting control devices, (2) standalone lighting control zones using distributed intelligence, (3) optional system backbone for remote, time based

and global operation.

2. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible so as to minimize overall device count of system.
 3. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone (see Control Zone Characteristics sections for each type of wired network connection).
 4. Networked luminaires and intelligent lighting control devices shall support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.
 5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as "distributed intelligence."
 - a. Lighting control zones of at least 128 devices per zone shall be supported.
 6. Networked luminaires and intelligent lighting control devices shall have distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones shall operate according to their defined default settings and sequence of operations.
 7. Lighting control zones shall be capable of being networked with a higher-level system backbone to provide time based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software interface.
 8. The system may include one or more system controllers that provide time-based control. The system controller also provides a means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.
 9. All system devices shall support firmware update, either remotely or from within the applications space, for purposes of upgrading functionality at a later date.
- B. Wired Networked Control Zone Characteristics
1. Connections to devices within a wired networked lighting control zone and to backbone components shall be with a single type of low voltage network cable, which shall be compliant with CAT5e specifications or higher. To prevent wiring errors and provide cost savings, the use of mixed types of low voltage network cables shall not be permitted.
 2. Devices in an area shall be connected via a "daisy-chain" topology; requiring all individual networked devices to be connected back to a central component in a "hub-and-spoke" topology shall not be permitted, so as to reduce the total amount of network cable required for each control zone.
 3. System shall provide the option of having pre-terminated plenum rated low voltage network cabling supplied with hardware so as to reduce the opportunity for improper wiring and communication errors during system installation.
 4. Following proper installation and provision of power, all networked devices connected together with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton). The "out of box" default sequence of operation is intended to provide typical sequence of operation so as to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
 5. Once software is installed, system shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
 6. All networked devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

7. Networked control devices intended for control of egress and/or emergency light sources shall not require the use of additional, externally mounted UL924 shunting and/or 0-10V disconnect devices, so as to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
 - a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
 - b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard, and shall automatically close the load control relay and provide 100% light output upon detection of loss of power sensed via line voltage connection to normal power.
8. Networked luminaires and intelligent lighting control devices located in different areas shall be able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy and photocell commands shall be available across a single controller, and switch commands shall be available across single or multiple controllers. These shall also be referred to as global control zones.
9. Wired networked Wall stations shall provide the follow Scene Control Capabilities:
 - a. Preset Scenes that can activate a specific combination of light levels across multiple local and global channels, as required.
 - b. Profile Scenes that can modify the sequence of operation for the devices in the area (group) in response to a button press. This capability is defined as supporting "Local Profiles" and is used to dynamically optimize the occupant experience and lighting energy usage. Wall stations shall be able to manually start and stop Local Profiles, or the local profile shall be capable of ending after a specific duration of time between 5 minutes and 12 hours. Parameters that shall be configurable and assigned to a Local Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.
 - c. 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local and global control zones, so as to support "multi-way" preset scene and profile scene control.
- C. System Integration Capabilities
 1. The system shall interface with third party building management systems (BMS) to support two-way communication using the industry standard BACnet/IP or BACnet MS/TP protocols. The following system integration capabilities shall be available via BACnet/IP and BACnet MS/TP protocols:
 - a. The system shall support control of individual devices, including, but not limited to, control of relay and dimming output.
 - b. The system shall support reading of individual device status information. The available status will depend on the individual device type and capabilities, which may include but not be limited to, relay state, dimming output, power measurement, occupancy sensor status, and photocell sensor states or readings. All system devices shall be available for polling for devices status.
 - c. The system shall support activation of pre-defined system Global Profiles (see Supported Sequence of Operations for further definition of Global Profile capabilities).
 2. The system shall support activation of Global Profiles from third party systems by receiving dry contact closure output signals or digital commands via RS-232/RS-485. (See Supported Sequence of Operations for further definition of Profile and Scene Preset capabilities.)
 3. The system shall support activation of demand response levels from Demand Response Automation Servers (DRAS) via the OpenADR 2.0a protocol.
- D. Supported Sequence of Operations
 1. Control Zones
 - a. Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) shall be capable of transmitting and

tracking occupancy sensor, photocell sensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within the area. These shall also be referred to as local control zones.

2. Wall station Capabilities
 - a. Wall stations shall be provided to support the following capabilities:
 - 1) On/Off of a local control zone.
 - 2) Continuous dimming control of light level of a local control zone.
 - b. 3-way / multi-way control: multiple wall stations shall be capable of controlling the same local control zones, so as to support "multi-way" switching and/or dimming control.
3. Occupancy Sensing Capabilities
 - a. Occupancy sensors shall be configurable to control a local zone.
 - b. Multiple occupancy sensors shall be capable of controlling the same local zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.
 - c. System shall support the following types of occupancy sensing sequence of operations:
 - 1) On/Off Occupancy Sensing
 - 2) Partial-On Occupancy Sensing
 - 3) Partial-Off Occupancy Sensing
 - 4) Vacancy Sensing (Manual-On / Automatic-Off)
 - d. On/Off, Partial-On, and Partial-Off Occupancy Sensing modes shall function according to the following sequence of operation:
 - 1) Occupancy sensors shall automatically turn lights on to a designated level when occupancy is detected. To support fine tuning of Partial-On sequences the designated occupied light level shall support at least 100 dimming levels.
 - 2) Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.
 - 3) To provide additional energy savings the system shall also be capable of combining Partial-Off and Full-Off operation by dimming the lights to a designated level when vacant and then turning the lights off completely after an additional amount of time.
 - 4) Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under Photocell Sensing Capabilities.
 - 5) The use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.
 - e. Vacancy Sensing mode (also referred to as Manual-On / Automatic-Off) shall function according to the following sequence of operation:
 - 1) The use of a wall station is required turn lights on. The system shall be capable of programming the zone to turn on to either to a designated light level or the previous user light level. Initially occupying the space without using a wall station shall not result in lights turning on.
 - 2) Occupancy sensors shall automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. To support fine tuning of Partial-Off sequences the designated unoccupied dim level shall support at least 100 dimming levels.
 - 3) To provide additional energy savings and an enhanced occupant experience, the system shall also be capable of dimming the lights when vacant and then turning the lights off completely after an additional amount of time.
 - 4) To minimize occupant impact in case the area or zone is still physically occupied following dimming or shutoff of the lights due to detection of

- vacancy, the system shall support an "automatic grace period" immediately following detection of vacancy, during which time any detected occupancy shall result in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.
- 5) Photocell readings, if enabled in the Occupancy Sensing control zone, shall be capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary to further reduce energy usage. Additional requirements and details for photocell sensing capabilities are indicated under Photocell Sensing Capabilities.
 - 6) At any time, the use of a wall station shall change the dimming level or turn lights off as selected by the occupant. The lights shall optionally remain in this manually-specified light level until the zone becomes vacant; upon vacancy the normal sequence of operation, as defined above, shall proceed.
- f. To accommodate diverse types of environments, occupancy time delays before dimming or shutting off lights shall be specifiable for control zones between 15 seconds to 2 hours.
4. Photocell Sensing Capabilities (Automatic Daylight Sensing)
 - a. Photocell sensing devices shall be configurable to control a local zone.
 - b. The system shall support the following type of photocell-based control:
 - 1) Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.
 5. Schedule Capabilities
 - a. System shall support the creation of time schedules for time-of-day override of devices including offsets from dusk and dawn.
 - b. System shall support blink warning and timed extension capabilities. At the end of a scheduled period, the system shall be capable of providing a visible "blink warning" 5 minutes prior to the end of the schedule. Wall stations may be programmed to provide timed overrides that turn the lights on for an additional period of time. Timed override duration shall be programmable for each individual device, zone of devices, or customized group of devices, ranging from 5 minutes to 12 hours.
 6. Global Profile Capabilities
 - a. The system shall be capable of automatically modifying the sequence of operation for selected devices in response to any of the following: a time-of-day schedule, contact closure input state, manually triggered wired wall station input, RS-232/RS-485 command to wired input device, and BACnet input command. This capability is defined as supporting "Global Profiles" and is used to dynamically optimize the occupant experience and lighting energy usage.
 - b. Global profiles may be scheduled with the following capabilities:
 - 1) Global Profiles shall be stored within and executed from the system controller (via internal timeclock) such that a dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.
 - 2) Global Profile time-of-day schedules shall be capable of being given the following recurrence settings: daily, specific days of week, every "n" number of days, weekly, monthly, and yearly. Lighting control profile schedules shall support definition of start date, end date, end after "n" recurrences, or never ending. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
 - 3) Global Profile Holiday Schedules should follow recurrent settings for specific US holiday dates regardless if they always occur on a specific date or are determined by the day/week of the month.
 - 4) Global Profiles shall be capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
 - 5) Software management interface shall be capable of displaying a graphic calendar view of profile schedules for each control zone.
 - c. System Global Profiles shall have the following additional capabilities:

- 1) Global Profiles shall be capable of being manually activated directly from the system controller, specially programmed wired input devices, scene capable wired wall stations, and the software management interface.
- 2) Global Profiles shall be selectable to apply to a single device, zone of devices, or customized group of devices.
- 3) Parameters that shall be configurable and assigned to a Global Profile shall include, but not be limited to, fixture light level, occupancy time delay, response to occupancy sensors (including enabling/disabling response), response to daylight sensors (including enabling/disabling response), and enabling/disabling of wall stations.
- d. A backup of Local and Global Profiles shall be stored on the software's host server such that the Profile backup can be applied to a replacement system controller or wired wall station.
7. System shall support automated demand response capabilities with automatic reduction of light level to at least three levels of demand response.

2.04 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

- A. System Controller
 1. Product Series: nECY
 2. System Controller shall be multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
 3. System Controller shall have 32-bit microprocessor operating at a minimum of 1 GHz.
 4. System Controller shall have minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support its own operating system and databases.
 5. System Controller shall perform the following functions:
 - a. Time-based control of downstream wired and wireless network devices.
 - b. Linking into an Ethernet network.
 - c. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
 - d. Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.
 6. System Controller shall have an integral web server to support configuration, diagnostics and hosting of software interfaces.
 7. Device shall have option for a graphical touch screen to support configuration and diagnostics.
 8. Device shall have three RJ-45 networked lighting control ports for connection to any of the following:
 - a. The graphical touch screen
 - b. Wired communication bridges
 - c. Direct connection to networked wired luminaires and intelligent lighting control devices (up to 128 total devices per port)
 9. Device shall automatically detect all networked devices connected to it.
 10. Device shall have an internal time clock used for astronomical and standard schedules.
 11. Device shall have 2 switched RJ-45 10/100 BaseT Ethernet ports for local area network (LAN) connection.
 - a. Ethernet connection shall support daisy chain wiring to other lighting control system LAN devices.
 - b. Ethernet connection shall support IPv4 and shall be capable of using a dedicated static or DHCP assigned IP address.
 12. Device shall have 2 x USB 2.0 Expansion ports for 802.11 Wi-Fi Adapter enabling wireless connectivity including:
 - a. Hot Spot
 - b. Access Point
 - c. Client
 13. Each System Controller shall be capable of managing and operating at least 750 networked devices (wired or wireless).
 - a. Multiple System Controllers may be networked together via LAN connection to scale the system up to 20,000 networked devices.

14. System Controller shall support BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without the need for additional protocol translation gateways.
 - a. BACnet MS/TP shall support 9600 to 115200 baud rate.
 - b. System Controller shall be BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.
15. System controller shall contain a "FIPS 140-2 Level 1 Inside" cryptographic module.
16. System controller shall support RESTful API control of BACnet objects, user management, date and time, and file management.
17. System controller shall be available within a NEMA 1 enclosure with Class 1 and Class 2 separation
 - a. Enclosure shall support power input power of 120-277VAC

2.05 WIRED NETWORKED DEVICES

- A. Wired Networked Wall Switches, Dimmers, Scene Controllers
 1. Product Series: nPODM, nPODM xS, nPODM xL, nPODMA, nPODMA xS, nPODMA xL.
 2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
 3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 4. All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
 5. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
 6. Devices with mechanical push-buttons shall be made available with custom button labeling.
 7. Wall switches & dimmers shall support the following device options:
 - a. Number of control zones: 1, 2 or 4
 - b. Control Types Supported:
 - 1) On/Off
 - 2) On/Off/Dimming
 - 3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types
 - c. Colors: Same as wiring devices.
 8. Scene controllers shall support the following device options:
 - a. Number of scenes: 1, 2 or 4
 - b. Control Types Supported:
 - 1) On/Off
 - 2) On/Off/Dimming
 - 3) Preset Level Scene Type
 - 4) On/Off/Dimming/Preset Level for Correlated Color Temperature
 - 5) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
 - 6) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
 - c. Colors: Same as wiring devices.
- B. Wired Networked Digital Key Switches
 1. Product Series: nPOD KEY, nPOD KEY MNTN
 2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
 3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 4. All switches shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.

5. Devices shall have LED user feedback to provide indication of on/off status of the programmed lights or scene, as well as indication of device power.
 6. Digital key switches shall support the following device options:
 - a. Control Types Supported:
 - 1) On/Off
 - 2) On/Off/Dimming
 - 3) Preset Level Scene Type
 - 4) Reprogramming of other devices within daisy-chained zone so as to implement user selected lighting scene. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
 - 5) Selecting a lighting profile to be run by the system's upstream controller so as to implement a selected lighting profile across multiple zones. This shall support manual start/stop from the scene controller, or optionally programmed to automatically end after a user selectable duration between 5 minutes and 12 hours.
 - b. Colors: Same as wiring devices.
- C. Wired Networked Auxiliary Input / Output (I/O) Devices
1. Product Series: nIO-1S, nIO-RLX, nIO-MLO-5STEPS, nIO-MLO-AB, nIO-NLI, nIO-X, nIO-D, nIO-EZ-PH, nIO-EZD, nIO-EZDL, nIO-EZDA, nIO-EZDX
 2. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a 1/2" knockout.
 3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 4. Auxiliary Input/Output Devices shall be specified as an input or output device with the following options:
 - a. Contact closure or Pull High input
 - 1) Input shall be programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, activate lights at a preconfigured level, ramp light level up or down, or toggle lights on/off.
 - b. 0-10V analog input
 - 1) Input shall be programmable to function as a daylight sensor.
 - c. RS-232/RS-485 digital input
 - 1) Input supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
 - d. 0-10V dimming control output, capable of sinking up to 20mA of current
 - 1) Output shall be programmable to support all standard sequence of operations supported by system.
 - e. Digital control output via EdoLED LEDcode communication
 - 1) Output shall be programmable to support light intensity control, as well as optional correlated color temperature (CCT) control, of the connected luminaire.
- D. Wired Networked Occupancy and Photosensors
1. Product Series: nCM, nCMB, nRM, nWV, nHW
 2. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
 3. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
 4. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
 5. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
 6. All sensing technologies shall be acoustically passive, meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these

technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.

7. System shall have ceiling, fixture, recessed & corner mounted sensors available, with multiple lens options available customized for specific applications.
 8. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 9. All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
 10. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device push-button.
 11. Ceiling mount occupancy sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).
 12. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
 13. Sensors shall have optional features for photosensor/daylight override, automatic dimming control, and low temperature/high humidity operation.
 14. Photosensor shall provide for an on/off set-point, and a dead band to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
 15. Photosensor and dimming sensor's set-point and dead band shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
 16. Dead band setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
 17. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The secondary daylight zone shall be capable of being controlled as an "offset" from the primary zone.
- E. Wired Networked Wall Switch Sensors
1. Product Series: nWSX LV
 2. Devices shall recess into single-gang switch box and fit a standard GFI opening.
 3. Communication and low voltage power shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors.
 4. All wall switch sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate a potential wiring issue.
 5. Devices with mechanical push-buttons shall provide tactile user feedback.
 6. Wall switches sensors shall support the following device options:
 - a. User Input Control Types Supported: On/Off or On/Off/Dimming
 - b. Occupancy Sensing Technology: PIR only or Dual Tech acoustic
 - c. Daylight Sensing Option: Inhibit Photosensor
 - d. Colors: Same as wiring devices.
- F. Wired Networked Power Packs and Secondary Packs
1. Product Series: nPP16, nPP16-ER, nPP20-PL, nSP16, nSP5-PCD, nSP5-2P-LVR, nSHADE, nAR40, nEPS-60, nPS-80
 2. Power Packs shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
 3. Power Packs shall accept 120 or 277 VAC and carry a plenum rating.
 4. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power.
 5. Power Supplies shall provide system power only, but are not required to switch line voltage circuit.
 6. Auxiliary Relay Packs shall switch low voltage circuits only, capable of switching 1 amp at 40 VAC/VDC (resistive only).
 7. Communication shall be delivered to each device via standard low voltage network cabling with RJ-45 connectors. Secondary packs shall receive low voltage power via

- standard low voltage network cable.
8. Power Pack programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
 9. Power Pack shall securely mount through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast/driver channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
 10. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
 11. Power/Secondary Packs shall be available with the following options:
 - a. Power Pack capable of full 16-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 100mA of sink current.
 - b. Secondary Pack with UL924 listing for switching of full 16-Amp Emergency Power circuits, with optional 0-10V dimming output capable of up to 100mA of sink current.
 - c. Power and Secondary Packs capable of full 20-Amp switching of general purpose receptacle (plug-load) control.
 - d. Secondary Pack capable of full 16-Amp switching of all normal power lighting load types.
 - e. Secondary Pack capable of 5-Amps switching and dimming 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
 - f. Secondary Pack capable of 5-Amps switching and dimming of 120/277 VAC magnetic low voltage transformers.
 - g. Secondary Pack capable of 4-Amps switching and dimming of 120 VAC electronic low voltage transformers.
 - h. Secondary Pack capable of louver/damper motor control for skylights.
 - i. Secondary Pack capable of providing a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
 - j. Secondary Pack capable of switching 1 amp at 40 VAC/VDC (resistive only) with the intent to provide relay signal to auxiliary system (e.g. BMS).
 - k. Power Supply capable of providing auxiliary bus power (no switched or dimmed load).
- G. Wired Networked Communication Bridge
1. Product Series: nBRG
 2. Device shall surface mount to a standard 4" x 4" square junction box.
 3. Device shall have 8 RJ-45 ports for connection to lighting control zones (up to 128 devices per port), additional network bridges, and System Controller.
 4. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to System Controller.
 5. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply, or powered via low voltage network connections from powered lighting control devices (e.g. power packs).
 6. Wired Bridge shall be capable of redistributing power from its local supply and connected lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.

PART 1 EXECUTION

3.01 INSTALLATION REQUIREMENTS

- A. Installation Procedures and Verification
1. The successful bidder shall review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.

2. The successful bidder shall install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals and plans specifications.
 3. The successful bidder shall be responsible for testing of all low voltage network cable included in the bid. Bidder is responsible for verification of the following minimum parameters:
 - a. Wire Map (continuity, pin termination, shorts and open connections, etc.)
 - b. Length
 - c. Insertion Loss
- B. Coordination with Owner's IT Network Infrastructure
1. The successful bidder is required to coordinate with the owner's representative to secure all required network connections to the owner's IT network infrastructure.
 - a. The bidder shall provide to the owner's representative all network infrastructure requirements of the networked lighting control system.
 - b. The bidder shall provide to the manufacturer's representative all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.
- C. Documentation and Deliverables
1. The installing contractor shall be responsible for documenting installed location of all networked devices, including networked luminaires. This includes responsibility to provide as-built plan drawing showing device address barcodes corresponding to locations of installed equipment.
 2. The installing contractor is also responsible for the following additional documentation to the manufacturer's representative if visualization / graphical floorplan software is provided as part of bid package:
 - a. As-Built floor plan drawings showing device address locations required above. All documentation shall remain legible when reproducing/scanning drawing files for electronic submission.
 - b. As-Built electrical lighting drawings (reflected ceiling plan) in PDF and CAD format. Architectural floor plans shall be based on as-built conditions.
 - 1) CAD files shall have layers already turned on/off as desired to be shown in the graphical floorplan background images. The following CAD elements are recommended to be hidden to produce an ideal background graphical image: Titleblock Text- Inclusive of room names and numbers, fixture tags and drawings notes Fixture wiring and homeruns Control devices Hatching or poché of light fixtures or architectural elements
 - 2) CAD files shall be of AutoCAD 2013 or earlier. Revit file overall floor plan views shall be exported to AutoCAD 2013.

3.02 SYSTEM STARTUP

- A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed.
1. For CAT5 wired devices, low voltage network cable testing shall be performed prior to system startup.
- B. System start-up and programming shall include:
1. Verifying operational communication to all system devices.
 2. Programming the network devices into functional control zones to meet the required sequence of operation.
 3. Programming and verifying all sequence of operations.
- C. Initial start-up and programming is to occur on-site.

3.03 PROJECT TURNOVER

- A. System Documentation
1. Submit software database file with desired device labels and notes completed. Changes to this file will not be made by the factory.
 2. Installing contractor to grant access to the owner for the programming database, if requested.
- B. Owner Training

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Bon Secours Charity Health System
Good Samaritan Hospital TMP 30 CT TMP 92 MRI
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1. Provisions for onsite training for owner and designated attendees to be included in submittal package.

END OF SECTION

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SECTION 262416 PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.
- D. Appendix A: WMC Facilities Department - "Desk" Procedure - Electrical Panel Access and Tamper Seals.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
 - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- F. Section 262813 - Fuses: Fuses for fusible switches and spare fuse cabinets.
- G. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2000, with Errata (2008).
- F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- G. NEMA PB 1 - Panelboards 2011.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- K. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- L. UL 67 - Panelboards Current Edition, Including All Revisions.
- M. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- N. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- O. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- P. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- Q. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.
- R. UL 1699 - Arc-Fault Circuit-Interrupters Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
 - 2. Include wiring diagrams showing all factory and field connections.
 - 3. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.
- F. Field Quality Control Test Reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and

traffic.

- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
 - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
 - 2. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- B. Substitutions: See Section 016000 - Product Requirements.
- C. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Seismic Qualification: Provide panelboards and associated components suitable for application under the seismic design criteria specified in Section 260548 where required. Include certification of compliance with submittals.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature:
 - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
 - b. Panelboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.
- D. Short Circuit Current Rating:
 - 1. Provide panelboards with listed short circuit current rating as indicated on the drawings.
 - 2. Listed series ratings are not acceptable.
- E. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- H. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 - 2. Provide 200 percent rated neutral bus and lugs where indicated.
 - 3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - 4. Provide separate isolated/insulated ground bus where indicated.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R Type 3R and Type 4X as indicated on drawings
 - 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.

- b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
 - c. Provide removable end walls for NEMA Type 1 enclosures.
 - d. Provide painted steel boxes for surface-mounted panelboards where exposed to public view, finish to match fronts.
- 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
- 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.
- M. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
 - 1. Ampere Rating: Not less than ampere rating of panelboard bus.
 - 2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
 - 3. Coil Voltage: As required for connection to control system indicated.
- N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
 - 2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
 - a. Use zero sequence ground fault detection method unless otherwise indicated.
 - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
- O. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Feed-through lugs.
 - 2. Sub-feed lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase and Neutral Bus Material: Copper.
 - 2. Ground Bus Material: Copper.
- D. Circuit Breakers:
 - 1. Provide bolt-on type for circuit breakers frame sizes 125A and smaller
 - 2. Provide bolt-on type for circuit breakers frame sizes 125A and larger; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures unless otherwise indicated.
 - 2. Fronts: Provide door-in-door trim with full lengthed piano hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 - 2. Phase and Neutral Bus Material: Copper.
 - 3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
 - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 - 2. Fronts: Provide door-in-door trim with full lengthed piano hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 - 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

- A. Fusible Switches:
 - 1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 - 2. Fuse Clips: As required to accept indicated fuses.
 - a. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
 - 3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
 - 4. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Copper, suitable for terminating copper conductors only.
- B. Molded Case Circuit Breakers:
 - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - 1) 22,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - 2) 25,000 rms symmetrical amperes at 480 VAC.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 3. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Copper, suitable for terminating copper conductors only.
 - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
 - b. Provide interchangeable trip units where indicated.

5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - a. Provide the following field-adjustable trip response settings:
 - 1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - 2) Long time delay.
 - 3) Short time pickup and delay.
 - 4) Instantaneous pickup.
 - 5) Ground fault pickup and delay where ground fault protection is indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
 - d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
 - e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
8. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
9. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
 - c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

2.06 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 260526.
 - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
 - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- K. Install all field-installed branch devices, components, and accessories.
- L. Provide fuses complying with Section 262813 for fusible switches as indicated.
- M. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 260573.
- N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- O. Provide filler plates to cover unused spaces in panelboards.
- P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
 - 1. Fire detection and alarm circuits.
- Q. Identify panelboards in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes. Tests listed as optional are not required.
- E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- F. Test GFCI circuit breakers to verify proper operation.
- G. Test AFCI circuit breakers to verify proper operation.
- H. Test shunt trips to verify proper operation.
- I. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

APPENDIX A

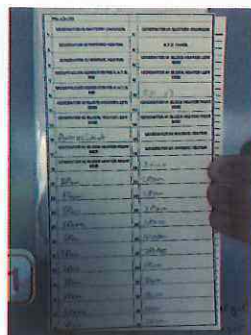
WMC FACILITIES DEPARTMENT - "DESK" PROCEDURE - ELECTRICAL PANEL ACCESS AND TAMPER SEALS

WMC Facilities Department – “Desk” Procedure – Electrical Panel Access and Tamper Seals

The Electrical Panel Directories are required to be in place and all breakers, blanks, and spares must be clearly identified. Spare breakers are required to be in the “Off” position at all times. Electrical Panels that have been validated shall have a “Safety/Tamper” Seal attached to the Panel Door.

The following process shall be followed when accessing an Electrical Panel to Reset Breakers or Troubleshoot Issues, Perform PM’s, make repairs, or when adding/removing circuits:

1. Record the existing tamper seal serial number
2. Break tamper seal and access the electrical panel for needed work
3. Ensure the electrical panel “Circuit Directory” is in place and update as needed
4. Ensure all “Spare” Breakers are in the “Off” position
5. Install a NEW Tamper Seal after work is completed
6. Record New Tamper Seal Serial Number
7. Provide the Facilities Office with the new tamper seal serial number and update the master inventory
8. Notify the Facilities Office for any issues found in the electrical panel (missing or incomplete directory, damaged, missing Tamper Seal, etc.)
9. See Below Pictures (for reference)
 - a. Pic 1 = Electrical Panel Name Designation (and Barcode if present)
 - b. Pic 2 = Electrical Panel with door closed and all covers installed (full view)
 - c. Pic 3 – Electrical Panel with cover removed showing Breakers with attached wires (full view)
 - d. Pic 4 – Electrical Panel Breakers with door open and all covers installed (full view)
 - e. Pic 5 – Electrical Panel Updated Directory
 - f. Pic 6 – Electrical Panel Key and Lock (show key next to the panel lock)
 - g. Pic 7 – Electrical Panel with Tamper Seal (ensure seal ID number is visible)



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SECTION 262726 WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates.

1.02 RELATED REQUIREMENTS

- A. Section 260533.16 - Boxes for Electrical Systems.
- B. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 260943 - Network Lighting Control Devices

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- C. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2015).
- D. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- G. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- I. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- J. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.
- K. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Operation and Maintenance Data:
 - 1. GFCI Receptacles: Include information on status indicators.
- D. Project Record Documents: Record actual installed locations of wiring devices.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.
- G. Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with white stainless steel wall plate.
- C. Wiring Devices Installed in Finished Spaces: White with white stainless steel wall plate.
- D. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.
- E. Wiring Devices Connected to Emergency Power: Red with stainless steel wall plate factory engraved "Emergency".
- F. Clock Hanger Receptacles: White with nylon wall plate.

2.03 WALL SWITCHES

- A. Manufacturers:
 1. Hubbell Incorporated: www.hubbell.com/#sle.
- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 WALL DIMMERS

- A. Manufacturers:
 1. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
- B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- C. Control: Slide control type with separate on/off switch.
- D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
 1. Magnetic Low-Voltage: 600 VA.

2. Electronic Low-Voltage: 600VA.

2.05 RECEPTACLES

- A. Manufacturers:
 1. Hubbell Incorporated: www.hubbell.com/#sle.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 2. Modular plug-in connectors for devices not allowed.
 3. NEMA configurations specified are according to NEMA WD 6.
 4. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.
- C. Convenience Receptacles:
 1. Standard Convenience Receptacles: Hospital grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
 3. Tamper Resistant Convenience Receptacles: Hospital grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
 4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- D. GFCI Receptacles:
 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - a. Provide test and reset buttons of same color as device.
 2. Standard GFCI Receptacles: Hospital grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
 4. Tamper Resistant GFCI Receptacles: Hospital grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type.
 5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
- E. USB Charging Devices:
 1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
 - a. Charging Capacity - Two-Port Devices: 5 A, minimum.
 2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (1 Type A, 1 Type C) USB charging device and receptacle, hospital grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type.
- F. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
 1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.
- G. Clock Hanger Receptacles: Single, 15A, 125V, NEMA 5-15R.

2.06 WALL PLATES

- A. Manufacturers:
 1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
 2. Mulberry Metal Products Inc: www.mulberrymetal.com.

- B. Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Size: Standard.
 - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- E. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
 - 1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
 - 4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

- I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- J. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- K. Install wall switches with OFF position down.
- L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- M. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- Q. Identify wiring devices in accordance with Section 260553.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

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SECTION 262813 FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fuses.
- B. Spare fuse cabinet.

1.02 RELATED REQUIREMENTS

- A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- B. Section 262413 - Switchboards: Fusible switches.
- C. Section 262419 - Motor-Control Centers: Fusible switches.
- D. Section 262513 - Low-Voltage Busways: Fusible switches.
- E. Section 262816.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements Current Edition, Including All Revisions.
- D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses Current Edition, Including All Revisions.
- E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses Current Edition, Including All Revisions.
- F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses Current Edition, Including All Revisions.
- G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses Current Edition, Including All Revisions.
- H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
 - a. Fusible Switches for Switchboards: See Section 262413.
 - b. Fusible Switches for Motor Control Centers: See Section 262419.
 - c. Fusible Enclosed Switches: See Section 262816.16.
 - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
 - 1. Spare Fuse Cabinet: Include dimensions.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Fuses: One set(s) of three for each type and size installed.
 - 3. Fuse Pullers: One set(s) compatible with each type and size installed.
 - 4. Spare Fuse Cabinet Keys: Two.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.
- B. Littelfuse, Inc: www.littelfuse.com/#sle.
- C. Mersen: ep-us.mersen.com/#sle.

2.02 APPLICATIONS

- A. Service Entrance:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. Feeders:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- C. General Purpose Branch Circuits: Class RK1, time-delay.
- D. Individual Motor Branch Circuits: Class RK1, time-delay.
- E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.
- F. Primary Protection for Control Transformers: Class CC, time-delay.

2.03 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class J Fuses: Comply with UL 248-8.
- H. Class L Fuses: Comply with UL 248-10.
- I. Class CC Fuses: Comply with UL 248-4.
- J. Provide the following accessories where indicated or where required to complete installation:
 - 1. Fuseholders: Compatible with indicated fuses.
 - 2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.04 SPARE FUSE CABINET

- A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- C. Install spare fuse cabinet where indicated.
- D. Identify spare fuse cabinet in accordance with Section 260553.

END OF SECTION

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SECTION 262816.13 ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- G. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- H. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- I. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- J. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted enclosed circuit breakers where indicated.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.
 - 1. Include characteristic trip curves for each type and rating of circuit breaker upon request.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed circuit breakers and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 4. Include documentation of listed series ratings upon request.
 5. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Project Record Documents: Record actual installed locations of enclosed circuit breakers.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- B. Substitutions: See Section 016000 - Product Requirements.
- C. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

- A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
1. Altitude: Less than 6,600 feet.
 2. Ambient Temperature: Between 23 degrees F and 104 degrees F.
- D. Short Circuit Current Rating:
1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.

- E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- F. Conductor Terminations: Suitable for use with the conductors to be installed.
- G. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 150 amperes.
- H. Provide electronic trip circuit breakers for circuit breaker frame sizes 150 amperes and above.
- I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- J. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.
- K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 4X, stainless steel.
 - 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
 - 3. Provide surface-mounted or flush-mounted enclosures unless otherwise indicated.
- L. Provide externally operable handle with means for locking in the OFF position.
- M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
 - 2. Where accessory ground fault sensing and relaying equipment is used, equip companion circuit breakers with ground-fault shunt trips.
 - a. Use zero sequence ground fault detection method unless otherwise indicated.
 - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

2.03 MOLDED CASE CIRCUIT BREAKERS

- A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
- B. Interrupting Capacity:
 - 1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - a. 22,000 rms symmetrical amperes at 240 VAC or 208 VAC.
 - b. 25,000 rms symmetrical amperes at 480 VAC.
 - 2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
- C. Conductor Terminations:
 - 1. Provide mechanical lugs unless otherwise indicated.
 - 2. Lug Material: Copper, suitable for terminating copper conductors only.
- D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 150 amperes and larger.
 - 2. Provide interchangeable trip units where indicated.
- E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1. Provide the following field-adjustable trip response settings:
 - a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - b. Long time delay.

- c. Short time pickup and delay.
 - d. Instantaneous pickup.
 - e. Ground fault pickup and delay where ground fault protection is indicated.
- F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
- G. Provide the following circuit breaker types where indicated:
 - 1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - 2. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 - 3. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
- H. Provide the following features and accessories where indicated or where required to complete installation:
 - 1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
 - 2. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed circuit breakers plumb.
- F. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- J. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 260573.
- K. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- L. Identify enclosed circuit breakers in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than 100 amperes. Tests listed as optional are not required.

- D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
 - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- E. Test GFCI circuit breakers to verify proper operation.
- F. Test shunt trips to verify proper operation.
- G. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 262816.16 ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 260573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.
- E. Section 262513 - Low-Voltage Busways: Fusible switch busway plug-in units.
- F. Section 262813 - Fuses.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
 - 2. Include wiring diagrams showing all factory and field connections.
 - 3. Identify mounting conditions required for equipment seismic qualification.

- D. Manufacturer's equipment seismic qualification certification.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Project Record Documents: Record actual locations of enclosed switches.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. See Section 262813 for requirements for spare fuses and spare fuse cabinets.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- B. Substitutions: See Section 016000 - Product Requirements.
- C. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short

- circuit study performed in accordance with Section 260573.
2. Minimum Ratings:
 - a. Switches Protected by Class H Fuses: 22,000 rms symmetrical amperes.
 - b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
 - c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
 - G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
 - H. Provide with switch blade contact position that is visible when the cover is open.
 - I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
 1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
 - J. Conductor Terminations: Suitable for use with the conductors to be installed.
 - K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
 - L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
 - M. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 4X, stainless steel.
 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
 - N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
 - O. Heavy Duty Switches:
 1. Comply with NEMA KS 1.
 2. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Copper, suitable for terminating copper conductors only.
 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
 - a. Provide means for locking handle in the ON position where indicated.
 - P. Provide the following features and accessories where indicated or where required to complete installation:
 1. Hubs: As required for environment type; sized to accept conduits to be installed.
 2. Integral fuse pullers.
 3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
 4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- J. Identify enclosed switches in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 265100 INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 233600 - Air Terminal Units: Air distribution accessories for air handling luminaires.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260533.16 - Boxes for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 260943 - Network Lighting Control Devices.
- F. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

1.03 REFERENCE STANDARDS

- A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code) 2013 (Corrigendum 2019).
- B. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information 2002 (Reaffirmed 2008).
- C. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products 2008.
- D. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).
- E. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 844 - Luminaires for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.
- I. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
- J. UL 1598 - Luminaires Current Edition, Including All Revisions.
- K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
 - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
 - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 - 2. Provide photometric calculations where luminaires are proposed for substitution as part or lighting submittals.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 - 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - 2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
- D. Samples:
 - 1. Provide one sample(s) of each luminaire proposed for substitution upon request.
 - 2. Provide one sample(s) of each product finish illustrating color and texture upon request.
- E. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.
- F. Field quality control reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
 - 3. Extra Ballasts: Two percent of total quantity installed for each type, but not less than one of each type.
- J. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for LED luminaires, including drivers.
- C. Provide five year full warranty for batteries for emergency lighting units. Life time warranty for LEDs.
- D. Provide three year full warranty and seven year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- H. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.
- I. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- J. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
 - 1. LED Tape - General Requirements:
 - a. Listed.
 - b. Designed for field cutting in accordance with listing.
 - c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
- K. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.
- L. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
 - 1. Sealed maintenance-free Nickel metal hydride (NiMH) unless otherwise indicated.
 - 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- G. Accessories:
 - 1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
 - 2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
 - 3. Provide compatible accessory wire guards where indicated.
 - 4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.04 EXIT SIGNS

- A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
 - 1. Number of Faces: Single- or double-face as indicated or as required for installed location.
 - 2. Directional Arrows: As indicated or as required for installed location.
- B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
 - 1. Self-Powered Exit Signs:
 - a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
 - b. Battery: Sealed, maintenance-free, Nickel metal hydride (NiMH) unless otherwise indicated.
 - c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
 - d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
 - e. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
- C. Accessories:
 - 1. Provide compatible accessory high-impact polycarbonate vandal shields where indicated.
 - 2. Provide compatible accessory wire guards where indicated.

2.05 DRIVERS

- A. Ballasts/Drivers - General Requirements:
 - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- B. Dimmable LED Drivers:
 - 1. Dimming Range: Continuous dimming from 100 percent to one percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.06 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
- D. Fire-Rated Luminaire Enclosures:
 - 1. Provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Suspended Ceiling Mounted Luminaires:
 - 1. Do not use ceiling tiles to bear weight of luminaires.
 - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 - 3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
 - 4. Secure pendant-mounted luminaires to building structure.
 - 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 - 6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
 - 7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- G. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
 - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
 - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Suspended Luminaires:
 - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
 4. Install canopies tight to mounting surface.
- I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
 2. Install lock-on device on branch circuit breaker serving units.
- M. Exit Signs:
1. Install lock-on device on branch circuit breaker serving units.
- N. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. See Section 017900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
- D. Just prior to Substantial Completion, LED's or drivers that have failed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

**SECTION 271333
CATV CABLING AND COMPONENTS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.
- B. Division 26 Specification sections apply to work in this section.

1.02 SUMMARY

- A. This specification covers the installation of a coaxial cable system to support video services and the distribution of local TV services within the facility. The coaxial network will consist of point to point (Home Run) coaxial cable between each drop location and all amplifiers, taps, and related equipment. The installation will include all cabling, connectors, components housing units, testing and documentation required to provide a complete certified operational system.
- B. The Contractor shall show evidence of having successfully completed at least three similar projects. Installations shall be performed by or under the supervision of the factory-authorized organization.
- C. The factory-authorized organization shall show evidence that they maintain a fully equipped service organization capable of furnishing adequate service to the system, including replacement parts. They shall be prepared to offer a service contract for maintenance of the system after the warranty period.
- D. The successful bidder shall warrant the system in its entirety for a period of five (5) years from date of acceptance to meet all performance requirements outlined herein. The installer will respond to a trouble call within twenty-four (24) hours after receipt of such a call.
- E. The system component manufacturer shall provide to the contractor all necessary schematics, diagrams and information in order for the Contractor to furnish a complete and operational system. The Contractor is responsible to furnish all necessary equipment, labor and installation materials, whether specified or not, to provide a complete and operational system.

1.03 SUBMITTALS

- A. Submit all shop drawings and product information and specifications. Include operating and maintenance instructions and information.
- B. The Contractor's submission shall contain engineering drawings of the system with specification sheets covering all component parts of the system. Provide full schematic and wiring details of the system.
- C. After completion of work under this contract, the Contractor shall furnish three (3) complete sets of operating instructions including circuit diagrams and other information necessary for the proper operation and maintenance of system components.
- D. As-built CAD drawings of the system shall be supplied. These drawings shall include all pertinent signal levels throughout the system as they were at the system acceptance date.
- E. **QUALITY ASSURANCE:**
- F. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of CATV systems, components and accessories, of types, capacities and characteristics required, whose products have been in satisfactory use in similar service for not less than 5 years.
- G. **Installer's Qualifications:** Firms with at least 5 years of successful installation experience with CATV system work similar to that required for this project.

1.04 CODES AND STANDARDS:

- A. **Electrical Code Compliance:** Comply with applicable local code requirements of the authority having jurisdiction and applicable sections of the National Electric Code (NEC) as to installation, and construction of television equipment and signal distribution systems.
- B. **NFPA Compliance:** Comply with applicable requirements of NFPA 78, "Lightning Protection Code," pertaining to television and antenna systems.

- C. UL Compliance: Comply with applicable requirements of UL Standards 486A Provide television systems and components which are UL-listed and labeled.
- D. NEMA Compliance: Comply with requirements of Stds Pub/No. WC 41, "Coaxial Communication Cable," pertaining to testing of coaxial cable.
- E. EIA Compliance: Comply with applicable requirements of Electronic Industries Association Standards RS-170, 222, 232, 312, 330, 403, 412, 420, 439, and 455 pertaining to television equipment and accessories.
- F. NESC Compliance: Comply with National Electrical Safety Code requirements pertaining to materials and installation of antenna supporting structures for MATV systems.
- G. FCC Compliance: Comply with Subpart J of PART 15, FCC Rules pertaining to computing devices including Class A, Class B, personal and equipment.

PART 2 PRODUCT

2.01 CABLE TV COMPATIBILITY

- A. Reception of television signal at any outlet in the system shall be equal to that obtainable by a single standard receiver connect directly to the CATV feed.
- B. The systems shall meet or exceed the technical standards set forth in the FCC Rules, Part 76.
- C. Equipment shall be capable of providing two-way communication over a single cable. Implementation of two-way communications shall not make present equipment obsolete but shall require only the addition of modules.
- D. Bandwidth of all passive devices shall be from 5 MHz to 1 GHz.
- E. Bandwidth of amplifiers shall be from 49 MHz to 1000 MHz.
- F. Amplifiers shall be of push-pull design to minimize harmonics and beats.
- G. The system shall be designed for -59 dB cross-modulation or better and a carrier-to-noise ratio of at least 46dB.
- H. System radiation shall not exceed the following limits:
 - 1. 5 MHz to 54 MHz 15 uV/meter @ 100 ft.
 - 2. 54 MHz to 216 MHz 20 uV/meter @ 100 ft.
 - 3. 216 to 400 MHz 15 uV/meter @ 100 ft.
- I. Isolation between any two outlets in the system shall be a minimum of 28 dB on any frequency between 10 and 300 MHz. Isolation between any two outlets shall exceed 20 dB over a total range of 5 MHz to 400 MHz.
- J. The station outlets, located as shown on the drawings, shall provide nominal signal levels of 6 dBmV.

2.02 CATV MATERIAL

- A. The cable shall be plenum rated cable suitable for video applications as manufactured by Berk-Tek, Commscope Corporation or equivalent.
 - 1. RG6 quad shield plenum coaxial cable will be home run between each drop locations and the designated wiring closet for all drops 320 feet or less in length.
 - 2. RG11 quad shield plenum coax cable will be home run between each drop locations and the designated wiring closet for all drops greater than 320 feet in length.
- B. Amplifiers shall be provided and designed for mounting on any flat surface. Amplifiers shall have frequency response flatness no greater than +/- 1.0 dB. Maximum output capability shall be +46 dBmV for 5% sync compression or less. Typical full gain shall be 31 dB. Input and output impedance shall be 75 ohms with a minimum return loss of 14 dB.
- C. Amplifiers, equalizers and return amp/filter shall be 1000 MHz compatible requiring 115 VAC as manufactured by Blonder Tongue or equivalent.
- D. Terminating resistors with 75-ohm impedance shall be installed at unused ports and at all outlets. Terminating resistors shall be designed to cover the frequency range from 5 MHz to 1 GHz with minimum return loss of 25 dB at UHF and 30 dB across the VHF band. Equipment shall be by Blonder Tongue or equivalent.
- E. Taps shall be provided as required for signal distribution. The taps shall be fully shielded and in compliance with FCC rules pertaining to radiation. Radiation shall be shielded to

- 100 dB. Frequency response through any port shall be from 5 MHz to 750 MHz.
- F. Any combination of taps shall provide a minimum isolation between tap ports of > 24 dB at 600-750 MHz. Return loss shall be > 16 dB at 50-750 MHz. Through connection to the Tap shall be made by standard type "F" fittings. Taps support 1GHZ bandwidth with low loss characteristics such as those manufactured by Toner Cable.
 - G. F style connectors: All cable ends in divided raceway and surface mount boxes shall be connected using a right angle F style connector or adapter at the drop location. Trunk and Tap connections will use standard straight F style connectors. The right angle connectors will facilitate the ease of installation and support, eliminating cable bends in tight locations.
 - H. Active components
 1. Frequency range 49-1000 MHz
 2. Amplifier PN BIDA-100A-30 With Return Path
 3. Equalizer PN BIDA-CE-7
 4. Return AMP/filter PN BIDA-RF-750
 - I. Multi-Taps
 1. PN's: RMT 108-11, RMT 108-17, RMT 108-20, RMT 108-23, RMT 108-26, RMT 104-14
 - J. Face Plate: 4 port face plate, Leviton # 41080-4IP
 - K. Inserts: F series couplers, Leviton # 41084-F
 - L. Blank insert: Leviton # 41084-4
 - M. Provide one three (3 foot) RG-6 jumper "whip" cable, with male "F" connectors on each end, for each TV/Projector outlet.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Notify Owner and Architect of associated monthly costs.
- B. Contractor to connect the CATV service feeds to the television distribution system.
- C. Contractor to coordinate required signal levels from the CATV service company and the television distribution system supplier.
- D. All equipment shall be installed in a neat and workmanlike manner and to the satisfaction of an authorized representative.
- E. All equipment power wiring and grounding shall conform to the National Electrical Code and applicable local codes. Electronic equipment, antennas and antenna supports shall be grounded using a No. 6 solid copper wire.
- F. Cable shall be adequately supported and connectors specifically designed for the type cable in use shall be installed.
- G. Amplifier input cables shall not be bundled with output cables. Physical separation between input and output cables shall be maintained as much as practical.
- H. All equipment except in-line pads shall be suitably mounted in cabinets or other solid support. Equipment suspended by its coaxial connection is not acceptable.
- I. All coaxial cables shall be home run, splices are not permitted.
- J. Cable shall be run in conduit in concealed/finished areas and run via J hooks through corridor areas.
- K. All cabling will be installed in ceiling cavities or a protected environment such as conduit or wire mold. The contractor will provide and install all cabling, connectors, components, surface mount boxes, face plate, inserts and associated hardware for each cable drop.
- L. Contractor will install cables neatly in wiring closet locations to the patch panel. Contractor shall insure that all cables, taps and amplifiers are neatly labeled using a permanent alpha numeric marking system on both ends and at the patch panel. Additional information on cable installation is provided on the drawings showing specific drop locations.
- M. All equipment shall be mounted on painted (to match) plywood backboard in main wiring closet A. Contractor to provide APA B-C grade ¾" plywood for mounting of all Time Warner demark and distribution equipment.

3.02 SYSTEM PERFORMANCE

- A. Upon completion of the system installation, it shall be the responsibility of the Contractor to perform the necessary adjustments and balancing of all signals and amplifier level controls to ensure proper system operation. The Contractor shall provide a listing of input and output signal levels for every room outlet, the signal level leaving the outlet, attenuation loss of cable and tap value.
- B. System balance tests shall employ Wavetech Stealth 1200 Signal Strength Meter or equivalent tester. Measurements shall be made at the combined output of the head-end system. The level of each channel's picture and sound carrier shall be measured and recorded.
 - 1. All levels shall be within +/- 3 dB from design levels specified. In no case shall levels measured exceed the maximum output rating for the head-end amplifier(s) employed.
- C. Using the field strength meter, measure the signal level at the last outlet on each feeder line and randomly selected outlets. The signal level on each channel shall not read less than 0 dBmV, or more than 15 dBmV, unless specified otherwise. Channels shall be tested from channel 0 through Digital.
- D. Using a standard TV receiver, connect to randomly selected outlets, not less than one per feeder, observe picture quality. No visible components of cross modulation (windshield wiper effect), ghosting or beat interference shall appear on the screen of a receiver tuned to any normal signal.
- E. Carrier-to-noise test shall employ a field strength meter. Measurements shall be made at output of the last amplifier in the system. With the normal levels in the system, the field strength meter shall be tuned to the picture carrier of each channel in turn and reading obtained on the meter noted. The signal shall then be removed and the input to the head-end amplifier shall be terminated at 75 ohms. With the field strength meter, read the level of remaining noise in absence of the signal and add a meter bandwidth correction factor of 4 dB to the reading. The difference between the two readings will give the system's signal-to-noise ratio. It shall not be less than 43 dB, unless otherwise specified.

END OF SECTION

**SECTION 284601
FIRE ALARM SYSTEM (EXISTING SYSTEM)**

PART 1 - GENERAL

1.01 SCOPE & RELATED DOCUMENTS

- A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the modifications and additions to the existing Fire Alarm System(s) as shown on the drawings and as herein specified.
- B. The requirements of the conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.
- C. The complete installation is to conform to the applicable sections of NFPA-72, NFPA-71, Local Code Requirements and National Electrical Code with particular attention to Article 760.
- D. Additionally, the entire installed system and all integrated system operations shall be within the guidelines of the SBCCI Standard Building Code.
- E. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.
- F. The contractor shall provide all required modifications and additions to the existing Fire Alarm System for the removal, relocation of existing devices and addition of new devices. This shall include all additional wiring, devices, modifications to the existing control panel, additional components and modules, addressable cards, testing, troubleshooting and instructions to the owner.

1.02 QUALITY ASSURANCE

- A. Each and all items of the Fire Alarm System shall be listed compatible with the existing system under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label. All control equipment is to be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable
- B. All items shall match and be of the same manufacturer as the existing system.
- C. The equipment and installation supervision furnished under this specification is to be provided by a manufacturer who has been engaged in production of this type (software driven) of equipment for at least ten (10) years, and has a fully-equipped service organization within thirty-five (35) miles of the installation.
- D. All control equipment must have transient protection devices to comply with UL864 requirements.
- E. In addition to the UL-UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760-23.
- F. Supplier shall provide documentation that fire alarm technicians are NICET LEVEL 2 certified (minimum of four).
- G. Suppliers' service organization must have been established in the local area for a minimum of ten (10) years with ten (10) years experience on specific equipment brand supplied.

1.03 SUBMITTALS

- A. Submit shop drawings for each piece of equipment specified including complete wiring and connection diagrams.
- B. All submittals shall be submitted in a single complete brochure, which shall be in the form of a soft cover binder with each group separated by an identified index tab.
- C. Submittals that fail to comply with the above requirements will automatically be rejected.
- D. It is the Contractor's responsibility to provide submittals in an organized and timely manner in order so as not to delay the project schedule and hamper the work of other trades.
- E. Submit certificate of Fire Alarm System operating tests.

PART 2 PRODUCTS

2.01 PERIPHERAL DEVICES

- A. The Contractor shall furnish and install addressable devices that are compatible with the existing Simplex fire alarm System
- B. Devices Required but not limited to:
 - 1. Manual Pull Stations
 - 2. Smoke Detectors
 - 3. Duct Smoke Detectors
 - 4. Heat Detectors
 - 5. Combination Speaker/Strobe Stations
 - 6. Visual Alarm (Strobe) Stations
 - 7. Auxiliary contacts on devices where indicated on drawings.
 - 8. Magnetic fire door holds
 - 9. Power Supplies
 - 10. Addressable Relay modules

2.02 MAGNETIC DOOR HOLDERS

- A. Description: Units shall be listed to UL 228. Units shall be equipped for wall or floor mounting as indicated on plans and are complete with matching door plate and extension arms as required. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source from fire alarm panel. Magnets must develop a minimum of 25 lbs. holding force for any of these voltages.
- B. Material and Finish: Match door hardware. All final hardware material and finishes must be coordinate with the GC.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide and install all devices in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 A and C, Power-Limited Fire Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760 A and B. Upon completion, the contractor shall so certify in writing to the owner and general contractor.
 - 1. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the installation.
- B. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.
- C. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
- D. The manufacturer's authorized representative shall provide on-site supervision of installation.

3.02 TESTING

- A. The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the owner's representative and the Local Fire Marshal. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor.

3.03 WARRANTY

- A. The contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.
- B. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72H guidelines.

END OF SECTION