

SECTION 23 0000 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. ***[Project LEED Requirements.]***
2. Certain Definitions.
3. References and Standards.
4. Certain Submittals.
5. General Quality Assurance and Safety Requirements.
6. General Operation and Maintenance Manual Requirements.
7. Chicago and Evanston Campus Steam Service Information.
8. Special Warranties.
9. General Delivery, Storage and Handling Requirements.
10. General Coordination Requirements.
11. General Product and Material Requirements.
12. General Requirements for Grout.
13. General Requirements for HVAC Demolition, Equipment Installation, Concrete Bases, and Erection of Metal and Wood Supports and Anchorages.

- B. Related requirements:

1. Section 013513 "Special Project Procedures" for Owner requirements
2. Section 017700 "CloseOut Procedures"
3. Section 017823 "Operation and Maintenance Data"
4. Section 017839 "Project Record Documentation"
5. Section 017900 "Demonstration and Training"
- 6.

- C. ***[It is intended this project pursue a LEED ["SILVER"] ["Gold"] rating. LEED criteria will be followed for the installation of building systems. This Contractor shall be responsible for the following items to ensure the Facility achieves LEED certification:***

1. ***SS credit 8 – Light Pollution Reduction.***
2. ***EA prerequisite 2 – Minimum Energy Performance.***
3. ***EA credit 1 – Optimize Energy Performance.***
4. ***MR credit 2 – Construction Waste Management.***
5. ***IEQ credit 4.1 – Low Emitting Materials: Adhesives and Sealants***
6. ***IEQ credit 4.2 – Low Emitting Materials: Paints and Coatings.***
7. ***IEQ credit 6.1 – Controllability of Systems: Lighting.***

## 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

## 1.4 REFERENCES AND STANDARDS:

- A. The editions recognized by latest **[City of Chicago Codes and Standards] [City of Evanston Codes and Standards]** of the following are hereby included in and made a part of Division 23:
  - 1. NFPA National Fire Protection Association
  - 2. UL Underwriters' Laboratories, Inc.
  - 3. AFI Air Filter Institute
  - 4. NEMA National Electrical Manufacturer's Association
  - 5. NEC National Electric Code
  - 6. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
  - 7. ARI American Refrigeration Institute
  - 8. AMCA Air Moving and Conditioning Association
  - 9. ASME American Society of Mechanical Engineers
  - 10. AWS American Welding Society
  - 11. ANSI American National Standards Institute
  - 12. AGA American Gas Association
  - 13. SMACNA Sheet Metal and Air Conditioning Contractors National Association
  - 14. HI Hydronics Institute
  - 15. OSHA Occupational Safety and Health Act
  - 16. MSS Manufacturer's Standardization Society of the Valve and Fittings Industry, Inc.
  - 17. ASTM American Society for Testing and Materials

## 1.5 SUBMITTALS

- A. **[As required for LEED portion of project.]**
- B. Welding certificates.
- C. For any equipment/components used by the contractor during construction, submit preventative maintenance records for same.

- D. Shutdown "Methods of Procedures", see 1.11-E.
- E. Notification to Work Forms, see 1.11-A.
- F. Operation and Maintenance Manuals: In PDF format.
- G. Northwestern University Maintenance Requirement Forms, see Division 01.
- H. As specified elsewhere in this Section.

1.6 QUALITY ASSURANCE, COORDINATION, AND SAFETY

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- D. Meet all in-force University, OSHA, state, and local safety requirements.
- E. To meet the University goals of safety, reliability, serviceability, and efficient operation, all contractors shall use the burn permit procedure. Burn permits are issued by the Facilities Management Operations Engineering Department. The respective trades that are performing any hot work must pick up a Burn Permit prior to commencing any work. Prior to the Burn Permit being picked up, the respective contractor will provide and indicate on the Burn Permit the Northwestern University work order. All procedures indicated on the Burn Permit are to be followed.
- F. All work to meet in-force local plumbing code. In the case of discrepancies between the project contract documents and the in-force local code, the most stringent shall govern.
- G. Comply with most current edition of Northwestern University Design Standards.
- H. All materials and installations shall meet applicable FM Global requirements.
- I. Complete Project Closeout list, Pre-Occupancy checklist, and Project Turnover checklist prior to project turnover to Owner.

1.7 GENERAL OPERATION AND MAINTENANCE MANUAL REQUIREMENTS

- A. Two weeks prior to shipment, the contractor shall submit three (3) bound copies (One copy for archive, two for shop use. One to the actual shop location and one left on site.) of operating and maintenance data on all equipment furnished (separated by individual unit) to include, but not limited to, the following: Shop Drawings; Model, system/tag and serial numbers of all equipment; Performance data/curves; Fan curves for fans with variable frequency drives shall show fan

performance at various percentages of frequency/speed from 100% to 0% in 10% increments; Manufacturer's written instructions for the operation and maintenance of the component equipment; Lubrication schedule indicating all equipment to be lubricated, recommended lubrication interval, and type and quality of lubricant to be used; recommended spare parts. And, submitter must obtain signed proof in writing that the University received this information.

- B. All of the above listed documents shall be provided in electronic format to each division in addition to the Northwestern University archives.
  
- C. Two of the bound copies are to be distributed to the Evanston Engineer's Department. One copy is to be located in the associated mechanical room and another to the shop. The associated manuals will be stored on a project supplied book shelf. Prints are to be installed on a vertical wall mounted print storage rack.
  - 1. Two copies Single line, full size, piping and ventilation prints laminated and stored on the respective print storage device. One copy is for the building and the other is for the shop files.
  - 2. Two copies of the piping print showing floor and branch isolation valves indicated by the respective tag number.
  - 3. Two copies of the ventilation print showing all smoke and fire dampers.
  
- D. Provide verification with Northwestern University Engineering Department to make sure there is record of them receiving Operation and Maintenance Manual.

#### 1.8 SPECIAL WARRANTIES

- A. Five years for new equipment and work, see Division 01.
- B. Extended warranties for equipment/work utilized by contractor during construction, see Division 01.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Piping, duct, equipment, and associated accessories kept on-site should be stored off the ground on skids, ends should be capped or sealed, and these items should be covered with plastic to prevent fouling or contact with excessive moisture. Piping, duct, and equipment should be cleaned of debris inside and out before installation and should be kept clean and protected throughout construction.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### 1.10 COORDINATION, INCLUDING WITH THE UNIVERSITY, FOR SHUTDOWNS

- A. All contractors are to fill out and submit University Notification of Work Forms, and coordinate with the respective University Project Manager.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- D. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- E. All shutdowns are to be requested with the respective University Project Manager. All shutdowns must have a shutdown request filled out for the applicable trade and submitted to the respective trades's shop calendar 48 hours in advance, they shall include Methods of Procedure. Emergency situations will be addresses and a case by case basis.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT AND MATERIALS:

- A. All equipment and materials shall be furnished in strict accordance with the equipment named and according to Specification requirements. Each bid shall be based upon one of the materials or manufacturers specified.
- B. Equipment and materials specified shall be considered to have prior approval, but submittal for approval is required. Furnish construction drawings to other Contractors when required to coordinate construction.
- C. Where multiple manufacturers are named the drawings and specifications are based on the requirements and layouts for the equipment of the first named manufacturer. Any change required by the use of other named manufacturers such as revisions to foundations, bases, piping, controls, wiring, openings, and appurtenances shall be made by the Contractor at no additional cost to the Owner. Changes must be submitted to the University for approval.

### 2.2 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 DEMOLITION

- A. Refer to Division 01 Section covering cutting and patching" and Division 02 Section covering demolition for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
  8. All piping and ductwork that is not to be reused shall be removed back to the nearest main and capped/plugged with similar material.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 GENERAL REQUIREMENTS

- A. All work shall be installed in a neat, workmanlike, and professional manner.
- B. All materials and equipment provided under this contract shall be new (except where otherwise noted) and shall be listed, labeled or certified by Underwriters Laboratories, Inc., or other acceptable entity.
- C. All materials, products, and equipment being installed which fall into a category covered by the ENERGY STAR<sup>®</sup> program must be labeled as such.
- D. All equipment of the same type shall be by the same manufacturer.
- E. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the diffuser"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.
- F. During construction the contractor shall at all times maintain HVAC utilities of the building without interruption. Should it be necessary to interrupt any HVAC service or utility, the contractor shall secure permission in writing from the University for such interruption at least seven days in advance. Any interruption shall be made with minimum amount of inconvenience to the University and any shut-down time shall have to be on a premium time basis and such time to be included in the contractor's bid. Arrange to provide and pay for temporary HVAC if required by project conditions.
- G. Measure indicated mounting heights to bottom of units/work for suspended items and to center of items of work for wall-mounted items.
- H. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

- I. Working clearance around equipment shall not be less than that specified by the in-force codes, standards, and the equipment manufacturer's instructions.
- J. The locations of sensors, grilles, registers, diffusers, equipment, piping, ductwork, etc. shown are approximate. The contractor shall use good judgment in placing the preceding items to eliminate all interference with lights, cabinetry, sprinklers, etc. The contractor shall check all furniture plans so that wall mounted sensors, panels, etc., are not located behind same. Relocate same as required, with approval from the Architect and Engineer. The University may direct relocation of sensors before installation, up to five (5) feet from the position indicated on the Drawings, without additional cost.
- K. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both HVAC equipment and other nearby work/installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity. Normal maintenance shall not require the removal of protective guards from adjacent equipment. Install equipment as close as practical to the locations shown on the Drawings.
  - 1. Where the University determines that the Contractor has installed equipment not conveniently accessible for operations and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the University.
  - 2. "Conveniently Accessible" is defined as being capable of being reached/serviced/maintained without climbing or crawling over or under obstacles such as ductwork, large conduits or banks of conduits, large piping or banks of piping, or similar.
- L. Coordinate work with all other trades. This is to include coordinating to eliminate interference to allow proper access to equipment doors, access to valves, and to not interrupt equipment or devices proper operation.
- M. Firestopping shall be applied to HVAC penetrations of fire-rated floor and wall assemblies to restore/create the required fire-resistance rating of the assembly according to appropriate Division 07 and 09 Sections and the University Fire Protection Group. All floor or wall penetrations will be sleeved with the same or compatible material and appropriately firestopped.
- N. Owner Furnished Equipment: Equipment furnished by the University shall be received, stored, protected, uncrated, moved into position, and installed by the Contractor with all appurtenances required to place the equipment in operation, ready for use. The Contractor shall be responsible for the equipment as if he had purchased the equipment himself/herself.

### 3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Provide access to mechanical equipment, components, and work per manufacturer's recommendations.

- E. Minimum service access size for HVAC equipment/components above ceilings shall be 24" cubed.
- F. Install equipment to allow right of way for piping installed at required slope.
- G. Install equipment to allow for proper access to all ancillary devices that are part of the equipment. This includes valves, circuit setters, building automation system controllers.
  - 1. If valves are not readily accessible for proper isolation, adequate pipe spacing needs to be allowed with consideration given to insulation that will be installed.
  - 2. Valves that are located in areas where access is difficult will be installed at the three or nine o'clock position to allow for service. If this any question about the serviceability, the owner's appropriate representative will be consulted for review.

### 3.4 EQUIPMENT USE DURING CONSTRUCTION

- A. Regardless of whether the equipment is existing to remain, or newly installed, if it is used by the Contractor in support of the Work, maintain the equipment according to its Operation and Maintenance manuals. Submit records of the maintenance per Division 1 requirements.

### 3.5 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Install dowel rods to connect concrete base to concrete floor.
  - 2. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete" unless otherwise noted on the drawings.

### 3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.
- D. All wood used to be fire retardant/treated wood, to be approved by the Architect, and is to be used minimally.

3.8 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

**END OF SECTION 23 0000**

NORTHWESTERN UNIVERSITY  
PROJECT NAME \_\_\_\_\_  
JOB # \_\_\_\_\_

FOR: \_\_\_\_\_  
ISSUED: 02/01/2021

**THIS PAGE IS INTENTIONALLY BLANK**