

SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Piping materials and installation instructions common to most piping systems.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. **KROGER DIRECT BUY PROGRAM:** Owner supplied/Contractor installed.
1. The Kroger Company has in place to purchase many HVAC related items directly from the manufacturer. The Owner will provide equipment and the Contractor will install.

1.3 SUBMITTALS

- A. Unless otherwise specified and in addition to provisions of the General Conditions, submit drawings having each sheet, and each page of a brochure, marked with identification and containing information described below. Submittals are to be complete, partial submittals will not be accepted.
- B. Identification:
1. Include project name and Architect's job number. If pages are securely bound in brochure, this is needed on cover only.

2. Identification by specification section and article under which equipment or material is described, and by name, number and intended use as designated by contract drawings and specifications.
3. When more than one item of equipment is covered by a single drawing or catalog cut, each project equipment item must be separately identified thereon with clear delineation as to which model or catalog number or performance data applied to each project item.

C. Information:

1. Include manufacturer's model number or catalog number, size and other data as requested.
2. Maintenance Manuals: Organize each maintenance manual with index and thumb-tab marker for each section of information; bind in **2-inch (51-mm)** 3-ring, vinyl-covered binder, with pockets for folded sheets, properly labeled on spine and face of binder.

1.4 QUALITY ASSURANCE

- A. Application: HVAC work shall comply with applicable requirements and recommendations of standards published by listed agencies and trade associations, except to extent more detailed and stringent requirements are indicated or required by governing regulations.

- B. Listing of Associations, Standards and Abbreviations Specific to HVAC Work (in addition to standards specified in individual work sections), conform to following applicable standards:

1. AABA - Associates Air Balance Council
2. AGA - American Gas Association
3. AMCA - Air Movement & Control Association
4. ARI - Air/Conditioning and Refrigeration Institute
5. ASC - Adhesive and Sealant Council
6. ASHRAE - American Society of Heating, Refrigeration & Air Conditioning Engineers
7. ASME - American Society of Mechanical Engineers
8. ASPE - American Society of Plumbing Engineers
9. ASSE - American Society of Sanitary Engineering
10. AWS - American Welding Society, Inc.
11. AWWA - American Water Works Association, Inc.
12. CAGI - Compressed Air and Gas Institute
13. CISPS - Cast Iron soil Pipe Institute
14. EPA - Environmental Protection Agency
15. FM - Factory Mutual System
16. MCA - Mechanical Contractor's Association of America
17. NIST - National Institute for Standards and Technology
18. (NBS) (formerly National Bureau of Standards)
19. NEC - National Electrical Code by NFPA
20. NEMA - National Electrical Manufacturer's Association
21. NFPA - National Fire Protection Association
22. NSF - National Sanitation Foundation
23. OSHA - Occupational Safety and Health Administration (U.S. Department of Labor)
24. PDI - Plumbing and Drainage Institute

25. SMACNA- Sheet Metal & Air Conditioning Contractors National Associations,
Inc.

26. TIMA - Thermal Insulation Manufacturers Association

27. UL - Underwriter's Laboratories, Inc.

- C. Symbols: Except as otherwise indicated in drawing legends, refer to "ASHRAE Handbook of fundamentals" for definitions of symbols used on the drawings to show mechanical work.
- D. Manufacturers: Firms regularly engaged in the manufacture of products of quality, types and sizes required; and which have been in satisfactory use of not less than four years in similar service, except as otherwise noted in specific sections of this division.
- E. Installer's Qualifications: Firm with at least three years of successful installation experience on projects with work similar to this project and meet applicable regulatory agencies requirements.
- F. Compatibility: Provide products which are compatible with other products of the plumbing work, and with other work requiring interface with the plumbing work. Provide products with the proper or correct power characteristics, fuel-burning characteristics and similar adaptations for this project. Coordinate the selections from among options (if any) for compatibility of products.
- G. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.
- H. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- I. 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.
- J. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DESCRIPTIONS

- A. "Kroger Purchased" and "Contractor Purchased" equipment is described in Division 00 Section General Conditions." Unless the Drawings indicate that it Kroger purchased, the Contractor is responsible for purchasing the equipment as shown on Drawings.
- B. Section specifies provisions for HVAC work, including:
1. Certain adaptive expansions of requirements specified in Division 00 Section General Conditions", uniquely applicable to HVAC work.

2. General performance requirements within HVAC work (all Division 23 Sections) as a whole.
 3. General work to be performed as HVAC work, because of its close association with HVAC work.
- C. Examine all Drawings, and visit site and become acquainted with all conditions which may affect execution of work.
 - D. Provide work in accordance with state and local codes, regulations and/or ordinances, and meet approval of authorities having jurisdiction. Provide only new material and as specified.
 - E. Furnish to Kroger Representative, a Certificate of Final Approval from governing authority prior to Kroger Representative's final acceptance, where applicable.
 - F. Comply with all requirements for permits and licenses, and pay all associated costs.
 - G. Provide piping specialties and condensate drain piping for air conditioning units.

1.6 COORDINATION OF HVAC WORK:

- A. Refer to Division 00 Section General Conditions" for general coordination requirements applicable to entire work. The Contract Documents are diagrammatic in showing certain physical relationships which must be established within HVAC work, and in its interface with other work, including utilities, control and electrical work, and that such establishment is Contractor's exclusive responsibility.
- B. Arrange HVAC work in a neat, well organized manner, with piping and similar services running parallel with primary lines of the building.
- C. Give right-of-way to piping as required for slope.
- D. Locate operating and control equipment properly to provide easy access, and arrange entire HVAC work with adequate access for operation and maintenance.
- E. Advise other trades of openings required in their work for the subsequent move-in of large units of HVAC work (equipment).
- F. Coordination of Drawings: For locations where elements of HVAC (or combined HVAC, plumbing, fire protection and electrical) work must be sequenced and positioned with precision in order to fit into the available space, provide to Contractor coordination drawings (shop drawings) showing the actual physical dimensions (at accurate scale) required for the installation. Prepare and submit to the Contractor coordination drawings prior to purchase/fabrication/installation of any of the elements involved in the coordination.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Compatibility: Provide products which are compatible with other products of the HVAC work, and with other work requiring interface with the HVAC work. Provide products with the proper or correct power characteristics, fuel-burning characteristics and similar adaptations for this project. Coordinate the selections from among options (if any) for compatibility of products.

2.2 SUBSTITUTIONS AND EQUIPMENT SELECTION:

- A. First listed manufacturer shown in Specifications and Drawings was used for design basis, layout, performance and indication of style and appearance.
- B. Equipment selected from this list of manufacturers, other than design basis, must be compatible with the facility and meet requirements of the Contract Documents.
- C. If any changes are required to the Work scope, due to the selected equipment being different from the design basis equipment, Contractor is responsible for coordinating increases or decreases in Work scope, paying Contractor's cost increases and any consultant fees.

2.3 CONDENSATE PIPING

- A. Drain Piping: Provide condensate drain piping from HVAC units as required to complete the system. Provide piping of Schedule 40 PVC. Trap and pipe as required.

2.4 PIPING SPECIALTIES

- A. Provide factory fabricated drainage piping, fittings and specialties recommended by manufacturer.
- B. Pipe Escutcheons: Provide pipe escutcheons with inside diameter close to outside diameter of pipe or outside diameter of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls or ceilings; and pipe sleeve extension, if any. Unless other indicated, furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

2.5 FABRICATED PIPING SPECIALTIES:

- A. Pipe Sleeves: Provide pipe sleeves of one of the following:
 - 1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams or welded longitudinal joint.
 - 2. PVC Pipe: Fabricate from Schedule 40, PVC

2.6 BASIC SUPPORTS AND ANCHORS:

- A. General: Provide supports and anchors in accordance with the following listing:
1. Adjustable steel clevises, for horizontal piping hangers and supports.
 2. Two bolt-riser clamps, for vertical-piping clamps.
 3. Concrete inserts, c-clamps, malleable beam clamps and steel brackets for building attachments.

2.7 HVAC SYSTEM IDENTIFICATION:

- A. Provide identification for HVAC equipment including but not limited to:
1. RTU's
 2. Exhaust Fans
 3. Supply Fans
 4. Hoods
 5. Air Handlers
- B. Text: Description, unit number, and location.
1. Example: "RTU-5 PHARMACY".
- C. Interior Identification: Provide either of the following interior identification methods:
1. For open structure, provide stencil-painted identification with lettering size not less than **1-1/2-inches (38-mm)** located in an easily visible location such as on the ductwork entering building from the roof.
 2. Where ceilings conceal the unit from sight, identify location with an engraved hard black plastic tag, **1 inch by 2 inch (25 mm by 50 mm)** plate with **3/4 inch (19 mm)** white lettering, pop riveted to the ceiling suspension grid directly below the location of the RTU or other piece of equipment.
- D. Exterior Identification (For equipment that does not have identification applied at the factory)
1. Stencil-Painted Identification: Lettering size not less than **1-1/2-inches (38-mm)**.
 2. Engraved Plastic-Laminate Signs: Sufficient size to convey adequate information at each location. Comply with recognized industry standards for color and design.
 3. Operational Tags: Plasticized card stock, with pre-painted or hand printed, to convey the message; example: "DO NOT CLOSE THIS VALVE EXCEPT WHEN BURNER IS OFF". Provide proper and adequate information on operation and maintenance of HVAC systems.

PART 3 - EXECUTION

3.1 HVAC DEMOLITION

- A. Refer to Division 00 Section "General Conditions" 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 Kroger Representative.
- C. Patch, insulate and seal any resulting openings to exterior.
- D. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
 - 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
 - 2. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
 - 3. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 - 4. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and clearance for light fixtures.
 - 5. Install piping to permit valve servicing.
 - 6. Install piping at indicated slopes.

7. Install piping free of sags and bends.
8. Install fittings for changes in direction and branch connections.
9. Install piping to allow application of insulation.
10. Select system components with pressure rating equal to or greater than system operating pressure.
11. Install escutcheons for penetrations of walls, ceilings, and floors.
12. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - a. Pipe Sleeves:
 - 1) For pipes passing through brick or concrete walls, or concrete floor slabs, provide steel pipe sleeves, two sizes larger than the pipe for which they are intended. Coordinate setting of sleeves as construction progresses. Set sleeves flush with finished line of walls and floors.
 - 2) Caulk sleeves through foundation walls to make them watertight.
13. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and HVAC sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing HVAC sleeve seals.
 - a. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
 - b. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
 - c. HVAC Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble HVAC sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
14. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using HVAC sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing HVAC sleeve seals.
 - a. HVAC Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble HVAC sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
15. Verify final equipment locations for roughing-in.
16. Refer to equipment specifications in other Sections for roughing-in requirements.
17. Where a pipe slot is indicated for a group of pipes passing through a wall, set a rectangular frame of structural angles, welded in the slot, at each side of wall. Close each side of opening with two No. 16 USG galvanized steel plates cut to fit the pipes and/or pipe insulation closely, and fasten to angle frame. For slots in exterior walls, slip flanged ferrules of sheet metal on pipes when they are installed, with flanges inside the closure plates at exterior wall face, caulk ferrules and plates to make weathertight joint, and pack space between closure plates with rock wool or glass fiber. At slots in fire walls, pack as specified above, but omit ferrules and caulking.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems:
1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 3. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
 4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
 5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
 6. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators.
 7. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
 8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - a. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - b. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - c. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - d. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - e. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - f. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
 9. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
 10. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - a. Plain-End Pipe and Fittings: Use butt fusion.
 - b. Plain-End Pipe and Socket Fittings: Use socket fusion.
 11. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping **NPS 2 (DN 50)** and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping **NPS 2-1/2 (DN 65)** and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. Follow manufacturer's suggested procedure for protection of equipment which will be idle for an extended period of time prior to start-up
- F. Mount and align equipment in strict accordance with manufacturer's recommendations and in accordance with procedures described below. In case of conflict, these procedures govern. Where structural or miscellaneous steel is not drilled, drill in field as directed.
- G. Lubricate all equipment as required and in accordance with manufacturer's recommendations. Furnish required lubricants.
- H. Neatly cut all openings in roof decks as needed for equipment, duct and pipe penetrations.
- I. Suspend Equipment, Piping and Ductwork:
 - 1. Provide structural steel and steel rod hangers, rigid in appearance. Weld (with approval of Architect where attaching to building steel) structural steel hangers or bolt with hex head machine bolts and with spring lock washers under nuts.
 - 2. For suspension from concrete, provide steel or malleable iron inserts in poured concrete construction, as specified for pipe hangers and supports, and expansion shields, toggle bolts or lag screws, in other construction. Use electric drill with carbide bit for drilling concrete blocks.
 - 3. For suspension from structural steel, use beam or channel clamps with locking clips.
 - 4. Do not support HVAC components from ceiling grids.
 - 5. Do not suspend hangers from roof decks.

6. Suspend from roof trusses and joists/joist girders only at panel points, at top cord only, unless otherwise indicated.
 7. Provide additional supports wherever needed, and structural steel members attached to building frame to provide additional points of support where required. Do no drilling of building structural and miscellaneous steel, except as directed or indicated.
- J. Hanger Rods and Hanger Spacing: 8-feet to 10-feet (2.4-m to 3-m) spacing maximum, provide auxiliary angles spanning between joints, as required. Comply with current A.S.M.E. code for pressure piping. Piping 5-inches (127-mm) size and larger to be supported by a minimum of two joists, with pipe center between joists.
- K. Insulated Pipe: Fit pipe hangers over outside diameter of insulation; provide sheet metal saddles 16 gage, 6-inches (152-mm) long by 1/3 of the circumference.
1. Select supports for a minimum safety factor of five.
- L. Rooftop Mounted Equipment Set on Structure:
1. Weld or bolt equipment to roof curbs or structural supports. For bolting equipment directly to structural supports, provide machine bolts, lock washers and nuts.
- M. Floor-Mounted Equipment:
1. Set and level equipment on foundation. Grout in place, using non-ferrous grout. Provide wedges and shims for leveling.
 2. Accurately align equipment prior to operation.
- N. Maintain daily log of operational data on HVAC equipment and systems through the close-out period; record hours of operation, assigned personnel, fuel consumption and similar information; submit copy to Kroger Representative.
- O. Turn Over of Operation: Upon substantial Completion, turn over prime responsibility for operation of HVAC equipment and systems to Kroger's personnel. However, until time of final acceptance, respond promptly with consultation and services, as required. Provide one operating engineer, who is completely familiar with the work, to consult with and continue training Kroger personnel.
- 3.6 INSTALLATION OF CONDENSATE PIPING:
- A. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems. Install piping with a minimum of offsets.
 - B. Accurately cut pipe to measurements established at the site and work into place without springing or forcing. Install piping with sufficient flexibility to adequately provide for expansion and contraction due to temperature fluctuation inherent in its work operation.
 - C. Do not conceal piping in walls or partitions nor underground or under the floor. Where pipe passes through building structure, pipe joints are not to be concealed, but located where they may be readily inspected.

- D. Discharge condensate water to comply with requirements of local jurisdiction.
- E. Run pipes to be insulated as shown as required with sufficient clearance to permit application of insulation.
- F. Use cadmium plated or galvanized nuts and bolts with self locking type nut or double nut on pipe clamps. Use double nuts or self locking nuts on hanger rods for piping support.
- G. Connect condensate drain piping to HVAC equipment in manner shown, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) 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 (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete Slabs."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Sections "Structural Steel" and "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.

3.9 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.

3.10 HVAC SYSTEM IDENTIFICATION

- A. Provide stencil-painted identification on rooftop equipment when not provided by manufacturer.
- B. Provide engraved plastic-laminate signs at locations of major equipment units, primary control devices, emergency equipment, dangerous elements of HVAC work and similar places. Mount permanently in an appropriate and effective location.
- C. Operational Tags: Provide proper and adequate information on operation and maintenance of mechanical systems.

3.11 INSPECTION

- A. Installer must examine areas and conditions under which products are to be installed. Notify Kroger Representative, in writing, of conditions detrimental to proper completion of work. Starting of installation constitutes acceptance.

3.12 CUTTING AND PATCHING

- A. Comply with Division 00 Section "General Conditions" for cutting and patching of other work, to accommodate the installation of HVAC work. Except as individually authorized by the Architect, cutting and patching of HVAC work to accommodate the installation of other work is not permitted, other than necessary penetrations of HVAC sheet metal work for electrical conduit and similar purposes.

3.13 TRIMMING

- A. Inspect ductwork, pipe supports, in occupied and equipment spaces for sharp angles which protrude into path of occupants and may cause injury. Trim such protrusions or cover with suitable spongy material to prevent such injuries.

3.14 TOUCH-UP

- A. Touch-up with zinc dust-zinc oxide primer galvanized or steel equipment which has been welded or otherwise scarred. Provide additional finished equipment with paint type and color to match original.

3.15 AIR FILTER MEDIA

- A. Provide necessary filter changes for equipment operated during building construction. Replace each set of filters with clean filters at time of project close-out.

3.16 SYSTEM TESTS

- A. Perform system tests in the presence of Kroger Representative. Notify Kroger Representative of system's tests at least 48 hours in advance.

3.17 SYSTEM INSPECTION

- A. Systems are to be inspected by Kroger Representative before covering, enclosing or concealing of work. Notify Kroger Representative of systems which are to be covered, enclosed or concealed at least 48 hours in advance.

END OF SECTION 23 05 00