

## SECTION 232300 - REFRIGERANT PIPING

### 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.
- B. Alternate #6: Refer to Section 012300 – “Alternates”.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Refrigerant piping system for new condensing unit and DX coil.
- B. Related Requirements:
  - 1. 238216.13 - Refrigerant Air Coils
  - 2. 236200 - Packaged Compressor and Condenser Units

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty.
- B. Shop Drawings; manufacturer shall size and be responsible for refrigerant pipe sizes, fittings, and components for proper operation of the system.
  - 1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; valve arrangements and locations; slopes of horizontal runs; oil traps; double risers (if needed); wall and floor penetrations; and equipment connection details.
  - 2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
  - 3. Pressure drops in the refrigerant lines shall be maintained at or below the ASHRAE recommendations and line lengths should be made as short as possible.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

- A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines: 300 psig.
  - 2. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L; ASTM B 280, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Brazing Filler Metals: AWS A5.8/A5.8M.
- E. Flexible Connectors:
  - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
  - 2. End Connections: Socket ends.
  - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
  - 4. Working Pressure Rating: Factory test at minimum 500 psig.
  - 5. Maximum Operating Temperature: 250 deg F.

## 2.3 VALVES AND SPECIALTIES

### A. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

### B. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).

1. Body and Bonnet: Plated steel.
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Threaded.
5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and coil.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

### C. Thermostatic Expansion Valves: Comply with AHRI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Reverse-flow option (for heat-pump applications).
6. End Connections: Socket, flare, or threaded union.

### D. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in parts per million (ppm).
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

### E. Replaceable-Core Filter Dryers: Comply with AHRI 730.

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Designed for reverse flow (for heat-pump applications).
4. End Connections: Socket.
5. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.

6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

## 2.4 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

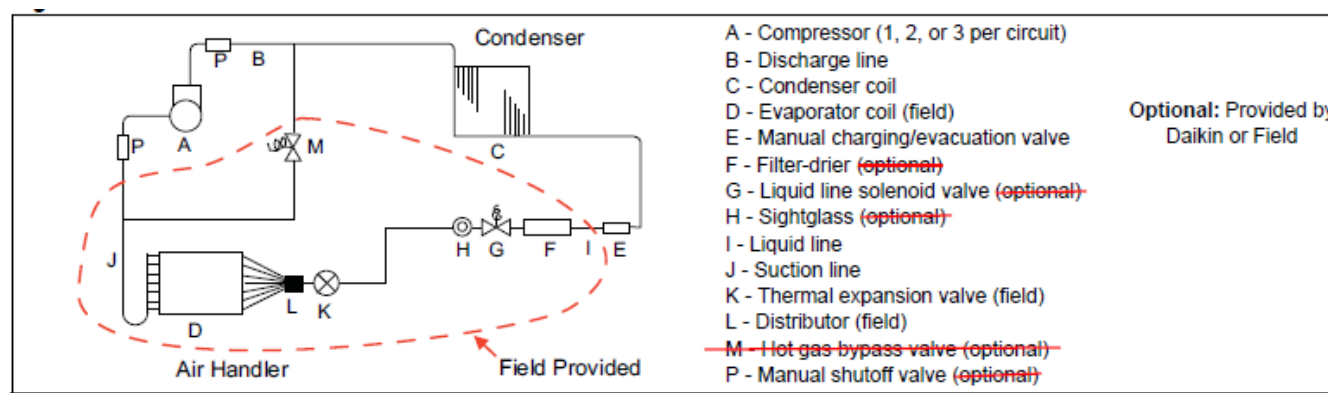
## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Type ACR, K, or L.

### 3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Provide in accordance with condensing unit manufacturer's installation instructions.



- B.
- C. Provide manual shutoff valves at:

1. Condensing unit liquid line outlet
2. Expansion valve
3. Distributor.

### 3.3 PIPING INSTALLATION

- A. Provide in accordance with the manufacturers piping drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- L. The piping systems shall extend above the highest component in the refrigeration system before dropping down to make the final refrigerant connections to components. This practice will hinder the draining of condensed refrigerant to the lower component when normal shutdown procedures do not occur (such as a power failure).
- M. Slope refrigerant piping as follows:
  - 1. Slope the refrigerant lines 1" per 10 feet of horizontal run in the direction of refrigerant flow to assist oil return.
  - 2. Suction risers shall be sized for proper oil return.
  - 3. Small traps shall be provided at the base of vertical gas riser to assist in the collection of oil. If vertical risers exceed more than 25 feet, install a small trap at the midpoint and at a maximum of 20 foot intervals.
  - 4. Liquid lines shall be sloped 1/8 inch per foot in the direction of refrigerant flow. Trapping is unnecessary.
- N. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

### 3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube." Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.

### 3.5 HANGERS AND SUPPORTS

- A. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal run.
  - 2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- B. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
  - 1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
  - 2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
  - 3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
  - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
  - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
  - 6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
  - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
- C. Support multi-floor vertical runs at least at each floor.

### 3.6 ROOF PENETRATIONS

- A. Provide in accordance with 230500 "Common Work Results for HVAC".
- B. Provide pre-molded pipe flashings at roof penetrations.

### 3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.
    - b. System shall maintain test pressure at the manifold gage throughout duration of test.

- c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
- d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

### 3.8 SYSTEM CHARGING

A. Charge system using the following procedures:

- 1. Install core in filter dryers after leak test but before evacuation.
- 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
- 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
- 4. Charge system with a new filter-dryer core in charging line.

### 3.9 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300