

SECTION 232301 – VRV/VRF REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes refrigerant piping used for VRV/VRF air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction (low pressure gas) Lines: 550 psig, or per equipment manufacturers recommendation.
 - 2. Hot-Gas (high pressure gas) and Liquid Lines: 550 psig, or per equipment manufacturers recommendation.

1.3 SUBMITTALS

- A. Product Data: Provide for each type of valve and refrigerant piping specialty indicated.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, valve arrangements and locations, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
 - 1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including 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.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."
- C. Installer Qualification: Only trained installers skilled in refrigeration pipe installation and assembly of Refrigerant Coupling Systems, Inc. mechanically attached fittings.

1.5 PRODUCT STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube:

1. Straight Lengths: ASTM B 75, UNS C12200, H55 Temper (Light Drawn), ACR Bending Quality; Cleaned, Eddy Current Tested, and Plugged per ASTM B 280.
2. Coiled: ASTM B 280, UNS C12200, O60 Temper (Soft Annealed), ACR, cleaned and capped

B. Mechanically Attached Fittings:

1. Brass Body mechanically attached fittings, ETL Listed, per UL-207 with an allowable working pressure of 1,167 psi.: Refrigerant Coupling Systems, Inc. (RCS) couplings, reducers, and flare fittings
2. Primary seal shall be metal to metal seal. Use of O-ring seals is not permitted.

C. Field Bends (all angles): ASME B31.5

2.2 VALVES AND SPECIALTIES

A. Service Valves:

1. Body: Forged brass with brass cap.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Straight ends.
5. Working Pressure Rating: 700 psig.
6. Maximum Operating Temperature 250 deg. F
7. Valves must be specifically rated for R-410A.

2.3 REFRIGERANTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Fittings shall be suitable for use with CFC, HCFC, HFC, HFO and R744 (CO₂) refrigerants within the design pressure rating. Fittings shall be suitable for use with Refrigerant class A2L (mildly flammable).

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Suction (low pressure gas), Hot Gas (high pressure gas) and Liquid Lines OD 5/8" and Smaller for Conventional Air-Conditioning, Heat Pump, and Heat Recovery Applications: Copper, Type ACR, O60 (soft annealed)-temper tubing and field bent fittings with mechanically attached joints.
- B. Suction (low pressure gas), Hot Gas (high pressure gas), and Liquid Lines OD 1-5/8" and smaller for Conventional Air-Conditioning, Heat Pump, and Heat Recovery Applications: Straight Lengths, Copper, Type ACR Type L, H55 (light drawn)-temper tubing and field bent fittings with mechanically attached joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install service valves as shown on plans or as required to isolate system components.

3.3 PIPING 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 to layout are approved on Shop 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.
- E. Install piping above accessible ceilings to allow enough 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. Field Bend changes in direction.
- I. Select system components with pressure rating equal to or greater than maximum allowable working 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. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Provide Jacketed insulation in locations where exposed to mechanical injury.
- M. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- N. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

- R. Provide proper compensation for pipe/tube expansion and contraction per equipment manufacturers recommendations.

3.4 PIPE JOINT CONSTRUCTION

- A. Mechanically Attached Joints: Construct joints with approved mechanically attached fittings as described above.
- B. Field Bends: Fabricate field bends with a center-line bend radius greater than or equal to 4 times the nominal OD of the pipe or tube. Tube shall be bent with a tubing bender sized for ACR OD tube sizes and shall not cause cracks or wrinkles in the tube or pipe. Do NOT use a conduit bender for bending ACR copper. The difference between maximum and minimum diameters for pipe bends should not exceed 8% of the nominal outside diameter of the pipe. Only O60 soft annealed-temper and H55 light drawn-temper shall be field bent. Do NOT field bend H58 drawn general purpose-temper copper tube.

C. JOINING PROCEDURE

1. Tube ends shall be cut with a clean sharp tubing cutter.
2. Deburr the I.D. of the cut tube end with a clean, sharp deburring tool.
3. Visually inspect the interior of each tube for obstructions and debris before assembly. Protect the joint from contamination before assembly.
4. Visually inspect the exterior of each tube end receiving a fitting. This tube end must be clean, free of burrs, scratches, pits, or deformation. End of fitting must be round.
5. Install joint in strict compliance with Refrigerant Coupling Systems, Inc. installation instructions.

D. THERMAL INSULATION AND VAPOR BARRIER

1. Insulate piping as required by equipment manufacturer, local codes and authority having jurisdiction.
2. Strictly comply with insulation manufacturers installation instructions to provide a vapor proof insulation system.
3. If properly sealed vapor proof insulation system is not possible, mechanically attached fittings installed outdoors or in extremely humid environments should be protected with cold shrink sleeves, or heat shrink sleeves.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 1. Adjustable steel clevis hangers for individual horizontal runs.
 2. Rigid high compressive strength foam insulating pipe support at all support points. Comply with Section 230719 "DX Piping System Insulation".
 3. Do NOT attach hangers directly to pipe or tube.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 1. Up to 3/4" OD: Maximum span, 60 inches; minimum rod size, 3/8 inch.
 2. Greater than 3/4" thru 1" OD: Maximum span, 72 inches; minimum rod size, 3/8 inch.
 3. Greater than 1" thru 2-1/8" OD: Maximum span, 96 inches; minimum rod size, 3/8 inch.

- D. Support multi-floor vertical runs every 10 feet and at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test as recommended by equipment manufacturers instructions.
 - 3. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - a. Fill system with 95/5 nitrogen/hydrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test all joints and fittings with hydrogen leak detector, at test pressure.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures and per equipment manufacturers instructions.
 - 1. Evacuate (triple evacuation procedure) entire refrigerant system with a vacuum pump to obtain a steady state vacuum of less than 500 micrometers. If vacuum holds for 12 hours, system is ready for charging. Do NOT evacuate the system through a charging manifold. Use only suction rated hoses and core removal tools.
 - 2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 3. Charge system as recommended by equipment manufacturer.

END OF SECTION 232301