SECTION 232301 – VRV/VRF REFRIGERANT PIPING

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
   * + 1. SUMMARY
          1. This Section includes refrigerant piping used for VRV/VRF air-conditioning applications.
       2. PERFORMANCE REQUIREMENTS
          1. Line Test Pressure for Refrigerant R-410A:

Suction (low pressure gas) Lines: 550 psig, or per equipment manufacturers recommendation.

Hot-Gas (high pressure gas) and Liquid Lines: 550 psig, or per equipment manufacturers recommendation.

* + - 1. SUBMITTALS
         1. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
         2. 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.

Retain subparagraph below to have Contractor size and design refrigeration piping.

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.

* + - * 1. Field quality-control test reports.
        2. Operation and maintenance data.
      1. QUALITY ASSURANCE
         1. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
         2. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."
         3. Installer Qualification: Only trained installers skilled in refrigeration pipe installation and brazing of copper tubing should be used.
      2. PRODUCT STORAGE AND HANDLING
         1. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1. PRODUCTS
   * + 1. COPPER TUBE AND FITTINGS
          1. Copper Tube:

Straight Lengths: ASTM B 75, UNS C12200, H55 Temper (Light Drawn), ACR Bending Quality; Cleaned, Eddy Current Tested, and Plugged per ASTM B 280.

Reftekk “HHC”

Coiled: ASTM B 280, UNS C12200, O60 Temper (Soft Annealed), ACR, cleaned and capped

Reftekk “CCE”

* + - * 1. Brazing Filler Metals: AWS A5.8.

Reftekk “BRG”

* + - * 1. Field Swaged Brazing Cups: MSS-SP-73, ASME B 16.50
        2. Field Bends (all angles): ASME B31.5
      1. VALVES AND SPECIALTIES
         1. Service Valves:

Body: Forged brass with brass cap including key end to remove core.

Core: Removable ball-type check valve with stainless-steel spring.

Seat: Polytetrafluoroethylene.

End Connections: Socket ends.

Working Pressure Rating: 700 psig.

Maximum Operating Temperature 250 deg. F

Valves must be specifically rated for R-410A.

* + - 1. REFRIGERANTS
         1. 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:
         2. ASHRAE 34, R-410A: R-32/R-125 (50.0/50.0)

1. EXECUTION
   * + 1. PIPING APPLICATIONS
          1. 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 brazed joints.
          2. Suction (low pressure gas), Hot Gas (high pressure gas), and Liquid Lines OD 2-1/8” 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 brazedjoints.
       2. VALVE AND SPECIALTY APPLICATIONS
          1. Install service valves as shown on plans or as required to isolate system components.
       3. PIPING INSTALLATION
          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 Shop Drawings.
          2. Install refrigerant piping according to ASHRAE 15.
          3. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
          4. 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.
          5. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
          6. Install piping adjacent to machines to allow service and maintenance.
          7. Install piping free of sags and bends.
          8. Field Bend changes in direction.
          9. Select system components with pressure rating equal to or greater than maximum allowable working pressure.
          10. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
          11. 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.
          12. Install insulated refrigerant piping in water-tight protective conduit where installed belowground.
          13. Provide Jacketed insulation in locations where exposed to mechanical injury.
          14. 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.
          15. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
          16. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."
          17. 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."

Retain first paragraph below for piping that penetrates an exterior concrete wall or concrete slab.

* + - * 1. 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."
        2. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."
        3. Provide proper compensation for pipe/tube expansion and contraction per equipment manufacturers recommendations.
      1. PIPE JOINT CONSTRUCTION
         1. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

Use Type BcuP-5 (15% Ag, 80% Cu, 5% P), copper-phosphorus alloy pre-formed brazing rings for joining copper swage fittings and copper socket fittings with copper pipe. Do NOT use flux.

Use Type Bag-5 (45% Ag), cadmium-free silver alloy for joining copper with bronze or steel. Use manufacturers recommended flux.

* + - * 1. Field Swaged Brazing Cups: Fabricate brazing cup on one tubing end for each coupling. Only O60 (soft annealed) and H55 (light drawn) may be swaged. Do NOT swage H58 (drawn general purpose). Use swaging tool designed to provide a minimum of 0.0015” brazing gap and a maximum of 0.005” brazing gap. Brazing cup depth for each tube size shall be as follows.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1/4" | 3/8” | 1/2" | 5/8” | 3/4" | 7/8” | 1-1/8” | 1-3/8” | 1-5/8” | 2-1/8” |
| 0.250” | 0.280” | 0.310” | 0.390” | 0.420” | 0.460” | 0.510” | 0.560” | 0.600” | 0.700” |

* + - * 1. 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.
        2. BRAZING AND JOINING PROCEDURE

Tube ends shall be cut with a clean sharp tubing cutter.

Deburr the I.D. of the cut tube end with a clean deburring tool.

Visually inspect the interior of each tube for obstructions and debris before assembly. Protect the joint from contamination before brazing.

Method of pre-cleaning: Non-shedding abrasive pads (Scotch Bright) to remove all oxides in the brazing area followed by wiping with a clean lint-free white cloth. Do not groove the surfaces while cleaning.

Purge all tubing with oil free nitrogen while brazing and until cool to the touch. Use an oxygen analyzer to verify the absence of oxygen prior to brazing. The oxygen content shall be less than 1% before start of brazing.

Use a neutral to slightly reducing flame using oxy/acetylene or oxy/propane.

Use the proper torch tip based on tube size as recommended by the torch manufacturer. Use of Turbo-Torch or Rosebud is permitted.

Post Brazing Cleaning: Exterior of all completed joints shall be washed with a water soaked rag or sponge, followed by brushing with a stainless-steel hand wire brush to remove any residue for inspection.

* + - 1. HANGERS AND SUPPORTS

Piping hangers and supports must accommodate expansion and contraction, vibration, dead load of piping and its contents, and seismic-bracing requirements.

* + - * 1. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
        2. Install the following pipe attachments:

Adjustable steel clevis hangers for individual horizontal runs.

Rigid high compressive strength foam insulating pipe support at all support points. Comply with Section 230719 “DX Piping System Insulation”.

Do NOT attach hangers directly to pipe or tube.

* + - * 1. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

Verify actual supported loads for hanger sizes and spacing. Consult structural engineer. Spacing and sizes in subparagraphs below are from the 2000 ASHRAE HANDBOOK - "HVAC Systems and Equipment."

Up to 3/4" OD: Maximum span, 60 inches; minimum rod size, 3/8 inch.

Greater than 3/4" thru 1” OD: Maximum span, 72 inches; minimum rod size, 3/8 inch.

Greater than 1” thru 2-1/8” OD: Maximum span, 96 inches; minimum rod size, 3/8 inch.

* + - * 1. Support multi-floor vertical runs every 10 feet and at least at each floor.
      1. FIELD QUALITY CONTROL
         1. Perform tests and inspections and prepare test reports.
         2. Tests and Inspections:

Comply with ASME B31.5, Chapter VI.

Test as recommended by equipment manufacturers instructions.

Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

Fill system with 95/5 nitrogen/hydrogen to the required test pressure.

System shall maintain test pressure at the manifold gage throughout duration of test.

Test all joints and fittings with hydrogen leak detector, at test pressure.

Remake leaking joints using new materials, and retest until satisfactory results are achieved.

* + - 1. SYSTEM CHARGING
         1. Charge system using the following procedures and per equipment manufacturers instructions.

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.

Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.

Charge system as recommended by equipment manufacturer.

END OF SECTION 232301