

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field refrigerant piping and associated drain and condenser water piping for split ductless air conditioning systems, including required piping insulation.
- B. Definitions:
 - 1. Refrigerating system: Combination of interconnected refrigerant-containing parts constituting one closed refrigeration circuit in which a refrigerant is circulated for the purpose of extracting heat.
 - a. Low side means the parts of a refrigerating system subjected to evaporator pressure.
 - b. High side means the parts of a refrigerating system subjected to condenser pressure.
 - 2. Brazed joint: A gas-tight joint obtained by the joining of metal parts with alloys which melt at temperatures higher than 449 degrees C (840 degrees F) but less than the melting temperatures of the joined parts.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 13 05 41, SEISMIC RESTRAINTS FOR NON-STRUCTURAL COMPONENTS.
- D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- E. Section 23 81 43, SPLIT DUCTLESS AIR CONDITIONING SYSTEM.

1.3 QUALITY ASSURANCE

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC, which includes welding qualifications.
- B. Comply with ASHRAE Standard 15, Safety Code for Mechanical Refrigeration. The application of this Code is intended to assure the safe design, construction, installation, operation, and inspection of every refrigerating system employing a fluid which normally is vaporized and liquefied in its refrigerating cycle.
- C. Comply with ASME B31.5: Refrigerant Piping and Heat Transfer Components.
- D. Products shall comply with UL 207 "Refrigerant-Containing Components and Accessories, "Nonelectrical"; or UL 429 "Electrical Operated Valves."

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Pipe and tubing, with specification, class or type, and schedule.
2. Pipe fittings, including miscellaneous adapters and special fittings.
3. Flanges, gaskets and bolting.
4. Valves of all types.
5. Piping Insulation Material.
6. Firestop Material.

C. Shop Drawings:

1. Complete information for components noted, including valves and refrigerant piping accessories, clearly presented, shall be included to determine compliance with drawings and specifications for components noted below:
 - a. Tubing and fittings
 - b. Valves
 - c. Flexible metal hose
 - d. Pipe and equipment supports
 - e. Refrigerant type
 - f. Pipe/conduit roof penetration cover
 - g. Soldering and brazing materials
2. Layout of refrigerant piping and accessories, including flow capacities, valves locations, and slopes of horizontal runs, roof/floor/wall penetrations, and equipment connection details.

D. Certification: Copies of certificates for welding procedure, performance qualification record and list of welders' names and symbols.

E. As-Built Drawings: Provide drawing as follows for refrigerant piping.

1. One set of reproducible drawings.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Air Conditioning, Heating, and Refrigeration Institute (ARI/AHRI):

495-05.....Standard for Refrigerant Liquid Receivers

730-05.....Flow Capacity Rating of Suction-Line Filters and
Suction-Line Filter-Driers

750-07.....Thermostatic Refrigerant Expansion Valves

760-07.....Performance Rating of Solenoid Valves for Use
with Volatile Refrigerants

C. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):

15-10.....Safety Standard for Refrigeration Systems (ANSI)

- 17-08.....Method of Testing Capacity of Thermostatic
Refrigerant Expansion Valves (ANSI)
- 63.1-95 (RA 01).....Method of Testing Liquid Line Refrigerant Driers
(ANSI)
- D. American National Standards Institute (ANSI):
 - A13.1-07.....Scheme for Identification of Piping Systems
 - Z535.1-11.....Safety Color Code
- E. American Society of Mechanical Engineers (ASME):
 - B16.18-12.....Cast Copper Alloy Solder Joint Pressure Fittings
 - B16.22-12.....Wrought Copper and Copper Alloy Solder-Joint
Pressure Fittings
 - B31.5-13.....Refrigeration Piping and Heat Transfer
Components
- F. American Society for Testing and Materials (ASTM):
 - A126-04 Standard Specification for Gray Iron Castings
for Valves, Flanges, and Pipe Fittings
 - B32-08 Standard Specification for Solder Metal
 - B88-09.....Seamless Copper Water Tube
 - B280-13 Standard Specification for Seamless Copper Tube
for Air Conditioning and Refrigeration Field
Service
 - B584-13 Standard Specification for Copper Alloy Sand
Castings for General Applications
- G. American Welding Society (AWS):
 - A5.8-12 Standard Specification for Filler Metals for
Brazing and Braze Welding
- H. Manufacturers Standardization Society (MSS) of the Valve and Fitting
Industry, Inc:
 - SP-110-10.....Ball Valves Threaded, Socket-Welding, Solder
Joint, Grooved and Flared Ends
- I. Underwriters Laboratories (U.L.):
 - 207-09 Standard for Refrigerant-Containing Components
and Accessories, Nonelectrical
 - 429-09.....Electrically Operated Valves

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS

- A. Provide in accordance with Section 13 05 41, SEISMIC RESTRAINTS FOR NON-
STRUCTURAL COMPONENTS.

2.2 PIPING AND FITTINGS

- A. Refrigerant Piping: For piping up to 100 mm (4 inch) use Copper refrigerant tube, ASTM B280, cleaned, dehydrated and sealed, marked ACR on hard temper straight lengths. Coils shall be tagged ASTM B280 by the manufacturer.
- B. Water and Drain Piping: Copper water tube, ASTM B88, Type M or L. Optional drain piping material: Schedule 80 flame retardant Polypropylene plastic.
- C. Copper fittings: Wrought copper fittings, ASME B16.22.
 - 1. Brazed Joints, refrigerant tubing: Cadmium free, AWS A5.8, 45 percent silver brazing alloy, Class BAg-5.
 - 2. Solder Joints, water and drain: 95-5 tin-antimony, ASTM B32 (95TA).

2.3 REFRIGERANT VALVES AND ACCESSORIES

- A. Isolation Service Valves: U.L. Listed and CE certified. 2-way Full port construction to match line size ID. Compatible with all CFC, HCFC and HFC refrigerants and oils. Maximum working pressure at 700 psig and working temperature range -40 Degrees F to 300 Degrees F. Internally equalized ball design, rupture-roof encapsulated stem, and solder ends with access port.

2.4 PIPE SUPPORTS

- A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.5 REFRIGERANTS

- A. Provide EPA approved refrigerant for proper system operation.

2.6 PIPE/CONDUIT ROOF PENETRATION COVER

- A. Penetration Cover: Galvanized sheet metal with flanged removable top. Provide 38 mm (1-1/2 inch) thick mineral fiber board insulation.
- B. Flashing Sleeves: Provide sheet metal sleeves for conduit and pipe penetrations of the penetration cover. Seal watertight penetrations.

2.7 PIPE INSULATION

- A. Insulate refrigerant suction and liquid piping from outdoor condenser to indoor evaporator. Use 20 mm (3/4-inch) thick insulation. Insulation material shall meet equipment (i.e. split ductless air conditioning system) manufacturer's requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC

equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

- B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

3.2 INSTALLATION

- A. Install refrigerant piping and refrigerant containing parts in accordance with ASHRAE Standard 15 and ASME B31.5.
 - 1. Install piping as short as possible, with a minimum number of joints, elbow and fittings.
 - 2. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide 25 mm (1 inch) minimum clearance between adjacent piping or other surface. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness insulation.
 - 3. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position.
 - 4. Install hangers and supports per ASME B31.5 and the refrigerant piping manufacturer's recommendations.
- B. Joint Construction: Braze Joints: Comply with AWS "Brazing Handbook" and with filler materials complying with AWS A5.8.
 - 1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper tubing.
 - 2. Swab fittings and valves with manufacturer's recommended cleaning fluid to remove oil and other compounds prior to installation.
 - 3. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.
- C. Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.
- D. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material.

3.3 SEISMIC BRACING

- A. Provide in accordance with Section 13 05 41, SEISMIC RESTRAINT

REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.4 PIPING INSULATION

- A. Apply two coats of weather-resistant finish as recommended by the manufacturer to insulation exposed to outdoor weather.

3.5 FIELD QUALITY CONTROL

- A. Prior to initial operation examine and inspect piping system for conformance to plans and specifications and ASME B31.5. Correct equipment, material, or work rejected because of defects or nonconformance with plans and specifications, and ANSI codes for pressure piping.
- B. After completion of piping installation and prior to initial operation, conduct test on piping system according to ASME B31.5. Furnish materials and equipment required for tests. Perform tests in the presence of the COR. If the test fails, correct defects and perform the test again until it is satisfactorily done and all joints are proved tight.
 - 1. Every refrigerant-containing parts of the system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gages, control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation.
 - 2. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure-relief device protecting the high or low side of the system, respectively, except systems erected on the premises using non-toxic and non-flammable Group A1 refrigerants with copper tubing not exceeding DN 18 (NPS 5/8). This may be tested by means of the refrigerant charged into the system at the saturated vapor pressure of the refrigerant at 20 degrees C (68 degrees F) minimum.
- C. Test Medium: A suitable dry gas such as nitrogen or shall be used for pressure testing. The means used to build up test pressure shall have either a pressure-limiting device or pressure-reducing device with a pressure-relief device and a gage on the outlet side. The pressure relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system components.

3.6 SYSTEM TEST AND CHARGING

- A. System Test and Charging: As recommended by the equipment manufacturer or as follows.
 - 1. Connect a drum of refrigerant to charging connection and introduce enough refrigerant into system to raise the pressure to 70 kPa (10 psi) gage. Close valves and disconnect refrigerant drum. Test system

- for leaks with halide test torch or other approved method suitable for the test gas used. Repair all leaking joints and retest.
2. Connect a drum of dry nitrogen to charging valve and bring test pressure to design pressure for low side and for high side. Test entire system again for leaks.
 3. Evacuate the entire refrigerant system by the triplicate evacuation method with a vacuum pump equipped with an electronic gage reading in mPa (microns). Pull the system down to 665 mPa (500 microns) 665 mPa (2245.6 inches of mercury at 60 degrees F) and hold for four hours then break the vacuum with dry nitrogen (or refrigerant). Repeat the evacuation two more times breaking the third vacuum with the refrigeration to be charged and charge with the proper volume of refrigerant.

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