PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for split system air-conditioning applications.

B. Refrigerant piping indicated is schematic only. Size piping and design the actual piping layout, including oil traps, double risers, and specialties, in accordance with the air-conditioning equipment manufacturer’s written instructions to ensure proper operation and compliance with warranties of connected equipment.

C. Refrigerant type shall be consistent with refrigeration equipment specified in other Sections.

1.2 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.

B. Pipe Sizing Criteria: Air-conditioning manufacturer’s refrigerant pipe sizing criteria.

C. Piping Layouts: For each split-type air conditioning system with a total equivalent pipe length greater than 75 feet, submit a sketch showing the following:

   1. System identification.

   2. Isometric drawing of refrigerant liquid and vapor piping showing straight piping lengths, Indicate total equivalent length of liquid and vapor piping.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE


B. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."

C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. **Refrigerants:**
   
a. Allied Signal, Inc./Fluorine Products; Genetron Refrigerants.
b. DuPont Company; Fluorochemicals Div.
d. ICI Americas Inc./ICI KLEA; Fluorochemicals Bus.

2. **Refrigerant Valves and Specialties:**
   
a. Climate & Industrial Controls Group; Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
b. Danfoss Electronics, Inc.
c. Emerson Electric Company; Alco Controls Div.
d. Henry Valve Company.
e. Sporlan Valve Company.

2.2 **COPPER TUBE AND FITTINGS**

A. **Drawn-Temper Copper Tube:** ASTM B 280, Type ACR.

B. **Annealed-Temper Copper Tube:** ASTM B 280, Type ACR.

C. **Wrought-Copper Fittings:** ASME B16.22.

D. **Brazing Filler Metals:**
   
   1. Copper-to Copper Joints: BCuP-5 or BCuP-6 without flux.
   2. Copper-to-Steel or Brass Joints: BAg-28 with non-acid flux.

2.3 **VALVES**

A. **Diaphragm Packless Valves:** 500-psig working pressure and 275 degrees F working temperature; globe design with straight-through or angle pattern; forged-brass or bronze body and bonnet, positive backseating, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless-steel spring, nylon seat disc, and with solder-end connections.

B. **Packed-Angle Valves:** 500-psig working pressure and 275 degrees F working temperature; forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, and with solder-end connections.

C. **Packed Ball Valves:** 500 psig working pressure and 300 degree F working temperature; two-piece, forged brass body with copper tube extensions, brass bonnet and seal cap, chrome-plated ball, Teflon seals, and neoprene ring stem seals.
D. Check Valves: 500 psig working pressure and 300 degree F working temperature; cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, and Teflon seat disc.

E. Solenoid Valves: Comply with ARI 760; 250 degrees F temperature rating and 400-psig working pressure; forged brass, with polytetrafluoroethylene valve seat, 2-way, straight-through pattern, and solder-end connections; manual operator; fitted with suitable NEMA 250 enclosure of type required by location, with 1/2-inch conduit adapter and holding coil.

F. Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, factory sealed and ASME labeled for standard pressure setting.

G. Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

H. Hot-Gas Bypass Valve: Pulsating-dampening design, stainless-steel bellows and polytetrafluoroethylene valve seat; adjustable; sized for capacity equal to last step of compressor unloading; with solder-end connections.

2.4 REFRIGERANT PIPING SPECIALITIES

A. Moisture/Liquid Indicators: 500-psig maximum working pressure and 200 degrees F operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.

B. Permanent Filter-Dryer: 500-psig maximum operating pressure and 225 degrees F maximum operating temperature; steel shell and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

C. Flexible Connectors: 500-psig (3450-kPa) minimum operating pressure; seamless tin-bronze core, high-tensile bronze-braid covering, and solder-joint end connections; dehydrated, pressure tested, minimum 7 inches (180mm) long.

D. Mufflers: 500-psig operating pressure, welded-steel construction with fusible plug; sized for refrigeration capacity.

E. Straight- or Angle-Type Strainers: 500-psig working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen of 80 to 100 mesh in liquid lines up to 1-1/8 inches, 60 mesh in larger liquid lines, and 40 mesh in suction lines; with screwed cleanout plug and solder-end connections.

2.5 RECEIVERS

A. Receivers, 6-Inch Diameter and Smaller: ARI 495, UL listed, steel, brazed, 400-psig pressure rating, with tappings for inlet, outlet, and pressure relief valve.
B. Receivers Larger Than 6-Inch Diameter: ARI 495, welded steel, tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII; 400-psig pressure rating, with tappings for liquid inlet and outlet valves, pressure relief valve, and liquid-level indicator.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Aboveground: Type ACR drawn-copper tubing. Type ACR annealed-copper tubing may be used on refrigerant piping 1-1/8 inch o.d. and smaller.

B. Belowground: Type ACR annealed-copper tubing with no joints belowground.

3.2 PIPING INSTALLATION

A. Install refrigerant piping according to ASHRAE 15, American Refrigeration Institute (ARI), and refrigeration equipment manufacturer's written recommendations.

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for HVAC."

C. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

D. Install valves and specialties as indicated on Drawings. Each refrigerant circuit shall have a minimum of one field-installed moisture/liquid indicator and one field-installed permanent filter-dryer. Provide isolation valves for the replacement of each of these items.

E. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

F. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

G. Pitch refrigerant piping and install oil traps, properly sized and located, to ensure that oil in any part of the system will return to the compressor under all system operating conditions.

H. Belowground, install copper tubing in Schedule 40 PVC protective conduit. Size conduit to permit easy replacement of largest refrigerant line. Vent conduit outdoors.

I. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

J. 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.
K. Hanger, support, and anchor products are specified in Division 22 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with requirements below for maximum spacing of pipe supports.

L. Install hangers with the following maximum spacing and minimum rod sizes:

1. 5/8 Inch O.D.: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 3/4 Inch O.D.: Maximum span, 5 feet; minimum rod size, 1/4 inch.
3. 7/8 Inch O.D.: Maximum span, 6 feet; minimum rod size, 1/4 inch.
4. 1-1/8 Inch O.D.: Maximum span, 6 feet; minimum rod size, 1/4 inch.
5. 1-3/8 Inch O.D.: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. 1-5/8 Inch O.D.: Maximum span, 8 feet; minimum rod size, 3/8 inch.
7. 2-1/8 Inch O.D.: Maximum span, 8 feet; minimum rod size, 3/8 inch.
8. 2-5/8 Inch O.D.: Maximum span, 9 feet; minimum rod size, 3/8 inch.

M. Support vertical runs at each floor.

3.3 PIPE JOINT CONSTRUCTION

A. Braze joints according to Division 22 Section "Common Work Results for HVAC."

B. Flow an inert gas (nitrogen or carbon dioxide) through pipe and fittings during brazing to prevent scale formation.

3.4 FIELD QUALITY CONTROL

A. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.

1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
2. Test high- and low-pressure side piping of each system at not less than the lower of the pressure specified in Chapter "Refrigeration" of the applicable edition of the International Mechanical Code or the setting of pressure relief device protecting high and low side of system.
   a. System shall maintain test pressure at the manifold gage throughout the test.
   b. Test joints and fittings by brushing a small amount of soap and glycerine solution over joint.
   c. Fill system with nitrogen to raise to test pressure.

3.5 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Evacuate with a vacuum pump to 500 micrometers. Hold for 12 hours, then charge.
2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
3. Charge system with a full-operating charge.

END OF SECTION