



SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Refrigerant piping.
 2. Unions, flanges, and couplings.
 3. Pipe hangers and supports.
 4. Refrigerant moisture and liquid indicators.
 5. Valves.
 6. Refrigerant strainers.
 7. Refrigerant pressure regulators.
 8. Refrigerant pressure relief valves.
 9. Refrigerant filter-driers.
 10. Refrigerant solenoid valves.
 11. Refrigerant expansion valves.
 12. Electronic expansion valves.
 13. Refrigerant receivers.
 14. Underground pipe markers.
 15. Bedding and cover materials.

1.2 REFERENCES

- A. Air-Conditioning and Refrigeration Institute:
1. ARI 495 - Refrigerant Liquid Receivers.
 2. ARI 710 - Liquid-Line Driers.
 3. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.
 4. ARI 750 - Thermostatic Refrigerant Expansion Valves.
 5. ARI 760 - Solenoid Valves for Use with Volatile Refrigerants.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.



- C. American Society of Mechanical Engineers:
 - 1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
 - 3. ASME B31.5 - Refrigeration Piping.
 - 4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

- D. ASTM International:
 - 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - 3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 - 4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
 - 5. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
 - 6. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.

- E. American Welding Society:
 - 1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
 - 2. AWS D1.1 - Structural Welding Code - Steel.

- F. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 - 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
 - 3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

- G. Underwriters Laboratories Inc.:
 - 1. UL 429 - Electrically Operated Valves.

1.3 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, provide compatible system components and joints. Use brass ball valve and 6" long brass nipple when joining dissimilar metals in the systems.

- B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.

- C. Provide receivers on systems if recommended by equipment supplier.



- D. Flexible Connectors: Use at or near compressors where piping configuration does not absorb vibration.

1.4 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-407C:
 - 1. Suction Lines for Air-Conditioning Applications: 230 psig.
 - 2. Suction Lines for Heat-Pump Applications: 380 psig.
 - 3. Hot-Gas and Liquid Lines: 380 psig.
- B. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

1.5 SUBMITTALS

- A. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.
- B. Product Data:
 - 1. Piping: Submit data on pipe materials, fittings, and accessories.
 - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
 - 3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
 - 4. Refrigerant Specialties: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes for the following:
 - a. Refrigerant. Type.
 - b. Refrigerant moisture and liquid indicators.
 - c. Refrigerant strainers.
 - d. Refrigerant pressure regulators.
 - e. Refrigerant pressure relief valves.
 - f. Refrigerant filter-driers.
 - g. Refrigerant solenoid valves.
 - h. Refrigerant expansion valves.
 - i. Electronic expansion valves.
- C. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.



- D. Test Reports: Indicate results of refrigerant leak test.
- E. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.
- F. Welding Certificates.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

- A. Copper Tubing: ASTM B280, drawn
- B. Fittings: ASME B16.22 wrought copper ASTM B16.26 Cast Copper.
 - 1. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 UNIONS, FLANGES, AND COUPLINGS

- A. 2 inches and Smaller:
 - 1. Ferrous Piping: 150 psig malleable iron, threaded.
 - 2. Copper Pipe: Bronze, soldered joints.

2.3 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. **B-Line.**
 - 2. **Tolco.**
 - 3. **PHD.**
- B. Conform to ASME B31.5.
- C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron Carbon steel, adjustable swivel, split ring.
- D. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
- E. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
- F. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- G. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
- H. Vertical Support: Steel riser clamp.



- I. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- J. Floor Support for Hot Pipe 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- K. Copper Pipe Support: Carbon steel rings, adjustable, copper plated.
- L. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- M. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
- N. Sheet Lead: ASTM B749.

2.4 REFRIGERANT MOISTURE AND LIQUID INDICATORS

- A. Manufacturers:
 - 1. **Alco Controls Div, Emerson Electric Co.**
 - 2. **Parker Hannifin Corp., Refrig. & Air Cond. Div.**
 - 3. **Sporlan Valve Division / Parker Hannifin Corporation.**
- B. Indicators:
 - 1. Port: Single or Double, UL listed.
 - 2. Body: Copper or brass, flared or solder ends.
 - 3. Sight glass: Color-coded paper moisture indicator with removable element cartridge and plastic cap.
 - 4. Maximum working pressure: 500 psig
 - 5. Maximum working temperature: 200 degrees F.

2.5 VALVES

- A. Manufacturers:
 - 1. **Alco Controls Div, Emerson Electric Co.**
 - 2. **Parker Hannifin Corp., Refrig. & Air Cond. Div.**
 - 3. **Sporlan Valve Division / Parker Hannifin Corporation.**
- B. Diaphragm Packless Valves:
 - 1. UL listed, globe or angle pattern, forged brass body and bonnet solder or flared ends.
 - 2. Phosphor bronze and stainless steel diaphragms, rising stem and hand wheel.
 - 3. Stainless steel spring, nylon seats, disc with positive back seating.
 - 4. Maximum working pressure: 500 psig.



5. Maximum working temperature: 275 degrees F.
- C. Packed Angle Valves:
1. Forged brass or nickel-plated forged steel, solder or flared ends.
 2. Forged brass seal caps with copper gasket, rising stem and seat, molded stem packing.
 3. Maximum working pressure: 500 psig.
 4. Maximum working temperature: 275 degrees F.
- D. Ball Valves:
1. Two-piece bolted forged brass body with Teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals, soldered or threaded ends.
 2. Maximum working pressure: 500 psig.
 3. Maximum working temperature: 325 degrees F.
- E. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends.
 2. Maximum working pressure: 500 psig.
- F. Refrigerant Check Valves:
1. Manufacturers:
 - a. **Alco Controls Div, Emerson Electric Co.**
 - b. **Parker Hannifin Corp., Refrig. & Air Cond. Div.**
 - c. **Sporlan Valve Division / Parker Hannifin Corporation.**
 2. Globe Type:
 - a. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, Teflon seat disc.
 - b. Maximum working pressure: 500 psig.
 - c. Maximum working temperature: 300 degrees F.
 3. Straight Through Type:
 - a. Spring, neoprene seat.
 - b. Maximum working pressure: 500 psig.
 - c. Maximum working temperature: 250 degrees F.

2.6 REFRIGERANT STRAINERS

- A. Manufacturers:
1. **Alco Controls Div, Emerson Electric Co.**
 2. **Parker Hannifin Corp., Refrig. & Air Cond. Div.**



3. **Sporlan Valve Division / Parker Hannifin Corporation.**
- B. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or Monel reinforced with brass.
 2. Maximum working pressure: 430 psig.
- C. Straight Line, Non-Cleanable Type:
1. Steel shell, copper plated fittings, stainless steel wire screen.

2.7 REFRIGERANT PRESSURE REGULATORS

- A. Manufacturers:
1. **Alco Controls Div, Emerson Electric Co.**
 2. **Parker Hannifin Corp., Refrig. & Air Cond. Div.**
 3. **Sporlan Valve Division / Parker Hannifin Corporation.**
- B. Brass body, stainless steel diaphragm, direct acting or pilot operated with remote pressure pilot, adjustable over 0 to 80 psig range, for maximum working pressure of 450 psig.

2.8 REFRIGERANT PRESSURE RELIEF VALVES

- A. Manufacturers:
1. **Alco Controls Div, Emerson Electric Co.**
 2. **Parker Hannifin Corp., Refrig. & Air Cond. Div.**
 3. **Sporlan Valve Division / Parker Hannifin Corporation.**
- B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB; for standard 425 psig setting; selected to ASHRAE 15.

2.9 REFRIGERANT FILTER-DRIERS

- A. Manufacturers:
1. **Alco Controls Div, Emerson Electric Co. Mo**
 2. **Parker Hannifin Corp., Refrig. & Air Cond. Div.**
 3. **Sporlan Valve Division / Parker Hannifin Corporation.**
- B. Replaceable Cartridge Angle Type:
1. Shell: ARI 710, UL listed, brass, steel, removable cap, for maximum working pressure of 500 psig, inches outside diameter size connections.
 2. Filter Cartridge: Pleated media with integral end rings, stainless steel support, ARI 730 rating.



3. Filter/Dryer Cartridge: Pleated media with solid core sieve with activated alumina, ARI 730 rating.
4. Wax Removal Cartridge: Molded bonded core of activated charcoal with integral gaskets, ARI 710 moisture rating.

2.10 REFRIGERANT SOLENOID VALVES

- A. Manufacturers:
 1. **Alco Controls Div, Emerson Electric Co.**
 2. **Parker Hannifin Corp., Refrig. & Air Cond. Div.**
 3. **Sporlan Valve Division / Parker Hannifin Corporation.**
- B. Valve: ARI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly, integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psig. Stem designed to allow manual operation in case of coil failure.
- C. Coil Assembly: UL 429 listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box.

2.11 REFRIGERANT EXPANSION VALVES

- A. Manufacturers:
 1. **Alco Controls Div, Emerson Electric Co.**
 2. **Parker Hannifin Corp., Refrig. & Air Cond. Div.**
 3. **Sporlan Valve Division / Parker Hannifin Corporation.**
- B. Angle or Straight Through Type: ARI 750; design suitable for refrigerant, brass body, internal or external equalizer.
- C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and oversized at part load.

2.12 ELECTRONIC EXPANSION VALVES

- A. Manufacturers:
 1. **Alco Controls Div, Emerson Electric Co.**
 2. **Parker Hannifin Corp., Refrig. & Air Cond. Div.**
 3. **Sporlan Valve Division / Parker Hannifin Corporation.**
- B. Valve:
 1. Brass bodies with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.



2. Capacity: Nominal as shown on drawings.
- C. Evaporation Control System:
 1. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, pre-selection allowance for electrical defrost and hot gas bypass.
- D. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

2.13 REFRIGERANT RECEIVERS

- A. Internal Diameter 6 inch and Smaller: ARI 495, UL listed, steel, brazed; 400 psig maximum pressure rating, with taps for inlet, outlet, and pressure relief valve.
- B. Internal Diameter 6 inch and Larger: ARI 495, welded steel, tested and stamped in accordance with ASME Section VIII; 400 psig with taps for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

PART 3 - EXECUTION

3.1 INSTALLATION - INSERTS

- A. Provide inserts for placement in concrete forms.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- B. Place hangers within 12 inches of each horizontal elbow.
- C. Install hangers to allow 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.



- D. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
- E. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
- F. Prime coat exposed steel hangers and supports in accordance with specifications herein. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

- A. Route piping parallel to building structure and maintain gradient.
- B. Install piping to conserve building space, and not interfere with use of space.
- C. Group piping whenever practical at common elevations.
- D. Provide sleeve for pipe passing through partitions, walls and floors.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide access where valves and fittings are not exposed.
- G. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- H. Flood refrigerant piping system with nitrogen when brazing.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- J. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
- K. Install valves with stems upright or horizontal, not inverted.
- L. Insulate piping and equipment per these specifications.
- M. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.
- N. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
- O. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.



- P. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.
- Q. Provide electrical connection to solenoid valves.
- R. Fully charge completed system with refrigerant after testing.
- S. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
- T. Install insulation as required.

3.4 INSTALLATION - REFRIGERANT SPECIALTIES

- A. Refrigerant Liquid Indicators:
 - 1. Install line size liquid indicators in main liquid line downstream of condenser.
 - 2. When receiver is provided, install line size liquid indicators in liquid line downstream of receiver.
 - 3. Install line size liquid indicators downstream of liquid solenoid valves.
- B. Refrigerant Valves:
 - 1. Install service valves on compressor suction and discharge.
 - 2. Install gage taps at compressor inlet and outlet.
 - 3. Install gage taps at hot gas bypass regulators, inlet and outlet.
 - 4. Install check valves on compressor discharge.
 - 5. Install check valves on condenser liquid lines on multiple condenser systems.
 - 6. Install refrigerant charging valve in liquid line between receiver shut-off valve and expansion valve.
- C. Strainers:
 - 1. Install line size strainer upstream of each automatic valve.
 - 2. Where multiple expansion valves with integral strainers are used, install single main liquid-line strainer.
 - 3. On steel piping systems, install strainer in suction line.
 - 4. Install shut-off valves on each side of strainer.
- D. Install pressure relief valves on ASME receivers. Install relief valve discharge piping to terminate outdoors.
- E. Filter-Dryers:
 - 1. Install permanent filter-dryers in low temperature systems.
 - 2. Install permanent filter-dryer in systems containing hermetic compressors.



3. Install replaceable cartridge filter-dryer vertically in liquid line adjacent to receivers.
 4. Install replaceable cartridge filter-dryer upstream of each solenoid valve.
- F. Solenoid Valves:
1. Install in liquid line of systems operating with single pump-out or pump-down compressor control.
 2. Install in liquid line of single or multiple evaporator systems.
 3. Install in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

3.5 FIELD QUALITY CONTROL

- A. Test refrigeration system in accordance with ASME B31.5.
- B. Pressure test refrigeration system with dry nitrogen to 200 psig.
- C. Repair leaks.
- D. Retest until no leaks are detected.

END OF SECTION 23 23 00