SECTION 232300

REFRIGERANT PIPING AND SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Check valves.

G. Pressure relief valves.

H. Filter-driers.

I. Solenoid valves.

J. Expansion valves.

K. Receivers.

L. Flexible connections.

M. Equipment drains and overflows.

1.2 RELATED SECTIONS

A. Division 08 - Access Doors.

B. Division 09 - Painting.

C. Section 23 07 00 - Piping Insulation.

D. Section 23 07 16 - Equipment Insulation.

E. Section 23 09 93 - Sequence of Operation.

F. Section 23 54 00 - Forced Air Furnaces.

G. Section 23 61 00 - Reciprocating Refrigerant Compressor.

H. Section 23 63 13 - Air Cooled Refrigerant Condensers.

I. Section 23 81 23 - Computer Room Air Conditioning Units.

J. Section 15790 - Air Coils.

K. Section 26 05 05 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. ARI 495 - Refrigerant Liquid Receivers.

B. ARI 710 - Liquid Line Dryers.

C. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter-Driers

D. ARI 750 - Thermostatic Refrigerant Expansion Valves.

E. ARI 760 - Solenoid Valves for Use with Volatile Refrigerants.

F. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

G. ASHRAE 34 - Number Designation of Refrigerants.

H. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

I. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

J. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.

K. ASME B31.5 - Refrigeration Piping.

L. ASME B31.9 - Building Services Piping.

M. ASME SEC 8D - Boilers and Pressure Vessels Code, Rules for Construction of Pressure Vessels.

N. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless.

O. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

P. ASTM B88 - Seamless Copper Water Tube.

Q. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

R. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

S. AWS A5.8 - Brazing Filler Metal.

T. AWS D1.1 - Structural Welding Code, Steel.

U. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

V. MSS SP69 - Pipe Hangers and Supports - Selection and Application.

W. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

X. UL 429 - Electrically Operated Valves.

1.4 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASTM B31.5 and MSS SP69 unless indicated otherwise.

C. Liquid Indicators:
1. Use line size liquid indicators in main liquid line leaving condenser.
2. If a receiver is provided, install in liquid line leaving receiver.
3. Use line size on the leaving side of liquid solenoid valves.

D. Valves:
1. Use service valves on suction and discharge of compressors.
2. Use gage taps at compressor inlet and outlet.
3. Use gage taps at hot gas bypass regulators, inlet, and outlet.
4. Use check valves on compressor discharge.
5. Use check valves on condenser liquid lines on multiple condenser systems.

E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Strainers:
1. Use line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, use a single main liquid line strainer.
3. On steel piping systems, use strainer in suction line.
4. Use shut-off valve on each side of strainer.

G. Pressure Relief Valves: Use ASME receivers and pipe outdoors.

H. Permanent Filter-Driers:
1. Use in low temperature systems.
2. Use in systems utilizing hermetic compressors.
3. Use filter-driers for each solenoid valve.

I. Solenoid Valves:
1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Use in liquid line of single or multiple evaporator systems.
3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

J. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.5 SUBMITTALS

A. Submit under the provisions of Division 01.

B. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

C. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturers catalog data including load capacity.

D. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of leak test, acid test.

F. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

A. Submit under the provisions of Division 01.

B. Record exact locations of equipment and refrigeration accessories on record drawings.

C. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.7 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this section with a minimum of three (3) years' experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 23 05 00.

B. Deliver and store piping and specialties in shipping containers with labeling in place.

C. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

D. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn or annealed.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

B. Copper Tubing to 7/8-inch OD: ASTM B88, Type K, annealed.
   1. Fittings: ASME B16.26 cast copper.
   2. Joints: Flared.

C. Steel Pipe: ASTM A53, Schedule 40, black.
   1. Fittings: ASTM A234, forged steel welding type.
   2. Joints: AWS D1.1, welded.

D. Pipe Supports and Anchors:
   1. Conform to ASME B31.5, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Wall support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   10. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   11. 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.

2.2 REFRIGERANT

A. Refrigerant: ASHRAE 34.
   1. HFC-R-410a
   2. HFC-R-134a

2.3 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   1. Sporlan Model SA.

B. Indicators: Double port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator and plastic cap; for maximum working pressure of 500-psig, and maximum temperature of 200 degrees F.

2.4 VALVES

A. Diaphragm Packless Valves:
   1. Manufacturers:
      a) Mueller Model A155 or A-148
   2. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500-psig and maximum temperature of 275 degrees F.

B. Packed Angle Valves:
   1. Manufacturers:
      a) Mueller Model A51.
   2. Forged brass, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder, or flared ends; for maximum working pressure of 425-psig and maximum temperature of 275 degrees F.

C. Service Valves:
   1. Manufacturers:
      a) Mueller Model A157 or A153.
   2. Forged brass body with copper stubs, brass caps, removable valve core, flared or solder ends, for maximum pressure of 500-psig.

2.5 CHECK VALVES

A. Globe Type:
   1. Manufacturers:
      a) Mueller Model A137.
   2. 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; for maximum working pressure of 425-psig and maximum temperature of 300 degrees F.

B. Straight Through Type:
   1. Manufacturers:
      a) Mueller Model A156.
   2. Brass body and disc, phosphor-bronze or stainless-steel spring, neoprene seat; for maximum working pressure of 500-psig and maximum temperature of 200 degrees.

2.6 PRESSURE RELIEF VALVES

A. Manufacturers:
   1. Mueller Model 155.

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 300-psig setting; selected to ASHRAE 15.

2.7 FILTER-DRIERS

A. Permanent Straight Through Type:
   1. Manufacturers:
      a) Sporlan Model C.
      b) Parker.
   2. ARI 710, UL listed, steel shell with molded desiccant filter core, for maximum working pressure of 500-psig.

2.8 SOLENOID VALVES

A. Manufacturers:
   1. Sporlan.
   2. Other acceptable manufacturers offering equivalent products.
      a) Parker.

B. Valve: ARI 760, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly with flared, solder, or threaded ends; for maximum working pressure of 300-psig. The stem shall permit manual operation in case of coil failure.

C. Coil Assembly: UL 429, UL listed, replaceable with molded electromagnetic coil, moisture, and fungus proof, with surge protector and color-coded lead wires, integral junction box.

2.9 EXPANSION VALVES

A. Manufacturers:
   1. Sporlan.
   2. Other acceptable manufacturers offering equivalent products.
      a) Parker.

B. Angle or Straight Through Type: ARI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, mechanical pressure limit (maximum operating pressure MOP feature), adjustable superheat setting, with capillary tube and remote sensing bulb.

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 excessively oversized at part load.

2.10 FLEXIBLE CONNECTORS

A. Corrugated bronze hose with single layer of exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 500-psig.

2.11 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53, Schedule 40 galvanized.
1. Fittings: Galvanized cast iron or ASME B16.3, malleable iron.
2. Joints: Threaded or grooved mechanical couplings.

B. Copper Tubing: ASTM B88, Type M, hard drawn.
1. Fittings: ASME B16.18 cast brass or ASTM B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver with melting range of 430 to 535 degrees F.

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and not interfere with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

G. Pipe Hangers and Supports:
1. Install in accordance with ASTM B31.5, ASTM F708 and MSS SP89.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping.

H. Arrange 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.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Division 08.

K. Flood piping system with nitrogen when brazing.

L. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare unfinished pipe, fittings, supports, and accessories ready for the finished painting. Refer to Division 09.

N. Insulate piping; refer to Section 23 07 00.

O. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

P. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

Q. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

R. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

S. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

T. Fully charge completed system with refrigerant after testing.

U. Provide electrical connection to solenoid valves. Refer to Section 26 05 05.

3.3 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test system with dry nitrogen to 600-psig for 24 hours. Perform triple evacuation:
   1. 1500 microns/HG broken with dry nitrogen for one hour.
   2. Repeat to 1000 microns.
   3. Repeat to 500 microns.

3.4 SCHEDULES

A. Pipe Hanger Spacing

PIPE SIZE Inches	MAX. HANGER SPACING Feet	HANGER ROD DIAMETER Inches
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2
4 to 6	10	5/8
8 to 12	14	7/8

END OF SECTION