

**PART 1 GENERAL****1.01 DESCRIPTION**

- A. The requirements of this section apply to the refrigerant piping system connecting refrigeration and HVAC equipment specified in other sections of these specifications. Provide pipe, pipe fittings and related items required for complete piping system.
- B. Related Work: The requirements of Section 23 0500, Common HVAC Materials and Methods, also apply to this section.

**1.02 QUALITY ASSURANCE**

- A. General: ASTM, and ANSI Standards are indicated. In addition, special standards are referenced where neither ASTM nor ANSI Standards are applicable. Comply with federal and local regulations regarding the handling of refrigerant.
- B. Labeling: All piping shall be continuously and legibly labeled on each length as required by codes and standards and including as a minimum, country of origin, manufacturer's identification marking, wall thickness designation, and applicable standards and approvals. Fittings shall be labeled as required by the referenced standard. Tubular fixture traps shall be stamped with manufacturer's mark and material thickness.
- C. Air Conditioning and Refrigeration Equipment Rating: Rated in accordance with ARI certified rating procedures and bear the ARI label.
- D. Installation Contractor: Manufacturer's authorized installation and start-up agency normally engaged and experienced in air conditioning/refrigeration work and certified in the handling of refrigerant.
- E. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- F. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

**1.03 SUBMITTALS**

- A. Submit catalog data, construction details, and performance characteristics for each type and size of refrigeration equipment.
- B. Submit operating and maintenance data.

**1.04 STORAGE AND HANDLING**

- A. Provide factory-applied end caps on each length of pipe and tube. Maintain end caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

**PART 2 PRODUCTS****2.01 PIPING MATERIALS**

- A. Copper Pipe and Tube:
  - 1. Application: Refrigerant.
  - 2. Pipe: ASTM B88 type L or K or ASTM B280, Type ACR hard temper copper with soldered joints. Cleaned and sealed at the factory.
  - 3. Refrigerant Fittings: ANSI/ASME B31.5 or SAE J 513-F, "Refrigeration Tube Fittings." Where conflicts occur, B31.5 shall govern.
  - 4. Wrought-Copper Fittings and Unions ASME B16.22.

**2.02 MISCELLANEOUS PIPING MATERIALS/PRODUCTS**

- A. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- B. Brazing Filler Metals: AWS A5.8.
- C. Flexible Connectors:
  - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
  - 2. End Connections: Socket ends.
  - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
  - 4. Pressure Rating: Factory test at minimum 500 psig.
  - 5. Maximum Operating Temperature: 250 deg F.

**2.03 REFRIGERATION SPECIALTIES**

- A. General: Provide the following equipment where they are not a part of the factory installed equipment accessories.] Select equipment for operation with the refrigerant being utilized and for the pressure and temperature conditions indicated. Sporlan, Alco, Henry, Detroit, or as listed for each equipment.
- B. Thermostatic Expansion Valve: Capacity matched for the system, angle or straight through pattern external equalizer, brass body complete with capillary and remote sensing bulb.
- C. Solenoid Valves: For installation in liquid, suction and/or hot gas circuit as indicated. Brass body, replaceable coil of voltage indicated.
- D. Liquid and Moisture Indicators: Moisture and liquid indicator installed after the liquid line filter dryer.
- E. Liquid Line Filter Dryer: Sealed container up to approximately 10 tons of capacity and replaceable desiccant dryer core and strainer on larger capacity systems.
- F. Charging Valves: Quick coupling type connection with removable valve core.
- G. Service Valves: Install liquid, suction and discharge line valves, all suitable for refrigerant used and location in the system, designed so as to be easily packed with pressure on the line and with wing caps that completely enclose valve stem. Install all purge valves, relief valves or other valves required for safe and proper operation of the system and as may be required by State or local codes. Detroit, Alco, Sporlan or Automatic Products approved substitute.

## PART 3 EXECUTION

### 3.01 PIPE INSTALLATION

- A. General: Install pipe, tube and fittings in accordance with recognized industry practices. Install each run accurately aligned with a minimum of joints and couplings, but with adequate and accessible unions and flanges for disassembly, maintenance and/or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings.
  - 1. Comply with ANSI B31 Code for Pressure Piping.
- B. Piping Runs: Route piping close to and parallel with walls, overhead construction, columns and other structural and permanent-enclosure elements of the building. If not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building or equipment and avoid diagonal runs. Wherever possible in finished and occupied spaces, conceal piping from view. Do not encase horizontal runs in solid partitions.
- C. Refrigerant Piping:
  - 1. Use Type "L" hard drawn copper tubing and make all changes in direction with specified fittings.
  - 2. Lay out the refrigerant piping system in a manner to prevent liquid refrigerant from entering the compressor and so that oil will return to the compressor.
    - a. Install all horizontal suction lines with a uniform slope downward toward the compressor.
    - b. Install horizontal suction lines with a uniform slope downward to compressor.
    - c. Use double-suction riser for maximum compressor efficiencies if load variation is expected.
    - d. Install traps and double risers to entrain oil in vertical runs.
    - e. Liquid lines may be installed level.
    - f. Take special care to keep all tubing clean and dry.
  - 3. Install all refrigerant piping straight and free from kinks and restrictions, properly supported to minimize vibration. Provide hangers at 5' spacing for 1/2" lines, 6' spacing for 1" lines and 8' spacing for 1-1/2" and larger lines. Provide flexible connections in lines at compressor unit. Submit complete diagram for approval.
  - 4. Comply with the refrigerant piping installation instructions of the refrigeration equipment manufacturer.

### 3.02 PIPING JOINTS

- A. General: Provide joints of the type indicated in each piping system, and where piping and joint as manufactured form a system, utilize only that manufacturer's material.
- B. Braze Copper Tube and Fitting Joints: Where indicated, in accordance with ANSI/ASME B31.5. Pass a slow stream of dry nitrogen gas through the tubing at all times while brazing to eliminate formation of copper oxide.
- C. When brazing or soldering, 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.
- D. Changes in Direction: Use fittings for all changes in direction. Run lines parallel with building surfaces.
- F. Expansion: Provide loops, swing joints, anchors, runouts and spring pieces to prevent damage to piping or equipment.

### 3.03 MISCELLANEOUS PIPING EQUIPMENT

- A. Floor, Wall and Ceiling Plates: Chrome-plated pressed steel or brass screw locked split plates on all pipe penetrations in finished spaces.
- B. Filters: Install in a manner to permit access for removal and replacement of filter cartridge.
- C. Sleeves: At all penetrations of concrete or masonry construction. PVC, 24 gauge galvanized steel or Schedule 40 galvanized steel pipe. Fabricate sleeves 1" diameter larger than pipe or insulation. PVC and sheet metal sleeves at non-structural penetrations only.
- D. Sleeve Caulking: Grout insulated pipe with cement mortar or approved waterproof mastic. All caulking or grouting shall extend full depth of sleeve. Install UL sealing caulk, putty and/or system at all penetrations of fire rated walls, floors and ceiling.

### 3.04 CLEANING

- A. General: Clean all dirt and construction dust and debris from all mechanical piping systems and leave in a new condition. Touch-up paint where necessary.
- B. Refrigeration System Piping: If, for any reason, sanitized and sealed-at-the-mill tubing is not used, clean the tubing as follows:
  - 1. Wipe each tube internally with a dry, lintless cloth followed with a clean lintless cloth saturated with recommended refrigerant.
  - 2. Repeat until the saturated cloth is not discolored by dirt.
  - 3. Wipe with a clean cloth saturated with compressor oil and squeezed dry.
  - 4. Wipe with a dry, lintless cloth.

### 3.05 TEST

- A. General:
  - 1. Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise concealing piping or connecting fixtures or equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.
  - 2. Provide all necessary temporary equipment for testing, including pump and gauges. Remove control devices before testing and do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for the indicated pressure and time.
  - 3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- B. Repair: Repair piping system sections which fail the required piping test by disassembly and re-installation, using new materials to the extent required to overcome leakage. Do not use chemical stop-leak compounds, solder, mastics, or other temporary repair methods.
- C. Refrigerant System:
  - 1. When the refrigerant connections have been completed, close the compressor suction and discharge valves (or receiver outlet valve in the case of condensing unit) and test the balance of the system to near operating pressure with a dry nitrogen.
  - 2. Carefully test all joints, using soap and water or other sudsing solution. After all joints are tested, discharge the gas and repair all leaks, then repeat the test with a mixture of nitrogen and R-410A and a halide torch or an electronic leak detector.

3. Evacuate the system to remove moisture and non-condensables. Lower the absolute pressure with a vacuum pump to 1000 microns of mercury. Apply external heat as required to vaporize moisture.
4. Dehydrate each refrigerant circuit by satisfactory use of a vacuum pump before charging with refrigerant. Furnish all necessary refrigerant and oil for complete operating charge of the system. Upon completion of the work of construction, test all refrigeration equipment under normal operating conditions and leave in operating order. Adjust automatic temperature controls.
5. After the first 24 hours of operation, measure the pressure drop across the suction filter. If the pressure drop exceeds 5 pounds per square inch, replace the cartridge with a new one, retesting and replacing the cartridge and/or adjusting the system as necessary to achieve a pressure drop of less than 5 pounds per square inch in 24 hours.

**END OF SECTION**