PHYSICAL FACILITIES
2018 Consultant's Handbook
Division 23 HVAC
2300 Refrigeration Systems

1 Safety Precautions
1.1 Safety relief valve discharge piping is to be run to the exterior of the building.
1.2 When the piping, the evaporator, or the condensing unit is located in an enclosed room consideration must be given to worker safety in the event of catastrophic piping failure.

Note: The designer must show calculations that indicate the percentage of breathable air in the enclosed room assuming full discharge of the refrigerant. Though rare this type of failure has occurred and must be considered.

1.3 If the calculations indicate a possible safety problem then consideration must be given to appropriate ventilation of the area such as cross ventilation, fan pulling off the floor, fan triggered by a refrigerant detector, etc.

2 All Refrigeration and Air Conditioning Lines
2.1 Use only refrigeration grade copper tube. Type “L” is preferred.
2.2 Tubing should be clean, dehydrated, and capped when received new.
2.3 Brace piping a minimum of every 6 feet with ‘cush-a-clamp’ and ‘super strut’ style supports.
2.4 Use only long radius sweat “Ls” elbows.
2.5 All refrigerant lines will be hard soldered using 15% silver-solder or better.

2.5.1 Bleed dry nitrogen through the pipe as it is being soldered.
2.6 Size the line properly according to tonnage of unit and length of run using the manufactures’ recommendations.

3 Testing and Filling Procedure
3.1 The system will be pressurized with an appropriate tracer gas and tested using a proper detector, such as an electronic, to check for leaks.
3.2 After determining that there are no leaks the tracer gas is to be removed and a vacuum of 50 microns is pulled on the system.

3.2.1 The vacuum pump will then be valved off and the system will be allowed to stand for 12 hours.
3.2.2 If the level rises above 200 microns but does not reach ambient pressure you may assume there is still moisture in system and continue pulling a vacuum, repeating the test procedure.

3.2.3 If the level approaches ambient pressure you must assume there is still a leak in the system and repeat the procedure for leak testing.

3.3 When the vacuum level for the test period does not rise above 200 microns the system can be charged.

3.4 The “Super Heat” will be checked on the expansion valve.

4 Documentation
4.1 In line with EPA regulations the University has set up policies that must be followed by contracted refrigeration mechanics when working on, or installing, University owned equipment containing refrigerants. It is expected that all contractors will comply with relevant EPA, Federal, State and local rules and regulations.

4.2 Before proceeding with any repair or installation of refrigerant containing equipment, a copy of all Refrigeration Mechanic Certifications are to be submitted to the Construction Manager. These will be kept in a permanent record, allowing the University to demonstrate that all mechanics installing or repairing University owned equipment are properly certified.

4.3 Record the total charge and refrigerant type of each refrigerant circuit. This record will be posted at the unit and submitted to the University on the Refrigerant Usage Compliance Form.

4.4 A Refrigerant Usage Compliance Form must be completed and submitted to the Construction Manager.

4.5 Refrigeration Compliance Coordinator:
Purdue Refrigerant Compliance Coordinator
775 Ahlers Rd. PFSB Bldg.
West Lafayette, Indiana 47907
Ph.: 765-494-9566

5 General Design Requirements
5.1 Refrigeration piping systems conveying 10 tons of nominal cooling capacity or greater shall be designed by the Engineer-Of-Record in a manner that is in conformance with the listed manufacturers’ written installation, operation & maintenance manuals and refrigeration piping
design guidelines.

5.1.1 If design is delegated (either in-part or in-whole) to the installing contractor, the Engineer-Of-Record shall review and ultimately approve project-specific, detailed design drawings produced and submitted by the installing contractor that shall include, but not be limited to the following: pipe sizing, floor-plan-specific pipe routing, suction riser details, trap details, velocity calculations, refrigerant specialties locations and specifications, and solenoid wiring diagram and control schematics.

5.1.2 In compliance with majority of refrigeration manufacturers’ guidelines: refrigeration piping shall not be routed underground.

6 Suction Lines
6.1 Install a ball valve at each evaporator that has remote condensing unit.
6.2 Slope ½” every 10’ back to the compressor.
6.3 Install “P” traps if evaporator is lower than the compressor.
6.4 When needed install vibration eliminators parallel with the compressor crank shaft. Eliminators are to be straight with no bends and to be braced on the end opposite the compressor.

7 Liquid Lines
7.1 Install a ball valve at the condenser on remote condensers. On multiple systems install ball valve on each system.
7.2 If the condensing unit does not have an internal dehydrator then install properly sized dehydrator.
7.3 If there is a solenoid valve then install a ball valve at the evaporator before the solenoid valve. If there is no solenoid valve then install a ball valve before the expansion valve.
7.4 Insulate with ½” thick insulation when the line is in extremely hot area, such as hot equipment rooms and roof tops.

8 Discharge Lines
8.1 Install a ball valve at the condenser on remote condensers.
8.1.1 On multiple systems install ball valve on each system.

8.2 When needed install vibration eliminators parallel with the compressor crank shaft. Eliminators are to be straight with no bends and to be braced on the end opposite the compressor.
8.3 Install proper “P” traps and vertical raisers whenever needed to insure proper velocity for oil return to the compressor.

9 Evacuation of the Refrigeration System
9.1 Use proper methods to assure the system is free of air, moisture, and containments.
9.2 It is required that a good high vacuum pump and vacuum gauge be used to be assured a proper vacuum level before the unit is charged.

10 Air Cooled Condensing Units and Condensers
10.1 When the unit has been properly charged, it should have the “amount and type” of refrigerant in the system posted on the equipment or close by.
10.1.1 On units with multiple systems, post the full charge of each system.
10.2 Locate the condenser such that:
10.2.1 Air flow to the condenser will not be blocked (i.e. not close to a wall or another piece of equipment)
10.2.2 Air to the condenser not pick up hot air from another piece of equipment or condensing unit
10.2.3 It can be readily serviced (it should not be blocked by ducts, water lines, conduit, etc.)
10.2.4 The cover for the control panel or the cover for the compressor is fully accessible
10.3 Install a 115 volt, 20 amp receptacle close to the unit.
10.4 If the unit is to be used in the late fall, early spring, or all year round, make sure it is set up with components for cold weather application.
10.5 Posted on each condenser unit should be the location of the associated evaporator.
10.6 On systems with thermostatic expansion valves, the superheat should be set properly so the compressor receives the proper amount of suction cooling.

11 Water Cooled Condensing Units and
**Condensers**

11.1 When the unit has been properly charged, it should have the “amount and type” of refrigerant in the system posted on the equipment or close by.

11.1.1 On units with multiple systems, post the full charge of each system.

11.2 The unit should be set up with “Clean-out Valves” in the water supply and discharge lines of the condenser.

11.2.1 A water shut off valve should be installed on the water supply line before the water regulating valve. Install a “clean out” valve, between the shut off and water regulating valve.

11.2.2 A water shut off valve should be installed on the water discharge line of the condenser. Install a “clean out” valve, with a hose connection, between the shut off and condenser.

11.3 A union should be installed in the water supply line before the water regulating valve so it can be removed for repair or replaced.

11.4 The unit should be located in a position so it can be serviced. It should not be blocked by ducts, water lines, conduit, etc.

11.5 Do not block the cover for the control panel or the cover for the compressor.

11.6 Install a 115 volt, 20 amp receptacle close to the unit.

11.7 The unit should have posted on it, or nearby, the location of the associated evaporator.

11.8 On systems with thermostatic expansion valves, the superheat should be set properly by the installing contractor so the compressor receives the proper amount of suction cooling.

12 DX Package Air Conditioners & DX Chillers

12.1 Locate the unit in a way that all removable covers can be removed for service.

12.2 On DX Package Air Conditioners and Chillers with remote condensers, post the type and amount of the full charge of refrigerant in the system.

12.3 On units with multiple systems, post the full charge of each system.

13 Walk-in, Reach-in & Roll-in Freezers

13.1 For freezers that normally run at 0°F or below, install, at a minimum, the following:

13.1.1 A suction line accumulator to help prevent “slugging back” liquid refrigerant to the compressor.

13.1.2 An expansion valve remote bulb at 4 or 8 o’clock on suction line and insulate.

13.1.3 A solenoid valves, liquid and hot-gas, outside the freezer box and in a location that can be serviced.

13.1.4 A sight glass at the condensing unit, on systems with thermostatic expansion valves.

13.1.5 A heater and insulation on evaporator drain lines.

13.2 Size the expansion and solenoid valves according to the BTU of the equipment or manufacture spec.

13.3 The lighting and alarm circuits should be all separate from the condensing unit and cooling coil.

13.4 Insulate suction line with ¾” wall insulation with cut corners.

13.5 Locate the evaporator in a location that it will blow towards the entrance door.

14 Walk-in, Reach-in & Roll-in Coolers

14.1 Install expansion valve remote bulb at 4 or 8 o’clock on suction line and insulate.

14.2 Size the expansion and solenoid valves according to the BTU of the equipment or manufacture spec.

14.3 Install solenoid valves in a location so they can be serviced.

14.4 Install sight glass at the condensing unit, on systems with thermostatic expansion valves.

14.5 The lighting and alarm circuits should be on a separate circuit from the condensing unit and cooling coil.

14.6 Insulate suction line with ½” wall insulation with cut corners.

14.7 Set the super heat on the thermostatic expansion valves.

14.8 Install the evaporator in a location that it will blow towards the entrance door.

15 DX Central Air Conditioners
15.1 Locate the unit in a way that all removable covers can be removed for service.
15.2 All removable covers should not be blocked by water lines, conduit, duct work, etc.
15.3 On DX Central Air Conditioners with remote condensing units, post the type and the full charge of refrigerant in the system. On units with multiple systems, post the full charge of each system.
15.4 10 ton or larger units, install replaceable core type suction and liquid dehydrators and filters.
15.5 Install ball valves on the inlet and outlet side of the dehydrators and filters so the cores can be changed.