

PART 1 - GENERAL

1.01 Work included:

- A. Piping, tubing and fittings.
- B. Piping specialties.
- C. Special duty valves.
- D. Refrigerants.
- E. Chillers.
- F. Refrigerant monitors.

1.02 General requirements:

- A. Reciprocating or open drive chillers not allowed for outdoor applications.
- B. Signed and stamped final refrigeration system drawings must be received for review prior to equipment installation for all custom refrigeration applications. This applies to all systems designed for -20 degrees F and lower other than factory fabricated chest freezers. Drawings must include capacities and sizing of specialty valves.
- C. All custom Ultra-Low (-40 degrees F and colder) refrigeration systems must be designed as cascading systems. Provide air dryer when possible.
- D. In order of desirability, from highest to lowest, (with the understanding that size precludes some styles of compressors/chillers), UAF Facilities Services prefers:
  - 1. Scroll compressors - preferable; these are limited in available size to about 60 tons.
  - 2. Screw compressors - acceptable above 60 tons.
  - 3. Centrifugal chillers - acceptable above 60 tons.
  - 4. Reciprocating compressors - discouraged, but may be considered above 60 tons.
  - 5. Steam absorption chillers – preferred by UAF Facilities Service, generally above 300 tons with adequate steam capacity
- E. Desired voltage for Ultra-Low (-20 degrees F and below) chest freezers is 120V at 15amps.
- F. Provide all Ultra-Low freezers with built-in set of Form-C (normally open - normally

closed) contacts for remote alarming.

- G. Coordinate custom refrigeration system control system design with UAF Facilities Services. Control logic will incorporate Siemens Building Technologies proprietary control language.
- H. Provide for outdoor air-cooled condensing units: Cold weather, low-temp motors and crank case heaters in compressors.

## PART 2 - PRODUCTS

### 2.01 Chillers:

#### A. Manufacturers:

1. Trane.
2. York.
3. McQuay
4. Alternate Brand Request or Substitution Request Required

### 2.02 Pipe and tubing materials:

- A. Copper tubing: Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, nitrogen charged, ready for installation, and have sealed end caps to protect interior of pipe until installed.

### 2.03 Fittings:

- A. Wrought copper fittings: streamlined pattern.

### 2.04 Joining materials:

- A. Brazing filler metals: Class B Ag-1 (Silver).

### 2.05 Valves:

- A. Solenoid valves: 250° F. temperature rating, 400 psig working pressure; forged brass with Teflon valve seat.
- B. Thermal expansion valves: Thermostatic adjustable, modulating type; size as required for specific evaporator requirements; factory set for proper evaporator superheat requirements.
- C. Hot gas bypass valve: Adjustable type, sized to provide capacity reduction beyond the last step of compressor unloading; wrought copper fittings for solder-end connections.

2.06 Refrigerant piping specialties:

- A. Strainers: 450 psig maximum working pressure; forged brass body with Monel 80-mesh screen and screwed cleanout plug.
- B. Moisture/liquid indicators: 450 psig maximum operating pressure, 200° F. maximum operating temperature.
- C. Filter-driers: 450 psig maximum operating pressure, steel shell, flange ring and spring. Furnish complete with replaceable filter-drier core kit, including gaskets, as follows:
  - 1. Standard capacity desiccant sieves to provide micronic filtration.
  - 2. High capacity desiccant sieves to provide micronic filtration and extra drying capacity.
- D. Suction line filter-drier: 350 psig maximum operating pressure, 225° F. maximum operating temperature.
- E. Suction line filters: 450 psig maximum operating pressure. Furnish complete with replaceable filter core kit including gaskets.
- F. Flanged unions: 400 psig maximum working pressure, 330° F. maximum operating temperature. Flanges and bolts shall have factory-applied rust-resistant coating.
- G. Flexible connectors: 450 psig maximum operating pressure, seamless tin bronze or stainless steel core, high tensile bronze braid synthetic covering. Stainless steel for all over 300 PSI.
- H. Hard braze all non-replaceable filter dryers.

2.07 Refrigerant:

- A. AC system refrigerant R-22 (Ozone Depletion Potential (ODP) =0.034) (Being Phased Out).
- B. AC system refrigerant R-410a (Environmentally friendly – ODP = 0).
- C. Other refrigerants compatible with existing systems shall be discussed with UAF Facilities Services

PART 3 - EXECUTION

3.01 Installation, general:

- A. Refrigeration system acid neutralizing agents are not allowed.
- B. Where refrigeration equipment is shipped in broken down condition on skids and requires field erection of piping joints, contractor must submit manufacturer-approved assembly instruction with names of factory authorized assembly technicians performing the work.
- C. When equipment is placed at the construction site, the contractor must provide visual confirmation that the factory applied holding charge is still intact.
- D. Do not exceed or bypass manufacturer-designed and specified safety limits and equipment (pressure switches, oil safe switches, etc.).
- E. All refrigeration piping joints shall be nitrogen purged during brazing. Designated UAF Facilities Services personnel is to witness process.
- F. No aftermarket alterations of factory fabricated freezer equipment.
- G. All refrigeration systems requiring field assembly and field charging of refrigerant system shall be pulled down by triple evacuation method and backpurged with dry nitrogen gas. Measure degree of vacuum with calibrated electronic meter. System specific evacuation requirements:
  - 1. Air conditioning systems:
    - a. Follow manufacturer's recommended evacuation and charging procedures.
    - b. Triple pull-down of entire system to 1000, 500, and 200 microns respectively.
    - c. Each pull-down held for 2 hours with no greater than 50 micron rise in any test.
  - 2. Walk-in freezers down to -40 degrees F:
    - a. Triple pull-down of entire system to 600, 300, and 150 microns respectively.
    - b. Each pull-down held for 1 hour with no greater than 50 micron rise in any test.
    - c. Execute procedure using ¼ inch soft copper tubing, braided hoses not allowed.
  - 3. Walk-in freezers below -40 degrees F and all Ultra-Low chest freezers:
    - a. Triple pull-down of entire system to 400, 200, and 50 microns respectively.
    - b. Each pull-down held for 1 hour with no greater than 50 micron rise in any test.
    - c. Execute procedure using ¼ inch soft copper tubing, braided hoses not allowed.

3.02 Piping installation:

A. Insulate suction and hot gas lines.

B. Slope refrigerant piping:

1. Install horizontal hot gas discharge piping with ½ inch per 10 feet downward slope away from the compressor.
2. Install horizontal suction lines with ½ inch per 10 feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.
3. Liquid lines may be installed level.
4. Reference manufacturers' standards.

C. Install refrigeration piping to maintain minimum 1 inch clear from all other piping and ductwork. Where piping or ductworks are insulated this requirement applies to surface of insulation.

D. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components. Install strainer upstream from TXV and in suction line upstream from compressor.

E. Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.

1. Install moisture/liquid indicators in lines larger than 2-1/8 inch OD, using a bypass line.

F. Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators. No unions in main refrigerant piping.

G. Install flexible connectors at the inlet and discharge connection of compressors. Purge with nitrogen at .2 CFH while brazing.

3.03 Pipe joint construction:

A. Fill the pipe and fittings during brazing with an inert gas (i.e. nitrogen or carbon dioxide) to prevent formation of scale.

3.04 Valve installation:

- A. Install globe valves on each side of strainers and driers, in liquid and suction lines at evaporators.
- B. Install a full sized 3-way bypass around each drier.
- C. Install solenoid valves ahead of each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at the top.
- D. Thermostatic expansion valves may be mounted in any position, as close as possible to the evaporator.
  - 1. Where refrigerant distributors are used, mount the distributor directly on the expansion valve outlet.
  - 2. Install the valve in such a location so that the diaphragm case is warmer than the bulb.
  - 3. Secure the bulb to a clean, straight, horizontal section of the suction line using two bulb straps. Do not mount bulb in a trap or at the bottom of the line.
  - 4. Where external equalizer lines are required, make the connection where it will clearly reflect the pressure existing in the suction line at the evaporator outlet.

END OF SECTION