Users Guide

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. 236000 – R744 (CO2) Refrigeration Installation Specifications

B. Codes and Industry Standard documents and releases

1.2 SUMMARY

A. This Users Guide is intended to support the growth of the use of Natural Refrigerants through the use of CO2. The installation specifications developed by NASRC are not intended to be "stand alone" or all encompassing. Section 236000 – R744 (CO2) Refrigeration Installation Specifications would be included as part of a full set of construction drawings, construction specifications, Refrigeration System specifications (racks, condensers, gas coolers, etc.), Manufactures recommendations, Display Case specifications facilitating CO2 refrigeration, and a complete EMS/BMS monitoring and control design and sequence of operation.

B. The user understands that there are many different types of CO_2 refrigeration systems and the Section 236000 should be modified by the user/owner and Engineer to produce a quality installation based on the design type. System design should include all aspects of the installation not consigned to Section 236000.

C. Section 236000 is intended to show all of the requirement of the Refrigeration Contractor, other than what is described in the construction drawing set, to provide a completely operational and functioning CO_2 Supermarket Refrigeration System.

1.3 Additional Design Documents

A. Refrigeration Schedule should include, at a minimum, the following information and detail:

1. Piping sizes, type, and max operating pressure requirement per system to include Liquid, Suction, and Discharge pressures.
2. Exact specificity of sizes, location, type, and number of valves, filters, dryers, etc.
3. Delineate any field installed refrigeration components.
4. Heat reclaim piping and components (if used)

B. Installation detail drawings

1. Detail drawings showing how to install the various refrigeration components and pieces of equipment.
2. Include details for every display case type used in the design
3. Include details for all field mounted, installed, and provided equipment and components.
4. Heat reclaim piping and components (if used).

C. Detailed Single Line Diagram of refrigeration system and components.

1. Show system schematic for all refrigeration components and equipment.
2. Highlight field required equipment and components.
3. Identification of safety relief system (resilience).
4. Identification of system max operating pressures, to include Liquid, Suction, and Discharge at all points in the system.
5. Identification of Pressure Vessels and Heat Exchangers
6. Identification of all control valves (both factory and field installed)
7. Diagrammatic location of compressors and display cases for Low Temperature Medium Temperature suction groups
8. Show Diagrammatic location of all High Side equipment, to include but not limited to, Condensers, Gas Coolers, intermediary pressure receivers, and pressure vessels.
9. Heat reclaim piping and components (if used)

D. Controls specifications

1. Identification of the controls manufacturer and associated controls installation specification.
2. Sequence of control that match the refrigeration design type (DX, Liquid feed, Cascade, Booster, Secondary, etc.)
3. Points list for control, monitoring, and safety.
4. Identification of responsibility for controls installation, including cases, heat reclaim, walk-ins, terminations, rack and condenser operation, and associated programming. Any control/EMS/Monitoring work products to be performed by the Refrigeration Contractor should be added to Section 236000.
5. Defrost management system and sequence of operation.
6. Heat reclaim (if used)

E. Display Case specifications

1. Showing installation requirements.
2. Describing pictorially the location of electrical, plumbing, control, and refrigeration connections.
3. Manufacturer's representative information for questions and issue resolution.
4. Case control specification to include electronic expansion valve, defrost, temperature control, and input/output requirements.

PART 2 - DESIGN CONSIDERATIONS

2.1 CONTROLS

A. Case controls and EEVs are required

B. Consider selecting one controls manufacturer to limit the amount of controls integration

C. Remote communications are highly desirable; may require blessing from IT/Info Security

D. Rack controls will require specialized programming to address the unique features of the CO2 system. Controls and sequence of operations will need to be developed and should contain programming setpoints, alarm parameters, and safety procedures.

E. Decide on the number and location of pressure transducers. Options are for one per case, one per "line up" or circuit for case control. Verify with Manufacturers the quantity and location required for control, monitoring and safety.

2.2 CONTROL VALVES and SPECIALTY DEVICES

A. Select Pulse or Stepper type Electronic control valves (EEV's).
   1. If Stepper type EEV's are used, Solenoids should be installed up stream of the solenoid valve(s). This will prevent liquid floodback during power outages.
   2. Note, no check valve around the Solenoid is required for those that lift during reverse flow. If Case Controllers are powered by a generator, these would not be necessary.

B. Verify automated control valves are compatible and supported by controls manufacturer and sequence of control requirements.

C. Optional inclusion of Liquid Line Filter Driers at each EEV. At a minimum, EEV's should be protected by serviceable screens or filters.

D. Utilize electric defrost due to contractor familiarity and lower complexity.

2.3 OTHER CONSIDERATIONS

A. Loop piping vs. circuit piping

   1. Circuit piping valves are at the rack, simplifies relief valve piping and service
   2. No valve stations (similar to a glycol fed system) and fewer "remote" connections and valves. Typically, electronic control valves are used and located at the display cases and coils.
   3. Smaller diameter piping
   4. Electronic EPR's may be required at certain points in the system and may be best applied if installed remotely.

B. The use of heat reclaim for hot water and space heating

   1. Consider direct CO_2 or use a secondary fluid (glycol) and heat exchanger for heat reclaim
   2. Use of heat reclaim saves a significant amount of energy but does complicate the installation, operation, control, and management of the refrigeration system.

C. With CO2, working pressure and Max Operating Temperature are extremely important, and is of critical importance on the "high side" of the system.
   1. There are two (2) pressure "high side" conditions within most CO_2 systems - High pressure (Medium temperature discharge, Gas Cooler, and transcritical) and Intermediate Pressure (Medium temperature typically, at the Flash tank and downstream of the Flash Tank)

a. High Pressure - components need to be rated to a working pressure of 1885 psi (130 Bar).
b. Intermediate Pressure - typically 700 psi (48 bar) to 1015 psia (70 bar)
c. The operating temperature range should be able to withstand -40°F - 240°F (-40°C - 115°C)

2. System must be designed in such a way that liquid refrigerant cannot be "trapped" between two stop valves or shut off valves, whereby the CO2 could flash and cause very dangerous conditions.

END OF USERS GUIDE