HUSSMANN®

Low and Medium Temperature Display Cases

using CO_2 in a Direct Expansion Refrigeration System

Installation & Operation Manual

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REVISION HISTORY

REVISION *A* — Original Issue

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ANSI Z535.5 DEFINITIONS

• **DANGER –** Indicate[s] a hazardous situation which, if not avoided, will result in death or serious injury.

• **WARNING –** Indicate[s] a hazardous situation which, if not avoided, could result in death or serious injury.

• **CAUTION –** Indicate[s] a hazardous situation which, if not avoided, could result in minor or moderate injury.

• **NOTICE –** *Not related to personal injury –* Indicates[s] situations, which if not avoided, could result in damage to equipment.

SAFETY MUST

1. Use PPE (Gloves, Safety Glasses, Long Sleeves, etc), and be aware of potential freezer burns from liquid CO2.

2. Pressure Transducers / Leak Detectors / Warning Lights / Sounders / and Plant Room Ventilation must all be operational prior to charging with CO2.

Notes:
Pressure Relief Devices or check valves must be located anywhere that liquid CO2 can be trapped. Trapped CO2 at –40°C will double in volume if allowed to rise to 30°C.

GENERAL GUIDELINES

This manual is written as a basic guideline for the installation and operation of low and medium temperature direct expansion cases using Carbon Dioxide (CO2) as a refrigerant. When CO2 is used as a refrigerant, systems must be designed for the higher pressures.

For detailed information regarding a specific component or application, contact your Hussmann representative. This manual is provided in addition to the standard Installation and Operation manual that is supplied with the display case to cover specific instructions and safety precautions that apply to CO2. Please refer to the installation instructions provided with the CO2 refrigeration system and to the case installation and service manual for more details regarding installation and operation.

All components must be installed according to manufacturer's specifications. All materials used must be compatible with the secondary coolant. Installation must comply with ANSI/ASME B31.5 Refrigeration Piping and Heat Transfer Components, ANSI/ASHRAE Standard 15 Safety Standard for Refrigeration Systems and local building codes.

Inspect all components prior to installation to ensure that they are free from defects or foreign materials and to confirm that they comply with all pressure and temperature ratings.

PIPING MATERIALS

Any piping material that meets all pressure & temperature ratings, material compatibility requirements and state and local building codes may be used for CO2 applications. The design pressure of the system is 600psi. These materials include:

1. Copper

a. Type K or L may be used with outside diameter no larger than 7/8"

b. Copper to copper joints may be soft soldered or brazed so long as the braze/solder material contains no zinc or zinc chloride. Soft solder must be used where the component manufacturer's installation instructions recommend.

c. Soft solder flux materials must contain no zinc and must also be water soluble.

2. Steel

a. Schedule 40 carbon steel pipe or stainless steel pipe (or tubing) is acceptable.

b. Must protect exterior from corrosion.

c. Additional system cleaning is required.

Use roll-stop couplings for straight line pipe joints. Swaging of pipe joints is not recommended. Swaging weakens the copper at the swage point, reducing the maximum operating pressure rating. Piping sizes must be considered to provide sufficient velocity to return oil to the compressor. Due to the efficiency of CO2 as a refrigerant, refrigerant velocities are much lower than traditional refrigerants, so tubing diameters will generally be smaller.

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INSULATION

Insulation should be used on system piping to reduce the heat transfer to ambient air and to maintain subcooling in the CO2 liquid supply line to the case. Tubing inside the case may also need to be insulated, depending on such factors as liquid temperature feeding the case, case operating temperature, and type of defrost. The insulation should be sized to allow for the worst case conditions of heating from showroom lighting and ambient temperatures. In order to minimize the required insulation thickness, install pipe in air conditioned space as much as possible. Do not size insulation for condensation prevention only. Pipe should be insulated according to local codes and customer specifications.

When installing piping that has not been pre-insulated, there are several options for insulation. Closed-cell elastomeric insulation is very popular in refrigeration applications. This type of insulation can also be used in CO2 system applications. For detailed information regarding this type of insulation visit the Armaflex website at www.armaflex.com.

Other types of insulation that can be used are TRYMER and Styrofoam insulation. These are both made by Dow and are well suited for insulating pipe. For detailed information regarding this type of insulation visit the Dow website at:

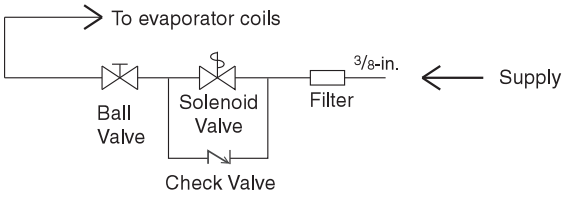
http://building.dow.com/styrofoam/na/dowpipe/library/index.htm.

Always follow the manufacturer's recommendations for insulation thickness and proper installation.

CHECK VALVES

Check Valves are required wherever there is a possibility of trapping liquid CO2 between valves that may be shut off, including solenoid valves, service valves, and electronic expansion valves. Check valves must be installed to vent high pressure CO2 back to the system.

Example of piping layout if hand valves are used in line with solenoid valves:



Optional Hand Valve and Check Valve

Note:
Care must be taken to ensure that defrost of all case lineups is staggered sufficiently so that no more than 25 percent of loops are in defrost at any time. See the refrigeration system instructions for more details.

⚠ WARNING

Trapping of liquid CO_2 can result in extremely high pressures and must be avoided to prevent damage to equipment and personal injury.

COMPONENTS

EEV and controller

Cascade CO2 systems use electronic expansion valves, which require electronic controllers compatible with the type of valve used.

Three inputs: one pressure transducer to monitor evaporator pressure, mounted on the suction tubing near the coil outlet, and two temperature sensors – one at the coil outlet and one measuring discharge air temperature.

These three inputs are used to modulate the refrigerant flow through the expansion valve to control the superheat at the evaporator coil outlet, and may also be used to control case temperature. An electronic controller must be programmed for the specific valves used, and any other control operation required (i.e. control of anti-sweat heaters, fans, or lights).

The pressure transducer is installed onto a line valve and must be isolated prior to pulling a vacuum on the system.

For low temperature cases, a five-minute time delay at defrost initiation allows liquid CO2 to be pumped out of the coil and case tubing before energizing defrost heaters. This is to prevent extreme pressures caused by flashing of liquid into gas faster than system tubing can withstand. Settings are provided on the CO2 application data sheets for each specific case model.

ADDITIONAL SAFETY DEVICES AND PRECAUTIONS

Hussmann CO2 cases are rated for a maximum design pressure of 600 psig. Pressure relief valves are shipped with the refrigeration rack, and must be installed according to the manufacturer's instructions. If the refrigeration system is de-energized, venting of the CO2 through the pressure regulating relief valves on the refrigeration system can occur. In such cases, the system may need to be recharged with CO2, but in any case, the pressure regulating relief valves(s) are not to be defeated or capped. The relief setting shall not be altered.

A sufficient number of pressure relief and pressure regulating relief valves may need to be provided based on the system capacity and located such that no stop valve is provided between the relief valves and the parts or section of the system being protected.

CO2 Leak Detector: Leak detectors are required anywhere that CO2 gas may leak or be vented. An alarm sounds if CO2 is detected at an amount that exceeds the maximum allowable CO2 concentration. Leak detectors are not provided with the case. Consult local codes for exact requirements.

Startup and shutdown: Provisions must be made for startup and shutdown to prevent excessive pressures. Consult the pumping station instructions and local codes for requirements. Use of gauges is not recommended to check pressure in a CO2 system that may contain liquid refrigerant.

CO2 QUALITY

1. Use high grade CO2 only (moisture<15ppm)
2. Moisture in CO2 systems will create heavy corrosion inside steel piping caused by carbonic acid production.