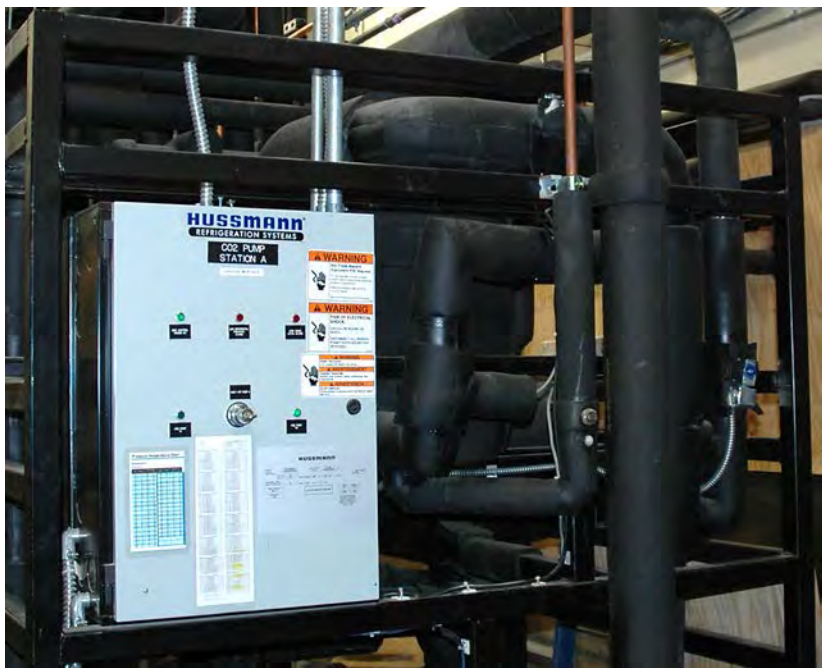
HUSSMANN®

Pumped Liquid CO_2 Secondary Refrigeration in Low and Medium Temperature Display Cases



Installation & Operation Manual

P/N 0516803_C

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Spanish 0533250
French 0533251

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REVISION HISTORY

REVISION C — Updated Page 8 Pressure Relief Valves; Safety Precautions

REVISION *B* — Added Start-up Checklist; Application data; and Med, LT System Diagrams

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.

GENERAL DESCRIPTION

This manual is written as a basic guideline for the installation and operation of low and medium temperature display cases using pumped liquid Carbon Dioxide (CO_2) as a secondary refrigerant. The primary refrigerant (for example, R404A) can vary depending on the customer's requirements. 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 supplied with the display case. To cover specific instructions and safety precautions that apply to pumped liquid CO_2, please refer to the installation instructions provided with the CO_2 pumping station for details related to the pumping station and primary system and to the display case installation and service manual for more details regarding installation and operation.

For optimum safety and performance, it is recommended that only Hussmann pumping stations be used as these have been tested and certified for use with pumped liquid CO_2 for Hussmann display cases.

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 GUIDELINES

Piping Materials
Any piping material that meets all pressure and temperature ratings, material compatibility requirements and state and local building codes may be used for pumped liquid CO_2 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-inch.
   b. Braze joints with alloy containing a minimum of 15% silver. Clean joints thoroughly before brazing and have dry nitrogen flowing through tubing during brazing so long as the braze/solder material contains no zinc or zinc chloride.
   c. Flux materials must contain no zinc and must also be water soluble. All field piping must be purged with nitrogen while brazing.

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.

⚠ WARNING

Under no circumstances add or leave schrader valves in the system.

Insulation
Insulation should be used in secondary system piping to reduce the heat transfer to ambient air and to maintain subcooling in the CO_2 liquid supply line to the case. 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 and manufacturer 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 secondary system applications.

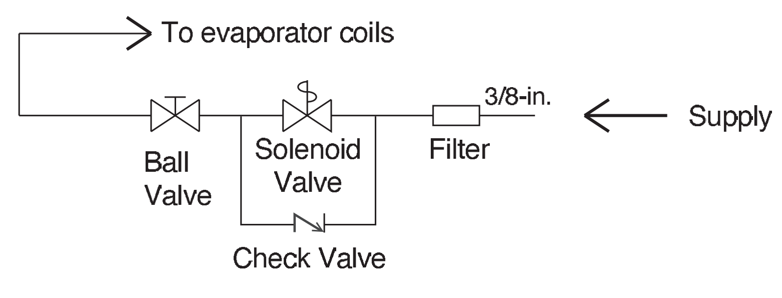
The manufacturer's internal case piping valves and components are insulated to prevent frost from building. Sufficient insulation is required on piping into the display case to eliminate frost on tubes and to minimize temperature rise of CO_2.

Check Valves
Check Valves are required wherever there is a possibility of trapping liquid CO_2 between valves that may be shut off, including solenoid valves, service valves, and balancing valves. Check valves must be installed to vent high pressure CO_2 back to the system. Hussmann recommends reverse return tubing instead of the use of shutoff valves for balancing purposes, but if shutoff valves are used they must be relieved to the system through check valves.

⚠ WARNING

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

Following is an example of a piping layout if hand valves are used in line with solenoid valves.



Optional Hand Valve and Check Valve

Supply and Return Loop Piping
Hussmann display cases are designed to minimize the pressure drop through the case, with no more than 10 psi pressure drop through the typical display case. Refer to CO_2 application data for pressure drop for specific case models. Field installed piping and store layout must be designed so that the total pressure drop in the liquid supply line and wet return line does not exceed 15psi through the entire circuit.

Application data for display cases can be found at Hussmann.com

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

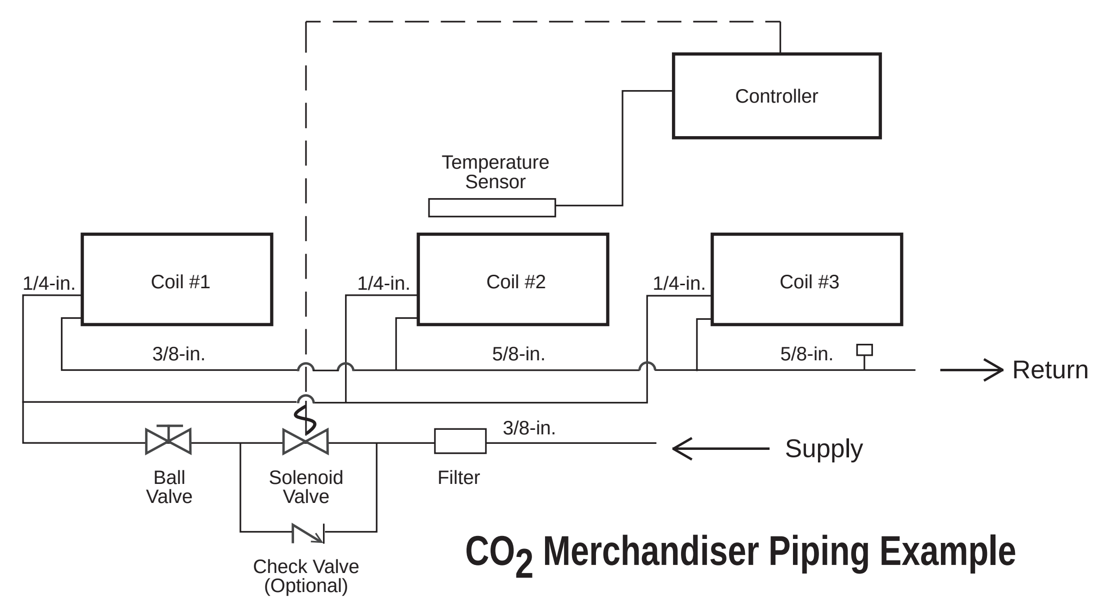
Valves
Solenoid, check and ball valves are to be installed upstream of the case/unit cooler heat exchangers.

FIELD ELECTRICAL CONNECTIONS

Case Inlet Solenoid Valve
The 120V case inlet Solenoid valve is normally closed, and must receive a signal from the rack controller to provide temperature control. The solenoid valve must shut off (de-energize) during defrost and when case discharge air temperature is satisfied. Settings are provided on the CO_2 application data sheets for each specific case model.

Differential of the controller must be set to 2°F or less to avoid large fluctuations in discharge air temperature. A swing of as much as 5°F total (+/- 2.5°F) will not affect product temperatures.

Liquid line solenoid lead wires are terminated in the raceway and marked with an identification tag.



CO_2 Merchandiser Piping Example

ADDITIONAL SAFETY DEVICES AND PRECAUTIONS

Hussmann pumped liquid CO_2 cases are rated for a maximum design pressure of 600 psig. Pressure relief valves are shipped with the pumping station, and must be field installed according to the manufacturer's instructions. Pressure relief valves are not provided with Hussmann's pumped liquid CO_2 display cases. For optimum safety and performance, it is recommended that only Hussmann pumping stations be used.

If the refrigeration system is de-energized, venting of the CO_2 (R744) through the pressure regulating relief valves on the refrigeration system can occur. In such cases, the system may need to be recharged with CO_2 (R744), but in any case, the pressure regulating relief valves(s) are not to be defeated or capped. The relief setting shall not be altered.

CO_2 Leak Detector: Leak detectors are required anywhere that CO_2 gas may leak or be vented. Leak detectors provide an alarm if CO_2 is detected at an amount that exceeds the maximum allowable CO_2 concentration. **LEAK DETECTORS ARE NOT PROVIDED WITH THE CASE.** Consult local codes for exact requirements.

⚠ WARNING

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 part of the system can be isolated without pressure relief capability.

Startup and Shut Down: Provisions must be made for startup and shutdown to prevent excessive pressures. Consult the pumping station instructions and local codes for requirements.

It is imperitive that the case piping is clean and dry prior to charging the system with CO_2. Use AC&R copper.

CO_2 QUALITY

1. Use high grade CO_2 only (moisture<15ppm)

2. Moisture in CO_2 systems will create heavy corrosion inside steel piping caused by carbonic acid production.

OTHER INFORMATION

Cases are designed for 100% liquid CO_2 at the inlet and for 50% quality at the outlet.

Operation at other conditions may adversely affect performance.

SAFETY MUSTs

1. Use personal protection equipment (PPE) –gloves, safety glasses, long sleeves, etc.– and be aware of potential freezer burns from liquid CO_2.

2. Pressure Transducers / Leak Detectors / Warning Lights / Sounders / and Plant Room Ventilation must all be operational prior to charging with CO_2.

3. Pressure Relief Devices or check valves must be located anywhere that liquid CO_2 can be trapped. Trapped CO_2 at –40°C will double in volume if allowed to rise to 30°C.

CO2 SECONDARY SYSTEMS START-UP CHECK LIST

1. When the system(s) are ready for commissioning. Visually check all components. Check pressure and vacuum sheets complete. See Report #1A and #1B.

2. Load and check the controllers program and verify all Inputs and Outputs.

3. Main power available. Check for three phase at sub-board. Connections tight on board. Compressors isolated. Check all cabinets (fans) clear of rubbish and that all electrical grounds have continuity and electrical tests have been completed by electrician.

4. Turn on power and check operation of cabinet and room fans, lights trim, heaters, door heaters, defrost heaters, drain heaters and all isolating switches. Start crank case heaters to warm oil.

5. Check individual breakers/fuse to prove circuits of all safety switches on refrigeration system, (HP/LP, oil failure). Compressor and condenser overloads for correct operation and set points, oil heaters and oil levels. All valves fully open. See Report #2.

6. Start primary side compressors individually and check for correct three phase power and current draw. Charge up primary system.

Open up hot gas bypass lines to impose a load on the primary system during intial startup. Shut off hot gas bypass lines after system is charged.

7. Charge R744 (CO_2) vessel initially with VAPOR until pressure is above 100 psig, then continue charging with liquid. Charge with liquid until high liquid level sensor in the receiver senses liquid.

Note:
Only one liquid CO_2 Pump may run at any given time. Shut off either the supply or return ball valve to the pump that is not in use

Dual pump operation – alternating pumps is not recommended by the pump manufacturer.

8. Start the liquid CO_2 pump. Then commence branch cooling in a staged basis of one branch at a time taking care to ensure that the CO_2 vessel pressure does not rise above 400 psig – do not rush this initial start-up stage, and do not run the CO_2 system until the high side system is fully operational.

NOTE:
Do not open all solenoid valves at once. Run high side plant and check (adjust if necessary) superheats and operation of interstage heat exchanger.

9. Check cabinet and room temp setting, including cut in and cut out operation.

10. Confirm the operation of the CO_2 leak detectors and alarm system. NOTE: CO_2 leak detectors are to be located in every cooler room, freezer room, food preparation area, plant room and the retail area (as required by code).

11. Check defrost (and current draw on elements) operation and safety termination for each individual branch.

12. Check oil temps / pressures and high pressure / low pressure, pressures and settings.

13. Check and record running amperages of compressors and condensers. Check moisture indicator.

14. Check and record operational amperages of all electrical loads (i.e. fans, lights, anti-sweat heaters, defrost heaters, etc.)

15. Turn off plant and recheck all electrical terminals for tightness or signs of overheating.

16. Check alarm system operation and settings.

17. After 100 hours of running on the primary system change:
drier cores, suction filter cores, lubricant, and replace oil filters / strainers

18. on the secondary sytem change:
liquid line and dryer cores

NOTE:
Maintenance requires these drier cores be replaced whenever the system is opened or at a minimum of every six months.

18. Leak test system and re-check electrical terminals. Re-check cabinet and room temp settings; including cut in and cut out operation.

19. Full training and the onsite Instruction Manual is to be provided by the refrigeration contractor to the employer's key (nominated) onsite store staff prior to the store opening date. This must include detailed safety training with particular attention to CO_2.

CO2 LIQUID RECIRCULATION SEQUENCE OF OPERATION

This section describes the general operation of the CO_2 Liquid Recirculation secondary systems. These CO_2 systems are designed to be used in conjunction with a centralized parallel compressor rack system. The CO_2 Liquid recirculation system regulates case temperatures by circulating carbon dioxide through a case evaporator as it absorbs heat. The returning carbon dioxide is cooled to a liquid by the primary refrigerant supplied from the rack. The carbon dioxide is then pumped back through the case evaporator.

When the secondary system control circuit is powered up (120 volts) the chiller controller is powered. This controller regulates superheat on the primary side and must be programmed before starting the refrigeration system.

Turn on the main on/off switch to energize the pump. One pump will be "ON" and one pump will be "OFF" as a backup pump. The pump that is "ON" will now run continuously. The CO_2 receiver pressure and temperature is controlled by stepping the primary rack compressor capacity.

The rack stages compressors on and off based on the input from CO_2 receiver pressure transducer. The EEV controller will regulate the superheat on the primary refrigerant side.

Defrost is initiated when the rack controller sends a signal to de-energize a case solenoid valve. The solenoid valve closes, and after a specified time delay, electric heat is switched on. Once the defrost period has elapsed, the electric heat is switched off, and after a 2nd time delay, the solenoid valve is energized. The CO_2
refrigerant then resumes flow through the case.

CO_2 TEMPERATURE CONTROL
The CO_2 temperature is controlled by using the CO_2 receiver pressure as the reference point for the primary side compressor capacity.

Read CO_2 receiver pressure control

CO_2 Receiver pressure:
IF
1. CO_2 receiver pressure rises 2 psi (make adjustable) above the saturation pressure for the selected CO_2 setpoint temperature
THEN
1. E2 rack controller increases the primary side compressor capacity until the set point temperature CO_2 saturation pressure is reached.

IF
2. CO_2 receiver pressure falls 2 psi (make adjustable) below the saturation pressure for the selected CO_2 setpoint temperature
THEN
2. E2 rack controller decreases the primary side compressor capacity until the set point temperature CO_2 saturation pressure is reached.

SHUT DOWN MODES

Low Pump Differential Pressure (psi)
The E2 rack controller monitors the discharge and suction pressure across the CO_2 pump that is “ON” and calculates the differential pressure using a flex combiner.

There will be dual pumps in parallel. One pump will be “ON” running continuously and one pump will be “OFF” as a backup. There is a switch on the control panel to switch between Pump 1 or Pump 2. The 2 pumps will have different sets of discharge and suction pressure transducers.

IF
1. The Differential Pressure (psi) across the Pump is greater than 5psi or less than 60psi (make adjustable)
THEN
1. E2 Rack controller sends output to turn the pump ON.

IF
2. The Differential Pressure (psi) across the Pump drops below 5 psi (make adjustable) for a period of 10 seconds (make adjustable)
OR
IF – The Differential Pressure (psi) across the Pump rises above 60 psi (make adjustable) for a period of 10 seconds (make adjustable).
THEN
2. E2 Rack controller sends output to turn the pump OFF. E2 Rack Controller sends Alarm to identify “LOW PUMP DIFFERENTIAL PRESSURE SHUT DOWN.” After a 2 min time delay (make adjustable), E2 Rack controller sends output to turn the pump ON.

MULTIPLE RESTART AND LOCKOUT PROCEDURE

If 2nd shutdown is within 15 minutes, re-start after time delay of 2 minutes.

If 3rd shutdown is within 15 minutes, re-start after time delay of 2 minutes.

If 4th shutdown within 15 minutes, lockout and require an inspection by service technician

(LOWER) LIQUID LEVEL SENSOR

IF
1. The Receiver Liquid Level drops below Lower Liquid Level Sensor for a period of 2 seconds (make adjustable)
THEN
1. E2 Rack controller sends output to turn the pump OFF. The rack controller sends an Alarm to identify “LOW RECEIVER LIQUID LEVEL SHUT DOWN.” After a 2 min time delay (make adjustable), E2 Rack controller sends output to turn the pump ON.

ALARM MODES

(Upper) Liquid Level Sensor

IF
1. The CO_2 receiver pressure exceeds 25 psi above the E2 controller suction setpoint for 30 seconds.

THEN
1. The exact controller suction setpoint may vary slightly from system to system; stating specific setpoints for 20° & +20° (CO_2 temperatures) using PSIA while the E2 controller is set using PSIG;

CO_2 LEAK DETECTOR ALARM

IF
1. The presence of CO_2 exceeds ____ ppm (adjustable setting 4000-9000ppm).
THEN
1. CO_2 leak detector sends alarm to identify “CO_2 LEAKAGE ALARM.”

CO_2 RECEIVER PRESSURE TRANSDUCER ALARM

Low Temp Systems (-20F)
IF
1. The CO_2 Receiver Pressure exceeds 25psi above 200psi for 30seconds.
THEN
1. Rack controller sends alarm signal to identify “HIGH CO_2 RECEIVER PRESSURE.”

IF
2. The CO_2 Receiver Pressure drops 25psi below 200psi for 30seconds.
THEN
2. Rack controller sends alarm to identify “LOW CO_2 RECEIVER PRESSURE”

Medium Temp Systems (+20F)

IF
1. The CO_2 Receiver Pressure exceeds 25psi above 422psi for 30seconds.
THEN
1. Rack controller sends alarm to identify “HIGH CO_2 RECEIVER PRESSURE.”

IF
2. The CO_2 Receiver Pressure drops 25psi below 422psi for 30seconds.
THEN
2. Rack controller sends alarm to identify “LOW CO_2 RECEIVER PRESSURE.”

GLOSSARY OF REFRIGERATION TERMS

Refrigerant
A fluid used to freeze or chill (a food) for preservation.

Primary Refrigerant
A fluid such as R404A used in a vapor compression system to cool a secondary coolant.

Secondary Coolant (Refrigerant)
A fluid such as Carbon Dioxide (CO_2) R744 used to remove heat from cases and unit coolers and transfer the heat to the primary refrigerant through a heat exchanger. Secondary coolants used with these systems are for Low and Medium Temperature applications. Typically, the Low Temperature secondary coolant supply temperature is -20°F and the Medium Temperature secondary coolant supply temperature is 20°F.

Pump
This is a device that circulates the secondary coolant throughout the system.

Pressure Relief Valve
There are two different types of Pressure regulating relief valve (PRV) and pressure relief valve (pop-off valve) This device is to control or limit the pressure in the system which can build up due to power outage, instrument or equipment failure, or fire. The pressure is relieved by allowing the pressurized fluid to flow from an auxiliary passage. The relief valve is set to open at a predetermined pressure to protect pressure vessels and other equipment from being subjected to pressures which exceed their design limits.

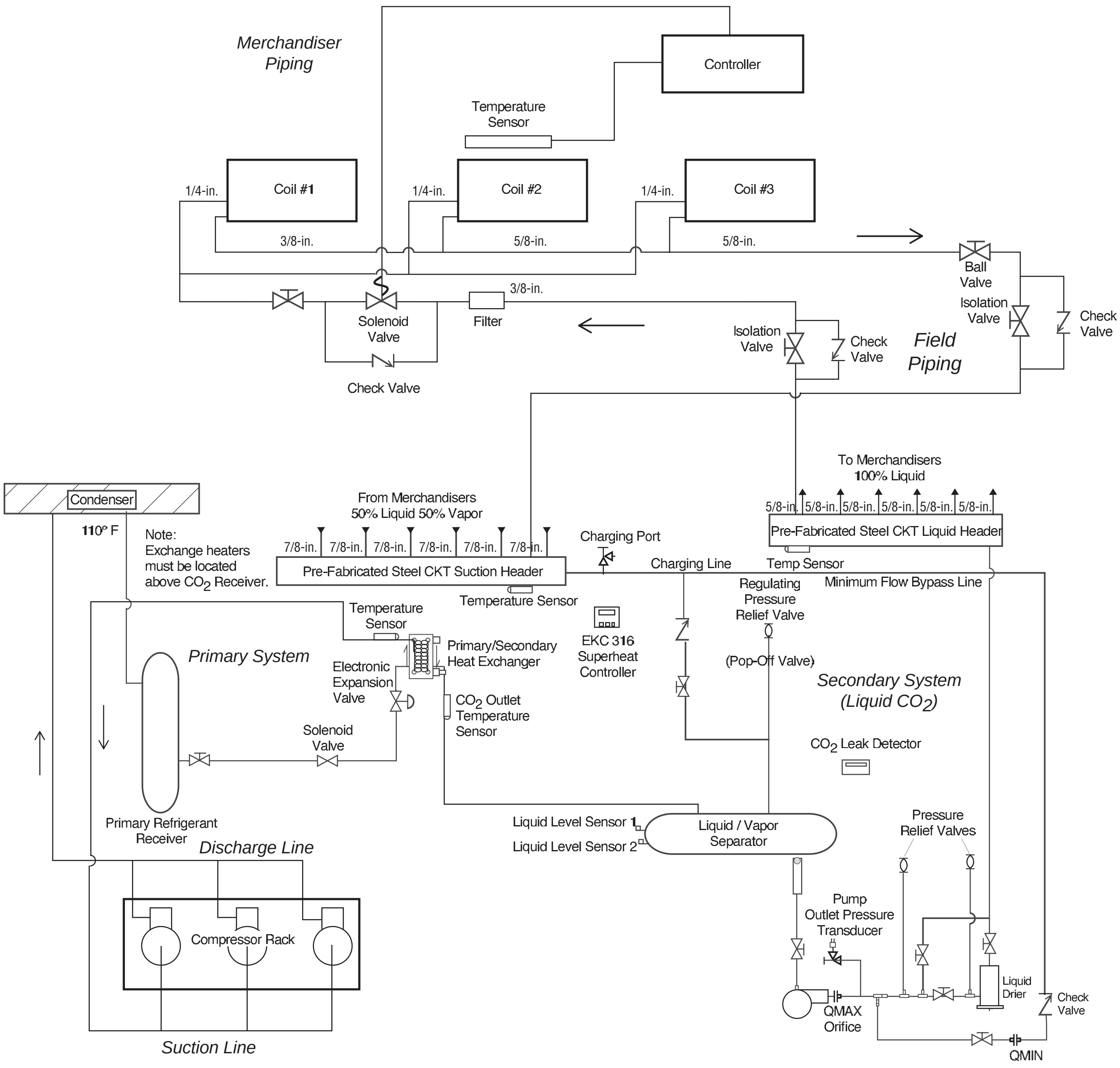
Cascade Heat Exchanger
This is a device built for efficient heat transfer between the primary refrigerant and secondary refrigerant. Heat exchangers may be classified according to their flow arrangement such as parallel flow, counter flow, or counter current design. For efficiency heat exchangers are designed to maximize the surface area of the wall between the two fluids while minimizing the resistance to fluid flow through the exchanger.

Liquid \ Suction Heat Exchanger
This is a device built for efficient heat transfer between the liquid line and suction line of the primary refrigerant. This device also subcools the liquid refrigerant and aids in the complete evaporation of the suction gas.

Liquid \ Vapor Separator
This is a vessel designed to separate the vapor and liquid phases of the secondary refrigerant. Gravity causes the liquid to settle to the bottom of the vessel where it is withdrawn to enter the inlet of the pump.

Electronic Expansion Valve
This is a device built to control the amount of superheat at the outlet of the primary side evaporator. In this system the Cascade Heat Exchanger is the evaporator for the primary refrigerant.

Liquid Filter Drier
This is a device designed to filter impurities and adsorb moisture from the refrigerant and lubricant in the liquid line.



Pumped Liquid CO_2 System Schematic

Commissioning Report – Pressure Test and Vacuum for high side of CO2 Secondary (Liquid Recirc.) Systems **REPORT #1A**

Commissioning Report	**Pressure & Vacuum Test**	**Date:**				
System:		**Project:**		**Job:**		
NOTE: The Engineer is to be given 48 hours notice of test (Date: / /)						
System Section	**Specified Value**	**Actual**	**Start**	**Finish**	**Checked**	**Date**
Low side - high side	Inaccessible piping pressure test prior to “covering-up” Nitrogen (350 psi) Duration 24 hr.					
	Complete system pressure test Nitrogen (250 psi) Duration 24 hr.					
Vacuum Test Test: 1. Vacuum	500 Microns					
	Hold 30 minutes with pump off					
Pressure	Dry Nitrogen 15 psig					
2. Vacuum	350 Microns					
	Hold 60 minutes with pump off					
	Pressure Dry Nitrogen 15 psig					
3. Vacuum	250 Microns					
	Hold 60 minutes with pump off					
Pressure	Charge System					

Comments:	**NOTE:** 1. HOLD POINT - If **any** pressure loss found, system deemed to have a leak and is to be leak checked and then re-tested. 2. HOLD POINT - If **any** vacuum test fails to hold, system is deemed to have a leak and is to be leak checked and passed. Then vacuum testing starts from #1 again.
High Side System fully Pressure Tested and Evacuated by:	Date:
COMMENTS:	
Commissioning Engineer:	Commission Date:

Commissioning Report – Pressure Test and Vacuum for secondary side of CO2 Secondary(Liquid Recirc.) Systems REPORT #1B

Commissioning Report		**Pressure & Vacuum Test**		**Date:**		
System:		**Project:**		**Job:**		
NOTE: The Engineer is to be given 48 hours notice of test (Date: / /)						
System Section	**Specified Value**	**Actual**	**Start**	**Finish**	**Checked**	**Date**
Low side - high side	Inaccessible piping pressure test prior to "covering-up" Nitrogen (250 psi) Duration 24 hr.					
	Complete system pressure test Nitrogen (250 psi) Duration 24 hr.					
Vacuum Test Test: 1. Vacuum	500 Microns					
	Hold 30 minutes with pump off					
Pressure	Dry Nitrogen 15 psig					
2. Vacuum	350 Microns					
	Hold 60 minutes with pump off					
	Pressure Dry Nitrogen 15 psig					
3. Vacuum	250 Microns					
	Hold 60 minutes with pump off					
Pressure	Charge System					

Comments:	**NOTE:** 1. HOLD POINT - If **any** pressure loss found, system deemed to have a leak and is to be leak checked and then re-tested. 2. HOLD POINT - If **any** vacuum test fails to hold, system is deemed to have a leak and is to be leak checked and passed. Then vacuum testing starts from #1 again.
High Side System fully Pressure Tested and Evacuated by:	Date:
COMMENTS:	
Commissioning Engineer:	Commission Date:

Rack Main Component Commissioning Checks **Report #2**

RACK COMMISSIONING for CO_2 Secondary (Liquid Recirc) Systems											
			COMP AMPS			Pressure In	Pressure Out	Min. Flow	Drier Pressure Drop		
CO_2 Rack	**LT**	**MT**	**R**	**Y**	**B**						
Pump #1											
Pump #2											
High Side Rack						**Oil Level**	**Open Valves**	**HP Setting**	**LP Setting**	**Oil Fail Type**	**Oil Fail Setting**
Comp #1											
Comp #2											
Comp #3											
Comp #4											
Comp #5											
Comp #6											
Comp #7											
Condenser Fans											
Fan #1											
Fan #2											
Fan #3											
Fan #4											
Fan #5											
Fan #6											
Fan #7											
Fan #8											
Fan #9											
Fan #10											
Fan #11											
Fan #12											

Notes:

1. Ensure that the compressors on the Primary (Rack) side are capable of stepping in capacity in 10% increments or less. This Can be accomplished by utilizing digital un-loading technology in the compressor or can be accomplished by standard un-loaders.
2. If the condenser fans are equipped with Variable Frequency Drives ensure that the motors are at full speed when recording amperage values.

CO_2 REFRIGERATION SYSTEMS COMMISSIONING CHECK LIST

Report #3

Project: ____________________

Date: ____________________

Commissioning Engineer: ____________________

System Model No.: ____________________

1.0	Preliminary	Checked (Date/Time)	
		Initial	Final
	Pressure tests and evacuation complete		
	Confirm all sub-Refrigeration Contractors work complete		
	Machine Room clear of all construction material		
	Controller Microprocessor Program Loaded and checked		

2.0	Electrical	Checked (Date/Time)	
		Initial	Final
	Check mains connections - MSB and at DB		
	Check trip block setting on MCCB in DB		
	Check phase rotation		
	Inspector to check board and approve		
	Power on to DB main isolator, remove all fuses and ensure all control and branch switches in off position		
	Check connections DB, fuse ways, contact relays, terminals OK		
	Check wire numbers against drawings		
	Check circuit charts against drawings		
	Check labels		
	Check compressor wiring		
	Check phase rotation		
	Install control circuit fuses and enable control circuits – manual		
	Check compressor safely circuit operation - pressure switched, oil failure switch, thermistor, overload settings		
	Install power fuses and compressors - check and record current		

CO_2 REFRIGERATION SYSTEMS COMMISSIONING CHECK LIST

Report #3

Project: ______________________________

Date: ______________________________

Commissioning Engineer: ______________________________

System Model No.: ______________________________

2.1	Cabinets	Checked (Date/Time)	
		Initial	Final
	Check cabinet terminals		
	Check terminations at switchboard		
	Install fuses		
	Enable branch isolators		
	Check and record current draw of each circuit		
	Ensure all fuse ratings correct size		

Cabinet Circuit Current Draw

Cabinet	Branch No.	Lights	Fans	Anti-Sweat	Solenoid	Defrost

CO_2 REFRIGERATION SYSTEMS COMMISSIONING CHECK LIST

Report #3

Project: ____________________

Date: ____________________

Commissioning Engineer: ____________________

System Model No.: ____________________

2.2	Walk-In Coolers and Freezers	Checked (Date/Time)	
		Initial	Final
	Check walk-in terminations		
	Check junction boxes on top of walk-ins		
	Check thermostat settings		
	Check terminations at switchboard		
	Ensure all fuse ratings correct size		
	Install fuses		
	Enable branch isolators		
	Check and record current draw of each circuit		

Walk-In Circuit Current Draw

Walk-In	Branch No.	Lights	Fans	Door/Drain Heaters	Solenoid	Defrost

CO_2 REFRIGERATION SYSTEMS COMMISSIONING CHECK LIST

Report #3

Project: ______________________________

Date: ______________________________

Commissioning Engineer: ______________________________

System Model No.: ______________________________

3.0	Microprocessor Controller Initial Final	Checked (Date/Time)	
		Initial	Final
	Check and identify all temperature sensors in cabinets and walk-ins		
	Check leak detector connection and operation		
	Check alarm output function (prove via Store Security Company)		
	Check lock-in alarms (if applicable)		
	Check local and remote alarms		
	Check butchery wash down panel operation		
	Record current on DB - incomer		
	Submit marked up As-Built drawings to the Engineer		
	Submit commissioning results to Engineer		
	Check all input signals		
	Check all output signals		

CO_2 REFRIGERATION SYSTEMS COMMISSIONING CHECK LIST

Report #3

Project: ______________________________

Date: ______________________________

Commissioning Engineer: ______________________________

System Model No.: ______________________________

4.0	Parallel Racks LT and MT	Checked (Date/Time)	
		Initial	Final
	Correct refrigerant used		
	Correct lubricant used		
	Proper lubricant level in sight glasses		
	Lubricant added to separator		
	Liquid line dryer cores installed		
	Suction filter installed		
	Sight glass installed		
	CPR's installed (if applicable)		
	EPR's installed (where applicable)		
	Compressor vibration eliminators installed		
	Transportation bolts removed		
	Refrigerant and oil identification labels/stickers installed		
	Split condenser valve(s) installed (if applicable)		
	Heat Reclaim valve(s) installed (if installed)		
	Pressure differential valve(s) installed		

5.0	Condensers	Checked (Date/Time)	
		Initial	Final
	Piped to correct Rack/Condenser		
	Bolted down to platform		
	Anti-vibration mounts installed (if applicable)		

CO_2 REFRIGERATION SYSTEMS COMMISSIONING CHECK LIST

Report #3

Project: ____________________

Date: ____________________

Commissioning Engineer: ____________________

System Model No.: ____________________

6.0	Cabinets	Checked (Date/Time)	
		Initial	Final
	Expansion valves installed		
	Expansion Valves - superheat set		
	Lighting installed and type verified		
	Shelving installed and size verified		
	Trim color correct		
	Trim installed - fit correct		
	Drain piping installed (sloped to drain)		
	Drain piping insulated/heated (if applicable)		
	Drain piping traps installed		

7.0	Walk-Ins	Checked (Date/Time)	
		Initial	Final
	Correct wall type and thickness		
	Bump rails fitted (if applicable)		
	Door seals correctly		
	Emergency exit installed		
	Relief vents heated (if applicable)		
	All penetrations sealed		
	Thermometer installed (if applicable)		
	Thermostat installed		
	Evaporator coil installed		
	Drain piping installed (sloped to drain)		
	Drain piping insulated/heated (if applicable)		
	Drain piping traps installed		

CO_2 REFRIGERATION SYSTEMS COMMISSIONING CHECK LIST
Report #3

Project: ____________________

Date: ____________________

Commissioning Engineer: ____________________

System Model No.: ____________________

8.0	Piping	Checked (Date/Time)	
		Initial	Final
	Circuit-Loop Combination installed		
	Liquid Line correct size and installed		
	Suction Line correct size and installed		
	Discharge Line correct size and installed		
	Liquid Drain Line (drop leg) correct size and installed		
	Liquid Line insulation (if applicable)		
	Suction Line insulation		
	All line installation sealed		
	Suction Line sloped to rack		
	Vertical traps every 10 feet of rise		
	Inverted trap at top of riser		
	All horizontal lines fully supported		

9.0	Refrigerant(s)	Checked (Date/Time)	
		Initial	Final
	Correct refrigerant used on Primary side		
	Refrigerant charge on Primary side _____ lbs		
	Correct fluids used on secondary side		
	Secondary Fluid charge on secondary side _____ gals/lbs		

CO_2 REFRIGERATION SYSTEMS COMMISSIONING CHECK LIST

Report #3

Project: ______________________________

Date: ______________________________

Commissioning Engineer: ______________________________

System Model No.: ______________________________

10.0	**Systems Readings and Settings**	**Checked (Date/Time)**	
		Initial	**Final**
	Oil failure settings		
	Oil pressure		
	HP cut out setting		
	HP cut in - manual for pressure switches, auto for microprocessor		
	Head pressure control setting (Microprocessor)		
	LP cut out setting		
	LP cut in setting		
	Super heat setting at TX valves		
	Pressure differential valve settings (if applicable)		
	Microprocessor suction pressure setting		
	LT Mechanical Liquid Sub-Cooler setting		
	Discharge pressure		
	Suction temperature		
	Discharge temperature		
	Pressure drop across suction filter		
	CPR setting (if applicable)		
	Refrigerant level in receiver		
	Condenser fan rotation correct		
	Condenser fan running Amps correct for ewquired fan speed		
	Relief valves Pump discharge - (xxx psig)		
	Relief valves Main CO2 vessel - (xxx psig)		
	Relief valves LT suction manifold - (xxx psig)		
	Relief valves LT discharge manifold - (xxx psig)		
	Relief valves LT compressors LP side - (xxx psig)		

CO_2 REFRIGERATION SYSTEMS COMMISSIONING CHECK LIST

Report #3

Project: ______________________________

Date: ______________________________

Commissioning Engineer: ______________________________

System Model No.: ______________________________

11.0	R744 HIGH PRESSURE FAULTS	Checked (Date/Time)	
		Initial	Final
	Alarm light - On 460 psig, Off 440 psig		
	CO2 Pump stop - On 470 psig, Off 450 psig		
	CO2 Branch Solenoids - On 490 psig, Off 450 psig		
	Mechanical Safety Pressure Switch - On 560 psig, Off 500 psig		

12.0	Post Commissioning	Checked (Date/Time)	
		Initial	Final
	Refrigeration system check lists		
	Commissioning report		
	Updated Microprocessor settings		
	Design updates		
	Wall mounted plans of total system		
	100 hour suction and liquid drier change		
	100 hour oil filter and oil change		
	Defrost time and frequency tweek		
	Electrical Compliance Certificate		
	Check condenser fan safety circuit operation - overload settings		
	Check all control circuit accessories, terminal numbers, ferrules etc.		