

Natural Refrigerant Training Summit

Building a Sustainable Workforce

Troubleshooting Booster Oil Systems

Rusty Walker

Hillphoenix



NORTH AMERICAN
Sustainable
Refrigeration
Council

Debunking CO2 Myth's

Rusty Walker



Booster Flex Low and Medium Temp Compressors

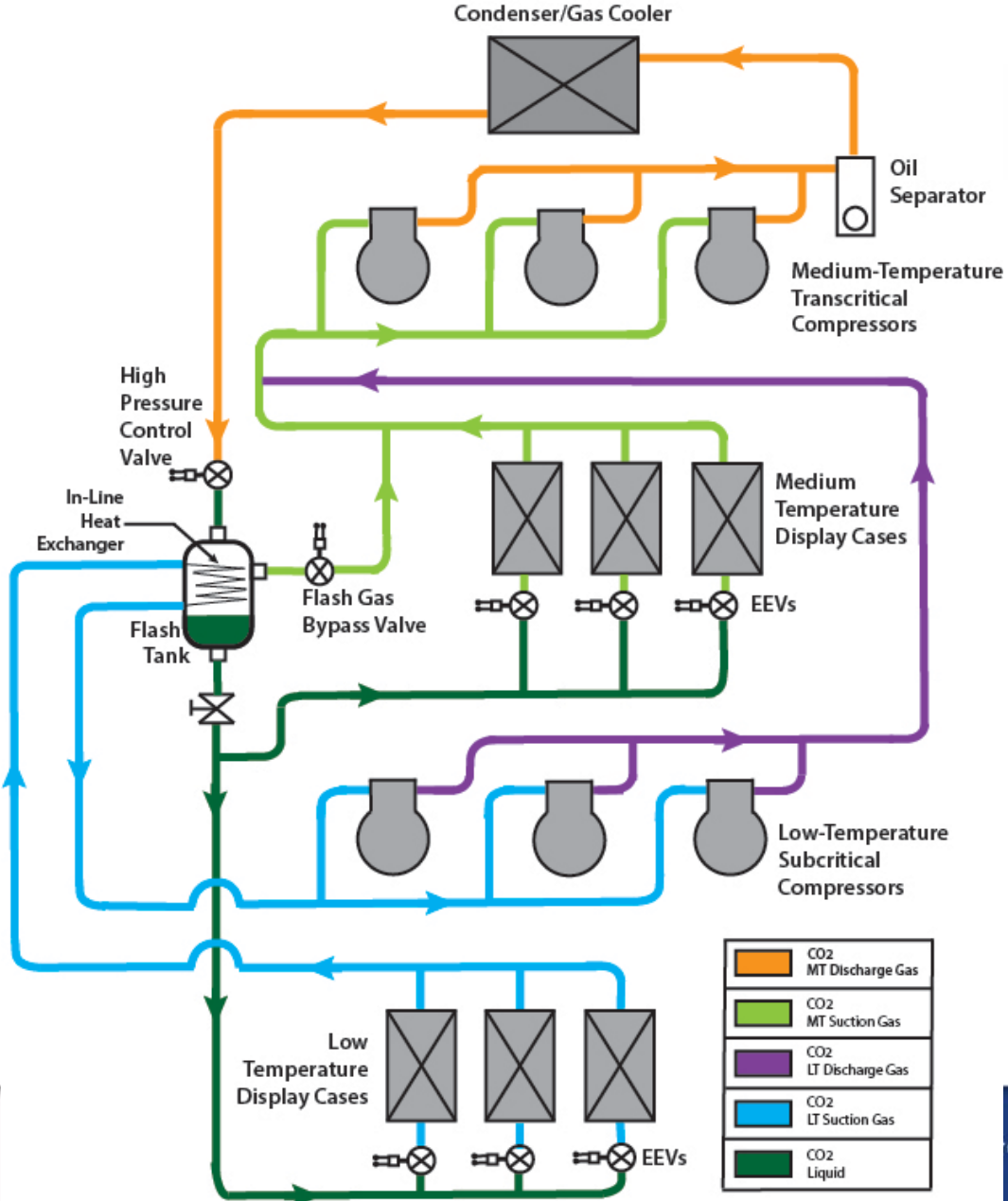


It's Only Refrigeration



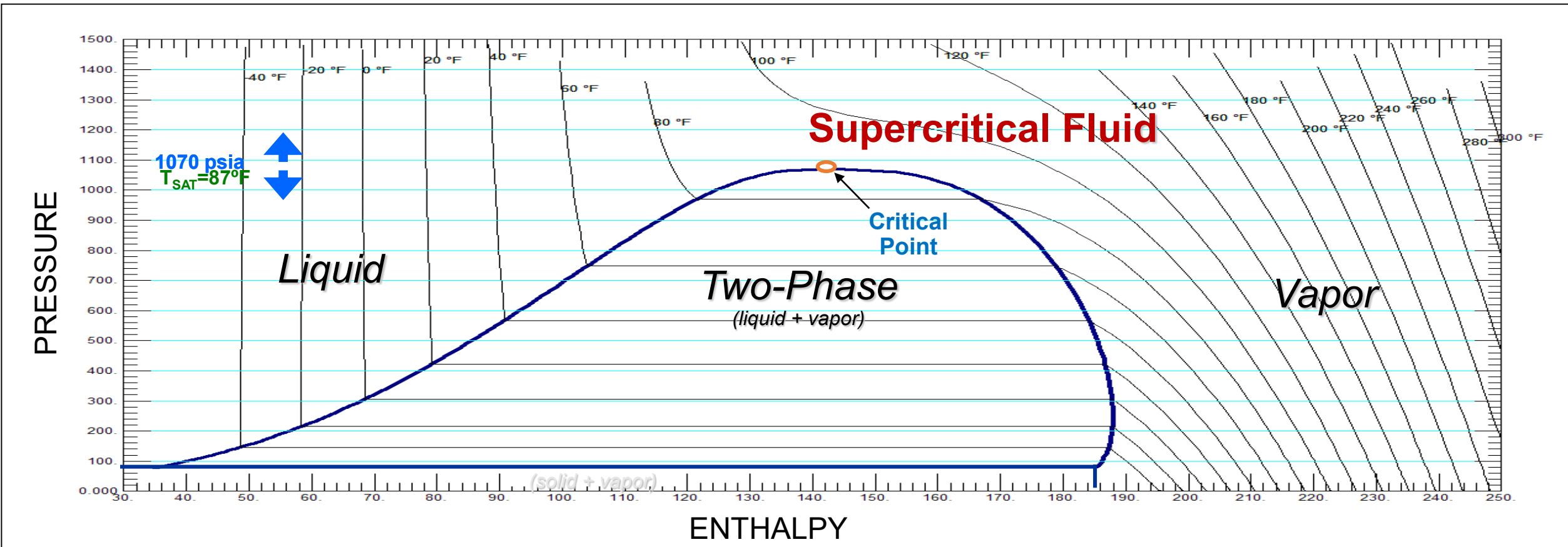
It's To Complicated

Basic R-744 (CO₂) Booster System



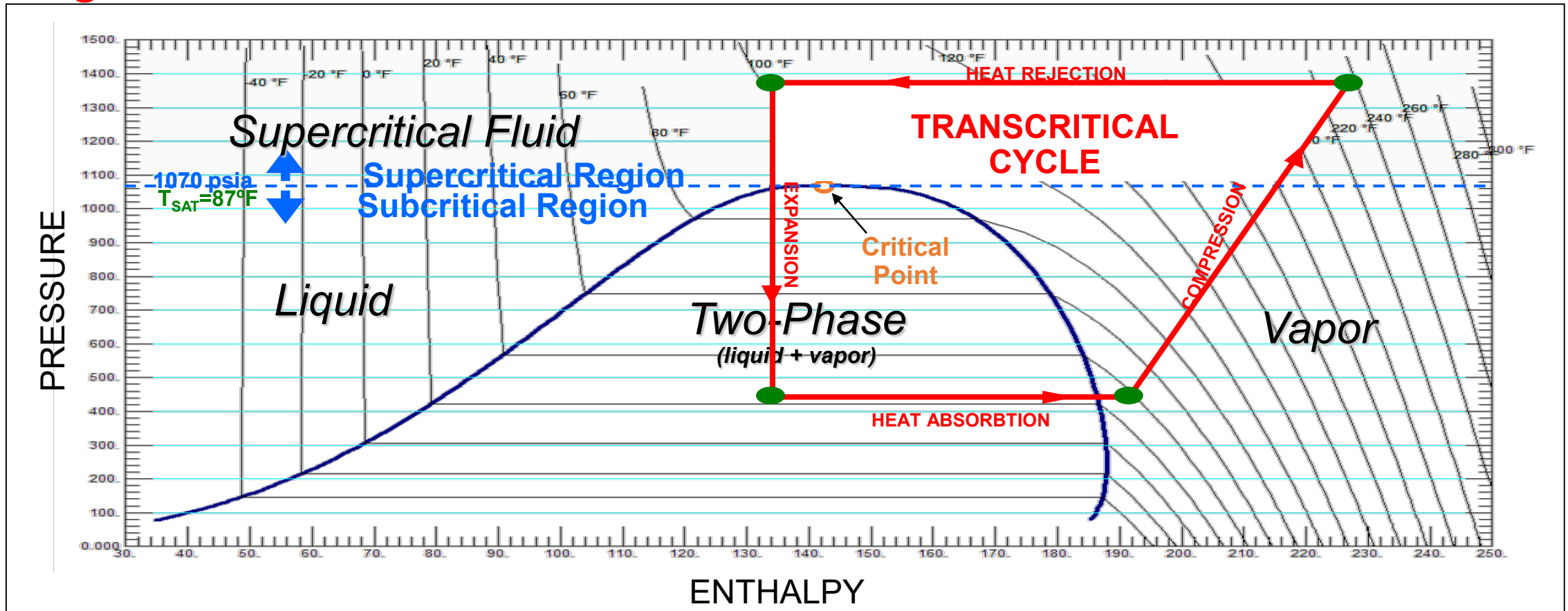
Useful Definition

❑ **Supercritical Fluid** – This will occur when sufficient temperature and pressure is applied to take it beyond its critical point. The substances therefore no longer can be defined as being in either a liquid or gas phases..



Useful Definition

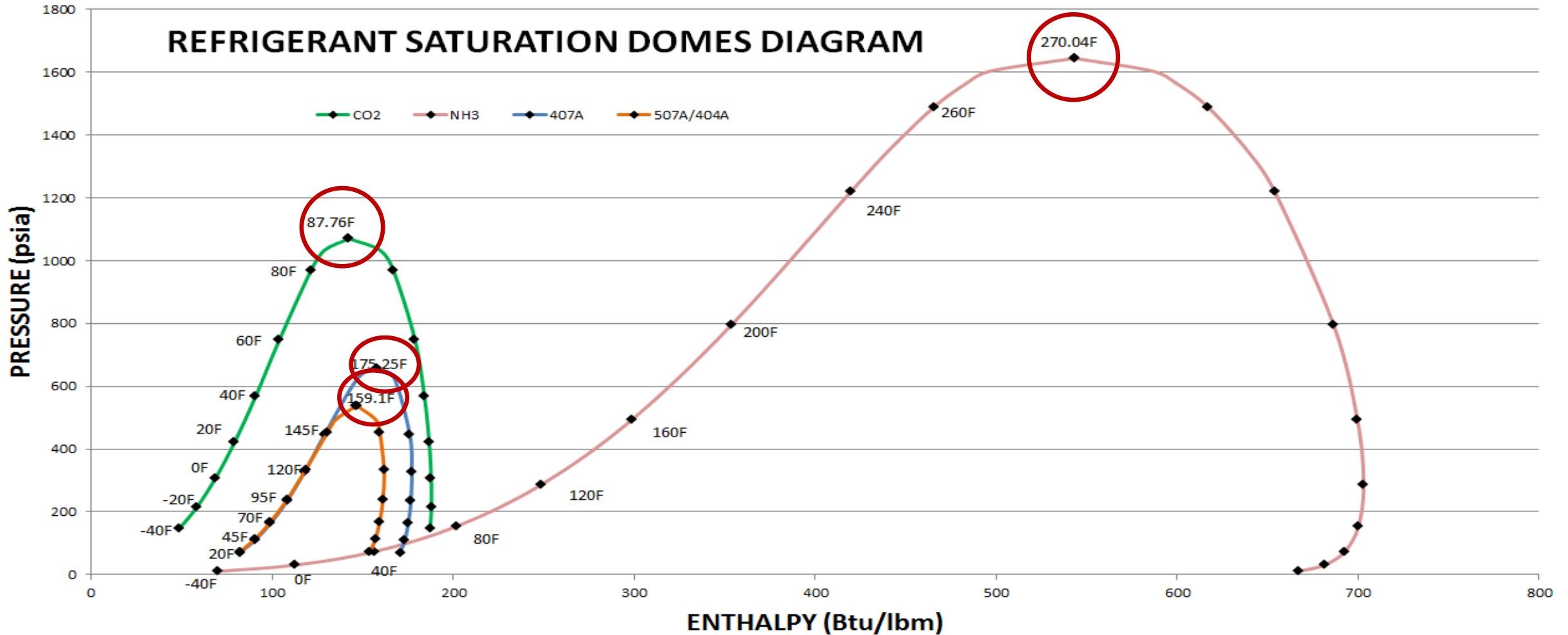
- Transcritical Cycle – Where the high side of the system operates **above** the critical point and the low side of the system operates **below** the critical point. **The system then transition between subcritical and supercritical and back again**



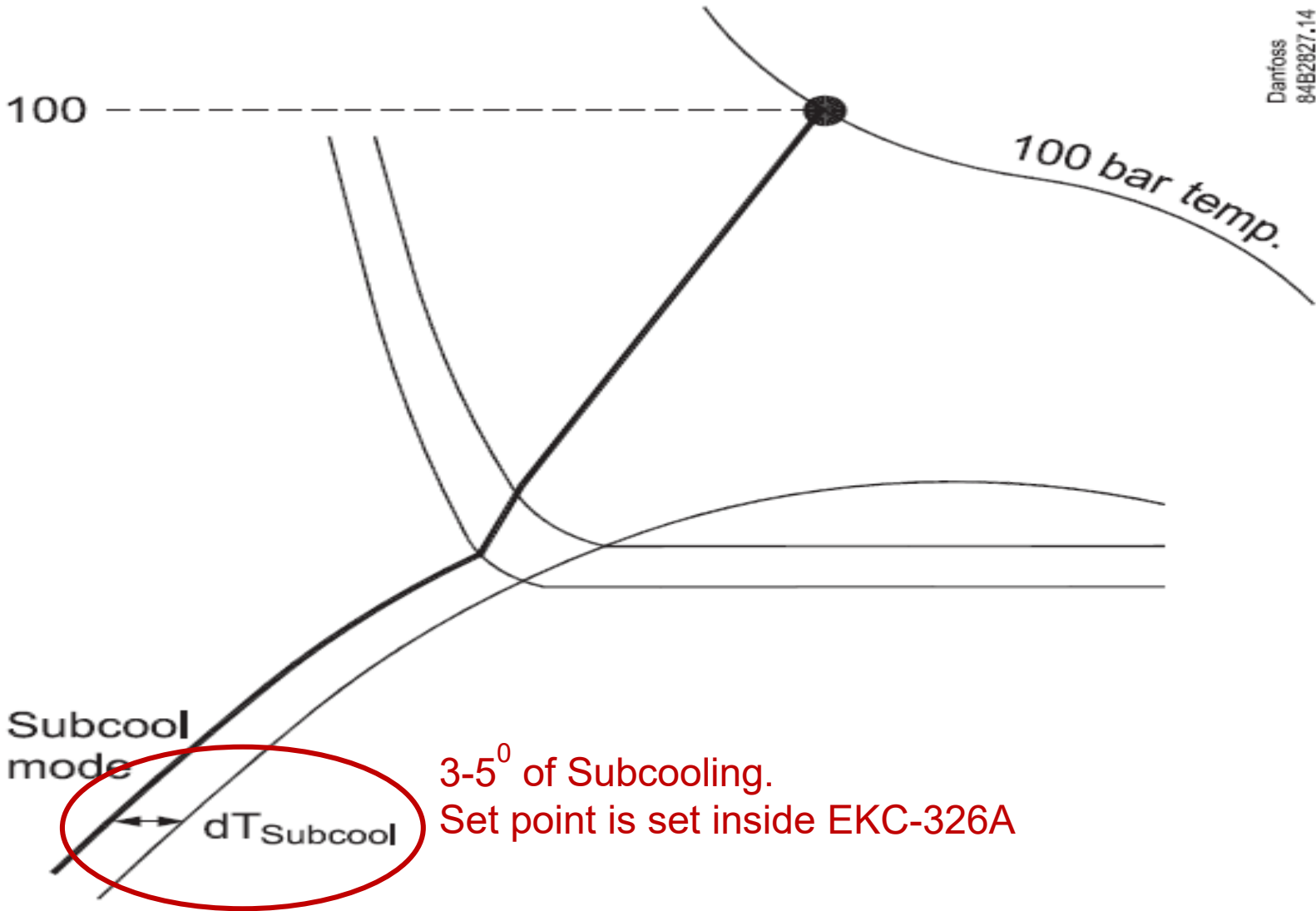
Critical Point

- ❑ Critical Point- The very top of the refrigerant enthalpy diagram is the critical point. **At a temperature above 87.7°F or 1055psig CO₂ cannot exist as a liquid. The highest pressure and temperature where the refrigerant can still condense.**
- ❑ The liquid expands and becomes less dense until, **at the critical point, the densities of liquid and vapor become equal**, eliminating the distention between the two phases and merge together into a single phase.
- ❑ All Refrigerants have a critical point, CO2 just has a low critical point vs. other refrigerants

Critical Point of Other Refrigerants

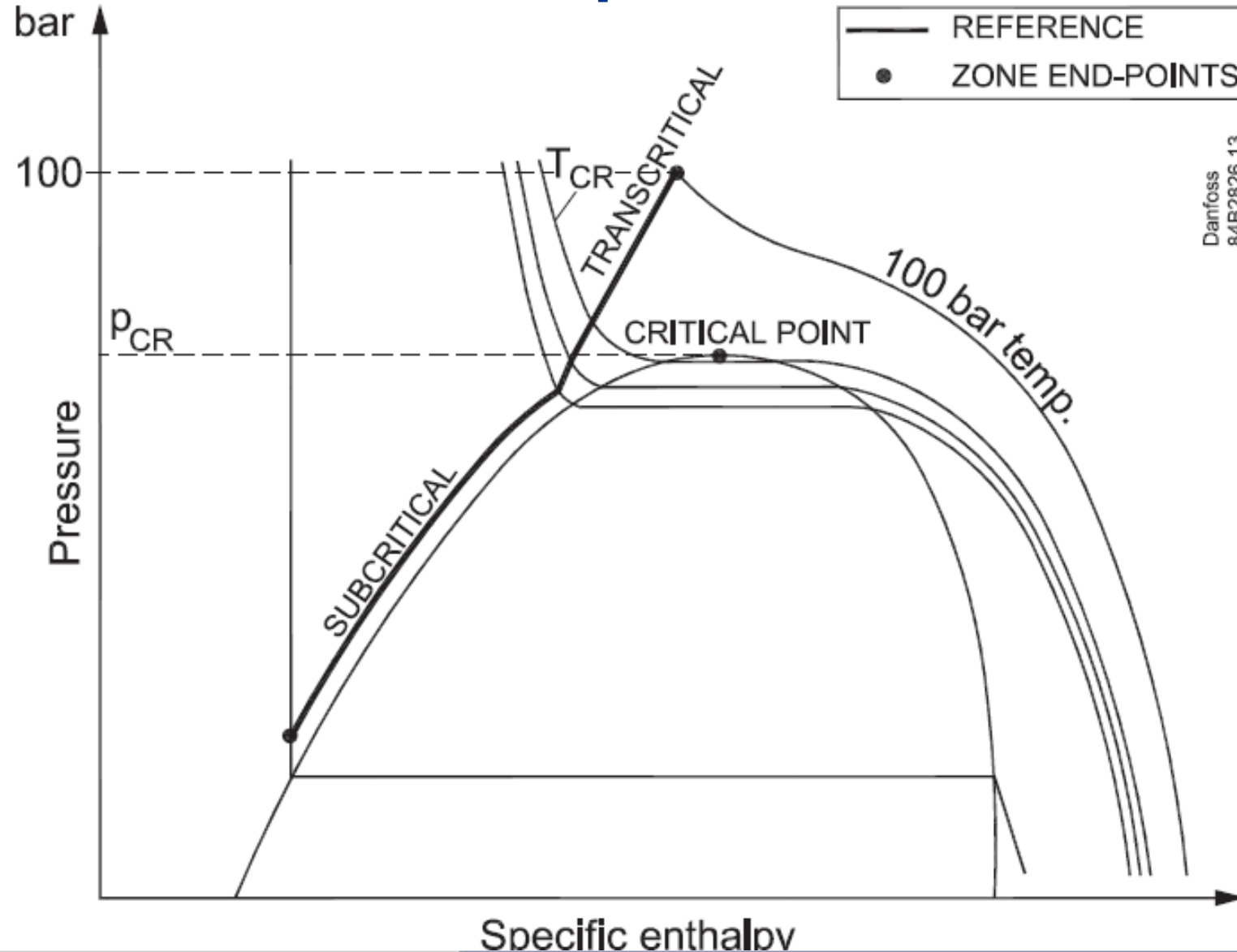


Subcritical Operation



Transcritical Operation

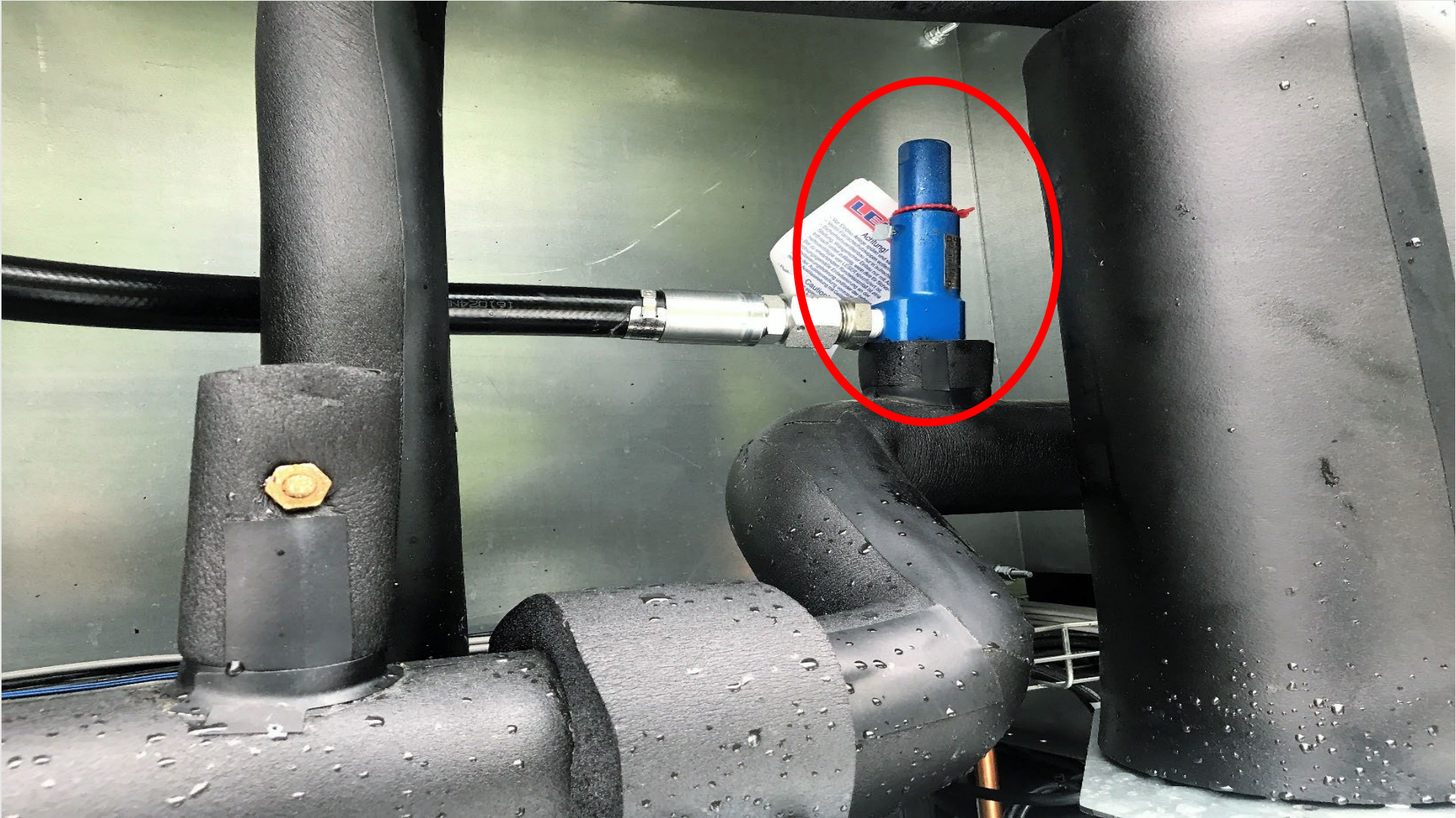
Maximum COP control
The controller maintains optimum pressure in the transcritical range based on a pressure and temperature reading. The reference line is defined with a point at 100 bar. The desired temperature can be set here



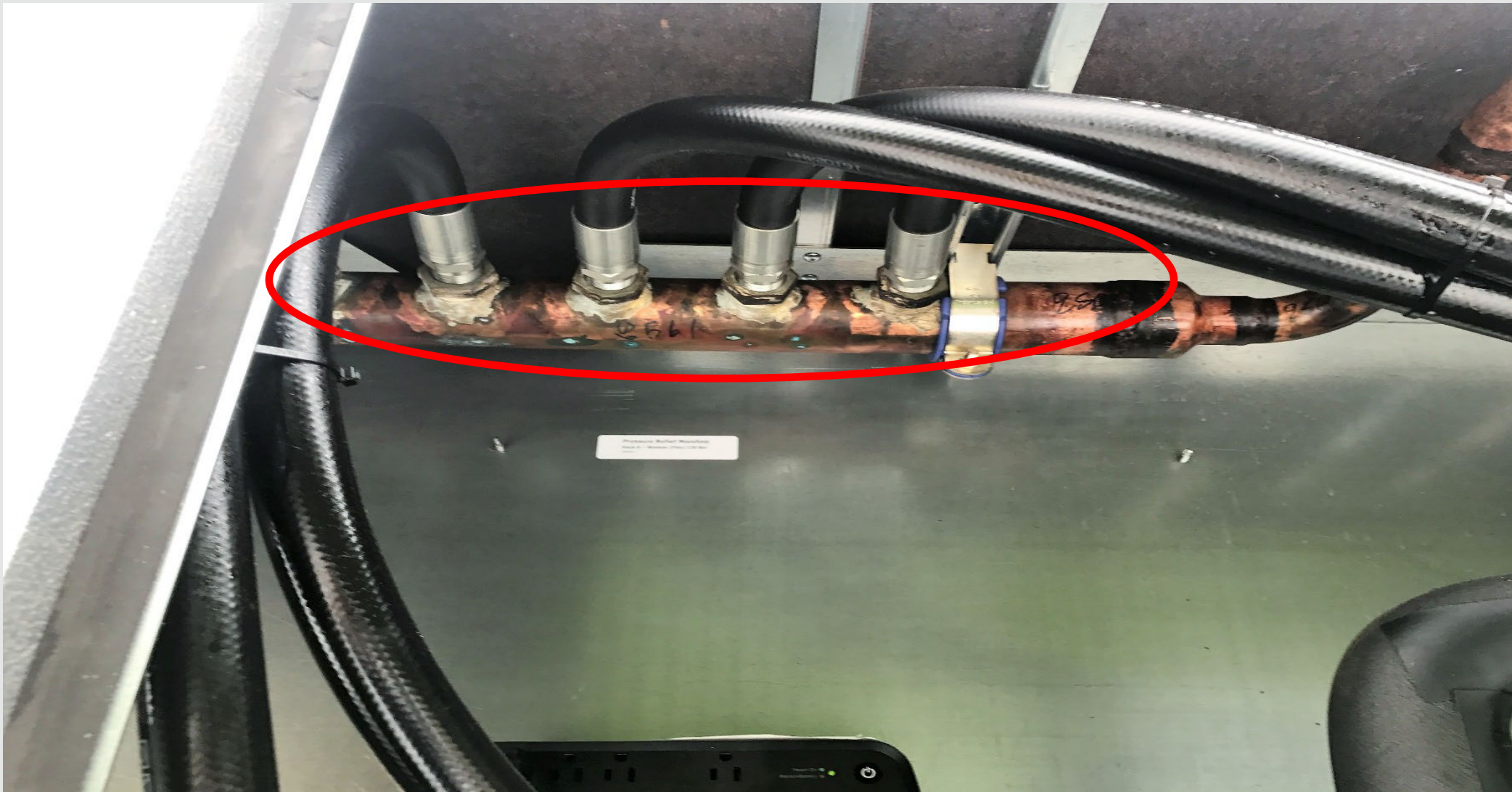
Danfoss
84B2826.13

Is it a Leak Or An Event

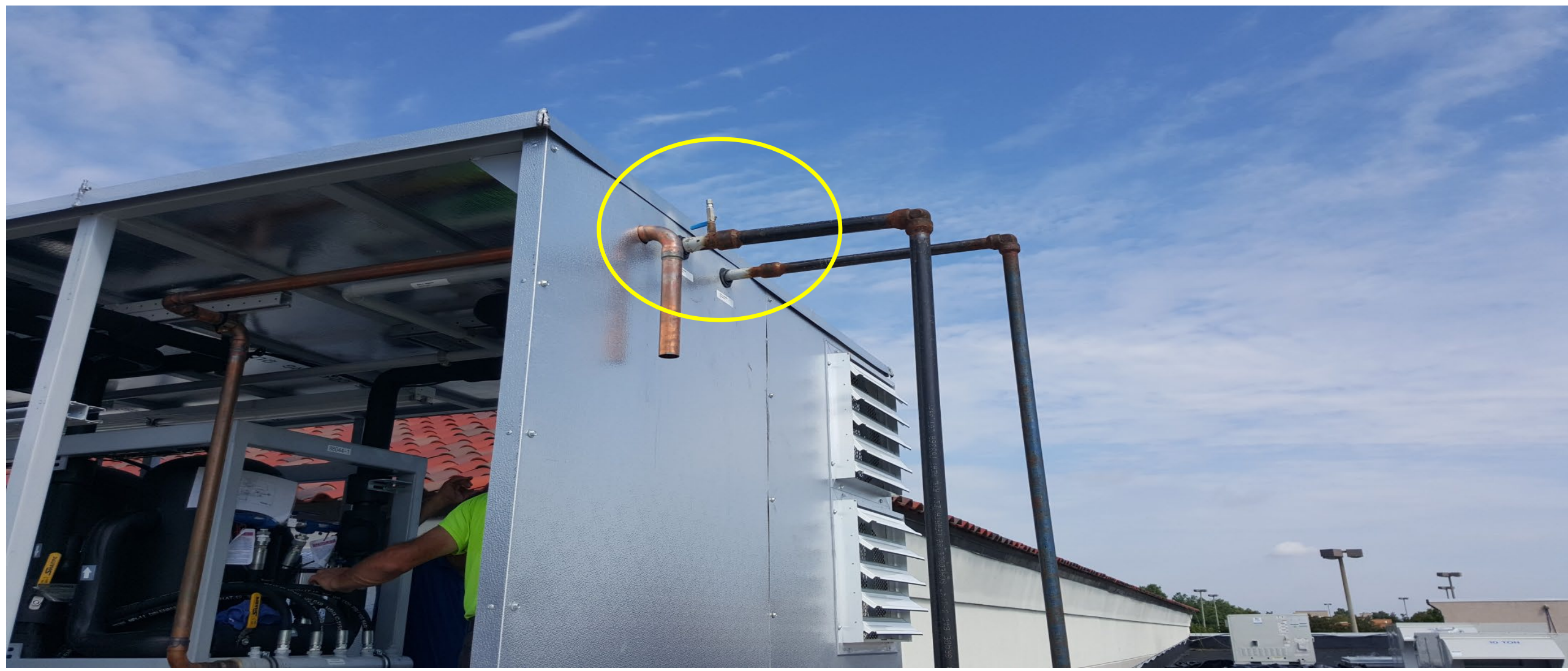
Safety Relief Valve



Safety Relief Valve Manifold



Relief Valve Manifold Outlet





Safety Relief Valve Manifold



Liquid CO2 Tanks



Liquid CO2 Tanks



MT Grade of CO2

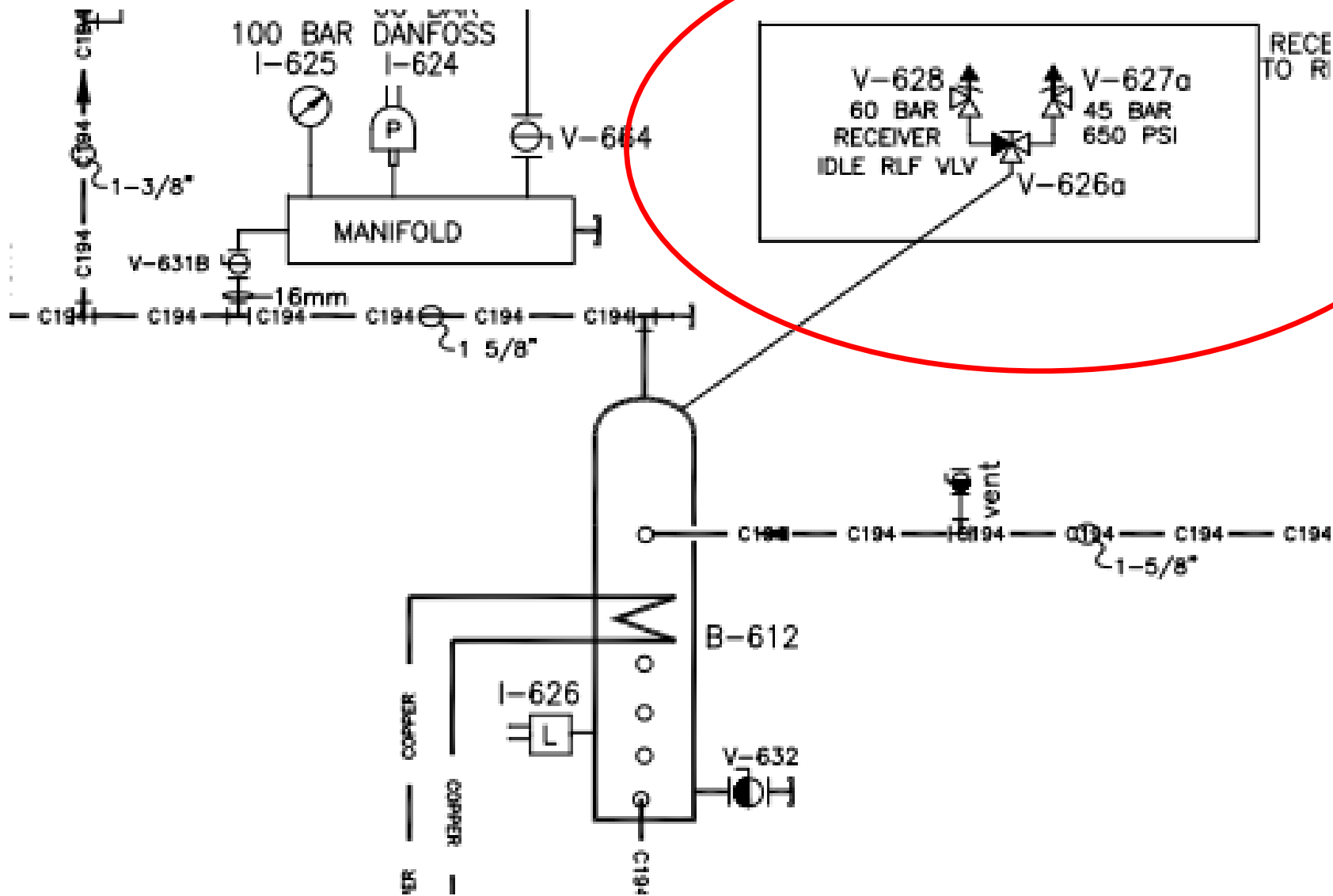


Servicing in the Summer

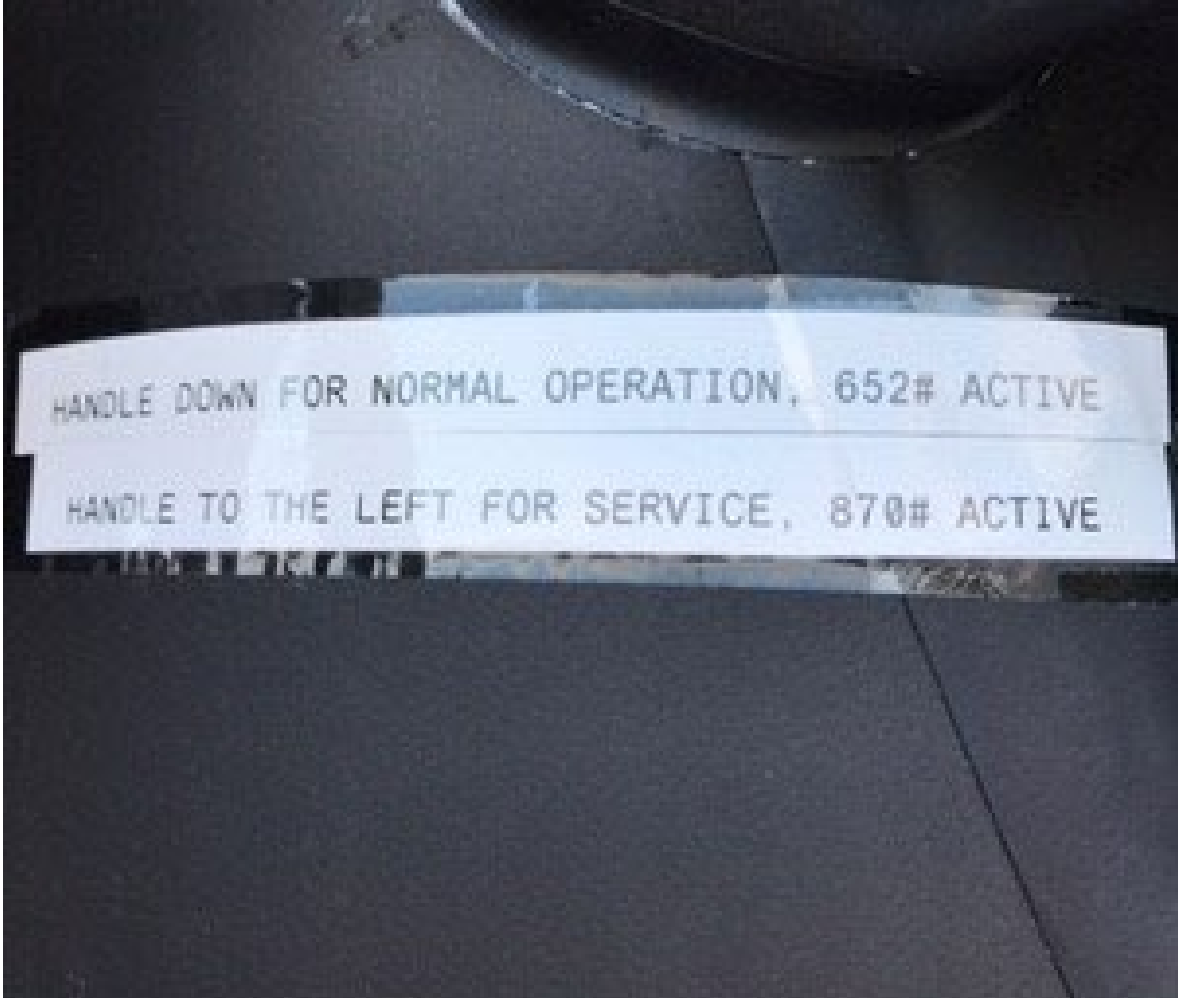
Westermeyer Coalescing Oil Filters



Safety Relief Valve Manifold



Flash Tank Relief Valve



Liquid Line Ball Valve



Liquid Line Ball Valve



WARNING
Lines must never be isolated without evacuating the CO₂ refrigerant.
Refer to instructions or contact Hillphoenix technical support.

Adiabatic Condenser/Gas Cooler

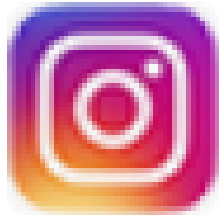


Air-Cooled Condenser/Gas Cooler



Charging Though The Evaporator

Be Careful



Instagram



Facebook

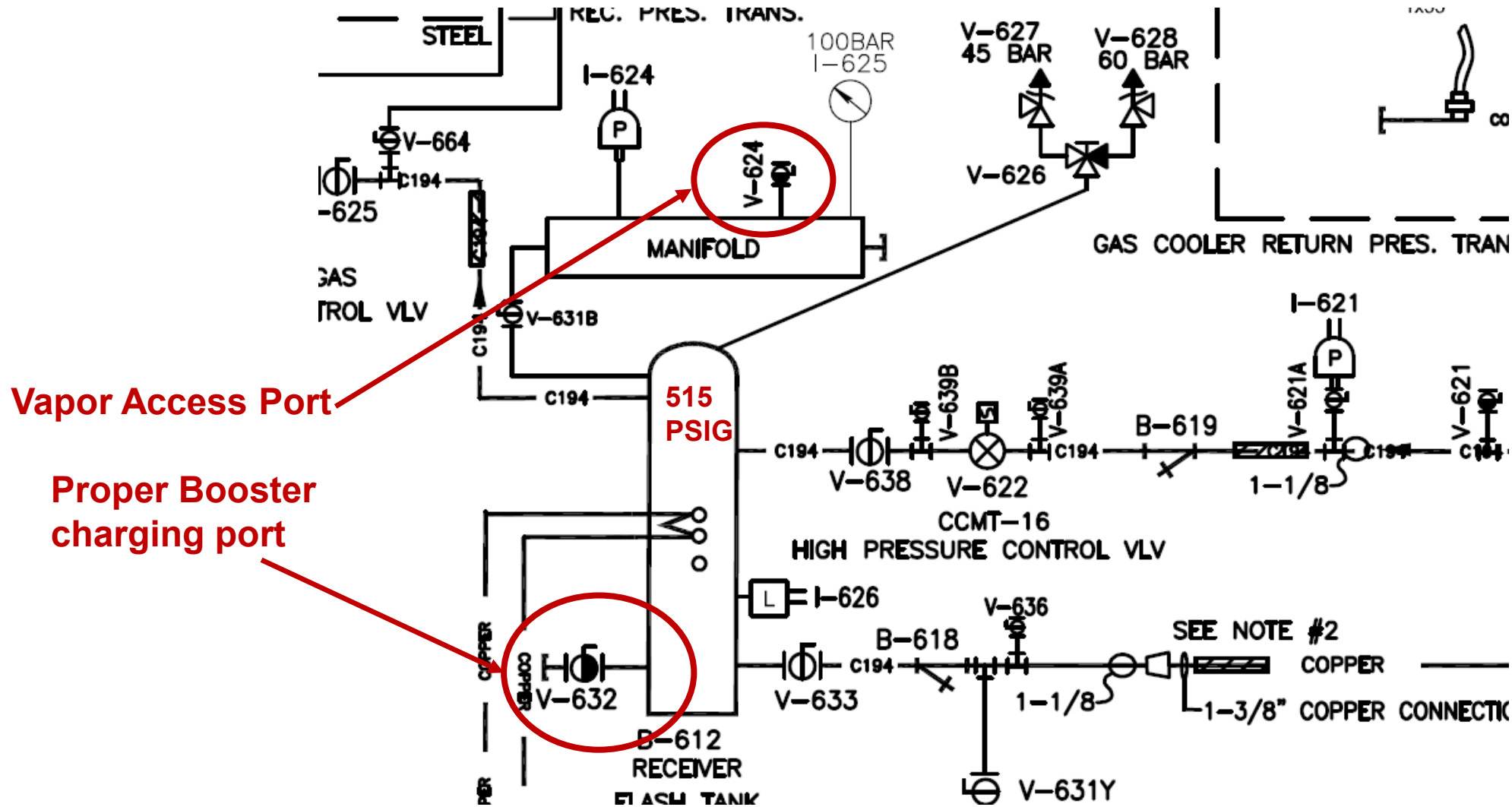


Twitter



LinkedIn

Charging CO2 Into a Booster Charging Port



Mueller Streamline Piping

2.A.1.a.i Mueller Streamline Copper Products

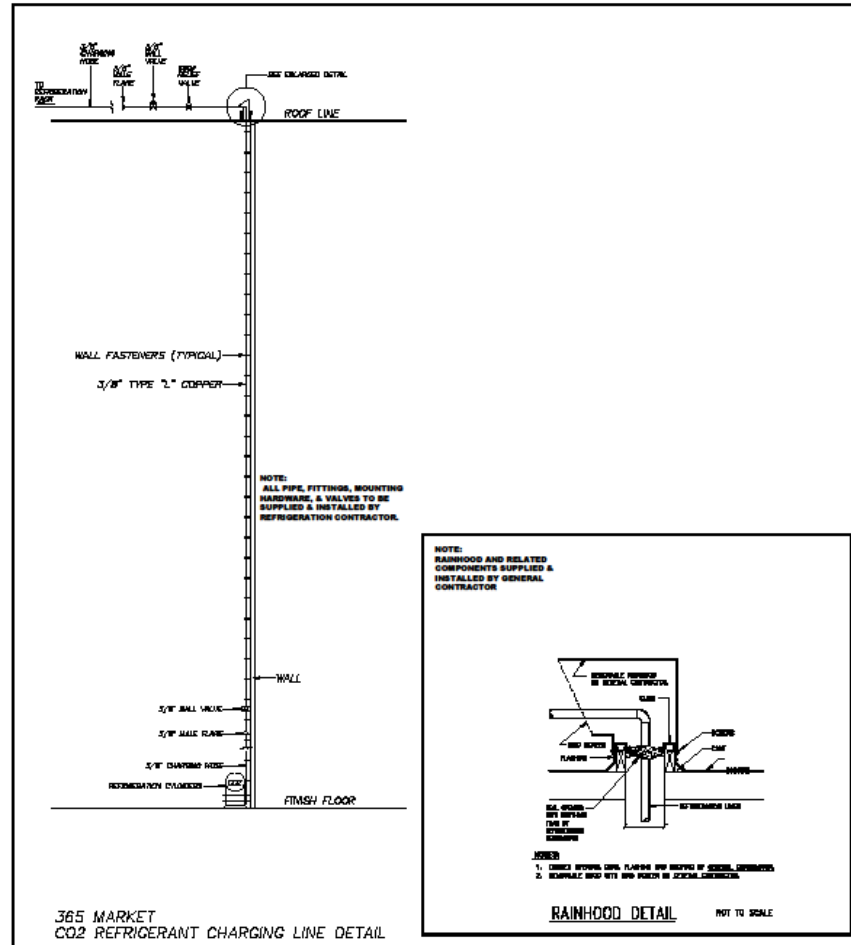
Refrigeration brazing is commonly performed at 900°F to 1300°F. **Take Note:** Temperatures in this range involve sufficient heat to anneal copper. Therefore, the working pressure ratings for all Streamline copper tube and wrot fittings should be based on performance in the annealed state—this is true whether referring to actual field brazing or to an annealing furnace. Following years of testing, the Mueller company is able to offer copper products rated for continuous up to **700 psi at 250°F**, as identified in the table provided below. All of these values have already been de-rated for brazing.

Product Line	Product Type	Diameters
Copper Tube	• Streamline Refrigeration Service Coils	1/8" to 1 1/8"
	• Streamline Line Sets & Mini-Splits	1/8" to 1 1/8"
	• Streamline ACR - Type L (Hard Lengths)	1/8" to 1 3/8"
	• Streamline ACR - Type K (Hard Lengths)	1/8" to 2 5/8"
Copper Fittings	• Streamline ACR - Wrot Solder - Joint Pressure	1/8" to 2 5/8"

Charging CO₂ Into a Booster



Charging CO2 Into a Booster



Not Enough Trained Technician



Certification

*Partnership
In
Training Excellence*

Classroom Training



Good training starts with classroom instruction giving service technician a strong understanding of how the system is works.

The Learning Center has trained 8000+ service technicians and installers

We have trained technicians who work with both commercial and industrial CO2 systems

Since 2006 the Learning Center has conducted CO2 training on all types of CO2 Refrigeration Systems.

CO2 Secondary Overfeed

CO2 Cascade

CO2 Booster

CO2 Secondary Overfeed MT/Cascade LT



Hands-On Training



Most technicians are visual learners, so after the classroom it is important to get as much hands-on training as possible. Onsite is the best place for this type of training



Since the beginning we have trained onsite and in many different locations, such as; NYC, Seattle, LA, Miami and Chicago.

We have also trained in smaller community's like, Duluth MN, Sioux Falls SD, Scranton PA, Waco TX, and Jupiter FL.

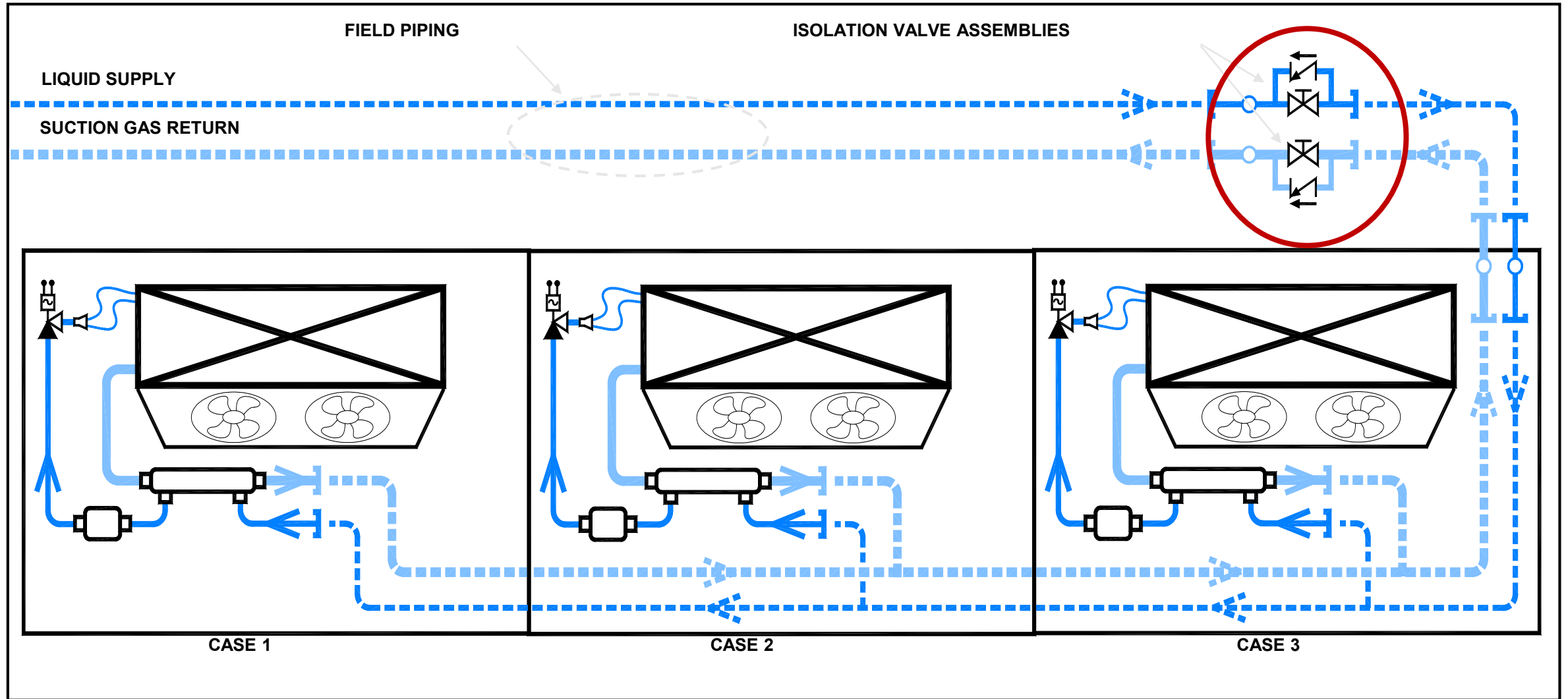
I Have Dry Ice In My System!!!!!!

Useful Definition

- **Triple Point** – The triple point is the pressure where all three phases of a substance (solid, liquid and vapor) can exist in equilibrium. The triple point of R-744 is **60 PSIG**

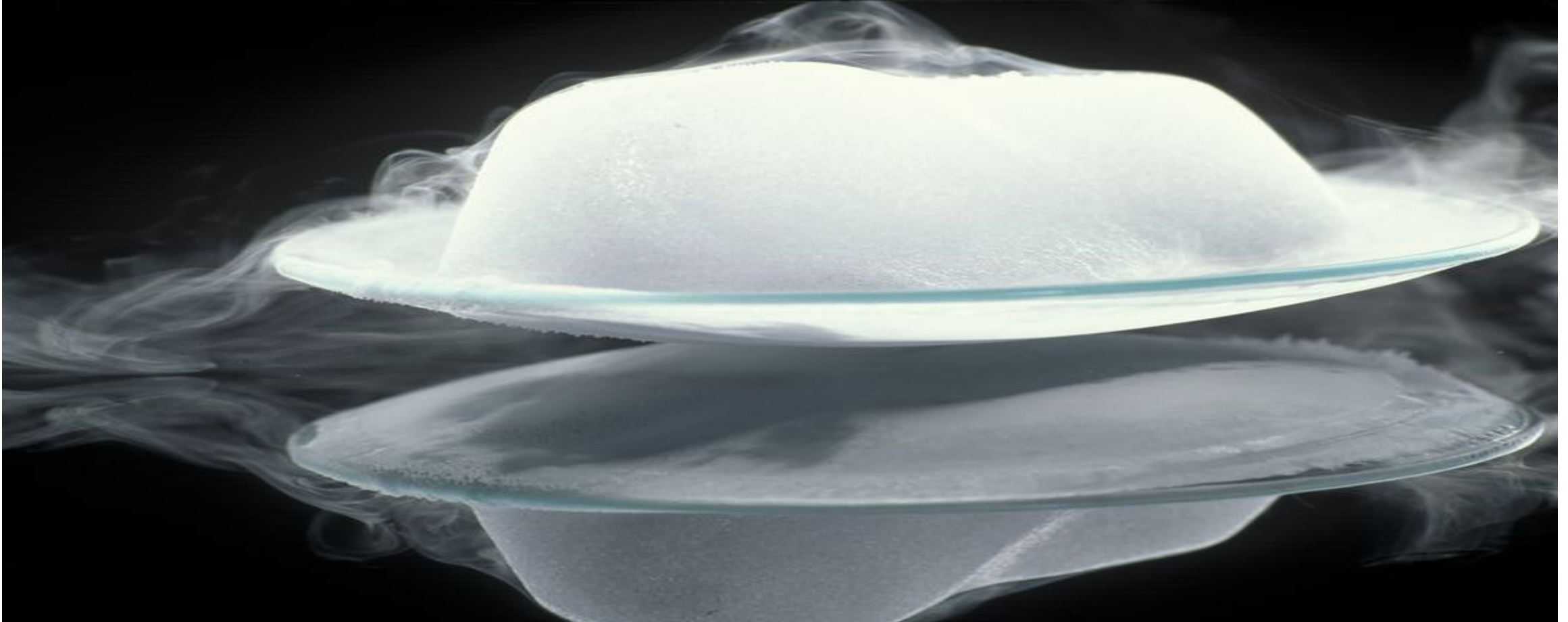


CO₂ DX Case Line-Up with Isolation Valve



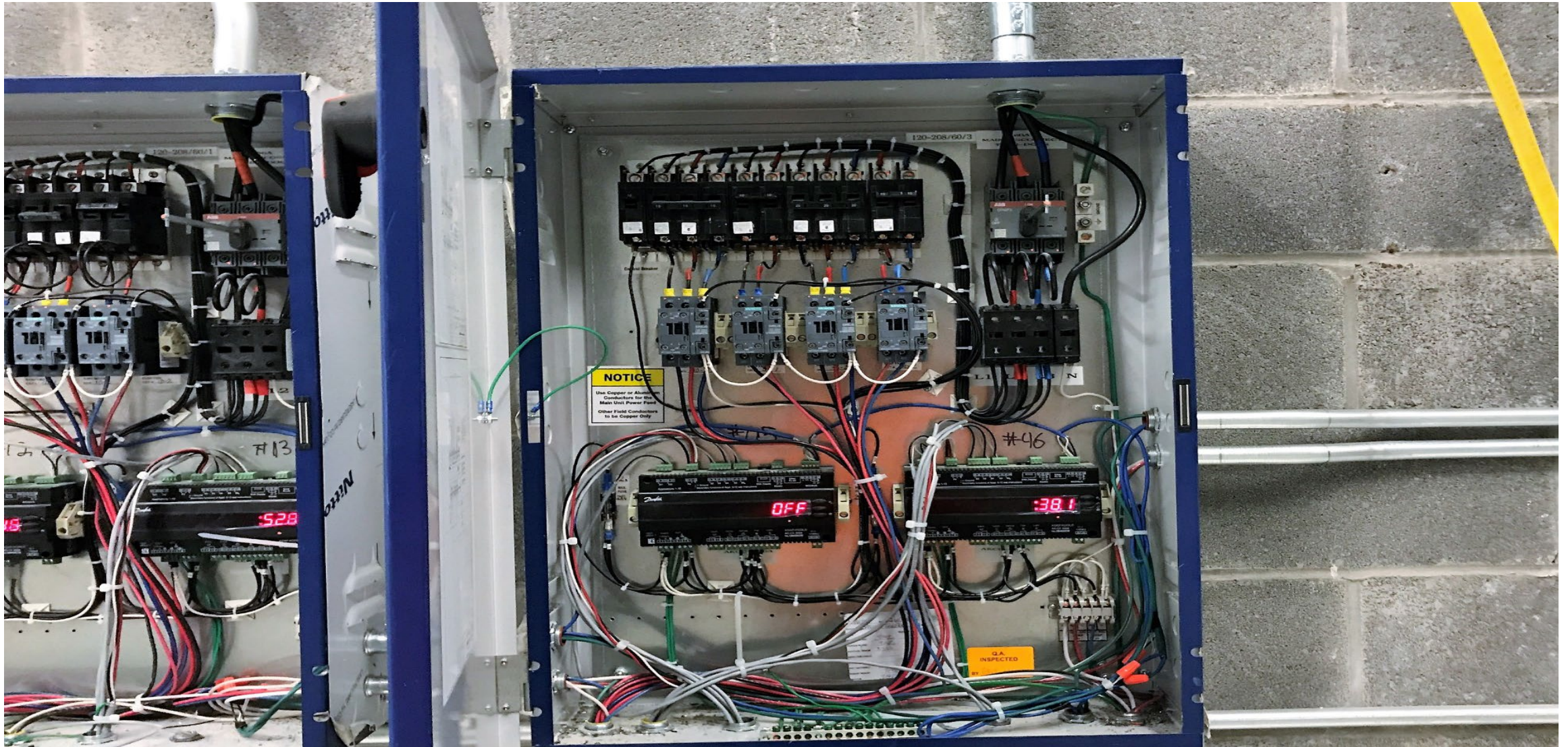
Useful Definition

- **Sublimation** – The transition of a substance directly from the solid to the gas phase, without passing through the intermediate liquid phase.



Case Controllers

AK-CC-550A Case Controller



Micro Thermo Evaporator Control



Sporlan/MT Case Controller

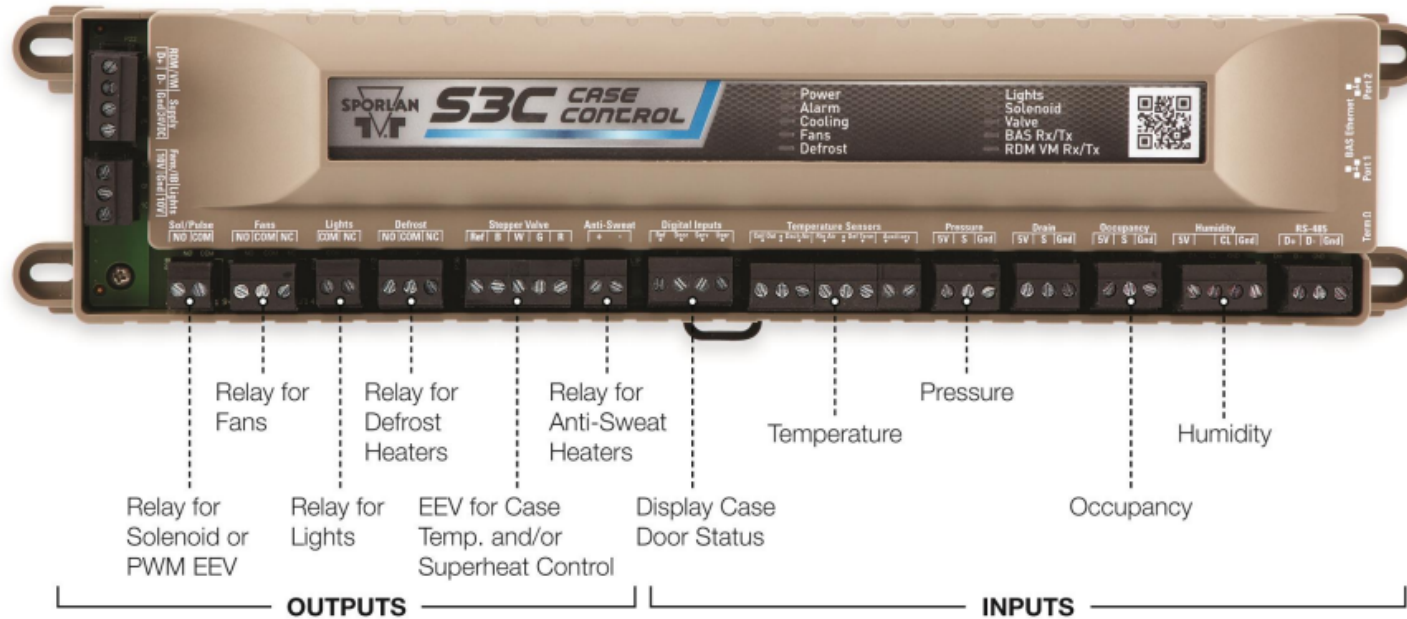


SELECTED STRUCTURE
08-19-15
COL.DV.1
DESCRIPTION
CONN. 120V ONLY
ISA ONE POSITION
ACC. AMPER
ACC. END WALL
ACC. PARTITION
ACC. END BLOCK
B. CONN. ONLY
OTHER 120V/240V/277V/480V
OTHER 120V/240V/277V/480V
HILLPHOENIX
100-1000000

Controller Overview – S3C Case Control

Electrical:

- Supply 22 to 26 VDC,
- 0.5 A minimum



Comm:

- 2 RS485
- 2 Ethernet

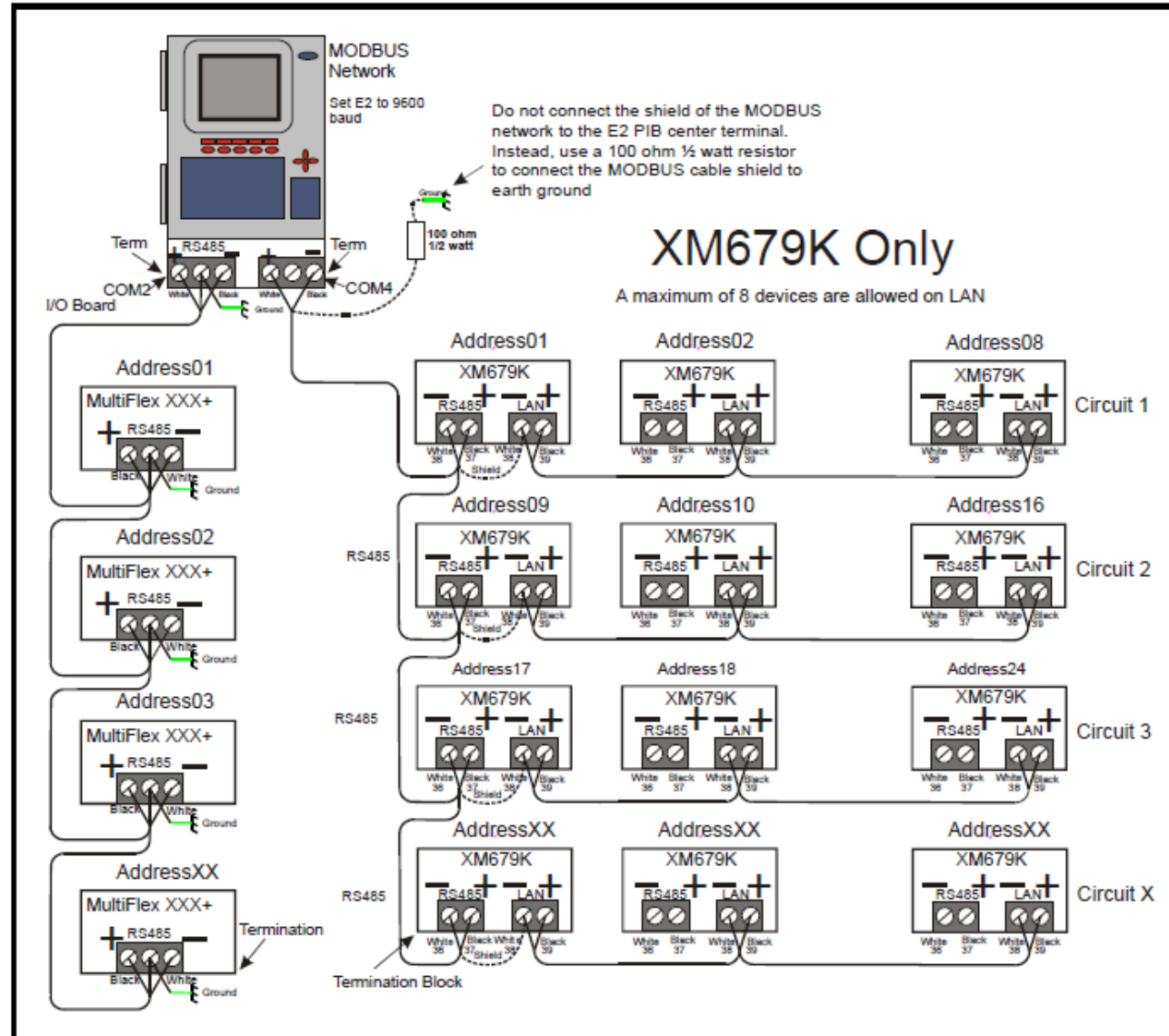
Outputs:

- Two 0-10 VDC
- One 0-5 VDC (anti-sweat)
- 4 Relays (Defrost, Solenoid, Lights, Fans)
- 1 Stepper Valve
- 1 Pulse Valve / Solenoid

Inputs:

- 3 Digital (Door, Service, User)
- 5 Temperature
- 1 Pressure
- Occupancy Sensor
- Humidity Sensor
- Defrost Amps

Copeland Case Controller I/O wiring and Modbus



We recommend Belden 8641 twisted pair with a maximum of 4000'

Pico Scope





Questions?

Download QR Code for Today Presentation



Share Your Feedback!



To receive an electronic training certificate:

1. Scan or visit nasrc.org/session-surveys
2. Provide your name and email at the end of the survey

Please Note: You will not receive a certificate unless you share your name on the survey form.

Troubleshooting Booster Oil

Rusty Walker

Hillphoenix