Natural Refrigerant Training Summit

Building a Sustainable Workforce

Using P&ID to Understand CO2 Booster Systems

Andre Patenaude

COPELAND

NORTH AMERICAN Sustainable Refrigeration Council

Natural Refrigerant Training Summit

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Who We Are

A 501c3 nonprofit working to create a sustainable future for supermarket refrigeration by removing barriers to natural refrigerant adoption.

160+
member companies

55K+
food retail locations

Goals

- Build a sustainable technician workforce
- Increase funding for natural refrigerant equipment
- Improve technology options, education, and awareness

What are Natural Refrigerants?

CO_2	C_3H_8	NH_3
R744	**R290**	**R717**
Carbon Dioxide	Propane	Ammonia

NORTH AMERICAN
Sustainable Refrigeration Council

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Using P&ID to Understand CO2 Booster Systems

NASRC – Natural Refrigerant Training Summit

Pittsburgh, PA

March 19-21, 2023

Andre Patenaude

Official Recognized Provider Attendance Record

Submit to: NATE • attn: Recognized Provider Recorder
2111 Wilson Blvd. Suite 510 • Arlington, VA 22201

Recognized Provider Name Copeland Date _____

Training Location, City & State Plumbers & Pipefitters Local 562 Training Center

Course Name CO2 System Basics / Booster System Ops NATE Course # 1212-0136

NATE Approved Hours 2 Course Hours Total 2

Instructions on filling out this form:

1. If additional sheets are needed, please use copies of this sheet, not blank paper
2. Course name, number and hours must match as submitted and approved by NATE.
3. Records must be received within 60 days to receive credit. Records received after this WILL NOT GET CREDIT.
4. To receive credit, the original roll and all information must be provided. No copies or faxes will be accepted.
5. If handwriting is unclear, credit will not be given.
6. Instructors hours will only be recorded in instructors box at bottom.
7. This record must be used for single-day courses. Multi-day courses use a different form.

Technician Name Please print as it appears on your NATE ID card	**NATE ID # Must be included to receive credit**	**Signature**

Instructors training credit requires NATE ID #. • Course ID# 1587-0003

Name _____ Date ___/___/___ NATE ID# _____

Signature _____ Email _____

Revised 03.09

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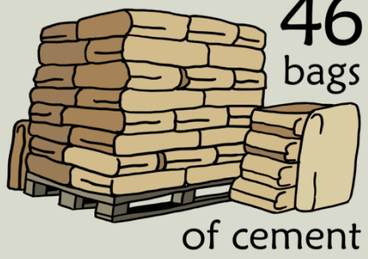
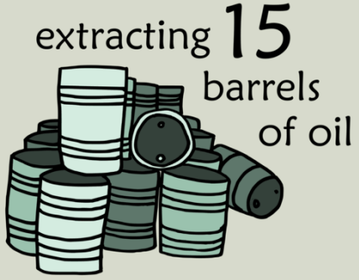
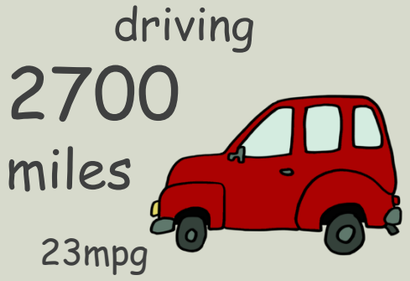
Carbon Emission Equivalency to 1 Metric Ton of Greenhouse Gas





1 TONNE of
Greenhouse Gases
comes from:



5,537 miles
Tokyo, Japan → Las Vegas, NV

https://en.as.com/entertainment/japan-to-las-vegas-what-is-taylor-swifts-carbon-footprint-for-traveling-to-the-super-bowl-from-tokyo-n/

SUPER BOWL 2024

Japan to Las Vegas: what is Taylor Swift's carbon footprint for traveling to the Super Bowl from Tokyo? 5,537 miles

While it may not be among the longest, a direct flight from the Japanese capital to Nevada is still a very time-consuming journey.

Andy Hall
Update: Feb 8th, 2024 13:55 EST

Calculating Taylor Swift's carbon footprint
The singer will be flying from a different time zone - Tokyo (JST) is 17 hours ahead of Las Vegas (PT), which buys her more time. A direct charter flight from one of Tokyo's major airports (Haneda or Narita) to Las Vegas (Harry Reid International Airport or North Las Vegas Airport) would add around 1.20 metric tons to Taylor Swift's individual carbon footprint.

1.2 to 1.8 metric tons CO2e

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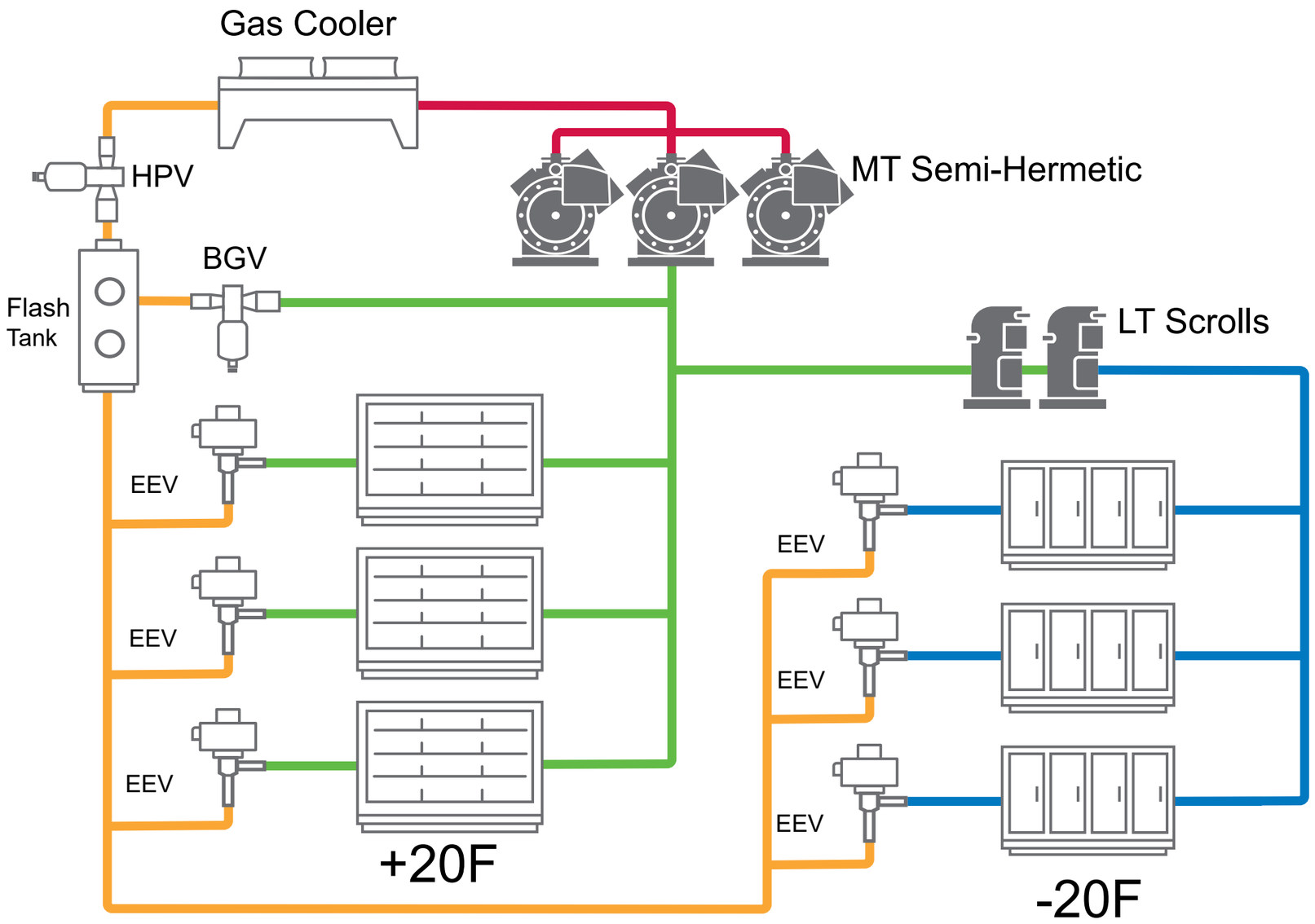
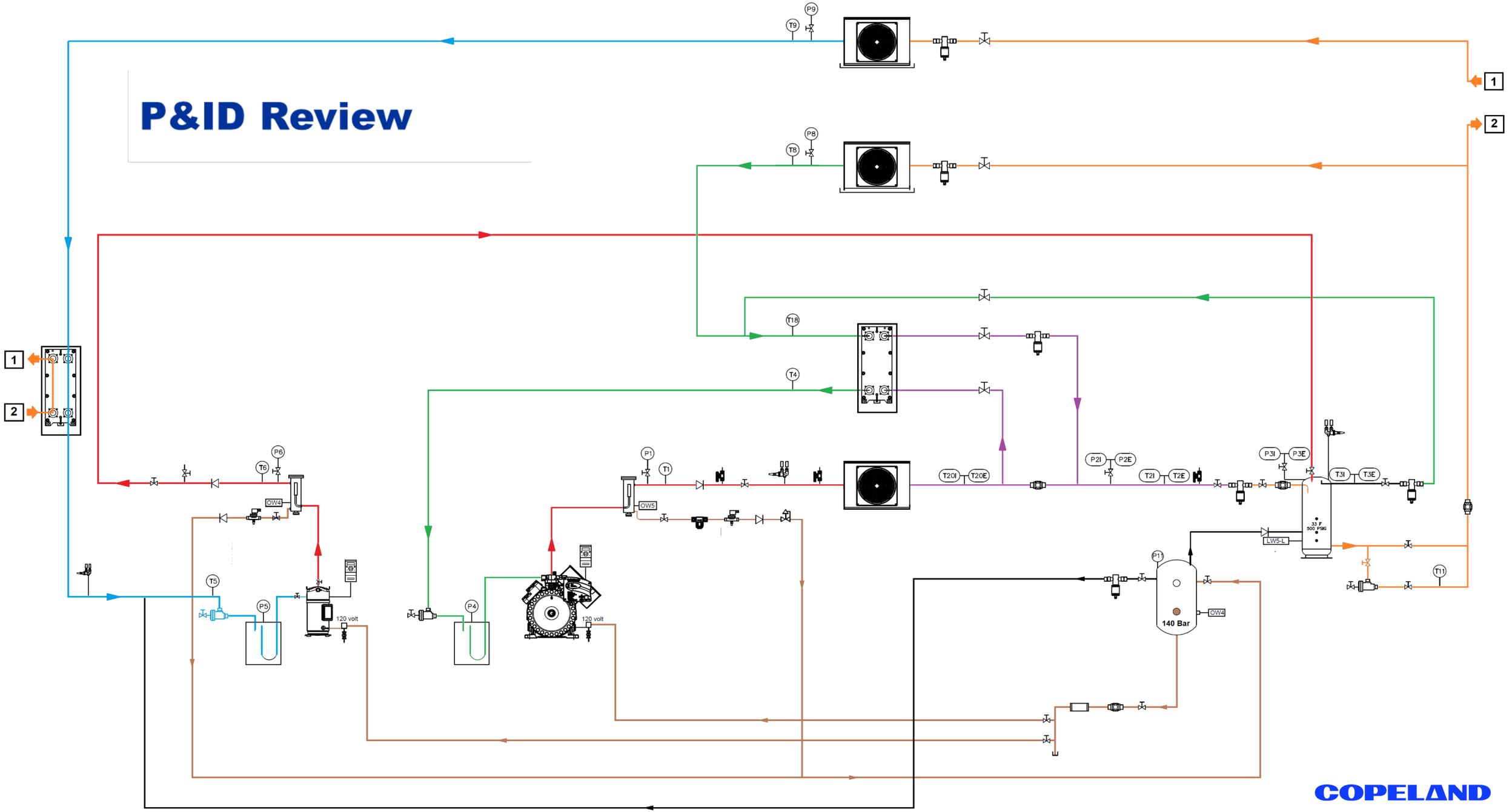
1.2 to1.8 metric tons

.66 to 1 lb
(300g to 453g)
of R404A
Leak

Basic CO2 Booster Systems



P&ID Review



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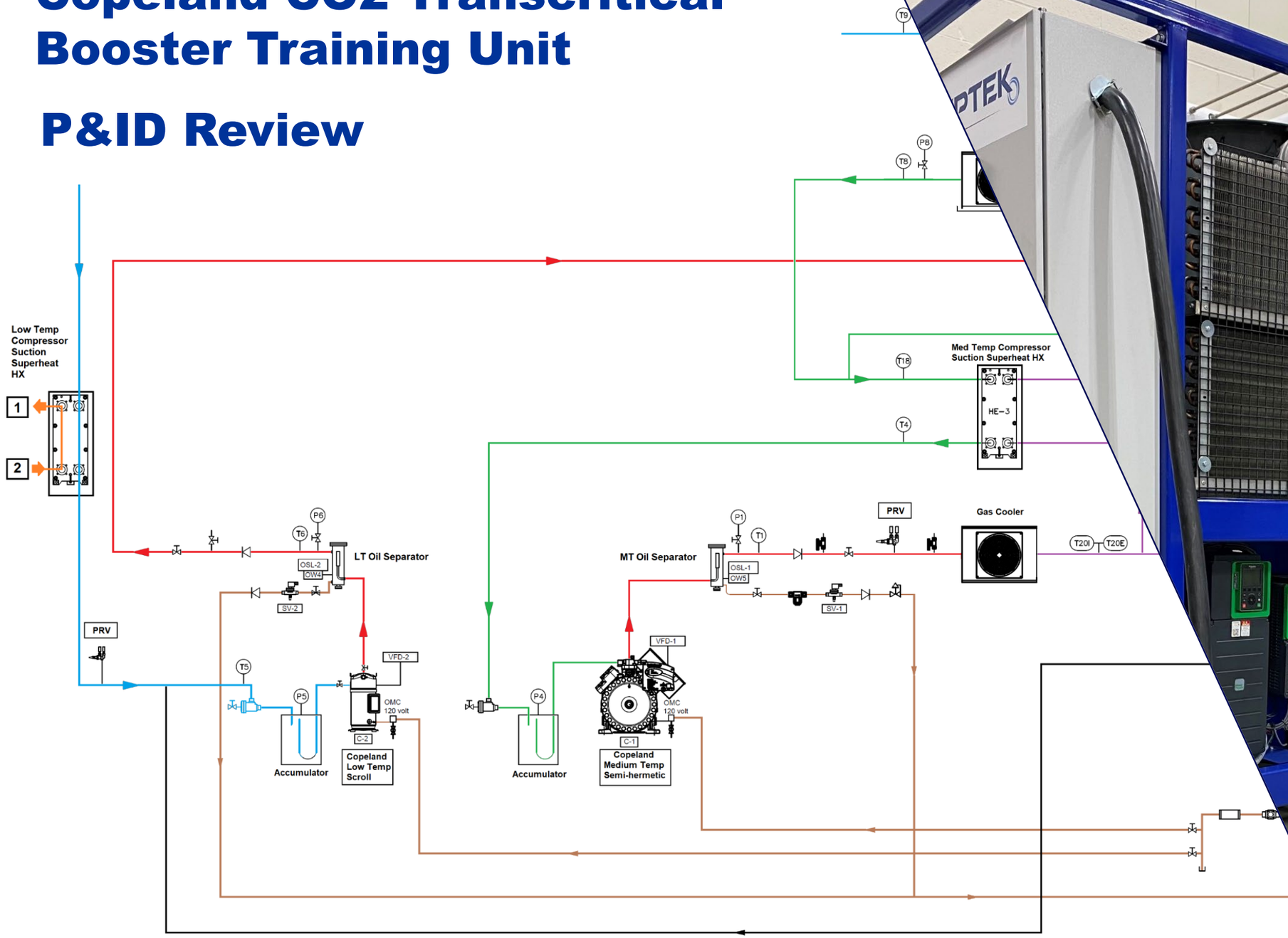
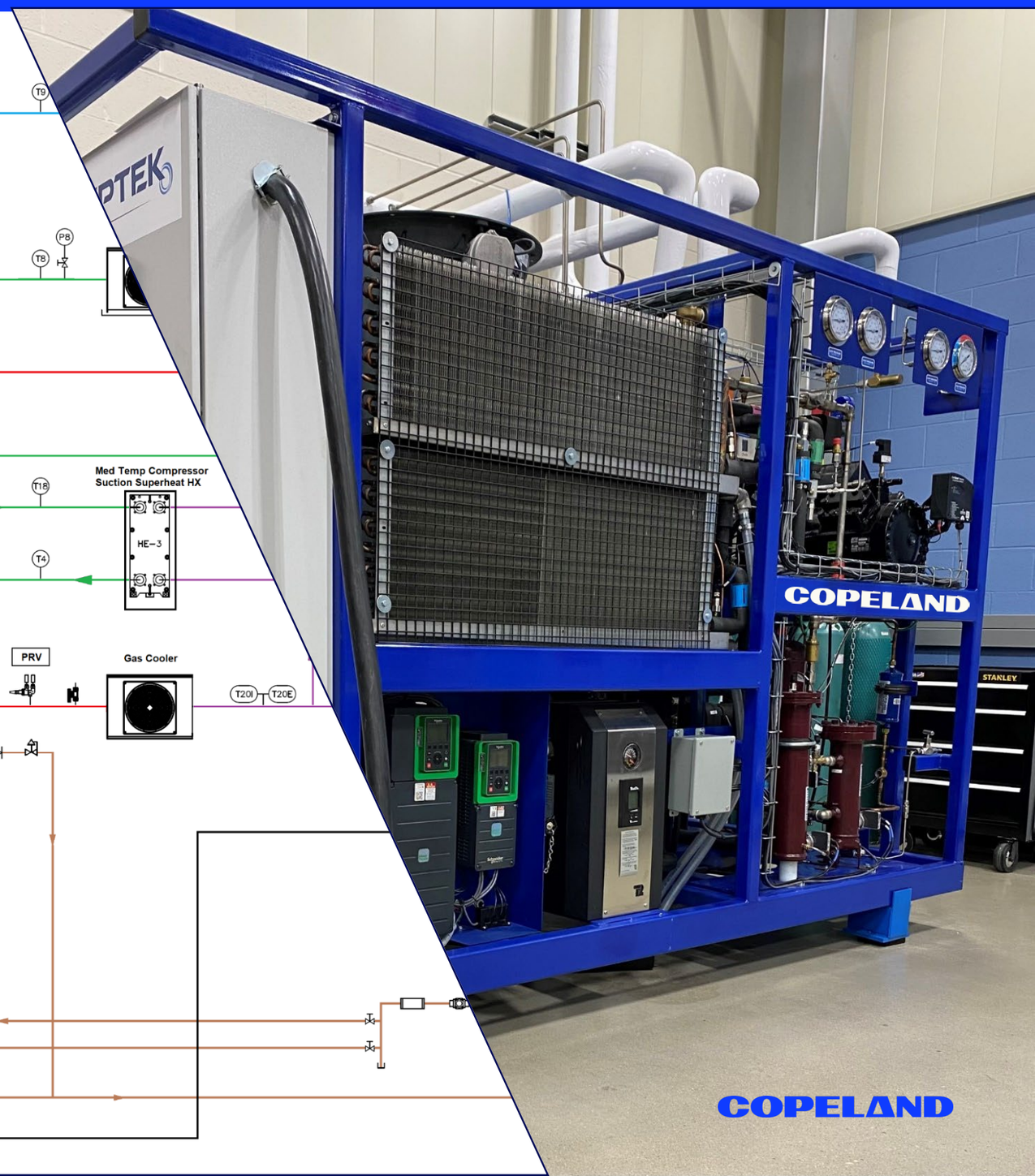
Copeland CO2 Transcritical Booster Training Unit

P&ID Review





CO2 Transcritical
MT Copeland Semi-hermetic
4MTLS

Low Temp Evaporator
Medium Temp Evaporator
Low Temp Compressor Suction Superheat HX
Med Temp Compressor Suction Superheat HX
HE–3
EV-5
* 50 % CLOSE
Gas Cooler
PRV
LT Oil Separator
MT Oil Separator
Accumulator
Accumulator
Copeland Low Temp Scroll
Copeland Medium Temp Semi-hermetic
OMC 120 volt
VFD-1
VFD-2
HPV
BGV
Flash Tank
Oil Reservoir
140 Bar
SV-1
SV-2
EV-1
EV-3
EV-8
OSL-1
OSL-2
OW4
OW5
LW5-L
C-1
C-2
P1
P2I
P2E
P3I
P3E
P4
P5
P6
P8
P9
P11
T1
T2I
T2E
T3I
T3E
T4
T5
T6
T8
T9
T11
T18
T20I
T20E
1
2

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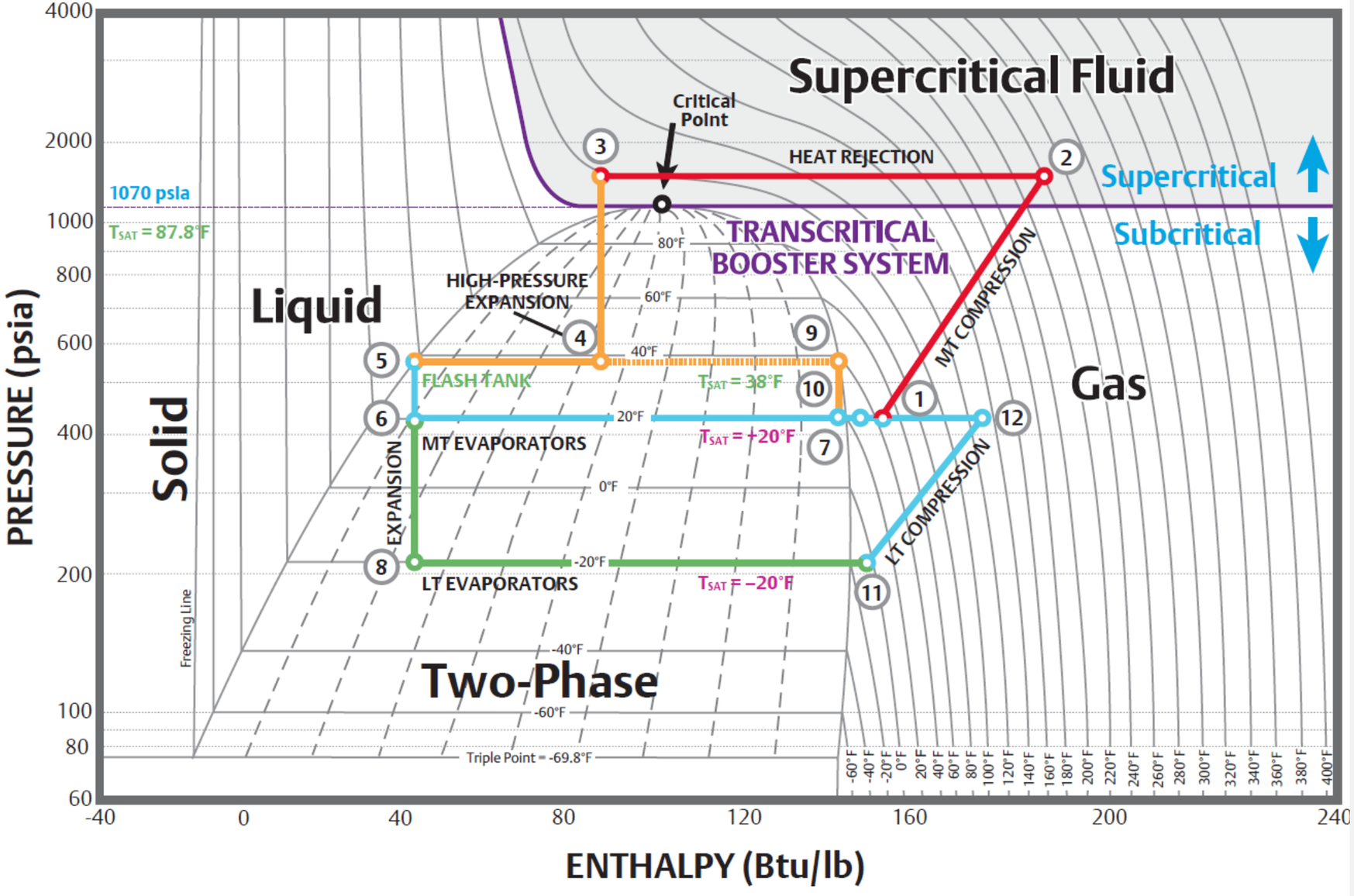
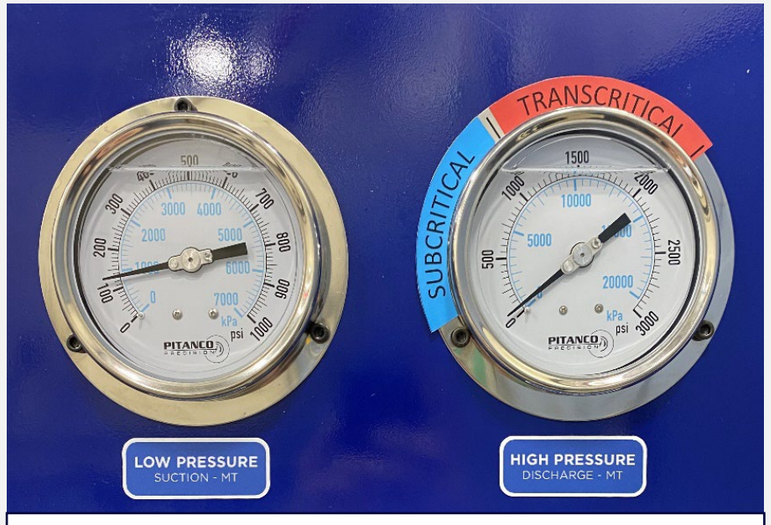
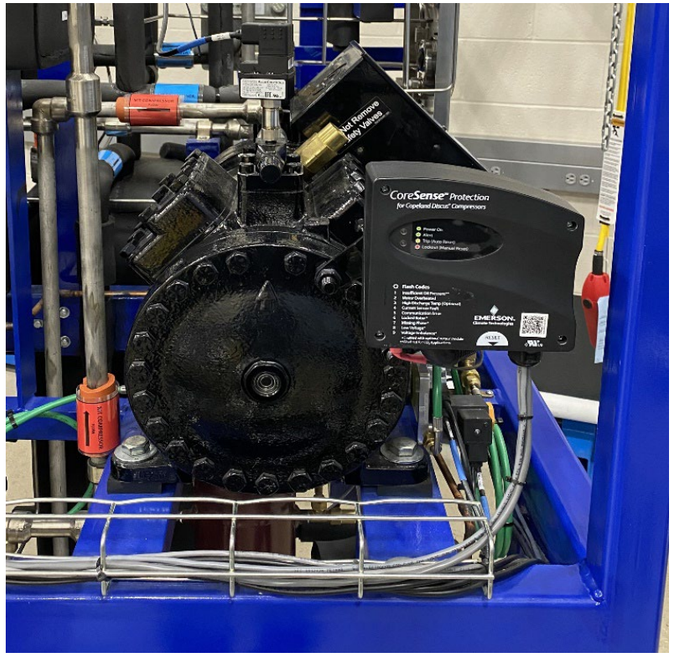

Supercritical Fluid
Critical Point
HEAT REJECTION
Supercritical
Subcritical
1070 psia
T_{SAT} = 87.8°F
TRANSCRITICAL BOOSTER SYSTEM
HIGH-PRESSURE EXPANSION
Liquid
Solid
Gas
MT COMPRESSION
FLASH TANK
T_{SAT} = 38°F
MT EVAPORATORS
T_{SAT} = +20°F
EXPANSION
LT COMPRESSION
LT EVAPORATORS
T_{SAT} = −20°F
Two-Phase
Freezing Line
Triple Point = -69.8°F
PRESSURE (psia)
ENTHALPY (Btu/lb)


SUBCRITICAL
TRANSCRITICAL
LOW PRESSURE
SUCTION - MT
HIGH PRESSURE
DISCHARGE - MT


CoreSense Protection

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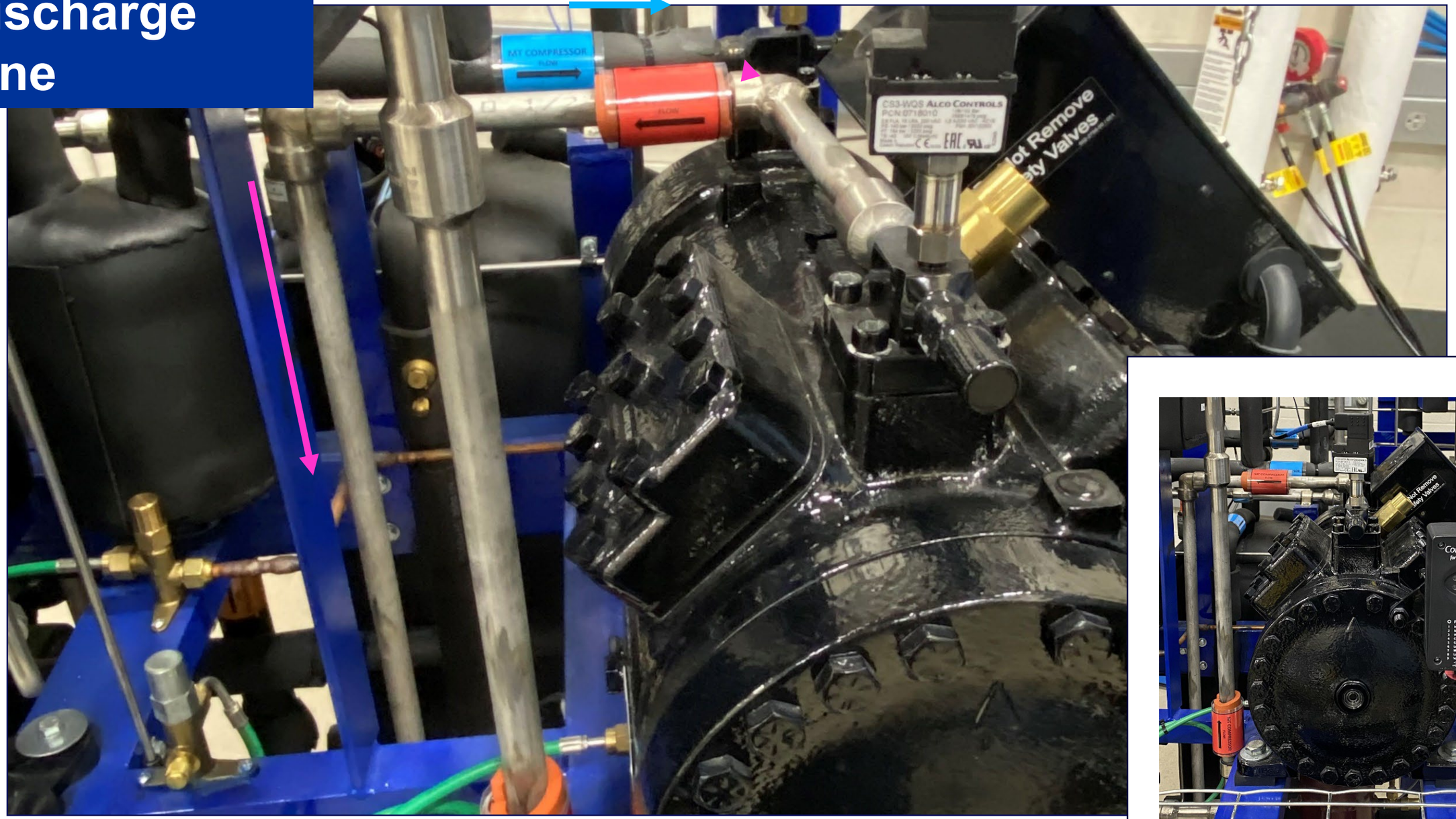
Discharge Line



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CO2 Transcritical
MT Copeland Semi-hermetic
4MTLS

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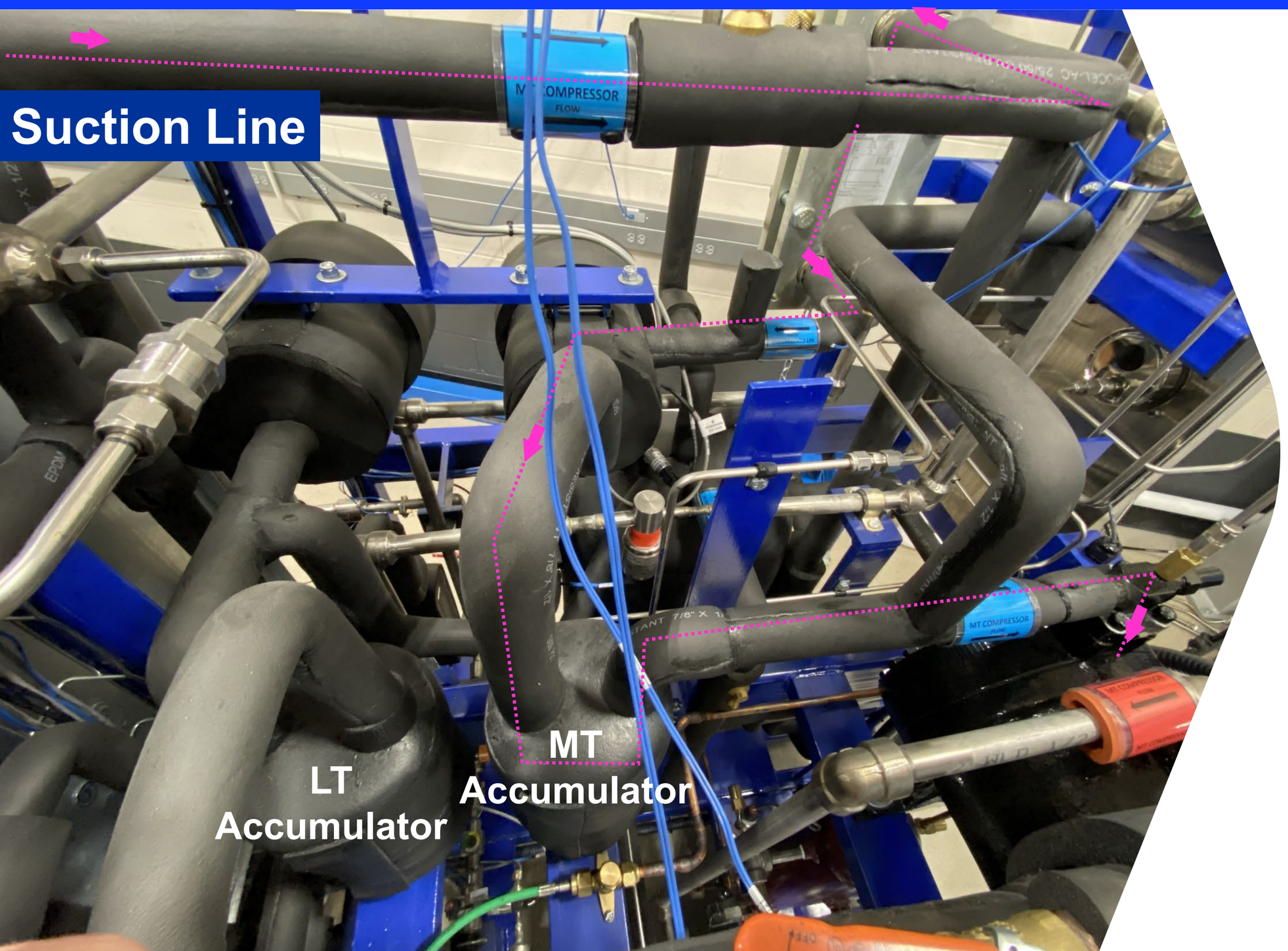
Suction Line



Suction Accumulators

are never Insulated
since they use the ambient heat to help superheat
the return gas to the compressor

For the Trainer;
We Insulated them for Safety,
To “Avoid Slipping Danger”
Due to Water Dripping on Training Floor

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Copeland Transcritical CO2 Compressors

Copeland 4MTLS Semi-hermetic

4MTLS Series; 4 Cylinders

Description:

- Cooling Capacity
  - 5 to 20HP Models, 40 to 150 MBH
  - 24 to 34HP Models 192 to 310 MBH

Main Characteristics:

- Pressures: Operating 120bar (1740 psig)
- Pressure Relief Valves Ratings
  - 135bar (1958psig)
- Low Sound Level, Vibration & Pulsation
- UL Approved for North America

Speed Range:

- 25Hz to 70Hz (4MTLS40K-15M)
- 30Hz to 70Hz (4MTLS20)
- 30Hz to 60Hz (4MTLS22M-28M)
- CoreSense, Advanced Protection, Preventive Maintenance, Remote Communication

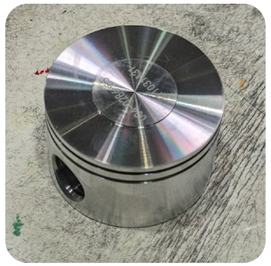
Compressors of same Capacity

Discus 4DH

CO2 4MTLS15

Compare HFC Vs CO2

2

Discus 4DH	CO2 - 4MTLS15	Discus 4DH	CO2 - 4MTLS15
			
			
			

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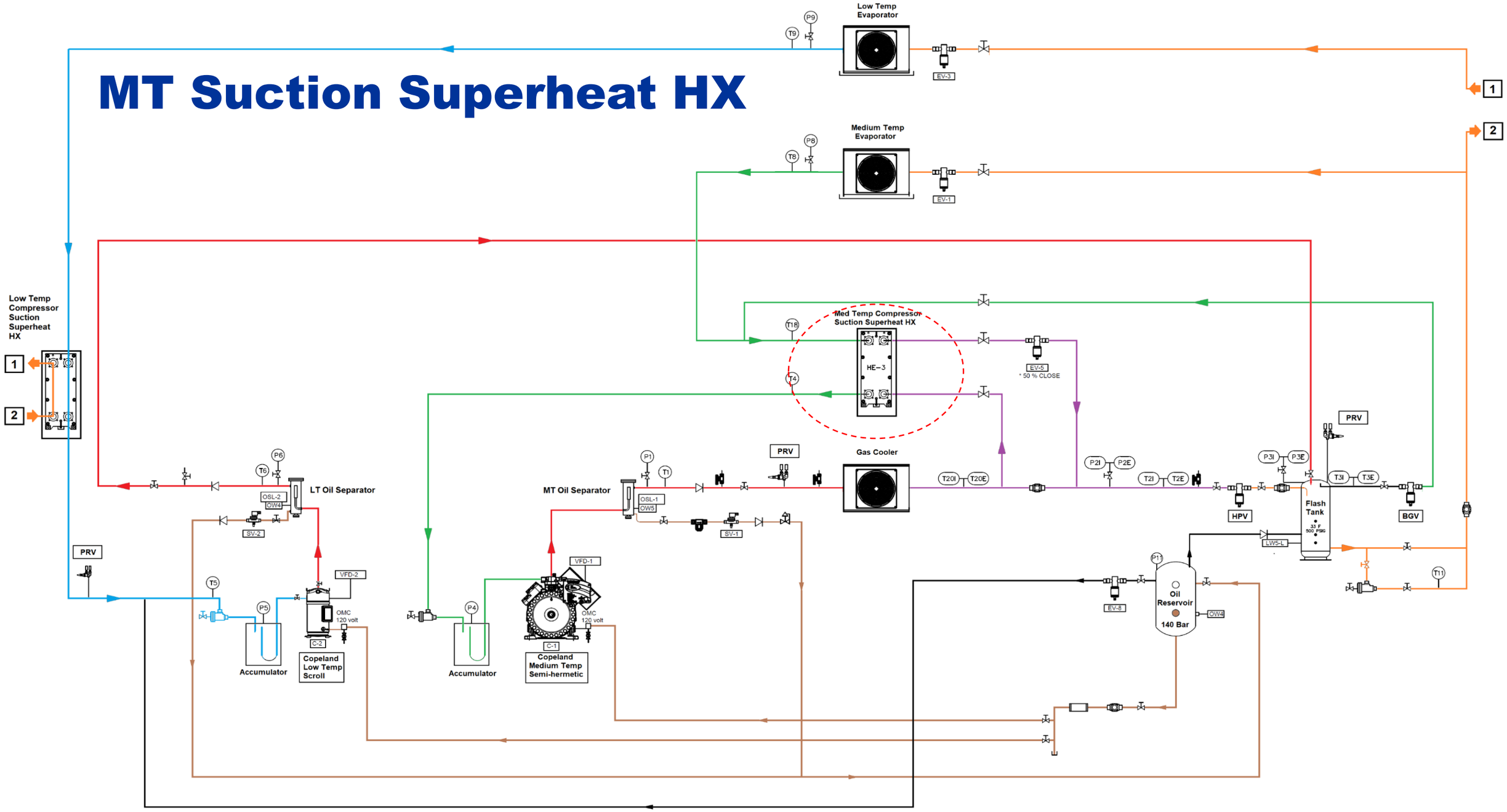
MT Suction Superheat HX



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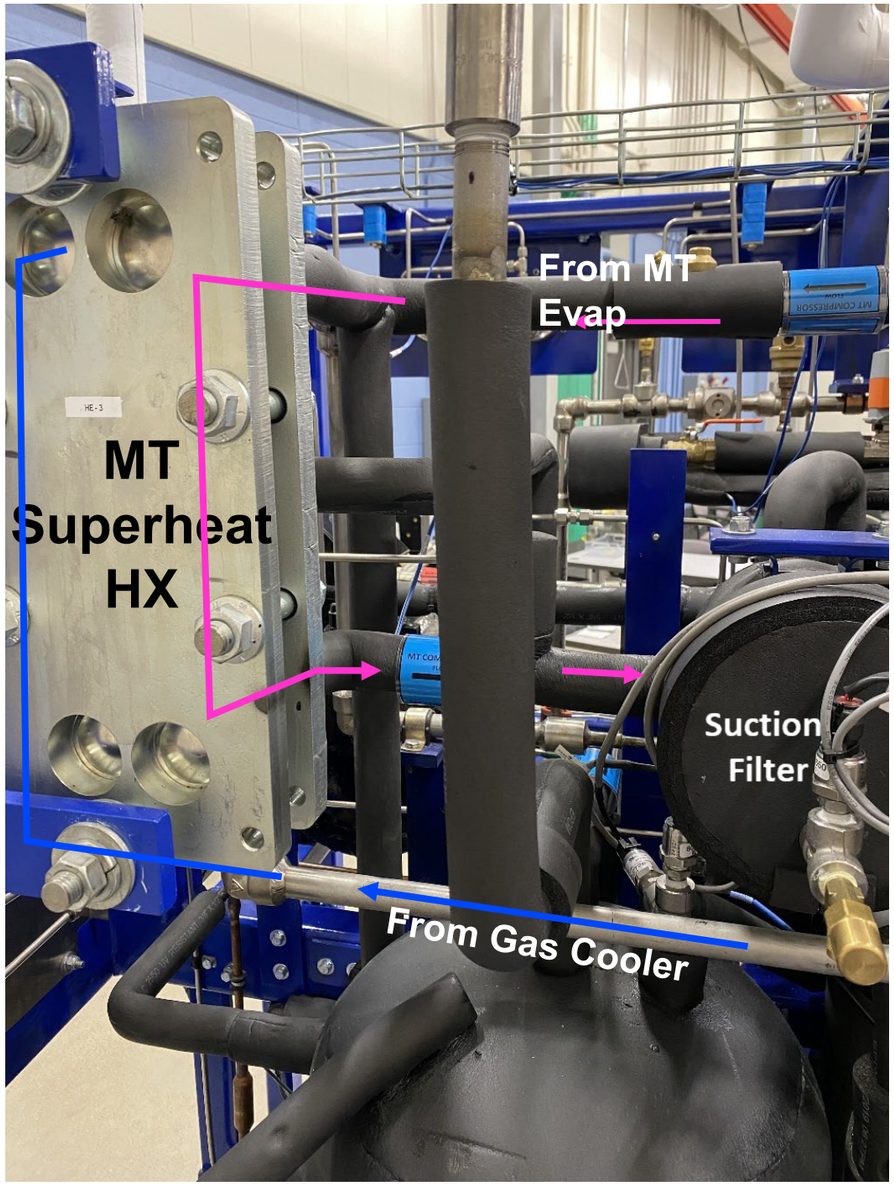
MT Superheat HX



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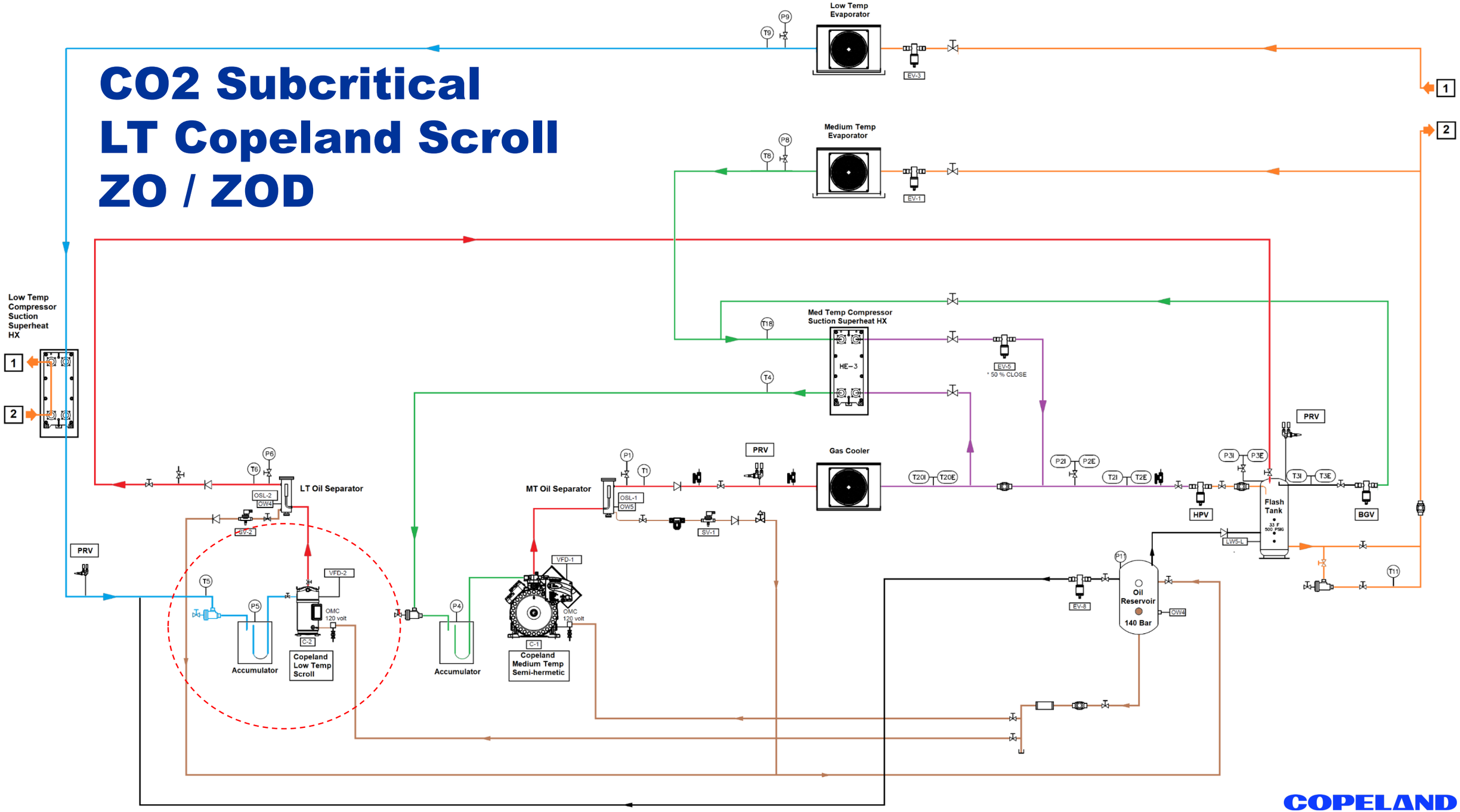
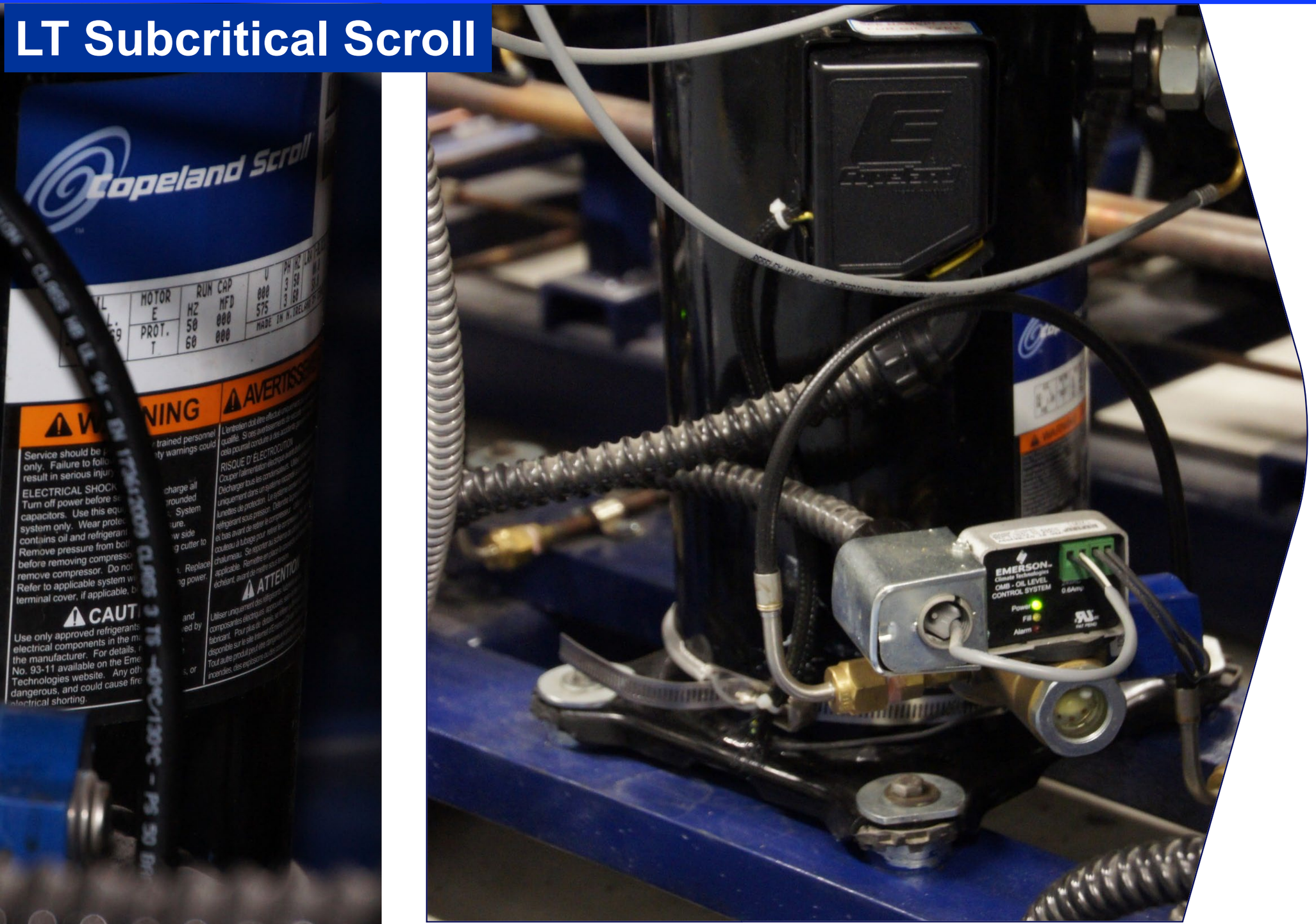
CO2 Subcritical
LT Copeland Scroll
ZO / ZOD



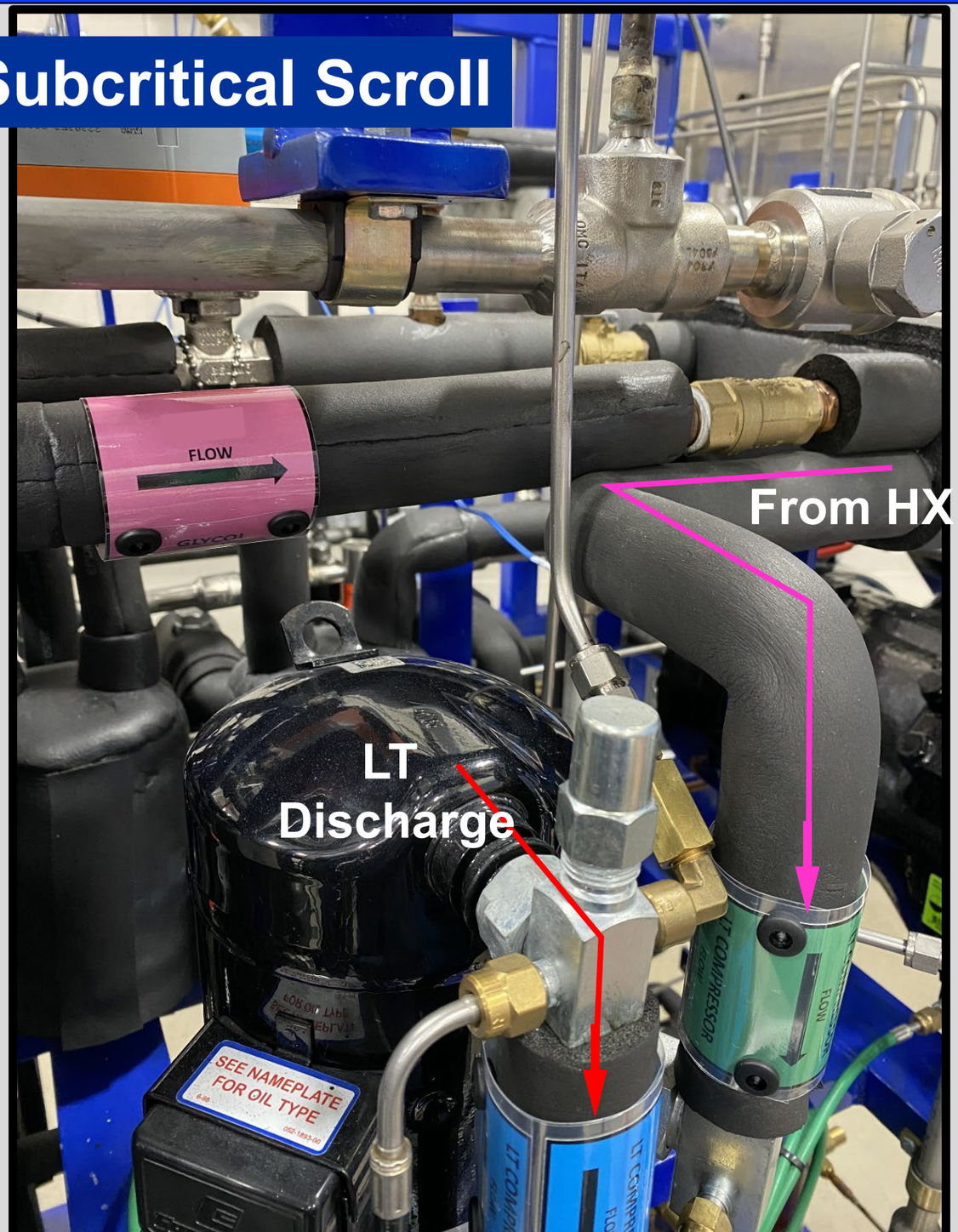
COPELAND

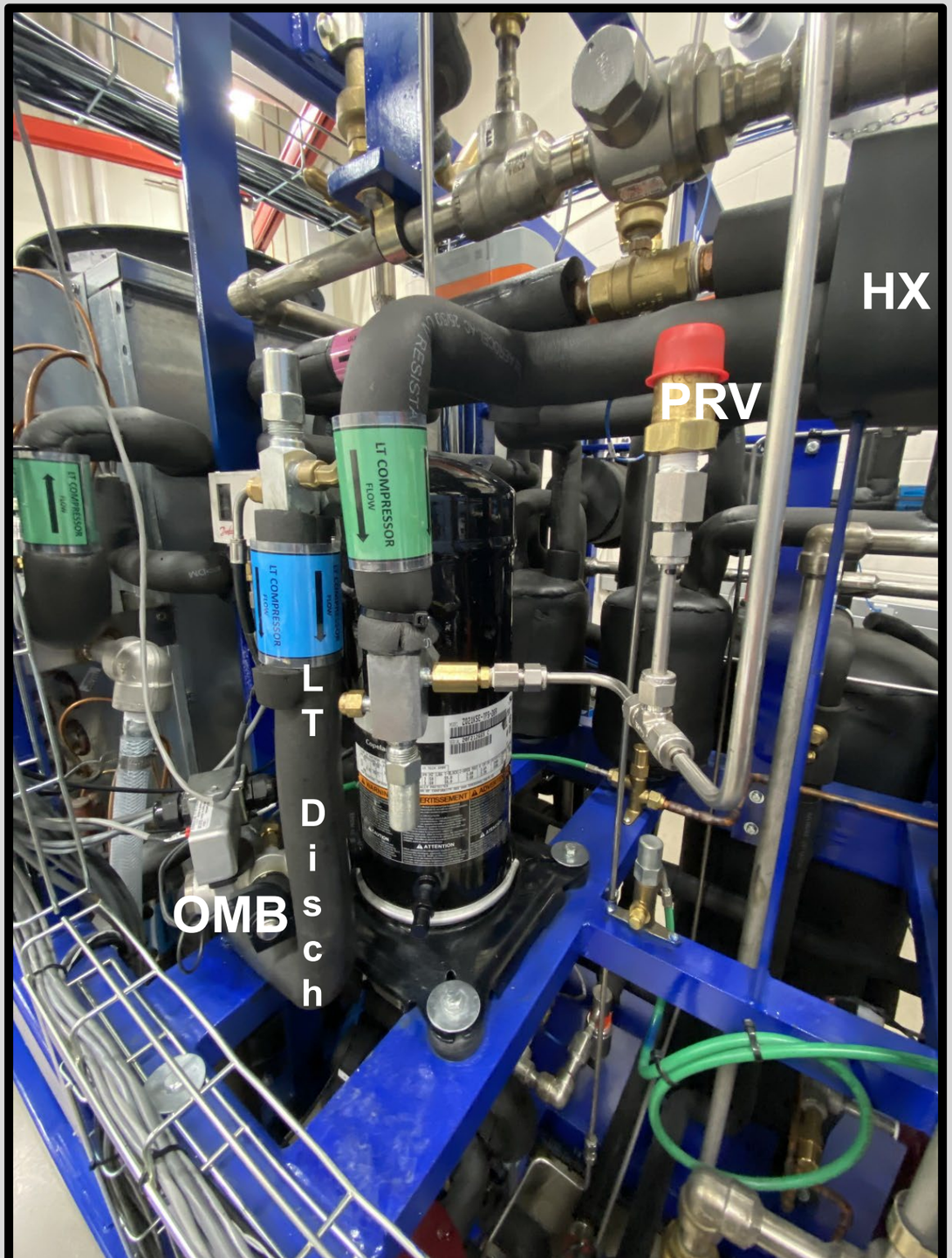
LT Subcritical Scroll



COPELAND

LT Subcritical Scroll





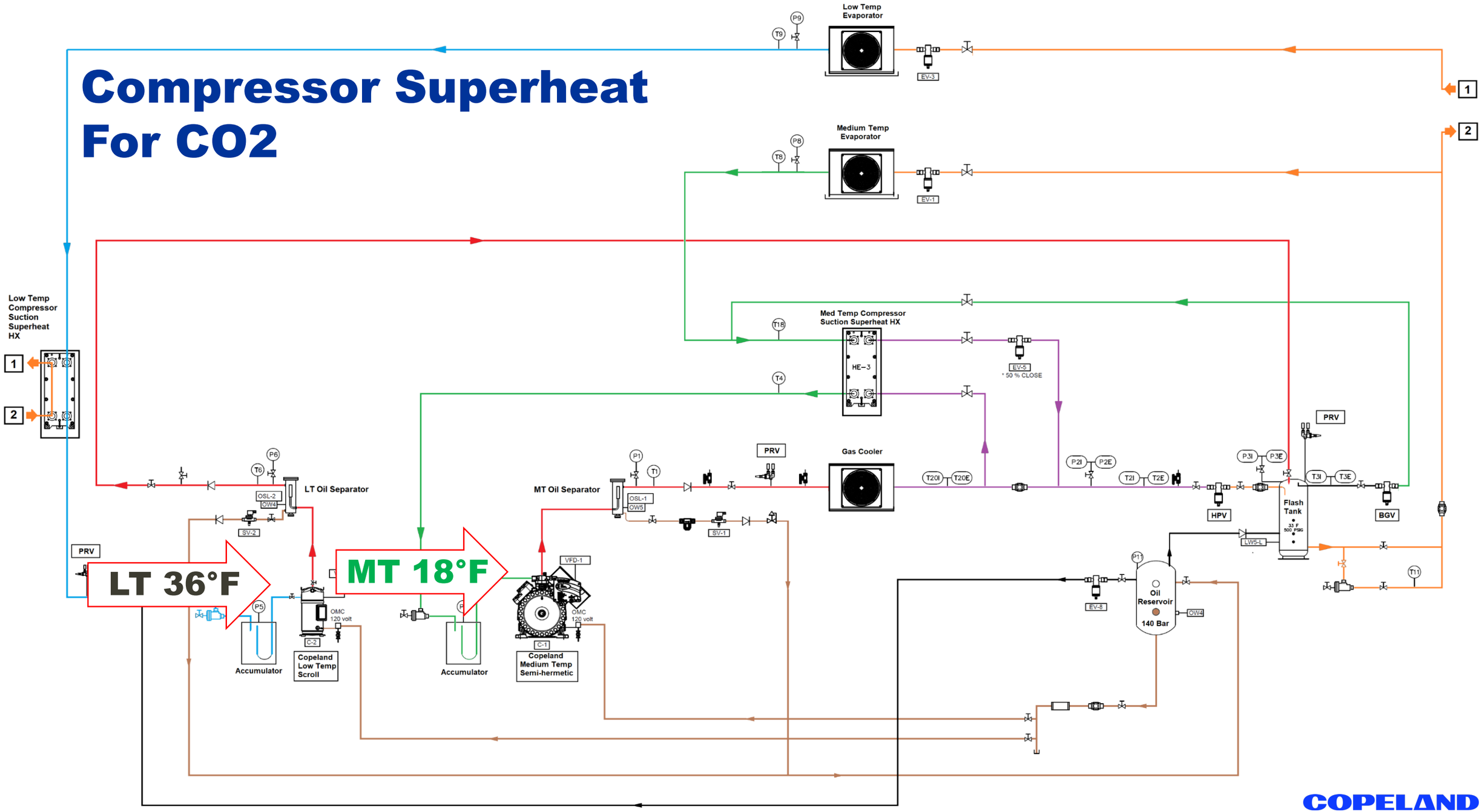
Copeland ZO Scroll Compressors

					Available (60Hz, 50Hz)				
Model	Nominal Horsepower	Displacement	Capacity Btuh	Capacity kW	EER	460V	230V	575V	380V
ZO21K5E	1.5	112 CFH	20,800	6.0	15.4	✓	✓		✓
ZO(D)34K3E	2.0	172 CFH	32,000	9.4	15.4	✓	✓	✓	✓
ZO45K3E	2.5	228 CFH	44,500	13.0	16.5	✓	✓	✓	
ZO58K3E ZO(D)58K3E	3.5	291 CFH	57,000	16.7	16.7	✓	✓	✓	✓
ZO88KCE	5.5	431 CFH	85,300	25.0	16.3	✓	✓	✓	✓
ZO(D)104KCE	6.0	498 CFH	98,500	28.9	16.3	✓	✓	✓	✓

Capacity with R-744 at -31F evap, 14F cascade cond, 5F RG, 14F liquid

- Axial And Radial Compliance For Improved Liquid And Debris Handling
- Low Sound Emission And Vibration
- High Volumetric Efficiency
- Digital Modulation Available Providing 10-100% Capacity
- Maximum Operating Envelop Pressure: Low Side = 229psig
- Maximum Operating Envelop Pressure: High Side = 561psig
- Maximum Standstill Pressure: Low Side = 500 psig (UL)
- Maximum Standstill Pressure: High Side = 500 psig (UL)

Compressor Superheat For CO2



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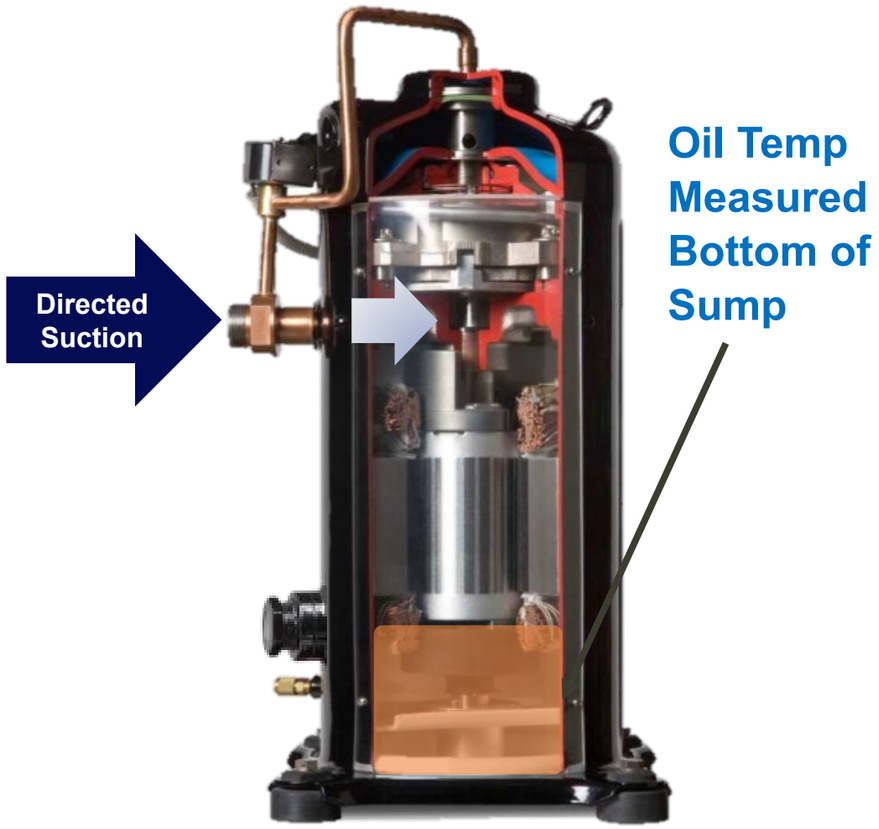
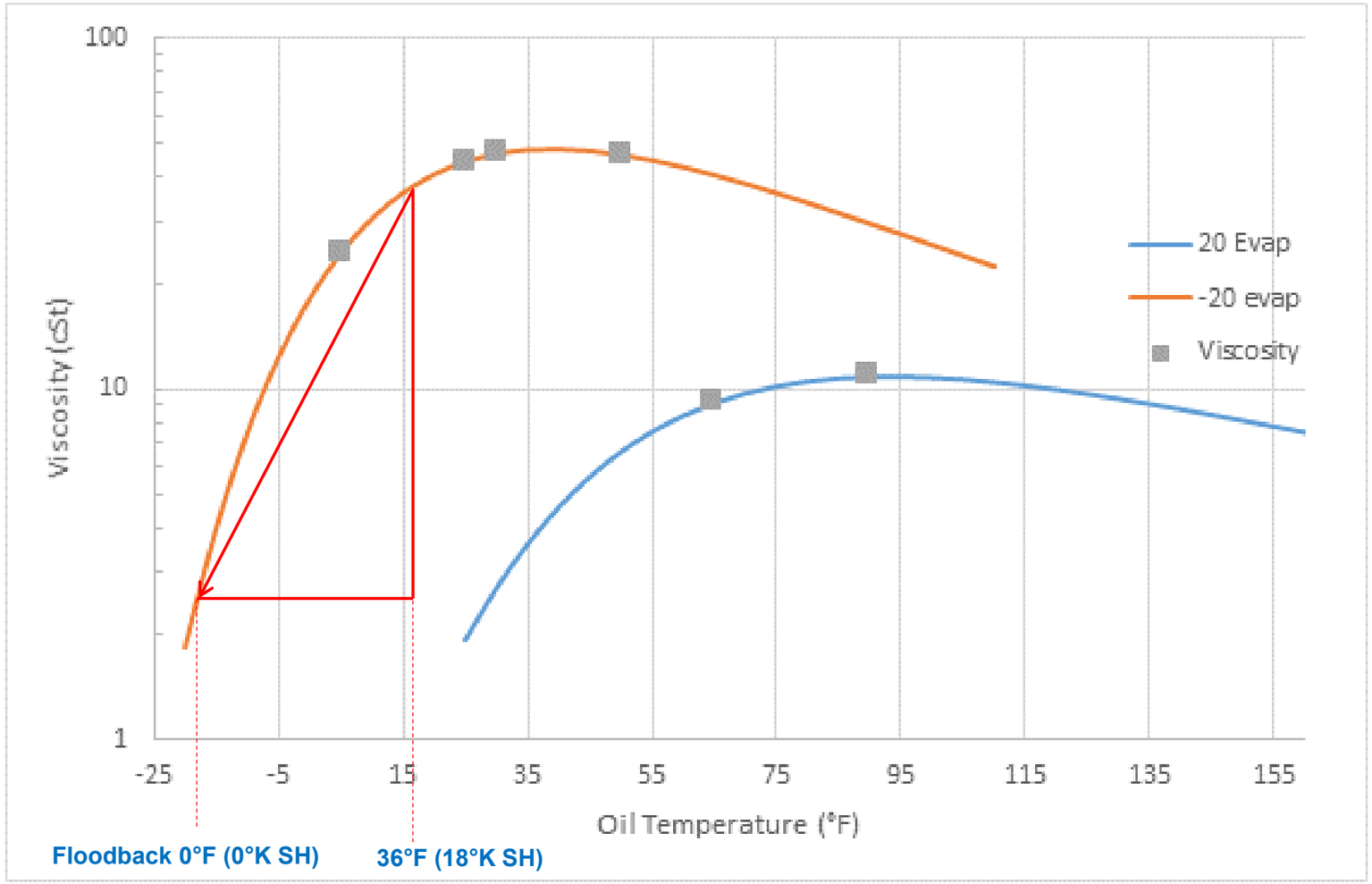
POE Oil Viscosity in CO_2 Vs Suction Superheat





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Scroll Drive Bearings
Lack of Lubrication

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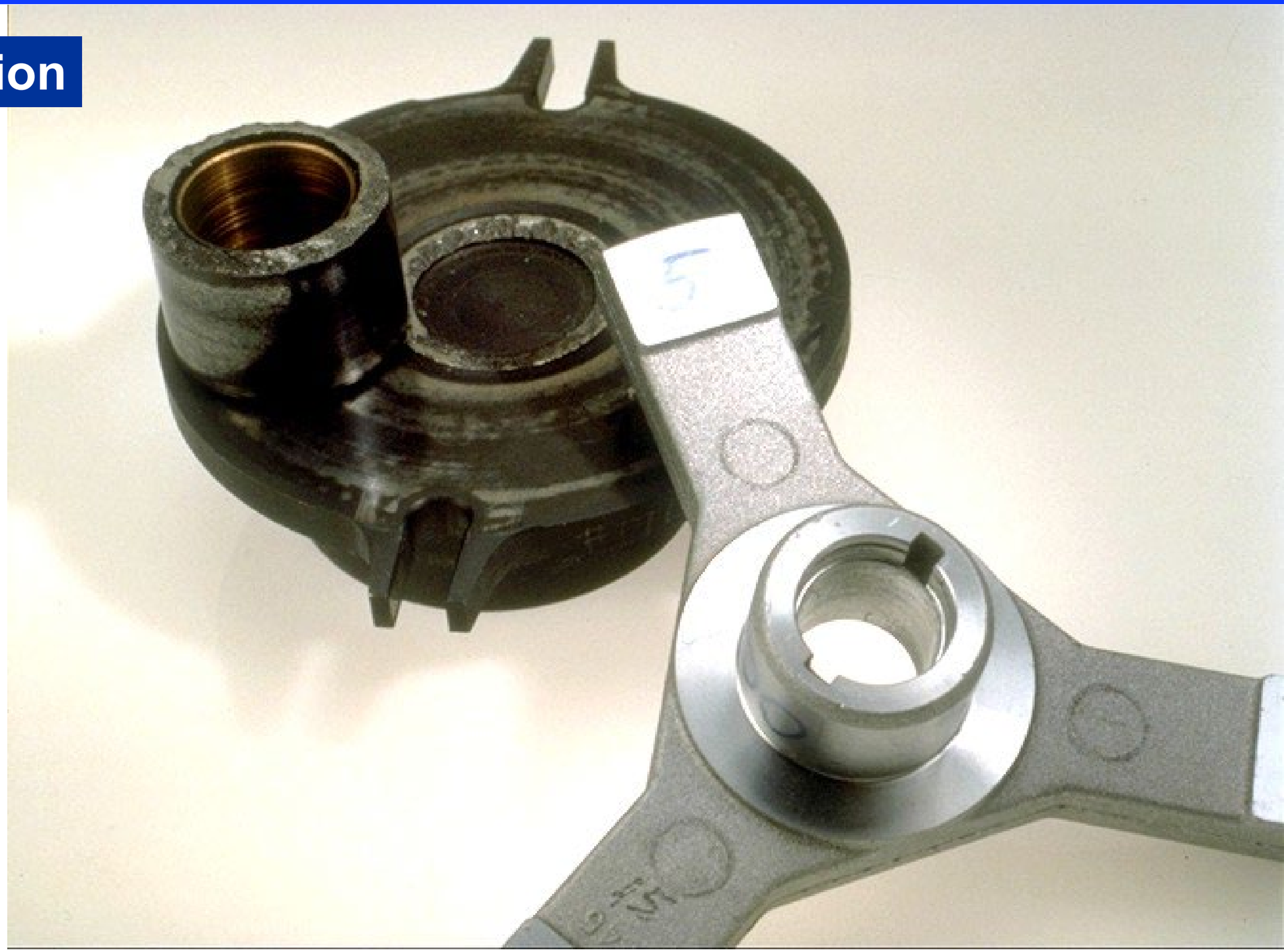
Lack of Lubrication



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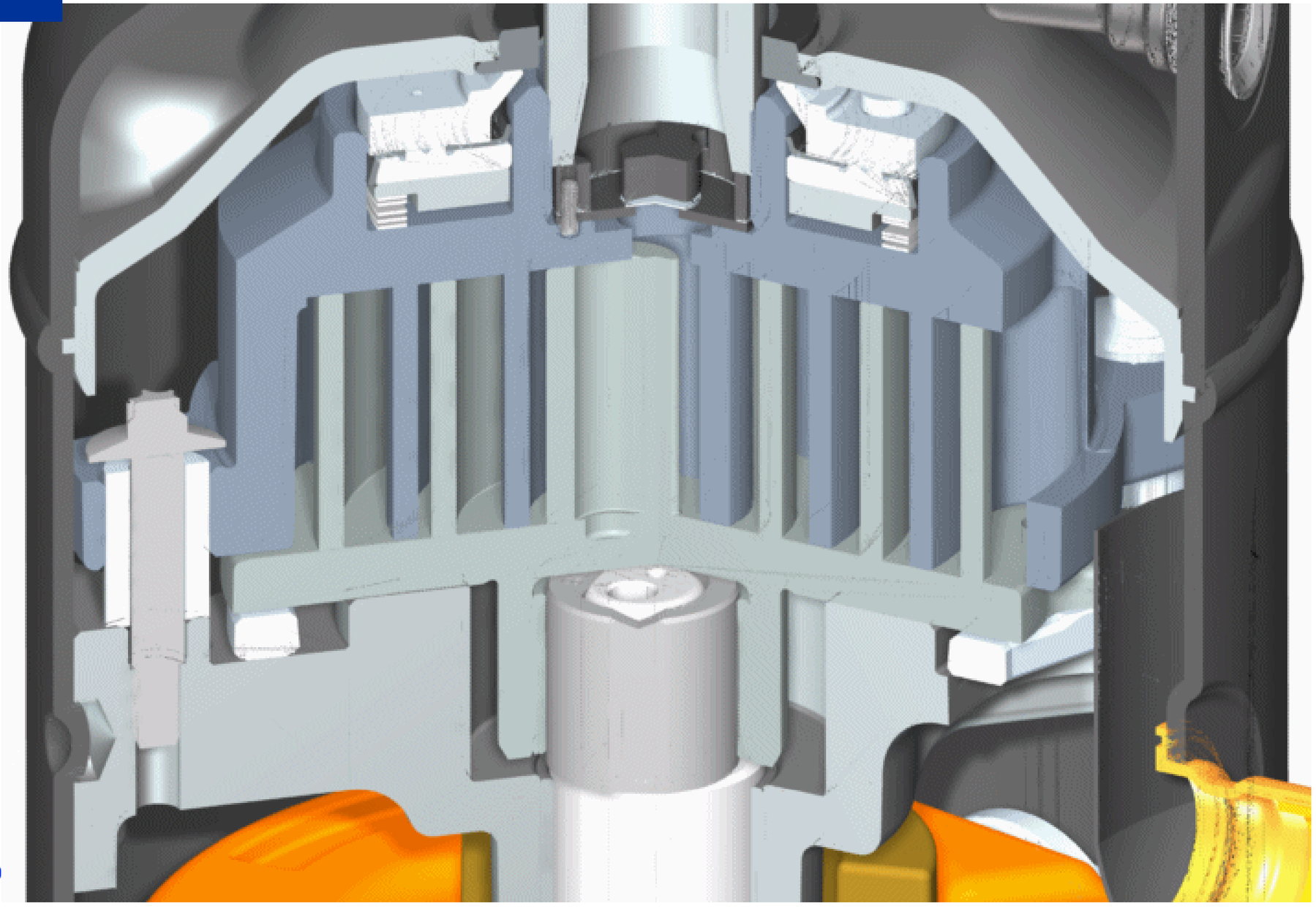
Scroll Drive Bearings

Scroll Modulation – How It Works



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Oil Management

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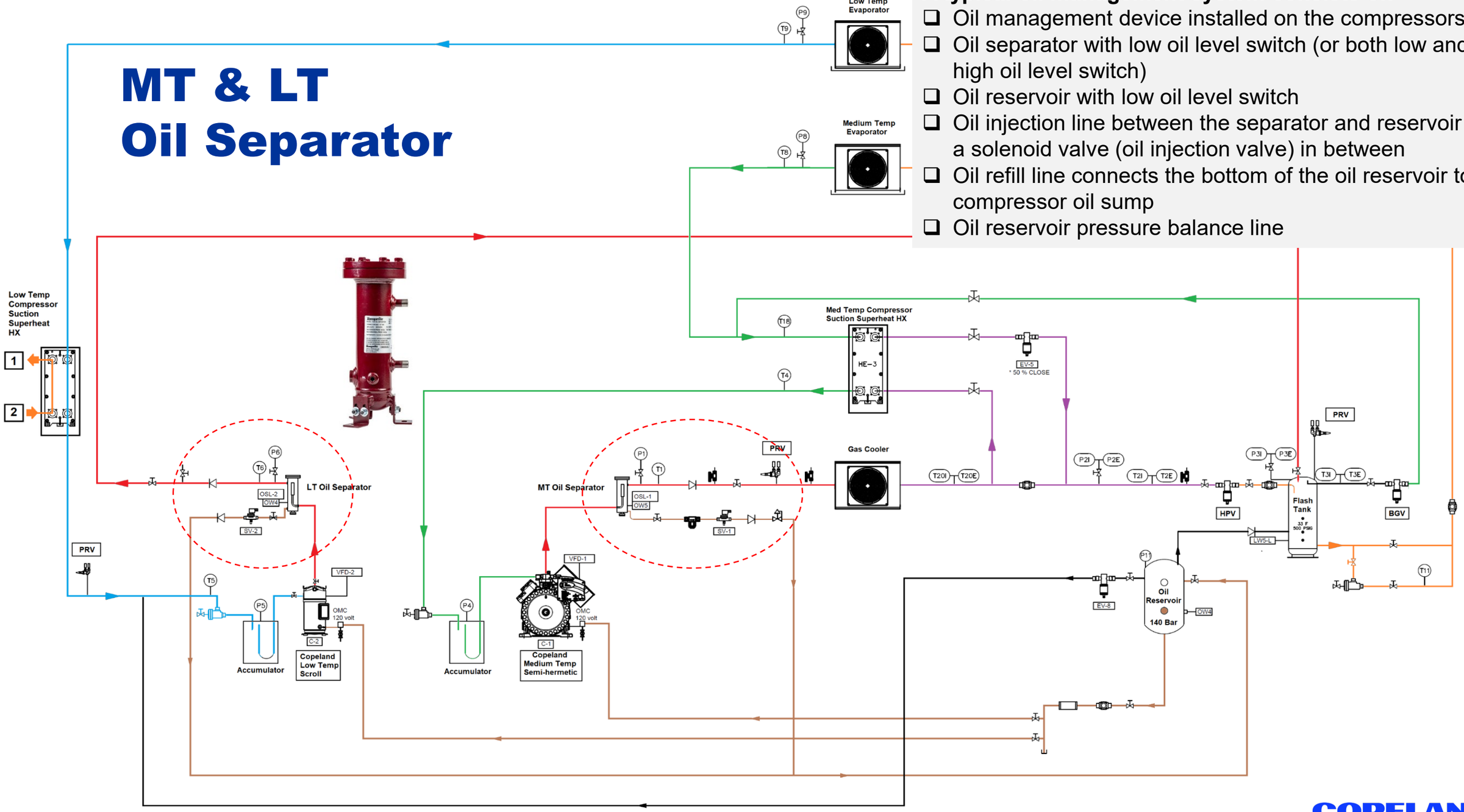
MT & LT Oil Separator

A typical oil management system consists of:

- ❑ Oil management device installed on the compressors
- ❑ Oil separator with low oil level switch (or both low and high oil level switch)
- ❑ Oil reservoir with low oil level switch
- ❑ Oil injection line between the separator and reservoir with a solenoid valve (oil injection valve) in between
- ❑ Oil refill line connects the bottom of the oil reservoir to the compressor oil sump
- ❑ Oil reservoir pressure balance line



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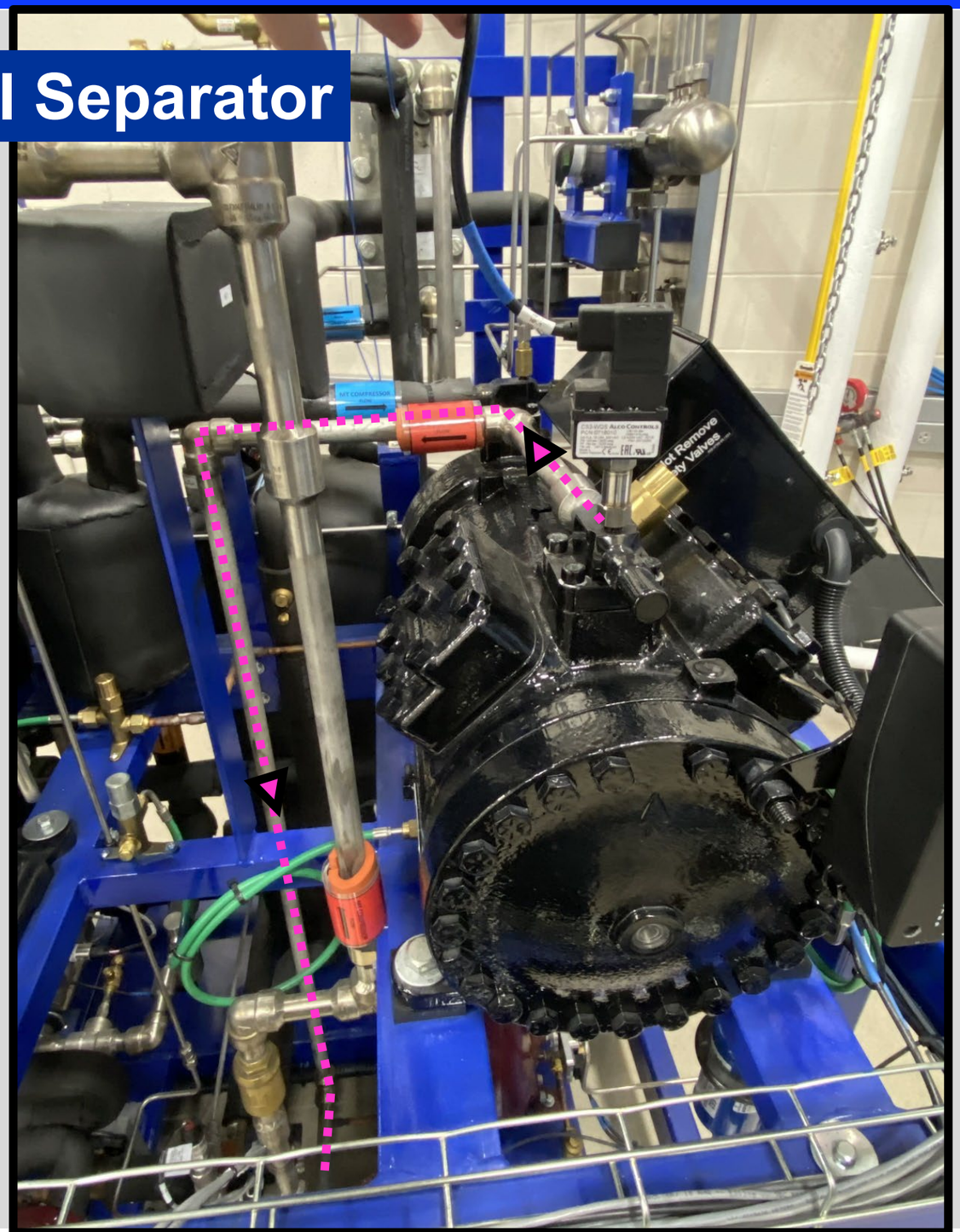
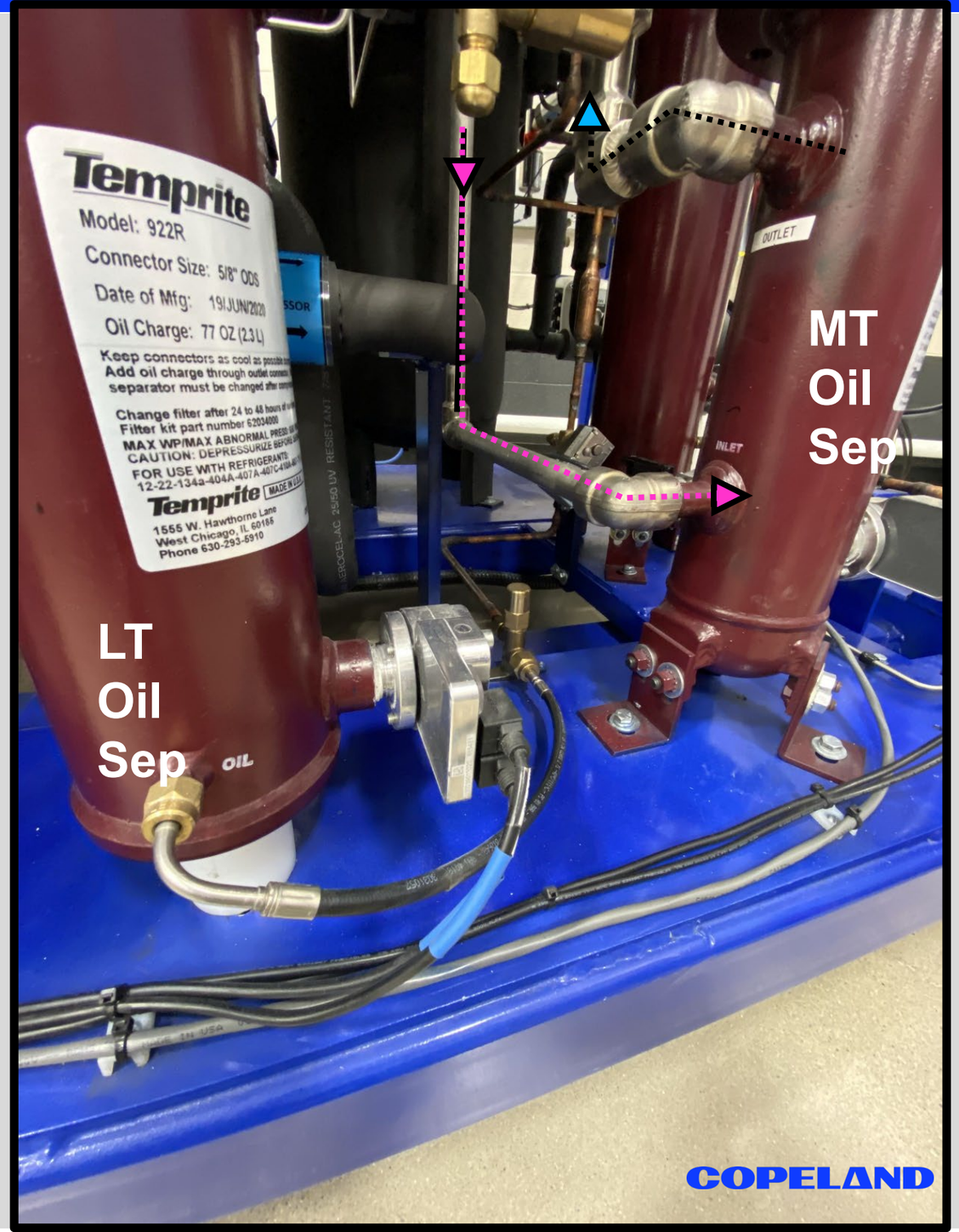
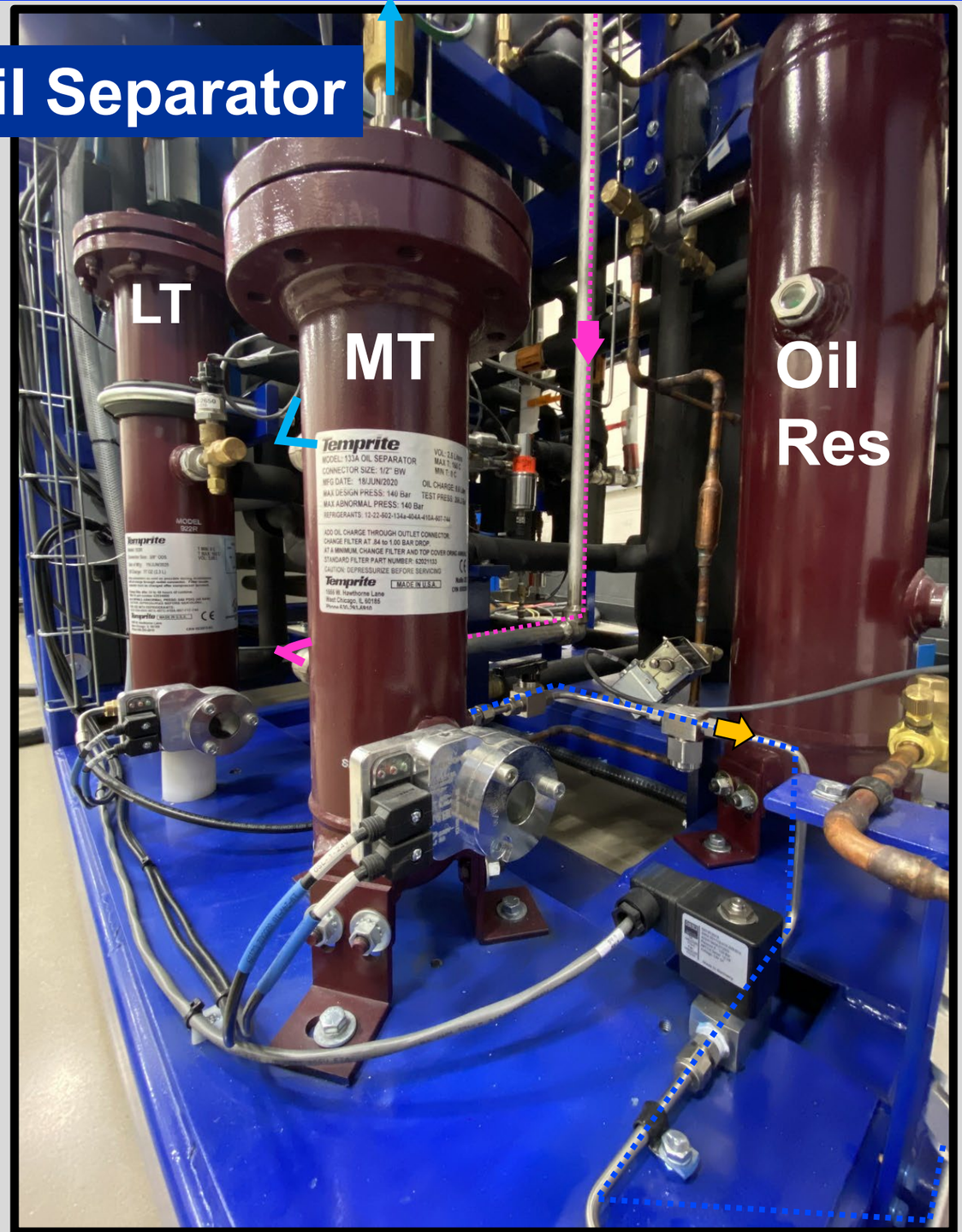
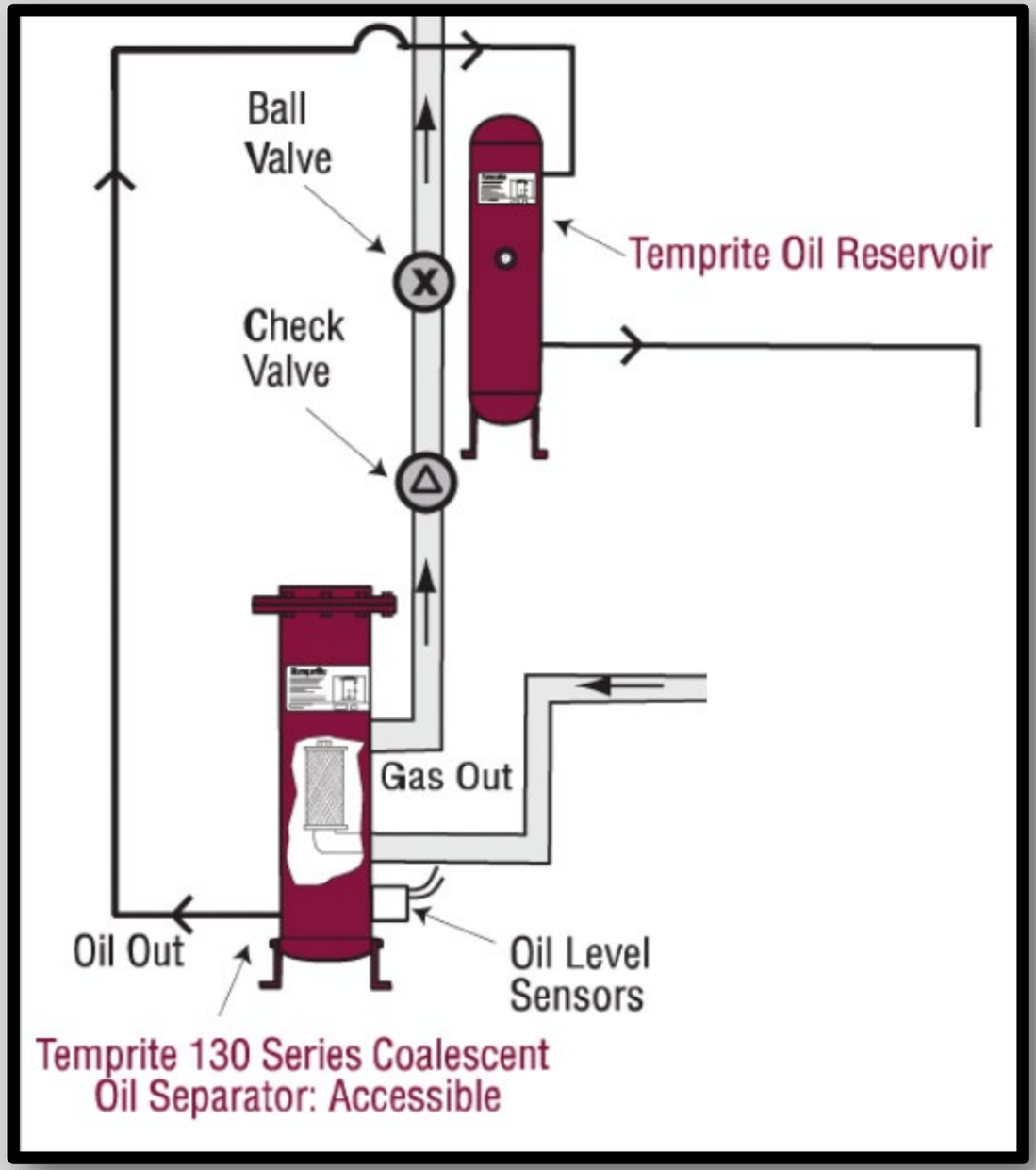
Oil Separator





Oil Separator





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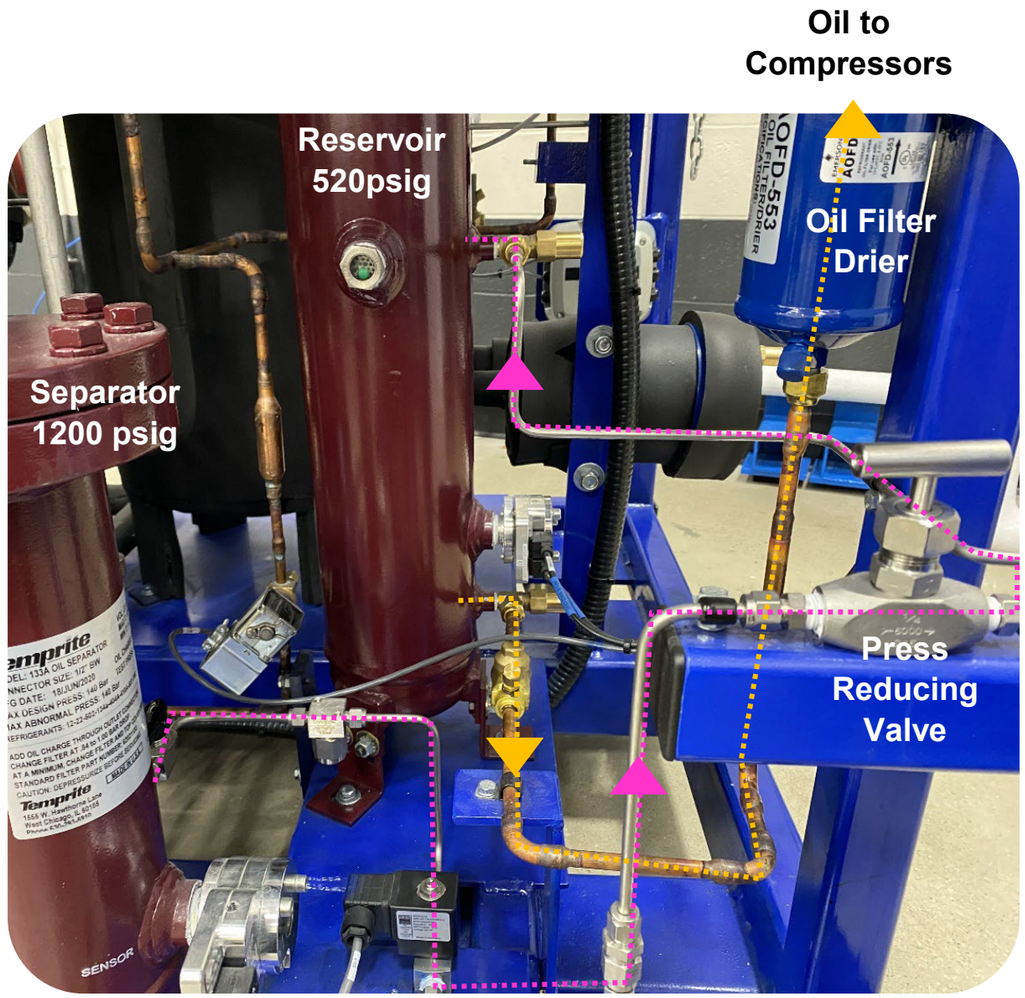
Operation of Oil Management System

- **Operation procedure:**
  - ❑ The oil separator separates the oil from the discharge gas and builds the oil level inside
  - ❑ When the oil level in the separator is high enough, the oil level switch is triggered & activates the oil injection valve, the differential pressure between the compressor discharge and the flash tank pushes the oil from the oil separator to the oil reservoir
  - ❑ When the low oil level switch in the separator senses no oil, it de-energizes (closes) the oil injection valve to prevent sending high-pressure gas to the oil reservoir
  - ❑ When the compressor calls for an oil refill, the oil management device opens the oil refill line, and the pressure difference between the reservoir to the compressor suction pressure pushes the oil to the compressor
  - ❑ Typical oil reservoir pressure is equalized to flash tank. If the FT is at 520 psig and crankcase is 410psig the 110psi oil pressure is sufficient to fill compressor as needed. Should oil differential pressure fall to approximately 50psid the oil may not fill the compressor in the 120sec time frame allowed. This can occur if the flash tank pressure is low and also reservoir pressure with an increase in MT suction when floating suction features are used.



Oil Separator

- Suitable for CO_2 Transcritical and subcritical ranges
- Maximum Operating Pressure of 2030 Psig (140 bar)
- **Coalescent oil separators** are used (98.5%⁺ separation efficiency)
- Separates the oil from the refrigerant to;
  - Reduce oil circulated through the system
  - Ensures adequate oil returning to the compressors

Oil Separator

- Removable top for filter replacement
- Uses a glass fibre media for high efficiency rates
- Has the ability to filter out dirt and particulates down to 0.3 microns
- Replace after initial 24 to 48 hours of operation
    - and when pressure drop across the separator exceeds 13 psi (0.9 bar)
- To ensure immediate oil return upon start-up, the oil separators are to be pre-charged with oil (mfg. specs) i.e... Model 133A (20 oz.)

Westermeyer Releases Electronic Oil-Filter Monitor and Oil Strainer for Transcritical CO_2 Systems

February 24, 2023 COMMERCIAL REFRIGERATION NORTH AMERICA

Westermeyer Industries displayed its newly released **RDP-01T Differential Pressure Monitor**

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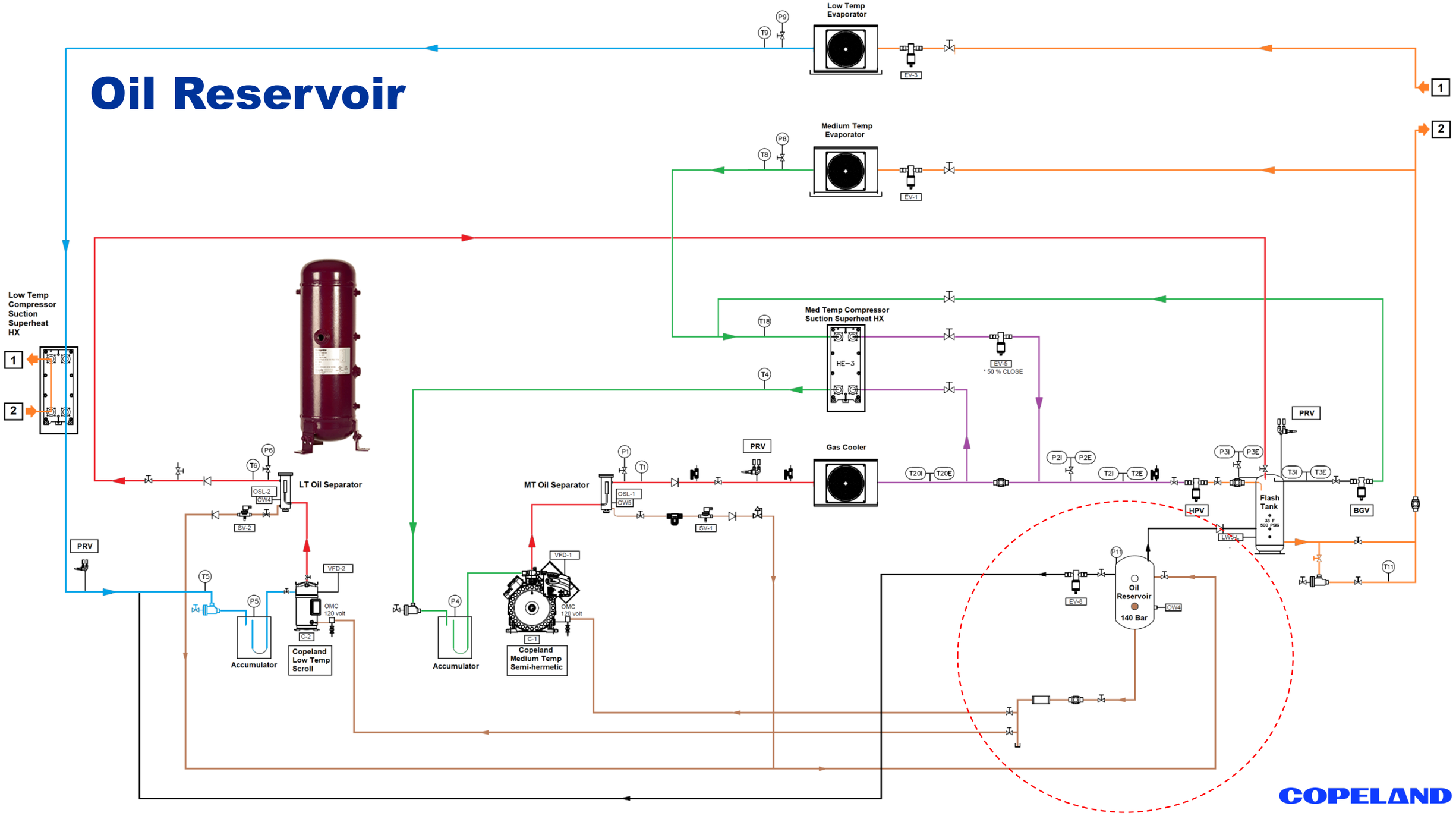
Oil Reservoir



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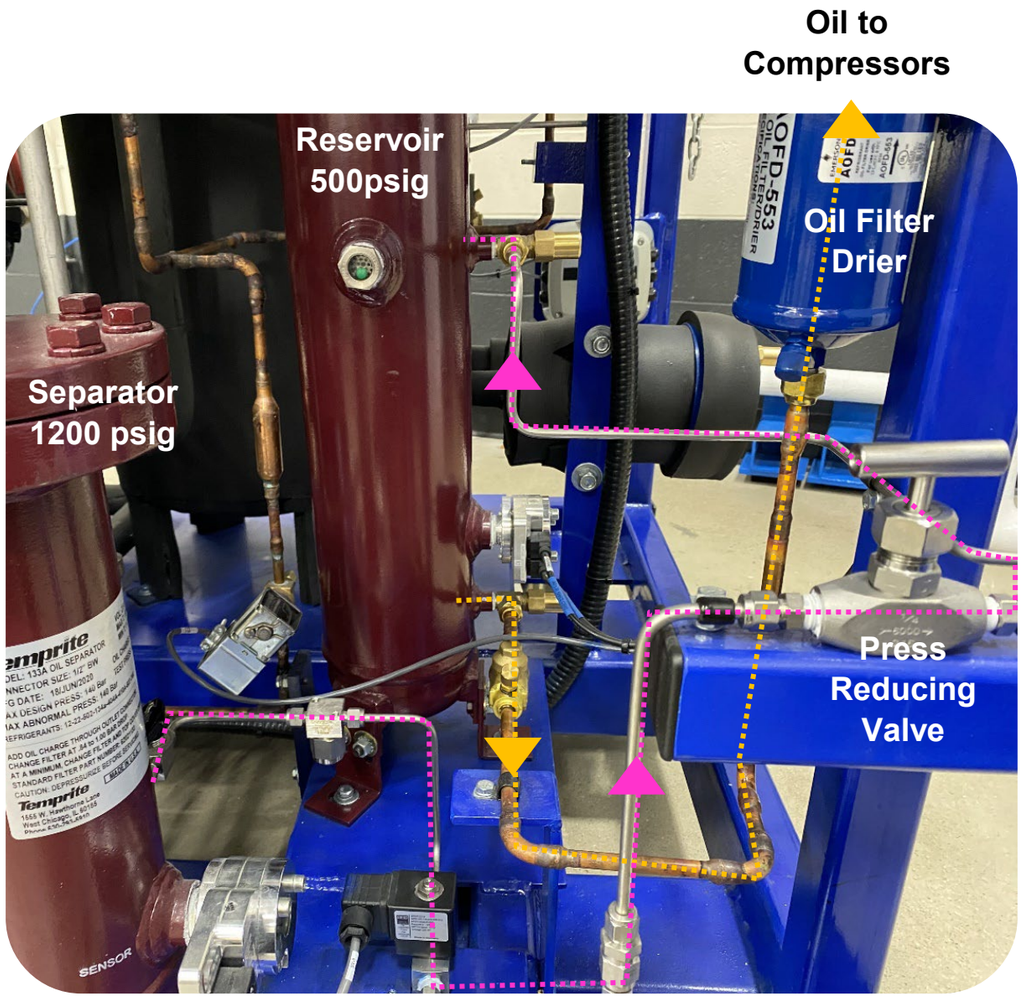
Oil Reservoir

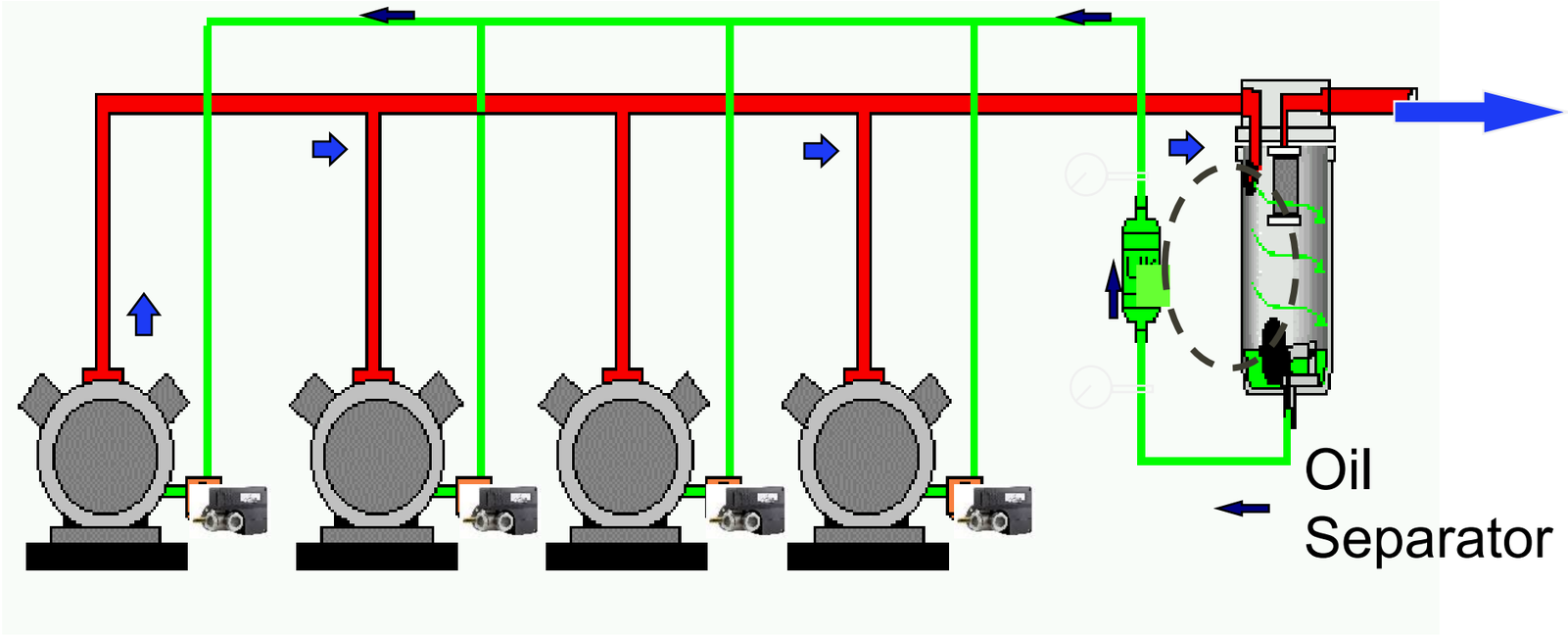
- To improve the control of oil return, oil from both separators are sent to a common oil reservoir
- From the reservoir, oil returned to the compressors becomes a function of pressure difference
- Each compressor has it's own oil monitoring, balancing and alarming system as previously mentioned i.e....(OMB, OM5, OW5 ....)
- The oil reservoir is to be pre-charged with oil (mfg. specs) i.e... RES 7 (68 oz. (min.) – centre of bottom sight-glass)
- Pressure reducing valve is used from the Transcritical oil separator due to the higher discharge pressure
  - Oil supply pressure must be higher than the crankcase pressures of all compressors

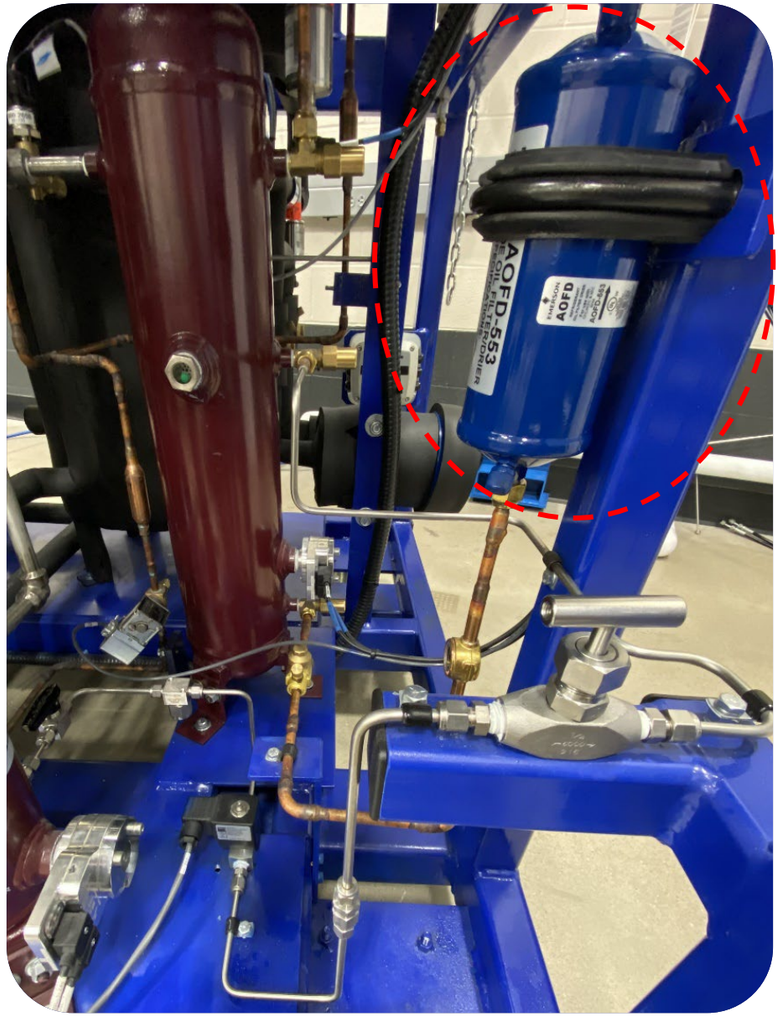


Oil Filter Drier

AOFD 553 - Emerson

- 100% Molecular Sieve For Moisture
- Removal in POE Oils while Fully
- Protecting the Oil Additives
- 3 Micron Filtration For Optimum
- Compressor Protection
- 3 / 8 “ SAE Connections





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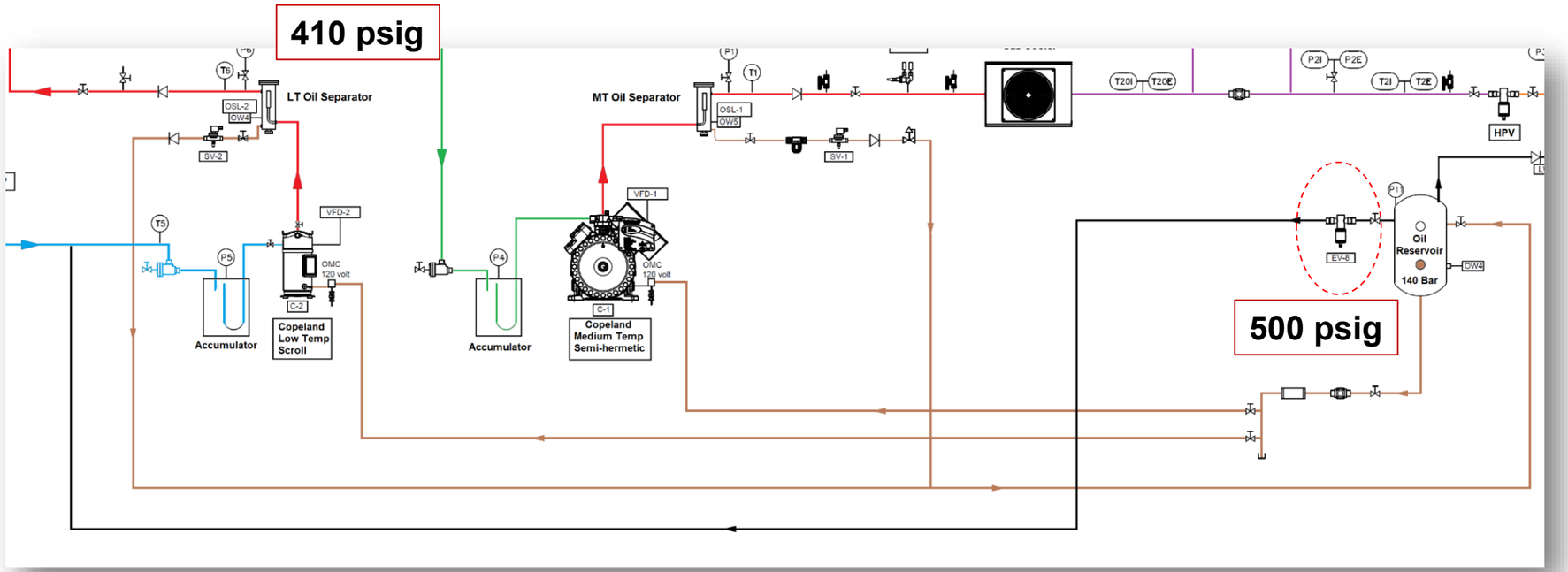
Oil Reservoir Pressure Reducing Valve

- When Low Temp Oil Separator operating at 410psig need to purge excess oil into the oil reservoir which is at 500psig, this valve opens temporarily to drop the pressure in the reservoir below 400 psig for the oil to oil from LT Oil Sep to oil Reservoir



Oil Reservoir Level Control Emerson OW5

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Oil Watch OW5

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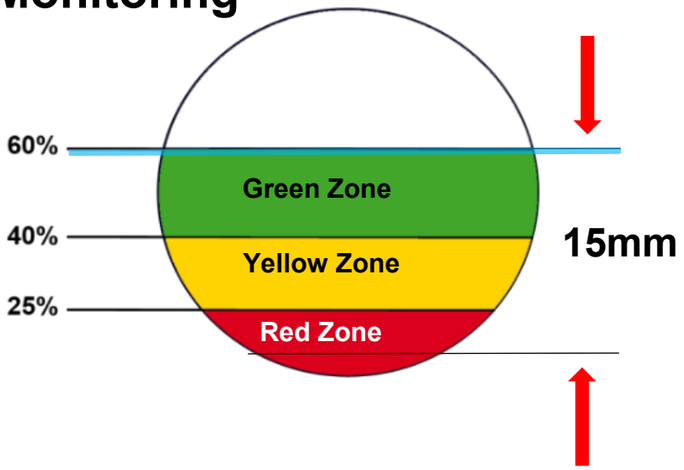
Compressor Oil Level Controls
Emerson OMC, OM5

COPELAND

Emerosn Hall-effect

Hall-effect Sensor
3 Zone Level Monitoring



LEDs	Status / Function	Function	Alarm
●	Oil Level in green zone (60 - 40%)		
● ●	Oil Level in green zone (60 - 40%)	Injection, delay 10s	
●	Oil Level in yellow zone (40 - 25%)	Injection	
● ●	Oil Level in red zone (25 - 0%)	Injection	Yes, delay 120s

OM5

OMC

SPDT output contacts for external connection

- Alarms, status lights, compressor off control

Uses a reverse Hall-effect sensor

- Uses a float to sense oil level
- Sealed semi-conductor device
  - non-contact, wear free
  - sealed – contaminate proof
- Immune to vibration, debris and water
- Debris retention magnet for reliable control

Oil Level Control

Adapter

LED Display

Power Green

Fill Yellow

Alarm (low oil) - Red

Subcritical Scroll

OMC
MOP
1885 psig
130bar
MOPD
100bar
1450psig

Subcritical Scroll

OMB-JB1
MOP
870psig
60bar
MOPD
24bar
350psig

Transcritical 4MTL(S)

OMC
MOP
1885 psig
130bar
MOPD
100bar
1450psig

OM5
MOP
1885 psig
130bar
MOPD
100bar
1450psig

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Drives
Copeland EVM, EVH

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Where Can You Add a VFD?

Fans
Evaporator
Condenser
Exhaust

Fixed Speed Compression
Scroll
Semi-Hermetic
Screw
(including non-Copeland brands)

Variable Speed Compression
Scroll
Hermetic Recip

Circ. Pumps

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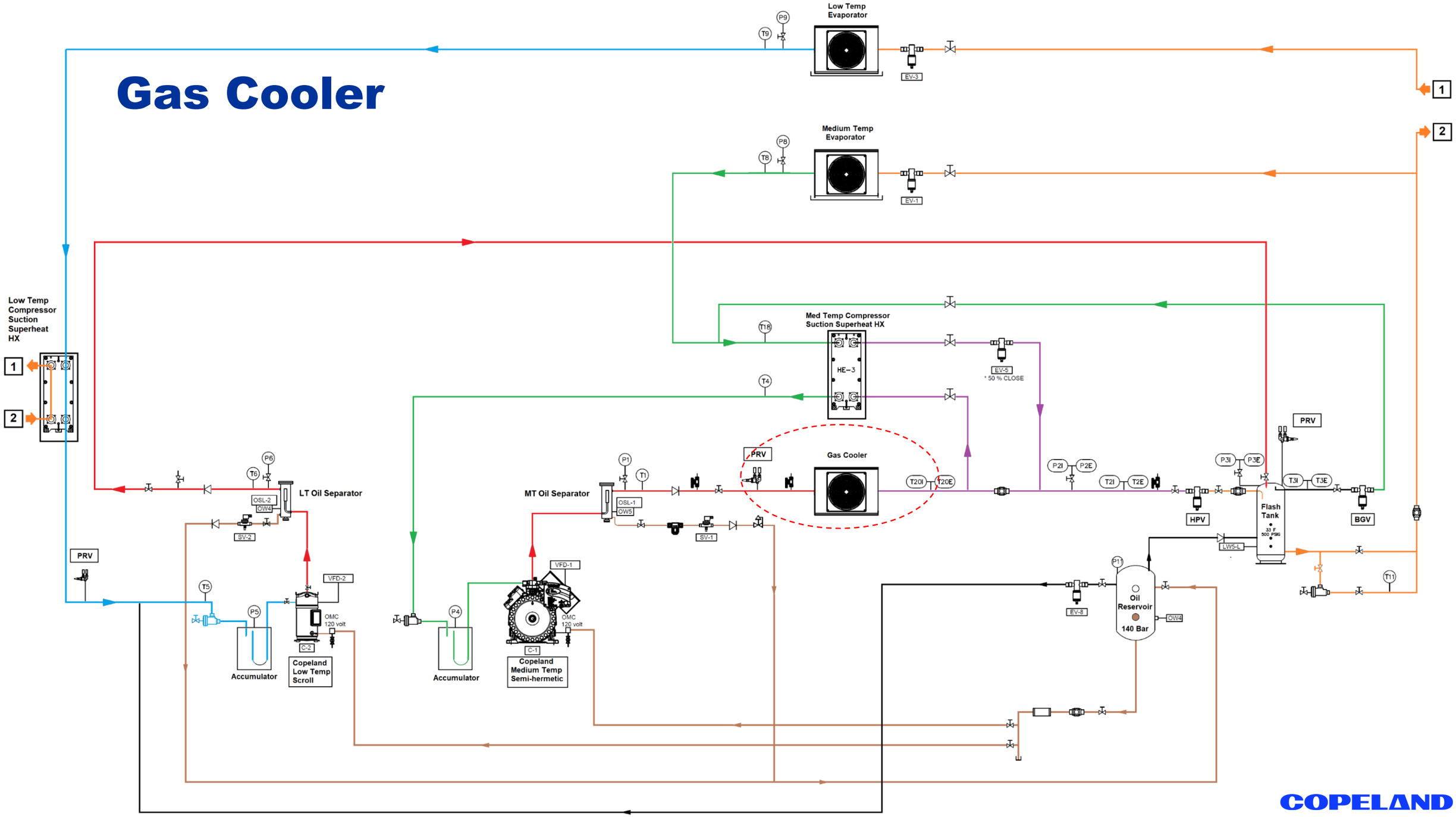
Gas Cooler



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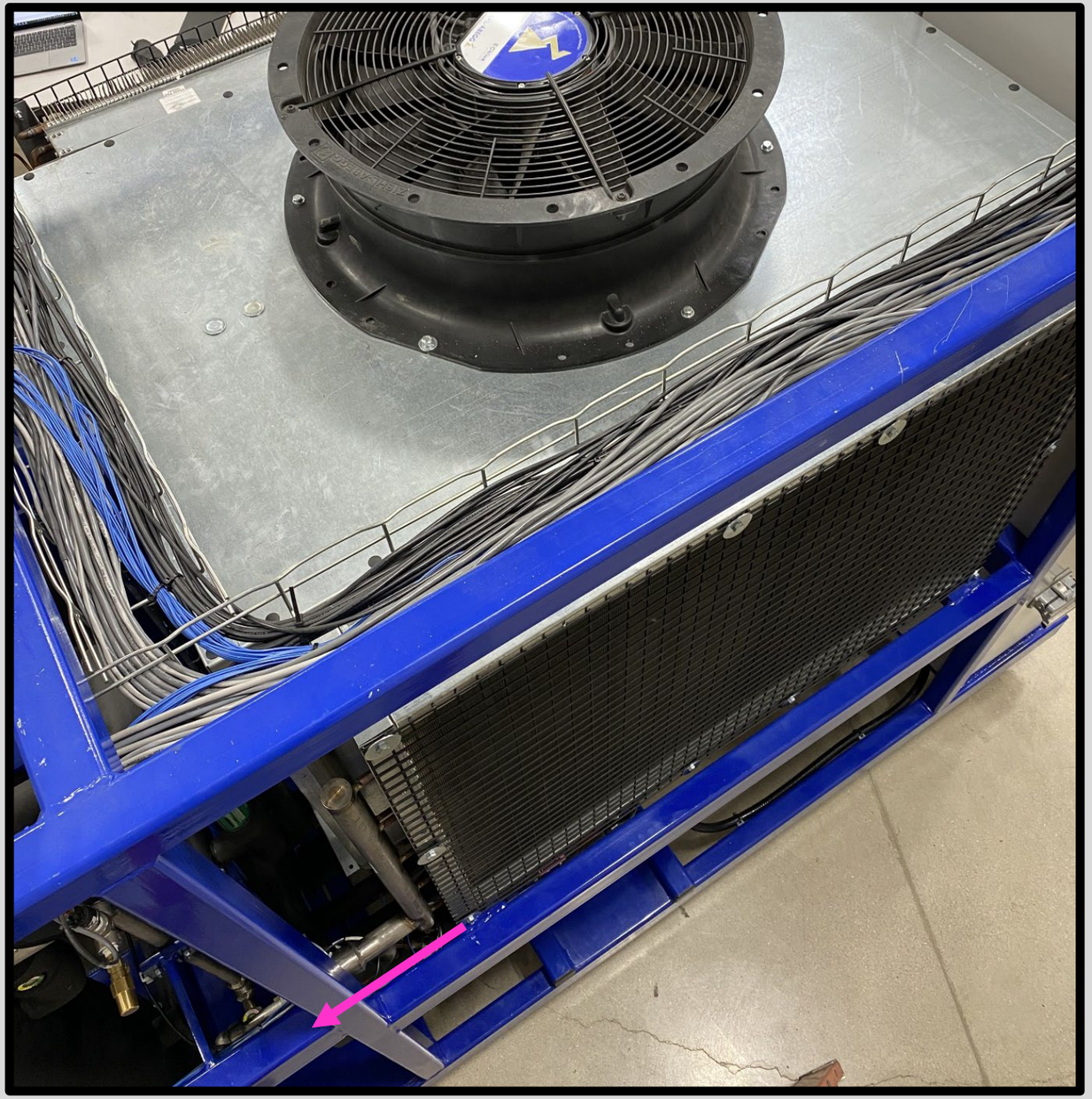
Gas Cooler



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Gas Cooler

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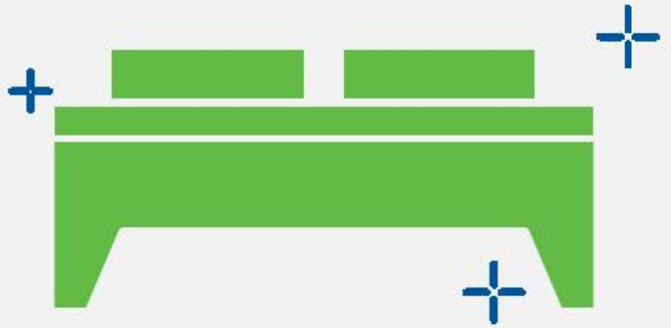
2

GAS COOLER

The gas cooler (aka condenser), typically located on the roof, is integral to a CO_2 TCB system's design.

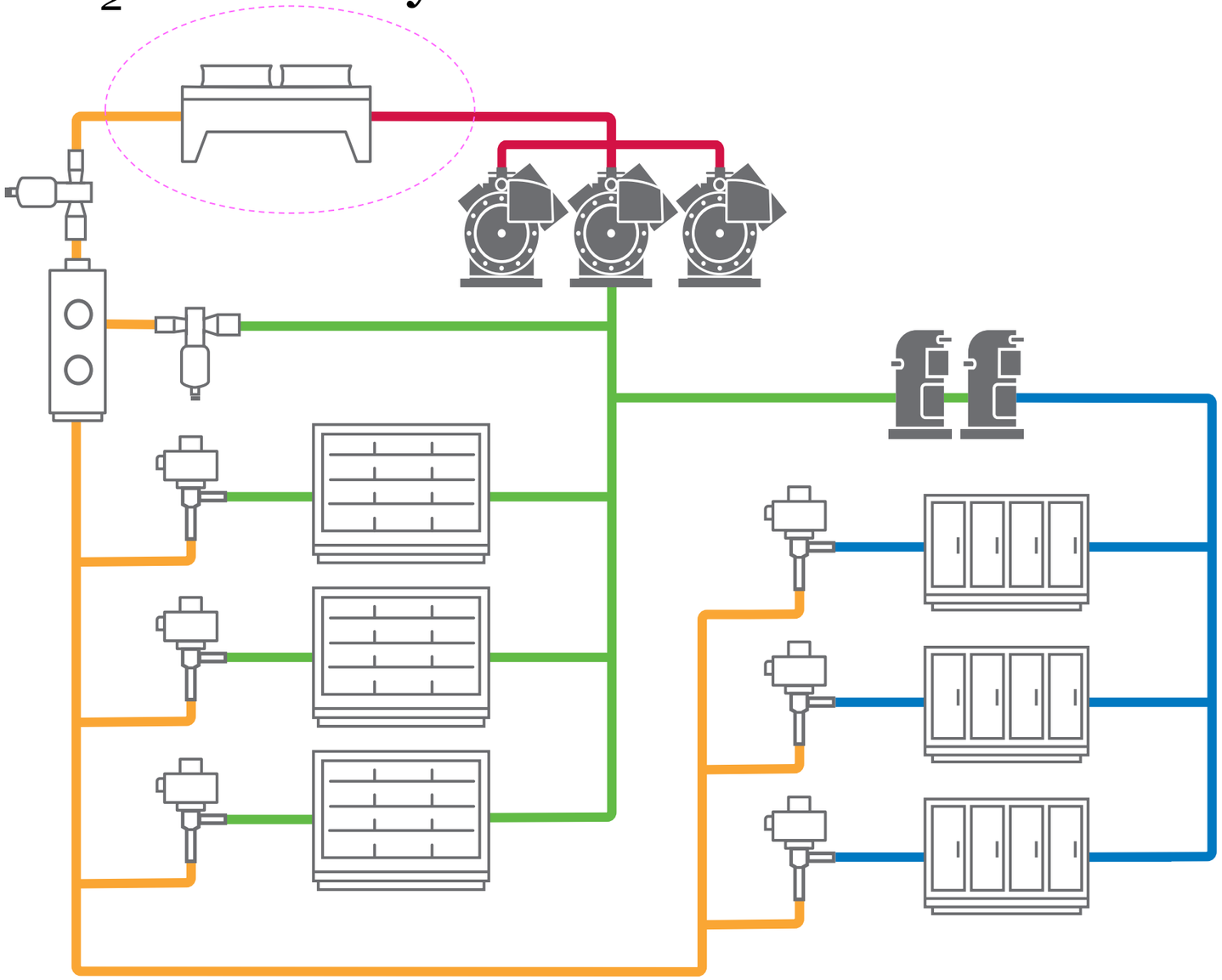
- Must be sized to handle the system's total heat of rejection from MT compressors at an installation location's design conditions
- Typically designed with variable speed fan motor control
- Can include adiabatic cooling pads to improve system efficiencies in warm ambient climates



GAS COOLER/CONDENSER

Dry Gas Cooler / Condenser

CO_2 Booster Systems Gas Cooler

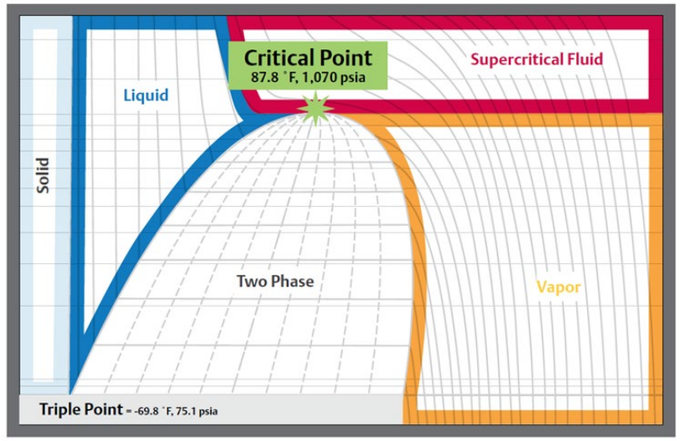


Transcritical Mode (AKA Supercritical)

- > 75F Ambient
- **5 to 7°F TD**

Subcritical Mode

- <75°F Ambient
- **10 to 13°F TD**



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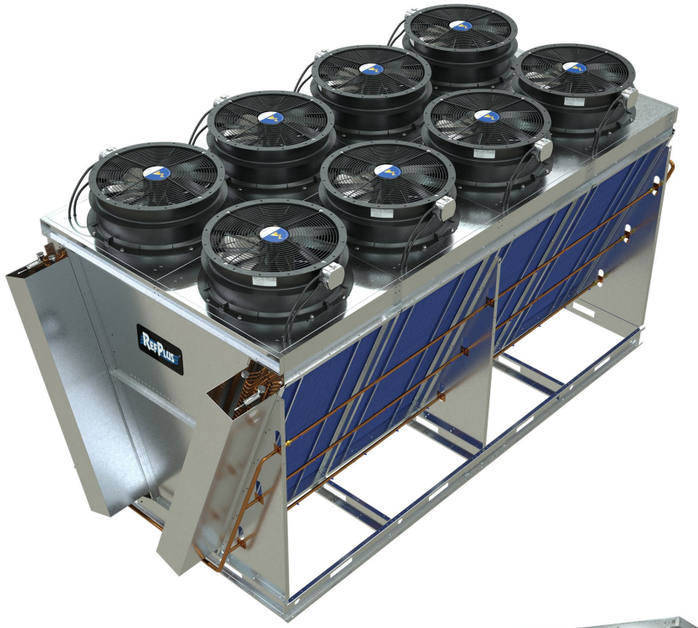
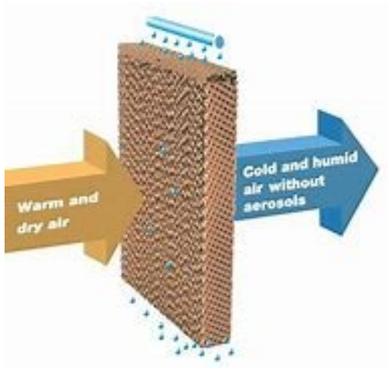
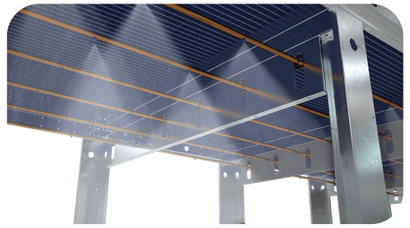
Gas Cooler fan control logic

- **For the major controllers used currently on CO2 system today, the fan speed is controlled on the gas cooler outlet temperature**
- The set point of the fan is based on the inlet air temperature plus a configurable TD and is limited by the minimum and maximum values which are also configurable.
  - ❑ **A TD of 3-10°F** is recommended to allow the fan speed to slow down in mild ambient to prevent wasting unnecessary fan power
  - ❑ **Max Fan Setpoint:** Fan is expected to run at the max. speed when the weather gets warmer. It is achieved through the max. setpoint setting. Once the ambient temperature is warm enough to keep the gas cooler outlet temperature above its max. fan setpoint, the fan remain at 100% speed to ensure the best efficiency
  - ❑ **Min. Fan Setpoint:** Limitation is needed to keep the flash tank pressure at the setpoint under colder weather. The min. fan setpoint should NOT be set lower than the flash tank saturation temperature, otherwise, CO_2 will leave the gas cooler and enter the flash tank via the HPV valves at a temperature lower than the flash tank vapor temperature and causing the FT pressure to drop below its setpoint, throwing the system out of balance.
- Therefore:
  - The gas cooler fan should be running at the max. speed under hot weather for the best efficiency
  - The gas cooler fan should regulate its speed to keep the required TD under mild weather to save fan power
  - The gas cooler fan should stay close to the min. speed under cold weather to maintain the min. gas cooler outlet temperature

Adiabatic Gas Cooler / Condensers
(Supercritical) / (Subcritical)







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“Split” Gas Cooler / Condenser

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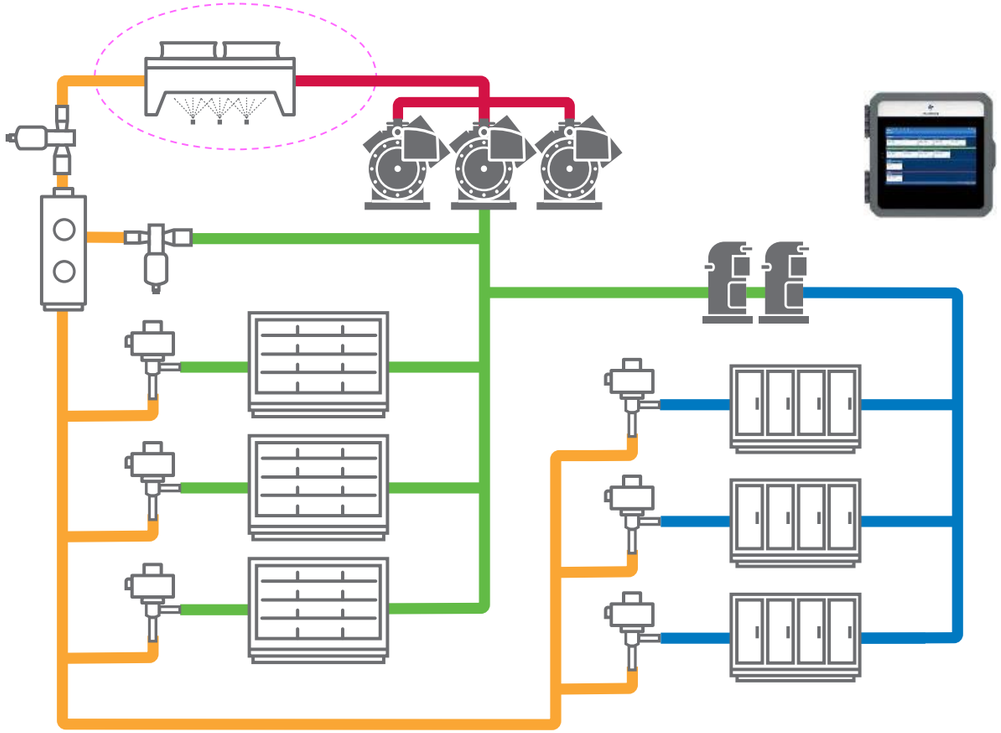
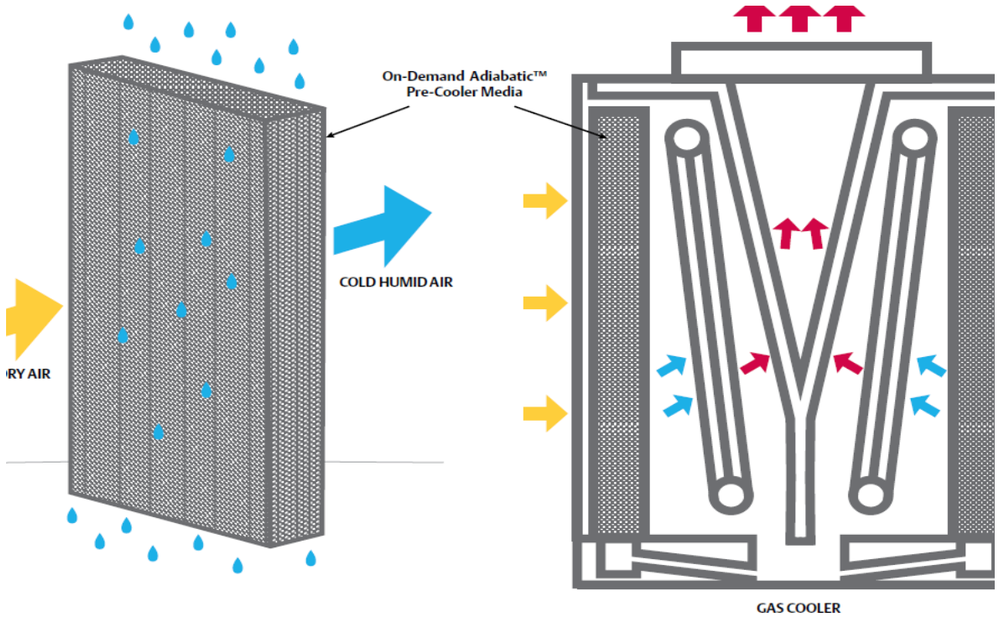
CO2 Booster System Condenser / Gas Cooler





4694 hrs TC Mode

Hot-Dry 3B Climate Zone		Max Temp	25F Bin	30F Bin	35F Bin	40F Bin	45F Bin	50F Bin	55F Bin	60F Bin	65F Bin	70F Bin	75F Bin	80F Bin	85F Bin	90F Bin	95F Bin	100F Bin	105F Bin	110F Bin	115F Bin	Total Hours
Dry Gas Cooler	PALM SPRINGS, CA	114.8	0	0	0	12	168	449	816	653	1063	905	860	967	498	851	536	570	227	178	7	8760
Adiabatic	PALM SPRINGS, CA	81.6	0	0	0	12	168	560	1448	1762	2421	1822	514	53	0	0	0	0	0	0	0	8760
			Subcritical operation										Transcritical operation									

567 hrs TC Mode

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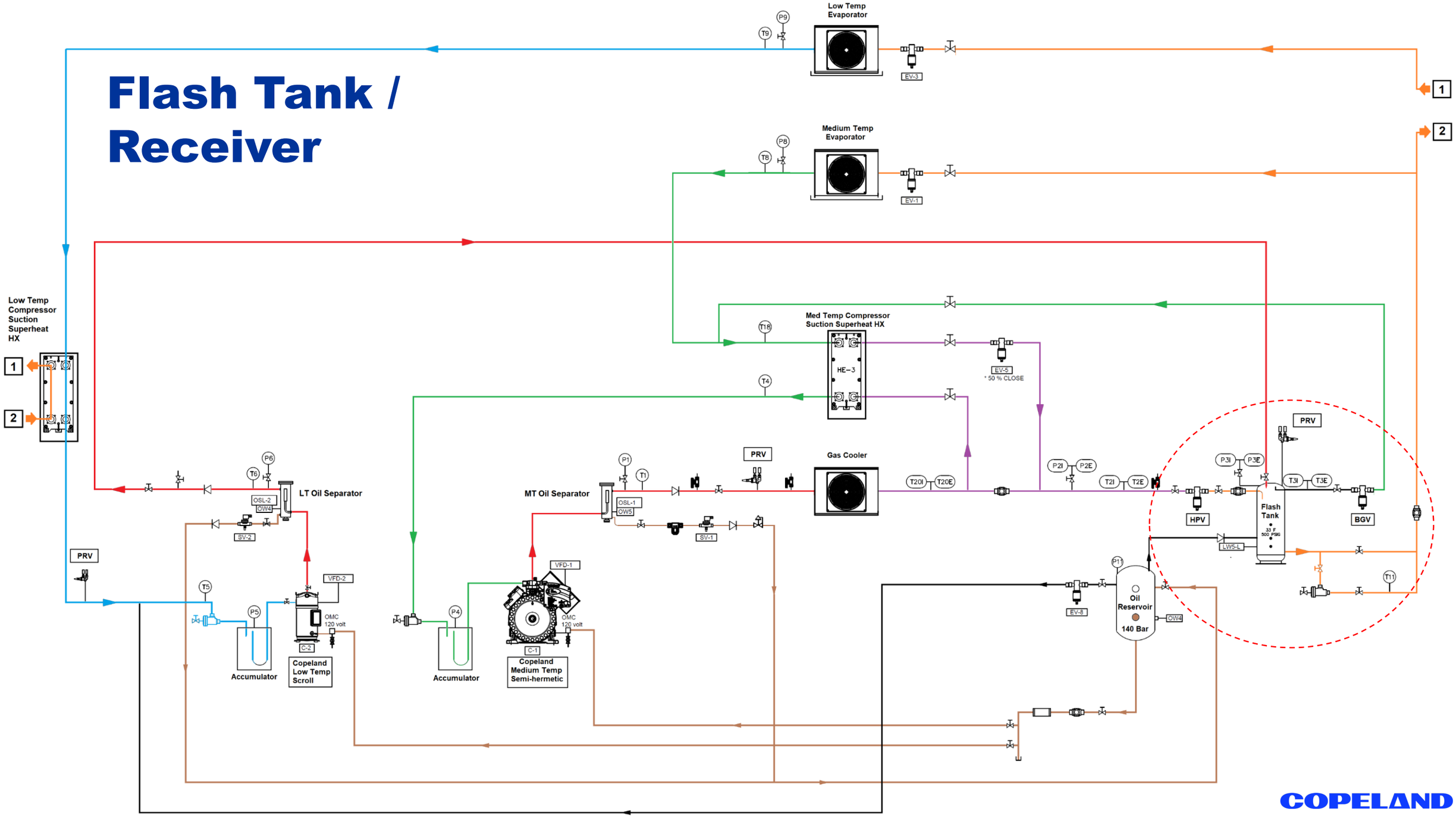
Flash Tank / Receiver



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Flash Tank / Receiver

- 30 to 40F = 476 to 553 pisg
- Sizing is Key
- Level Management
- Insulated Flash Tank
- Insulated Liquid Lines

Stable Flash Tank pressure is the key to smooth performance year round

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Pressure Relief Valves

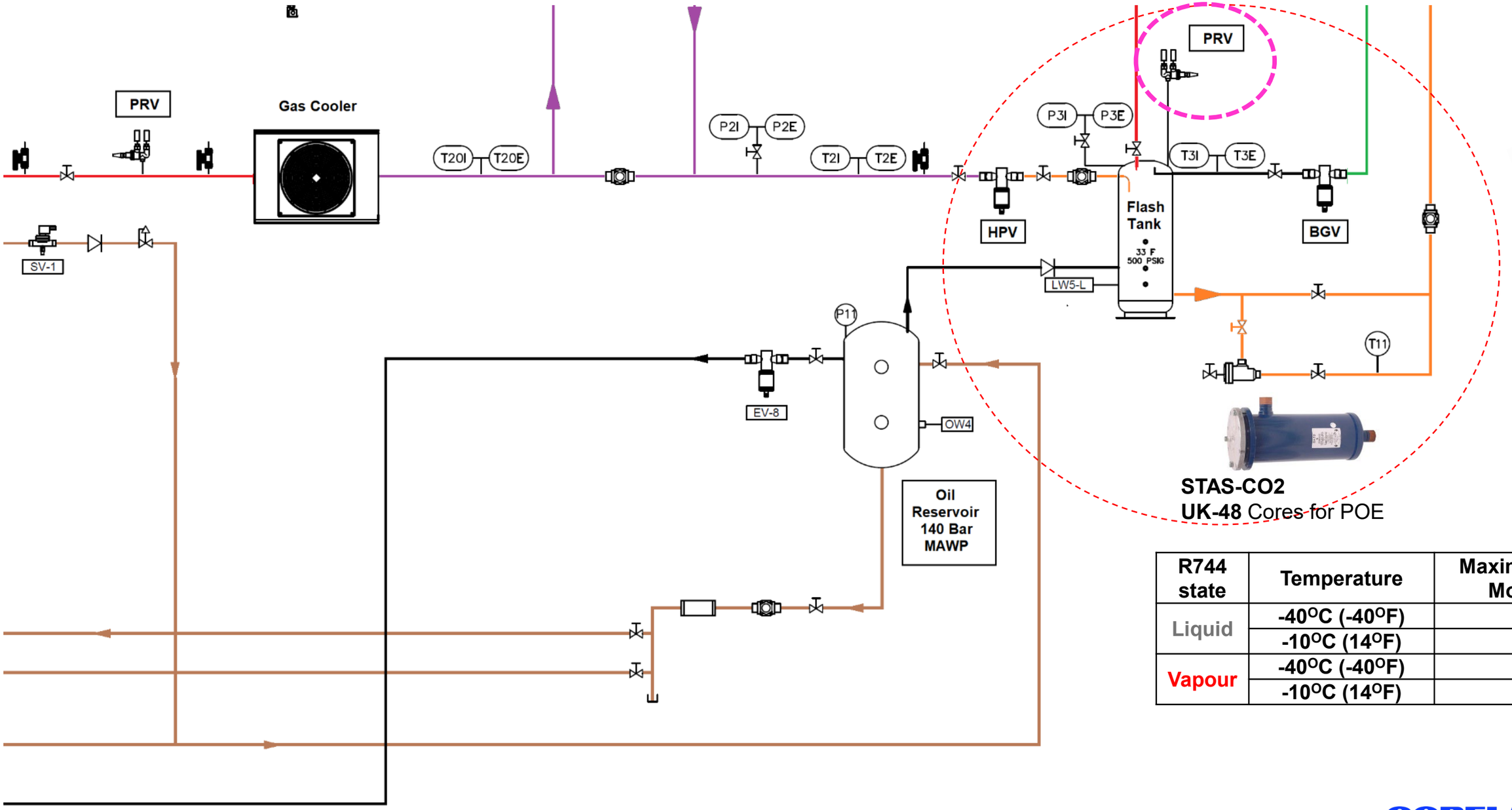
Typical PRV Setting For Supermarket

- **Discharge; 1600psi (110bar)**
- **Flash Tank / Liquid Line; 650psi (45bar)**
- **MT Suction; 650psi (45bar)**
- **LT Suction; 500psi (35bar)**

After a few releases, most PFVs will drift from setpoint, causing early relief.

- Changing PFV to protect against early release will save CO2, system issues and keep customer happy

Flash Tank



STAS-CO2
UK-48 Cores for POE

R744 state	Temperature	Maximum ppm Moisture
Liquid	-40°C (-40°F)	130
	-10°C (14°F)	405
Vapour	-40°C (-40°F)	7
	-10°C (14°F)	33

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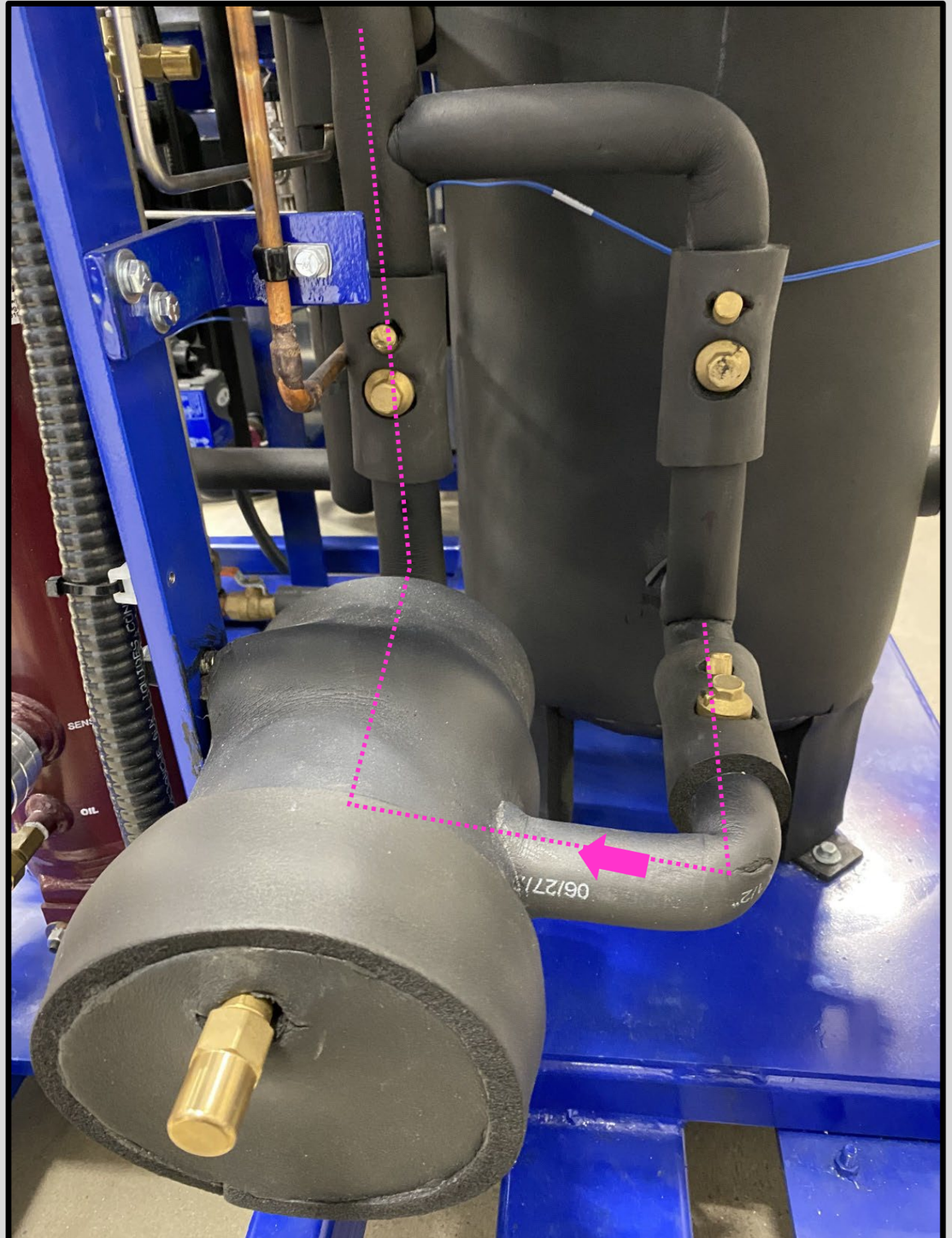
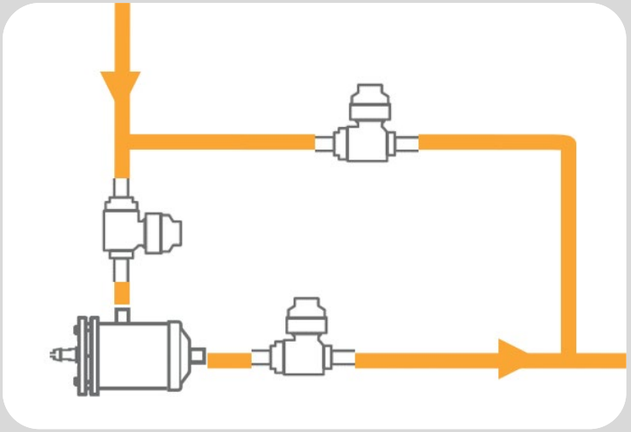
Liquid Line Filter Drier

R744 state	Temperature	Maximum ppm Moisture
Liquid	-40°C (-40°F)	130
	-10°C (14°F)	405
Vapour	-40°C (-40°F)	7
	-10°C (14°F)	33





Dry Ice, if Liquid is left in drier shell when opening

Installed at the Bottom of the Flash Tank

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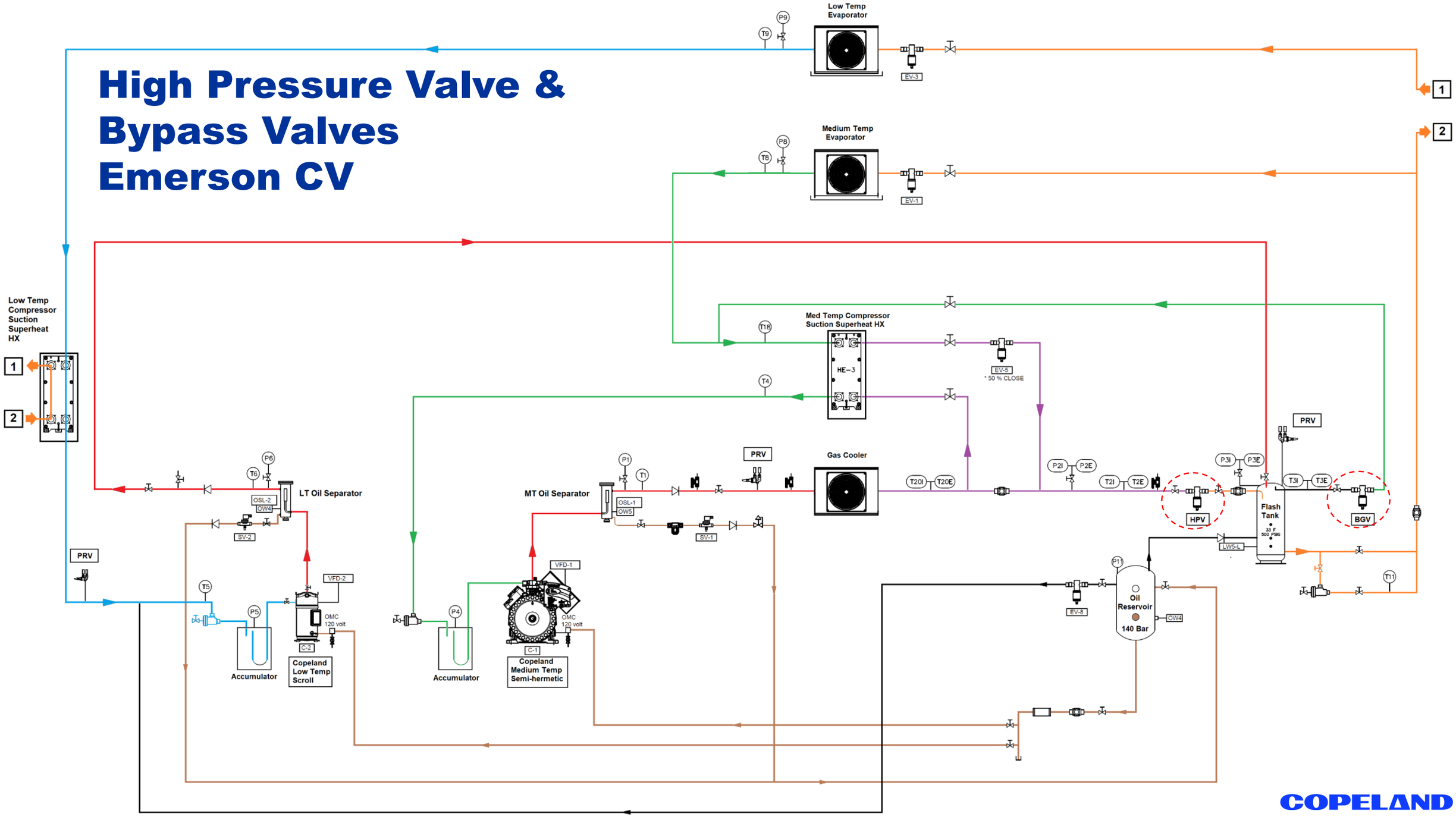
High Pressure Valve & Bypass Valves Emerson CV



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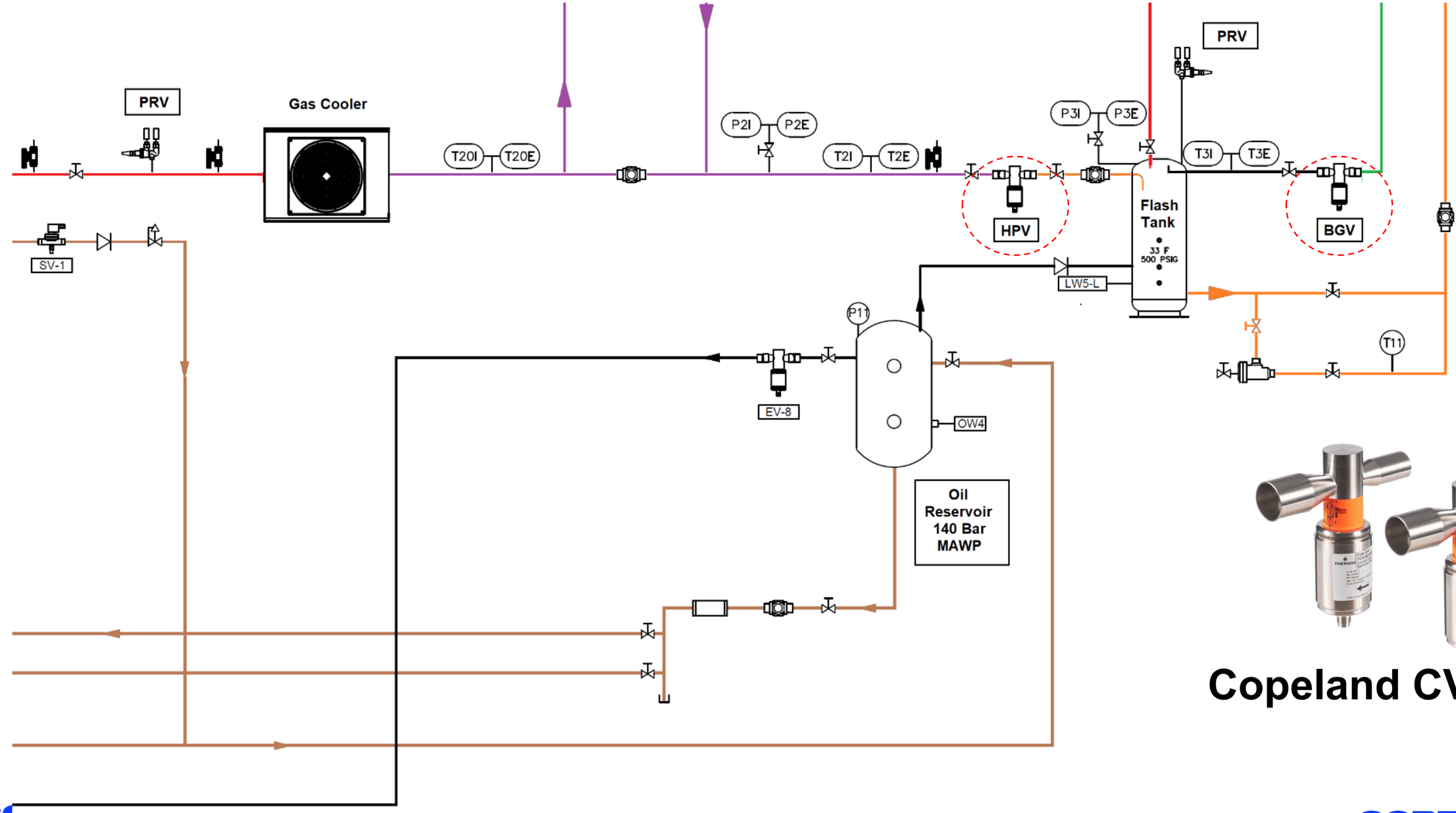
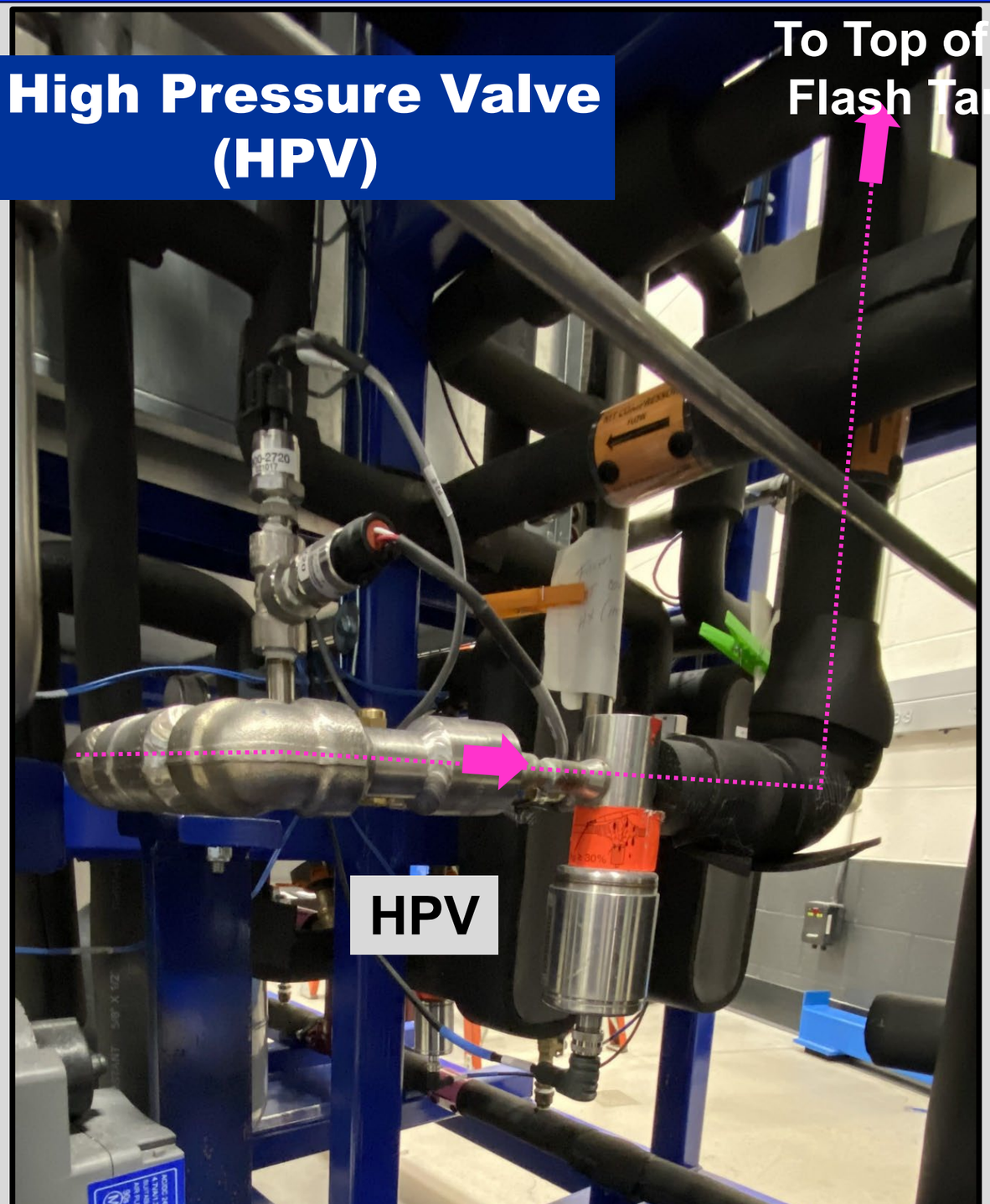
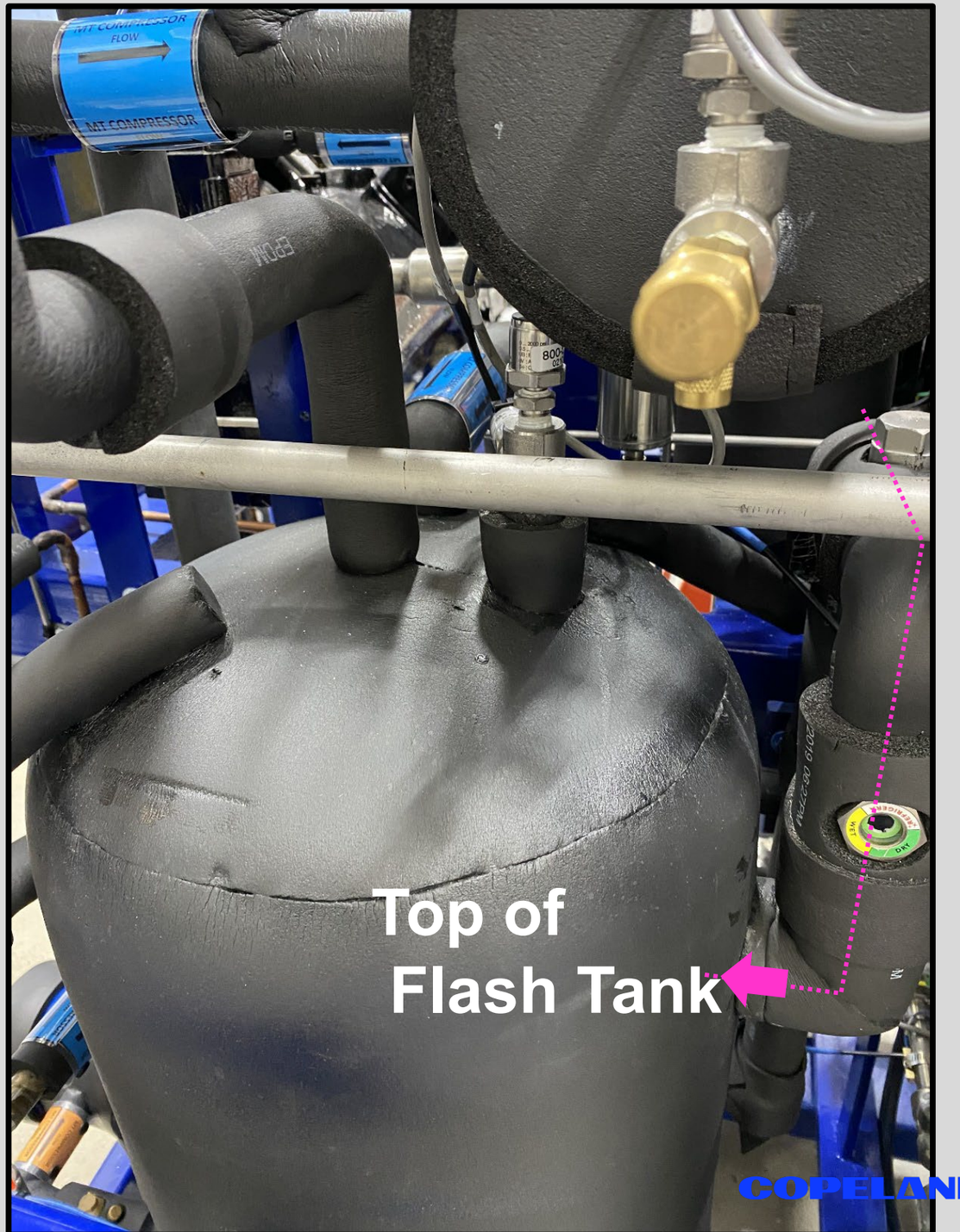
High Pressure Valve & Bypass Valve



Copeland CV Valves

High Pressure Valve (HPV)





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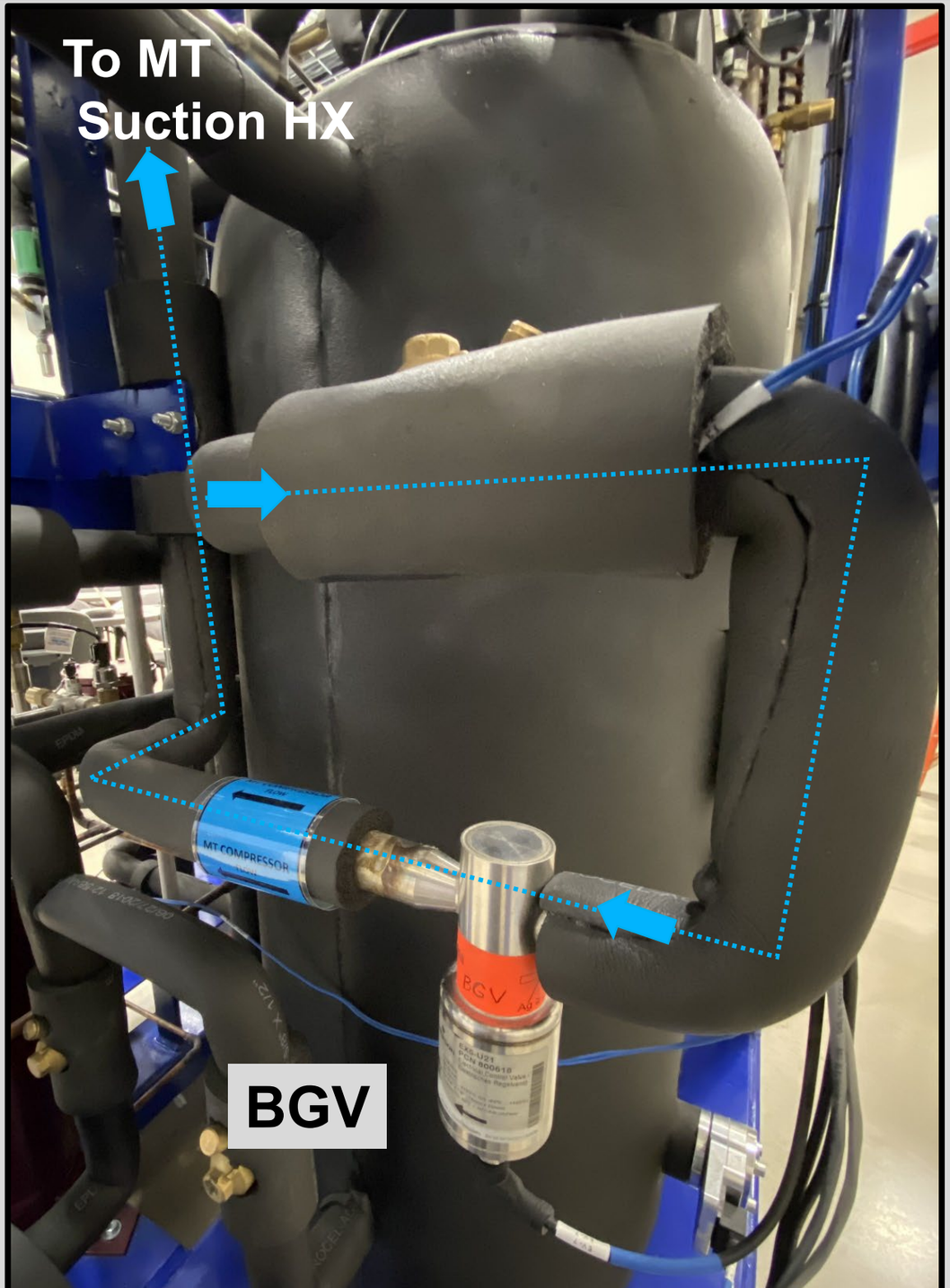
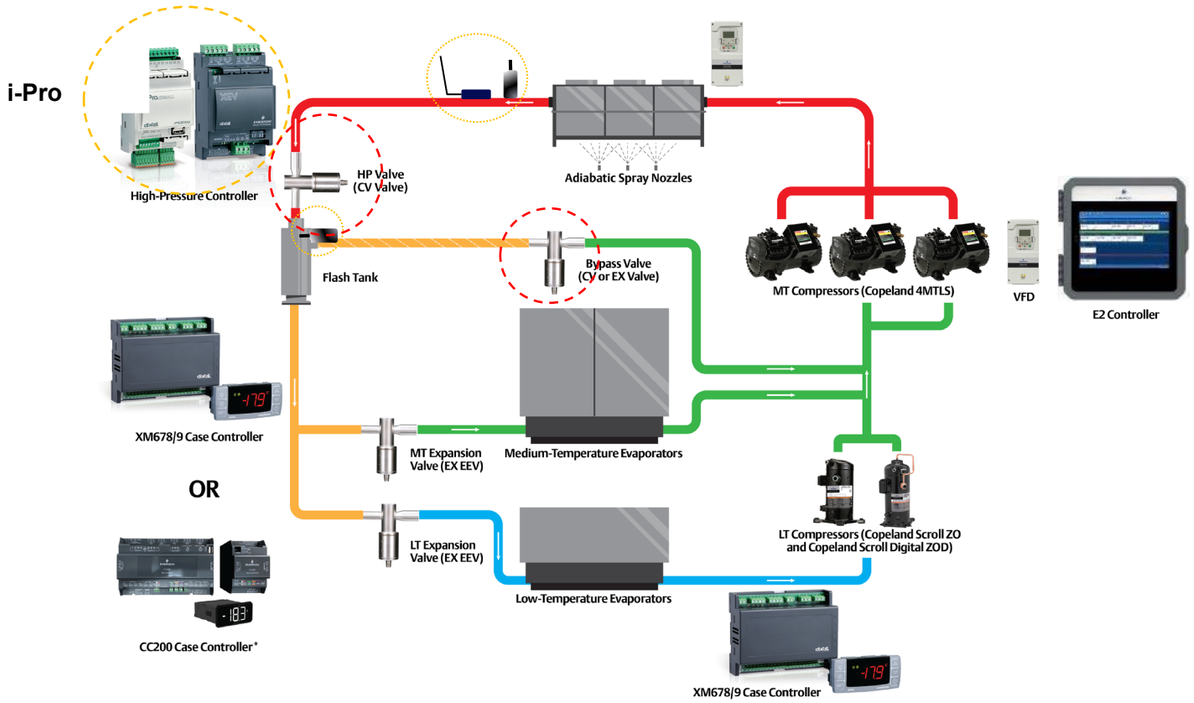
Bypass Gas Valve (BGV)



CO2 High Pressure Controller



Inputs

1. Gas Cooler Out Pressure
2. Gas Cooler Out Temp.
3. Flash Tank Pressure
4. Capacity Demand Input

Subcritical Operation

- Maintains Subcooling In Condenser

Transcritical Operation

- Ignores Subcooling Control & Controls Gas Cooler Pressure

Transient Operation

- Avoids Hard Switch In Either Sub or Transcritical To Evade Effects of Rapid CO2 Density Change

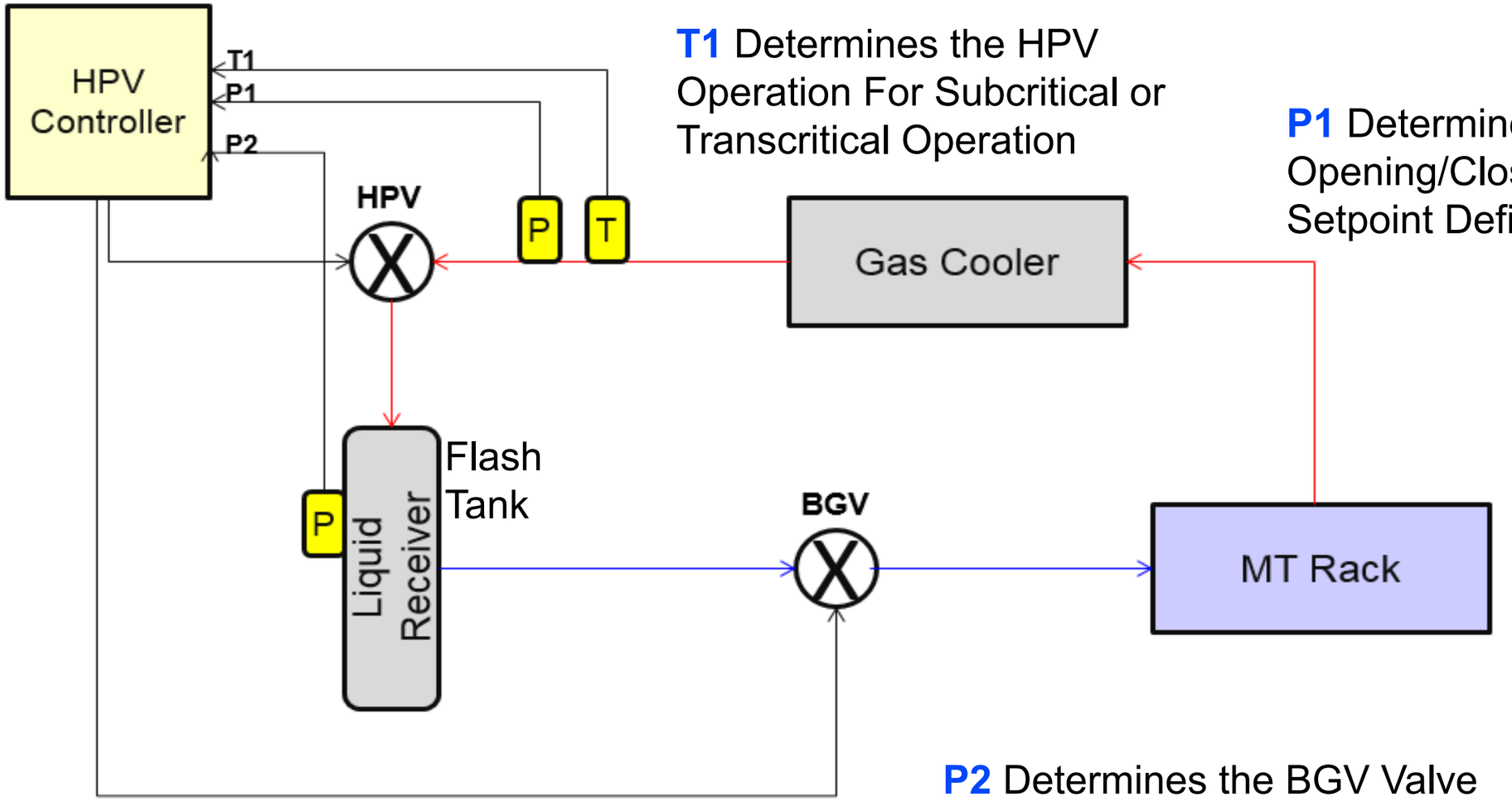
High Pressure Valve (HPV) & Bypass Valve (BPV)

–The Control Point In Both The Valves Is Flash Tank Pressure
– If Pressure Is > Set Point, The HPV Throttle & BPV Opens
– If Pressure Is < Set Point. The HPV Opens & BPV Throttles

CO_2 High Pressure Controller

- Gas Cooler Pressure & Temp, Flash Tank Pressure
- High Pressure Valve & Bypass Gas Valve
- Subcritical & Transcritical Modes
- Optimizes COP In Transcritical Mode
- Heat Reclaim Mode
- Integrated to E3 for visibility and setpoint configuration

CO_2 High Pressure Controller

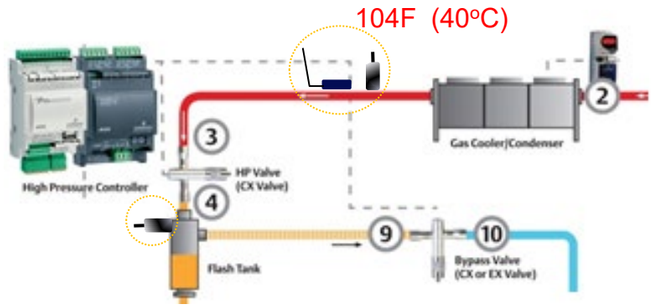


T1 Determines the HPV Operation For Subcritical or Transcritical Operation

P1 Determines the HPV Valve Opening/Closing to Maintain Setpoint Defined By T1

P2 Determines the BGV Valve Opening/Closing to Maintain BGV Setpoint

Three Examples Same Evaporator Conditions



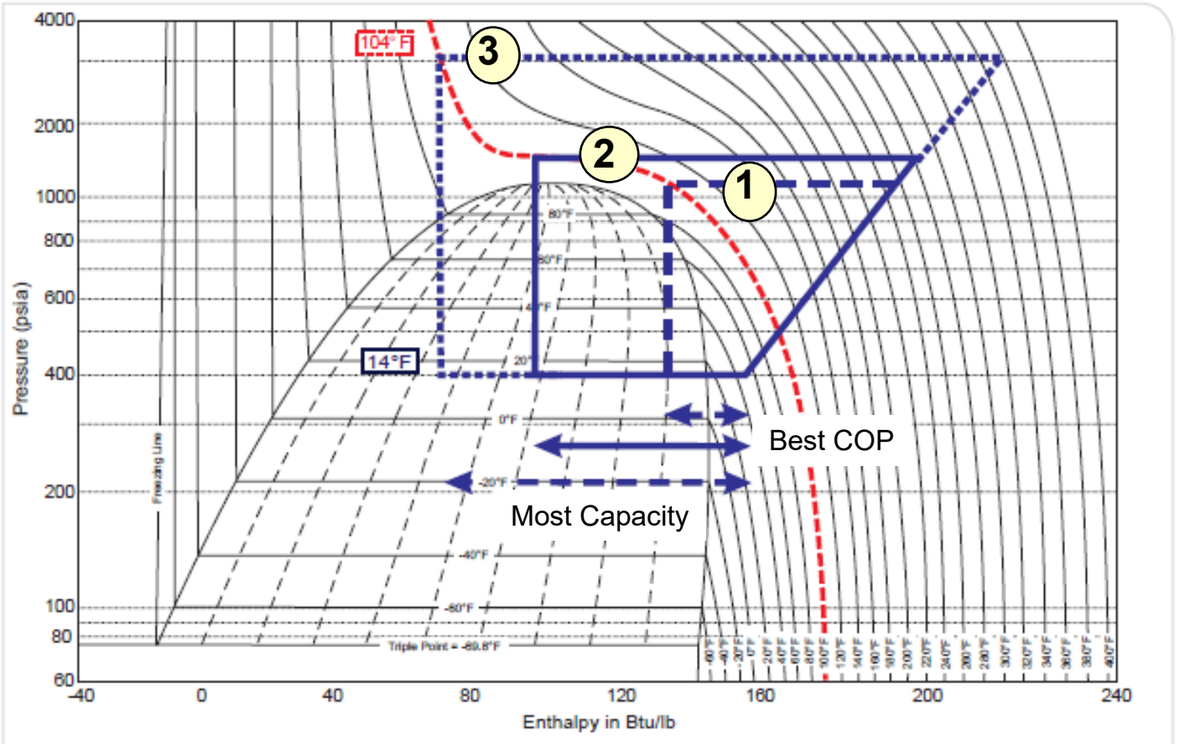
COP= Heat Energy Removed (BTU) / Power Input

Transcritical Setpoint:

- Control Temperature Value determines setpoint
  - T1 (gas cooler outlet temp) or T2 (gas cooler temp bypass) calculation setpoint

Reference Table

Gas Cooler T1 or T2 Transcritical Setpoint			
C	Bar	F	PSI
21	65	69.8	942.5
22	65	71.6	942.5
23	65	73.4	942.5
24	65	75.2	942.5
25	65	77	942.5
26	65	78.8	942.5
27	66.1	80.6	958.7
28	69.2	82.4	1002.7
29	72.2	84.2	1047.0
30	75.3	86	1091.5
31	78.3	87.8	1135.9
32	81.4	89.6	1180.2
33	84.4	91.4	1224.2
34	87.4	93.2	1267.7
35	90.4	95	1310.7
36	93.3	96.8	1352.8
37	96.1	98.6	1394.1
38	98.9	100.4	1434.4
39	101.6	102.2	1473.5
40	104.2	104	1511.2
41	106.7	105.8	1547.4
42	109.1	107.6	1582.0



For each example , R744 exits the gas cooler at 104°F. This exit temperature is a function of the size of the gas cooler and the ambient temperature, in the same way as condensing temperature is a function of the size of the condenser and the ambient temperature.

HPV and BPV Controller Display

- **Menu Driven Local Display With Ability To Change:**
  - The Modbus Address, Baud Rate, Screens Update, Time And Date, I/O, And Valve Setup
- **Status Screen Shows Both HPV And BGV With Their Corresponding Control Values And Parameters.**
  - HPV Dual And Failure/Alarm Operation Modes
  - Online/Offline Status On The XEV20
- **The I/O Configuration Screen Shows Type Of Sensors & Polarities**
- **Setup Screens Protected**

E3

CO_2 High Pressure Controller

Evaporators EEV
Emerson “CV” or “PM”

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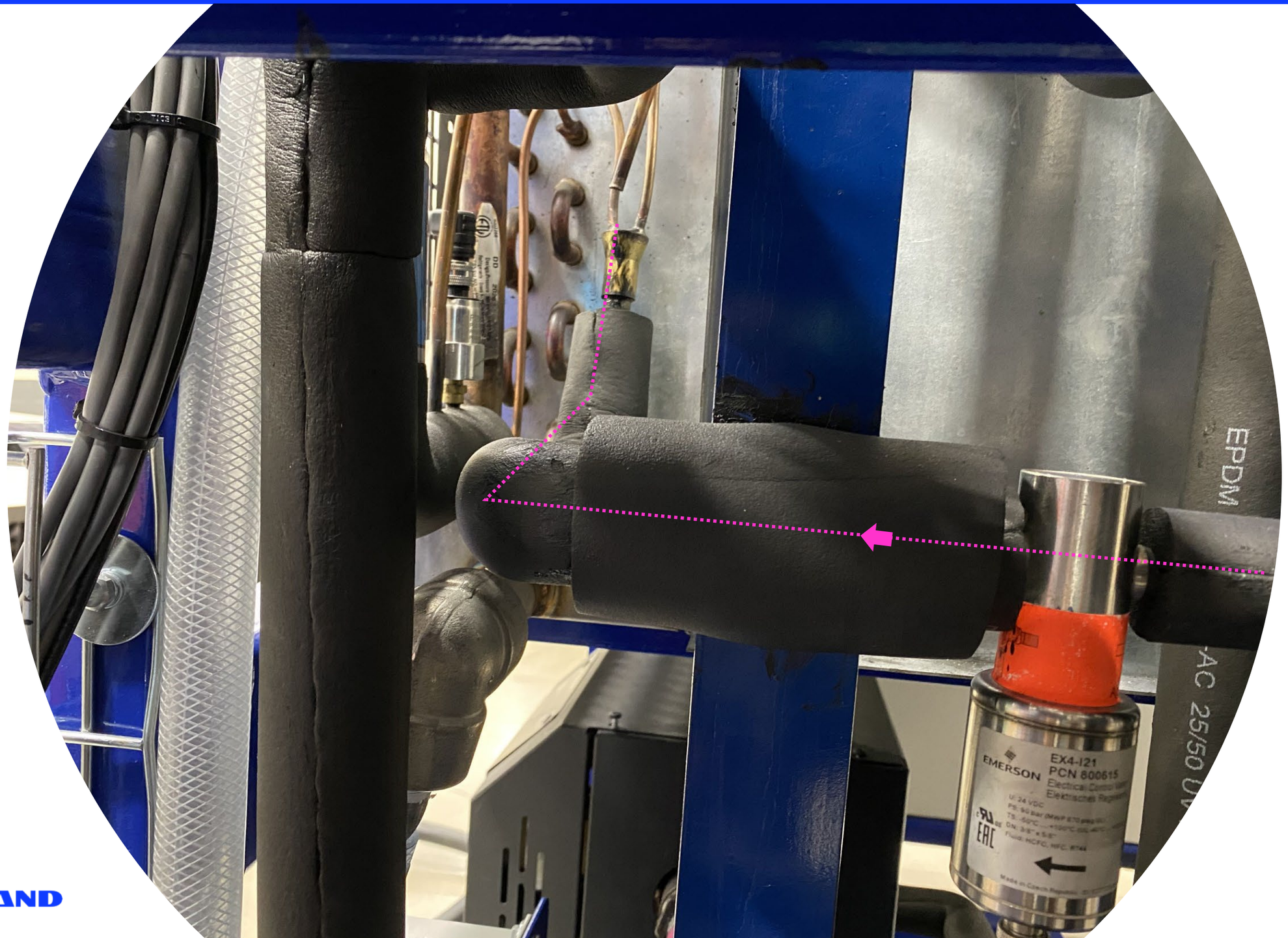
EEV



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EEV

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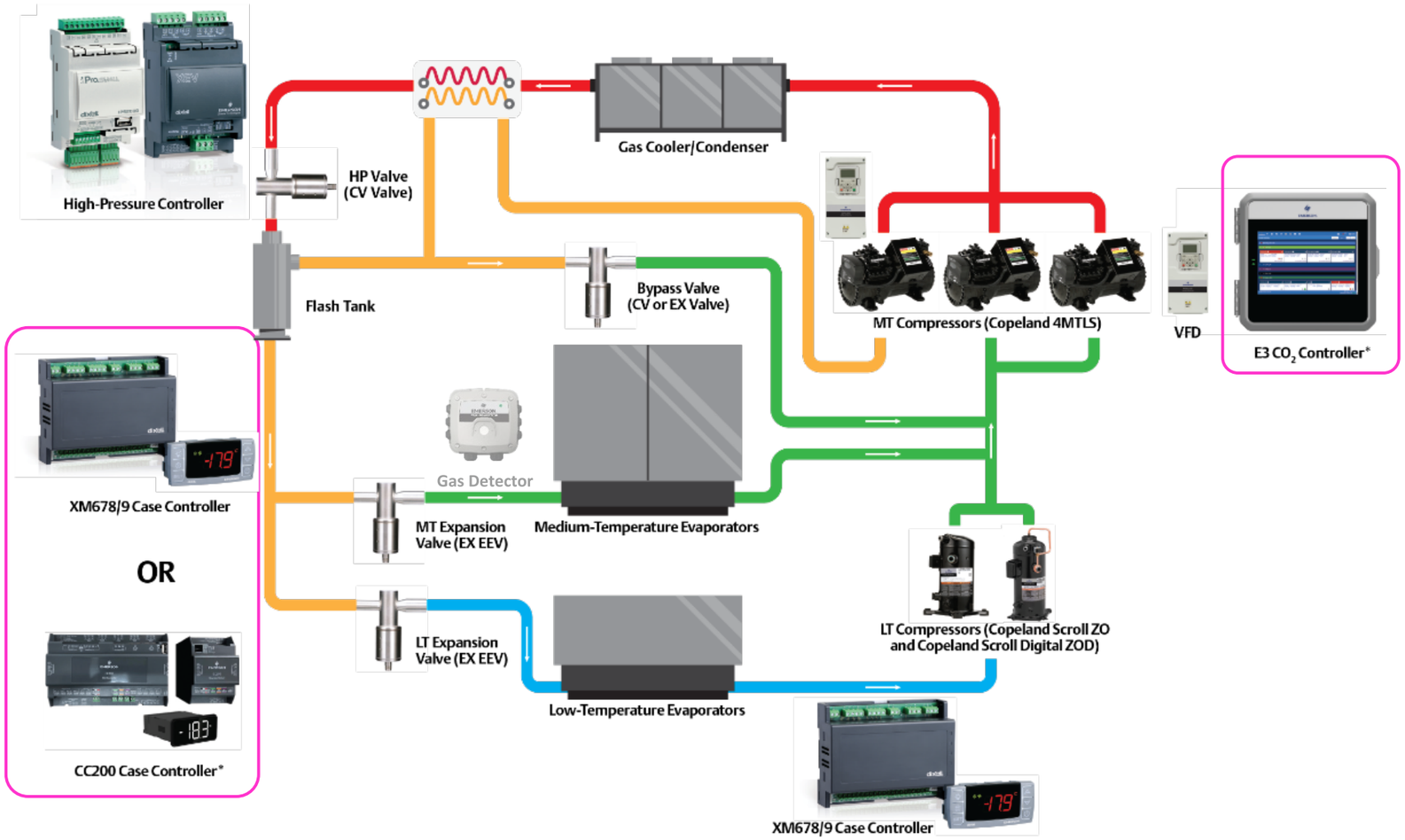
Supervisory & Case Controls



E3 Supervisory Controls

Simplified and Intuitive User Interface

- ***Intuitive Navigation***
- ***Increased Visibility:***
- ***Priority Actions:***
- ***Fast Response:***
- ***Mobile-Optimized:***
- ***Secure Data:***

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Supervisory Control

E3 with CO2 Application

CC200 Case Controls

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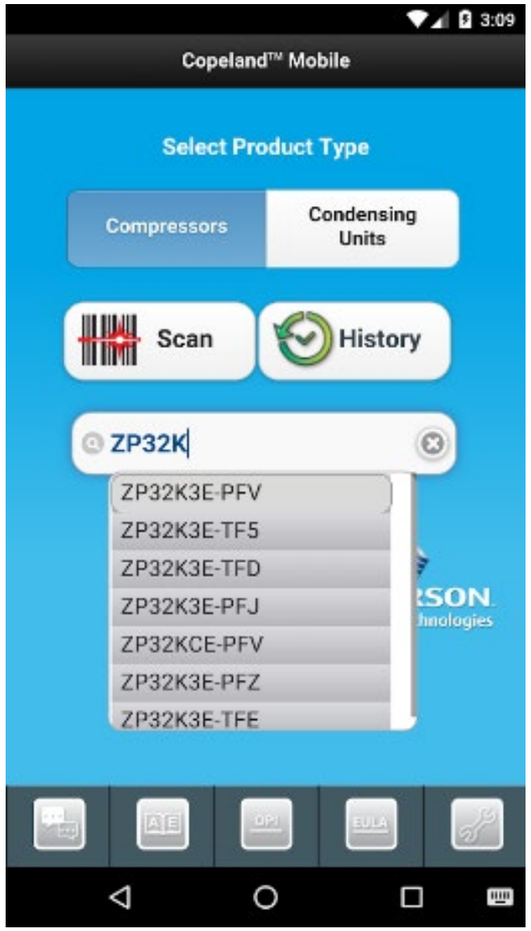
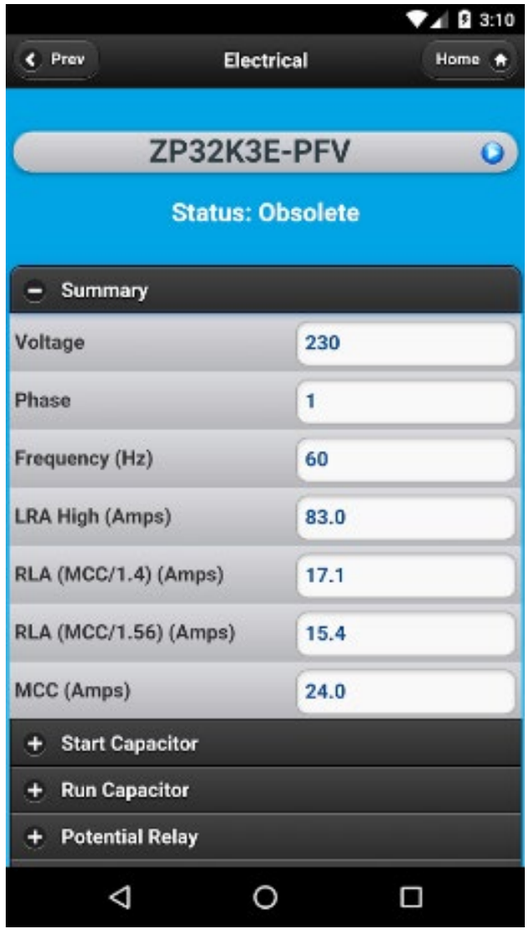
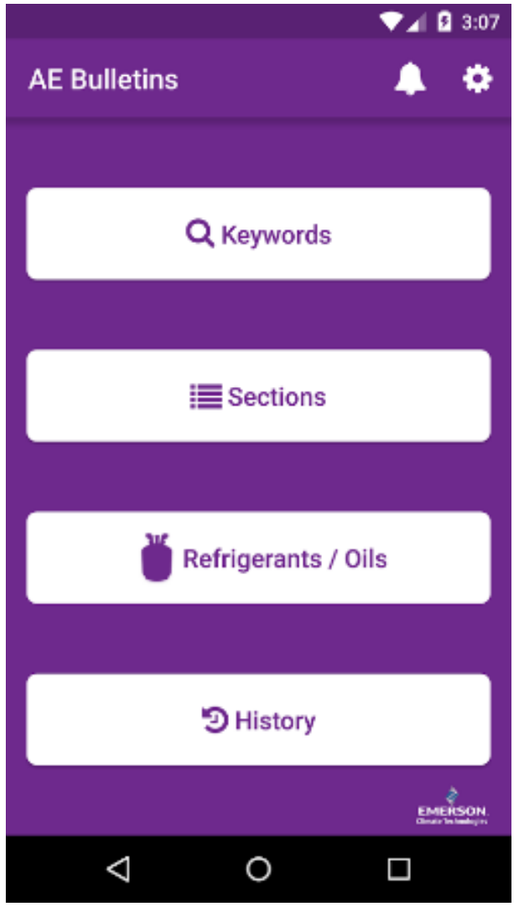
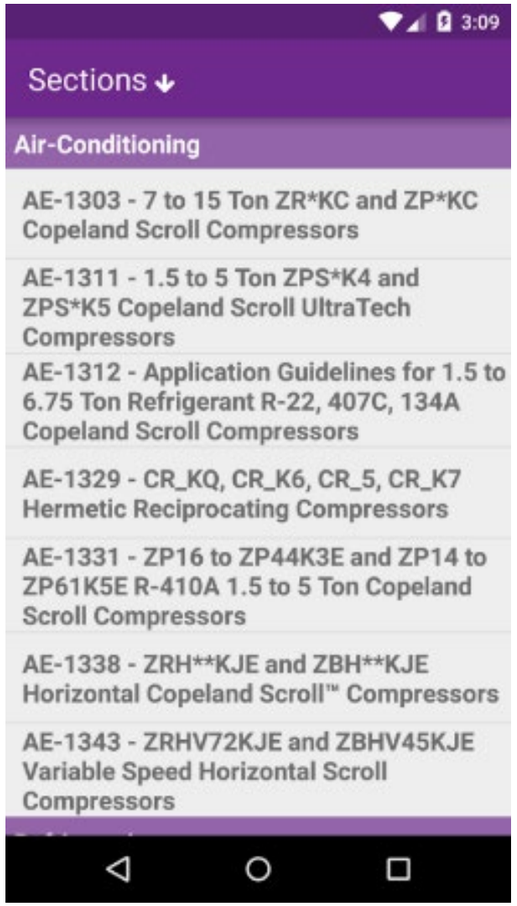
Copeland Mobile

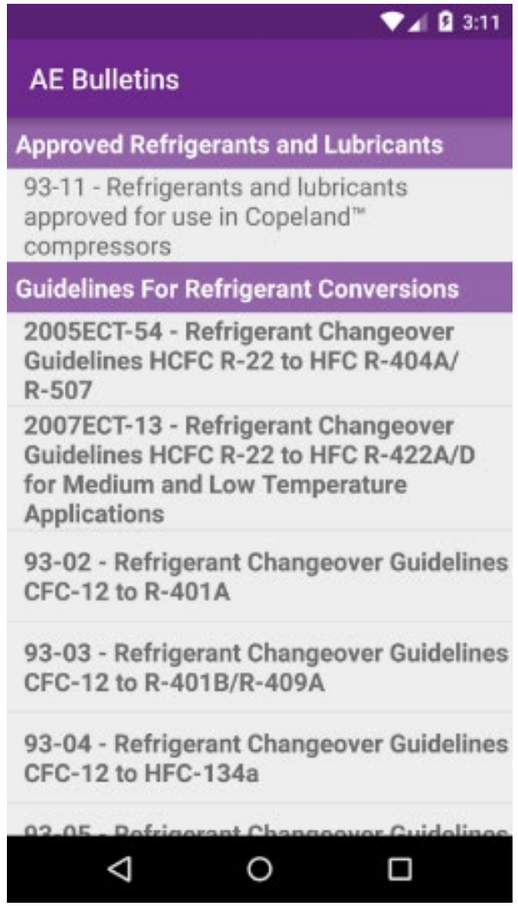


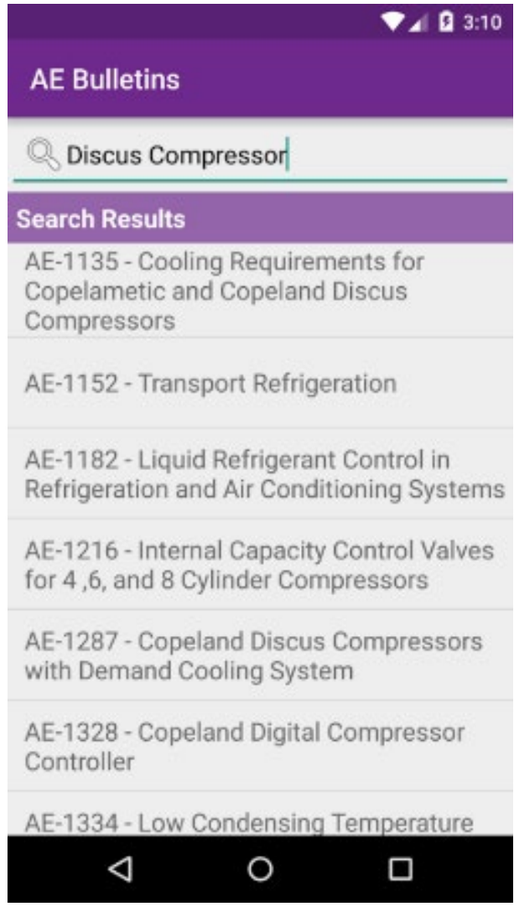


AE Bulletins – App, OPI, PSS, CPID,



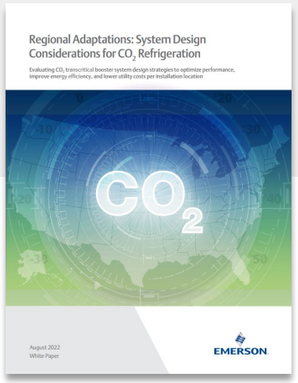




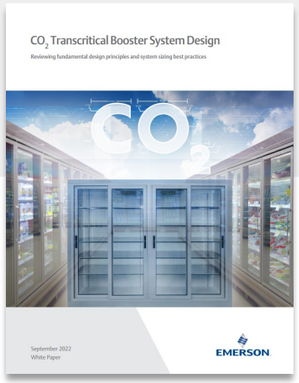


CO_2 Technical White Papers – Update and Promotional Plan

1 ***Regional Adaptations: System Design Considerations for CO_2 Refrigeration *(Not Published Yet)***

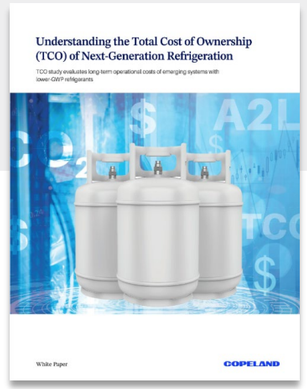


2 **CO_2 Transcritical Booster System Design**

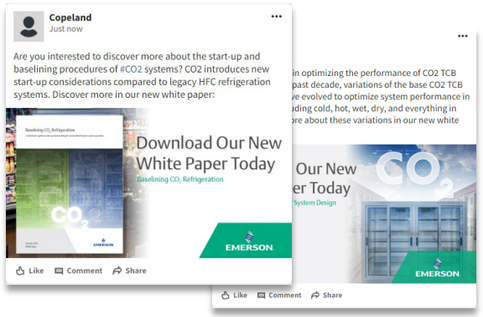


3 **Baselining CO_2 Refrigeration**

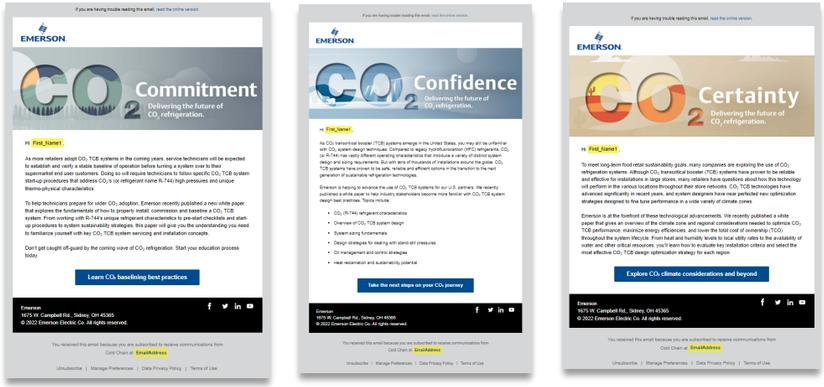
4 **Total Cost Of Ownership**



Social



Email Communications



→ You can access the white papers within our https://e360hub.copeland.com/

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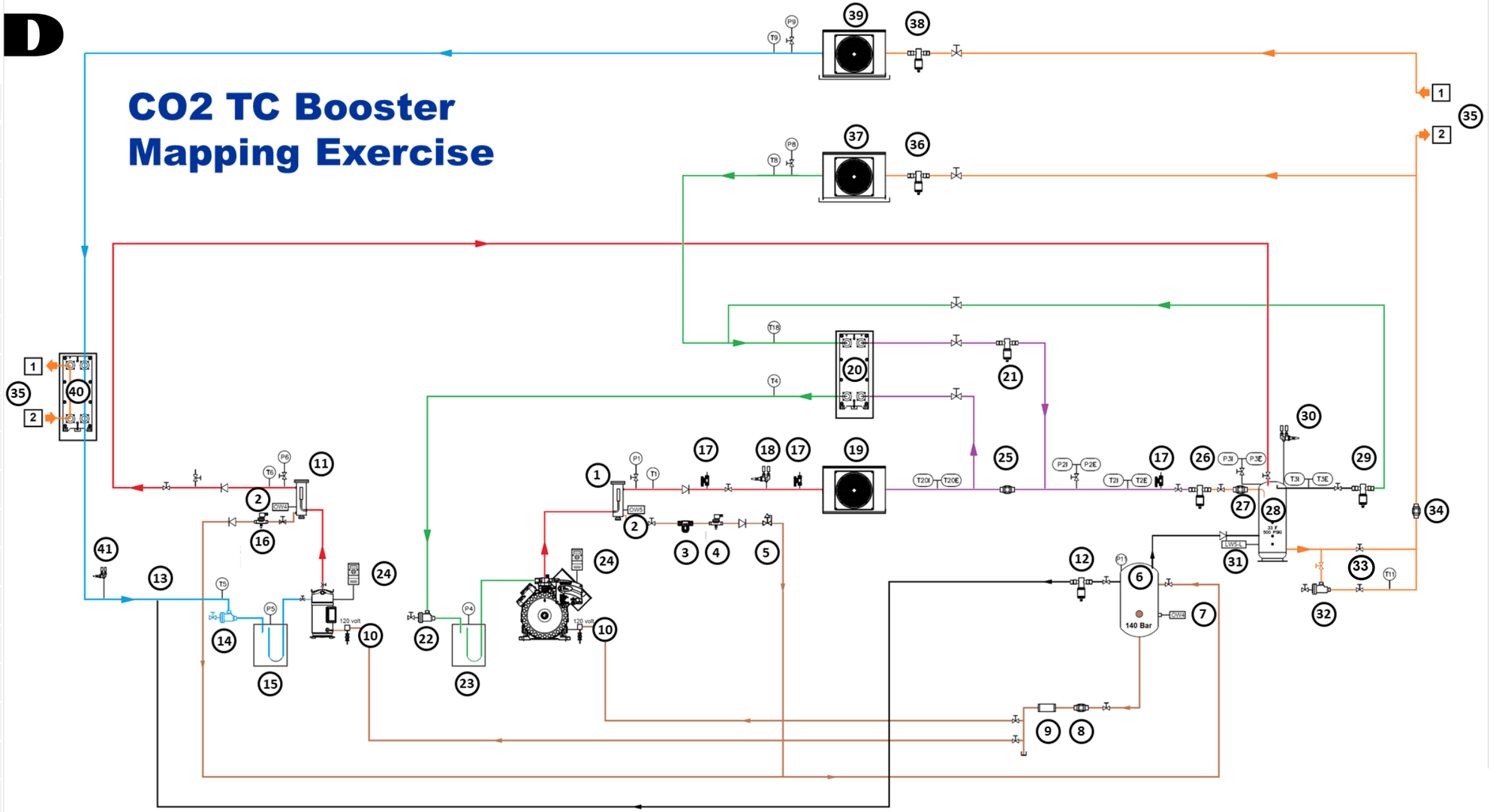
Let’s go Check out The Unit!

Thank you!

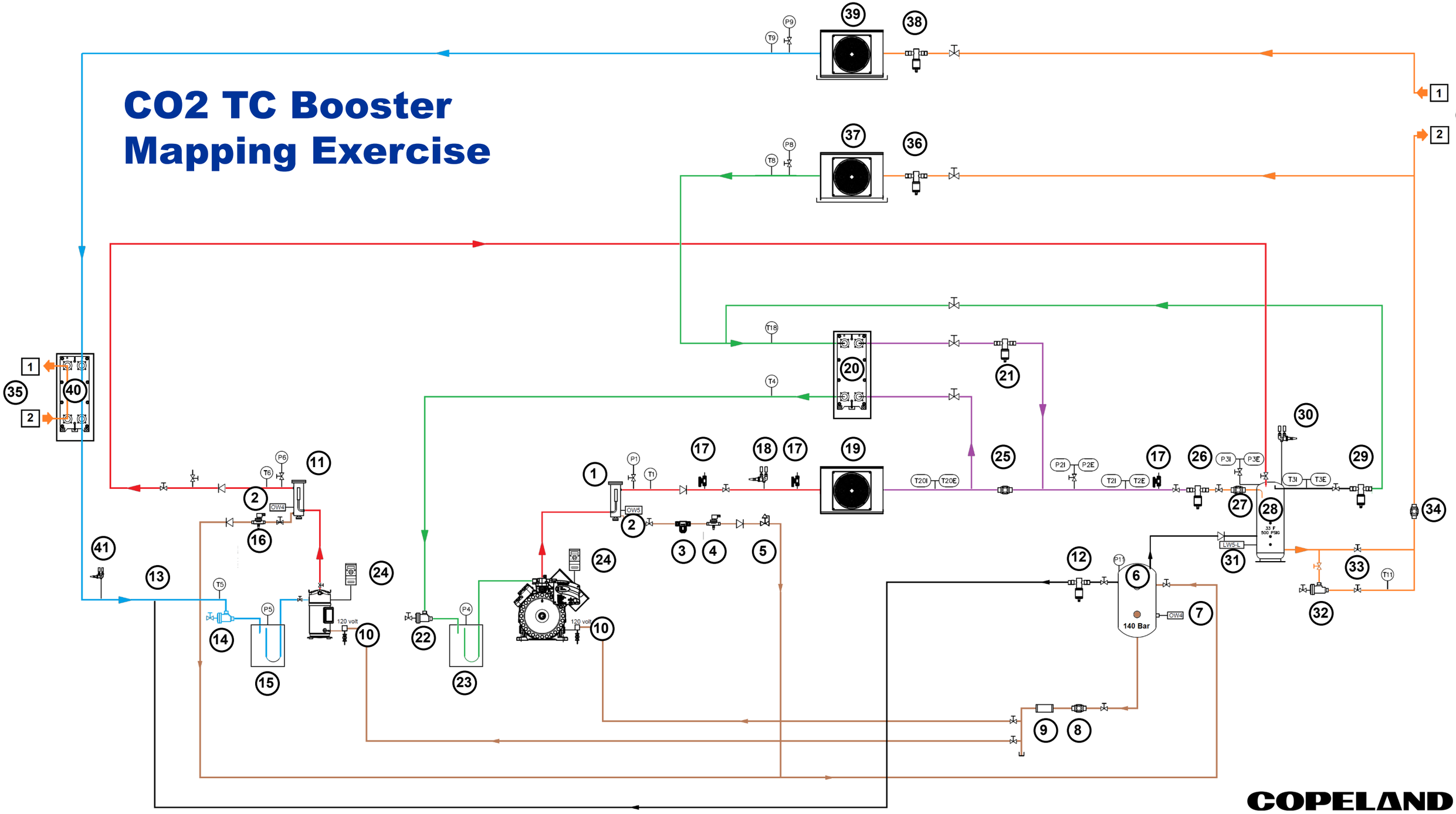
COPELAND

CO2 TC Booster Mapping Exercise



-	MT Copeland 4MTLS Compressor
-	LT Copeland Scroll Compressor
1	MT Oil Separator
2	Oil Level Control; MT Oil Separator
3	Oil Line; MT Press. Reducing Valve
4	Oil line, MT Solenoid Valve
5	Outlet Pressure Reg, MT Oil Line
6	Oil Reservoir
7	Oil Reservoir, Oil Level Control
8	Oil Line Sight Glass
9	Oil Line Filter Drier
10	Oil Level Regulator for Compressor
11	LT Oil Separator
12	Reservoir Press. Reducing Valve
13	Oil Reservoir Press. Release Point
14	LT Suction Filter
15	LT Suction Accumulator
16	LT Sep. Outlet Oil Solenoid Valve
17	Access Valve MT High Side
18	PRV for MT Discharge Line
19	Gas Cooler
20	MT Suction Heat Exchanger
21	Flow Reg Valve for MT Suction HX
22	MT Suction Filter
23	MT Suction Accumulator
24	Variable Speed Drive
25	Sight Glass Gas Cooler Out
26	High Pressure Valve (HPV)
27	Sigh Glass at outlet of HPV
28	Flash Tank / Receiver
29	Bypass Gas Valve (BGV)
30	PRV for Flash Tank
31	Low Liquid Level Control for Flash Tank
32	Liquid Line Filter Drier
33	Shut Off Valves to Change Drier Core
34	Liquid Line Sight Glass
35	Inlet & Outlet if Liquid to LT Suction HX
36	EEV for MT Evaporator
37	MT Evaporator
38	EEV for LT Evaporator
39	LT Evaporator
40	Liquid to LT Suction HX
41	PRV for LT Suction

CO2 TC Booster
Mapping Exercise



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