

Today's Presentation



Natural Refrigerant Training Summit

Building a Sustainable Workforce

Troubleshooting HPCV/FGBV

Rusty Walker

Affiliation/Company



NORTH AMERICAN
Sustainable
Refrigeration
Council



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Natural Refrigerant Training Summit

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North American Sustainable Refrigeration Council (NASRC)



Mission Create sustainable future for supermarket refrigeration by removing barriers to natural refrigerant adoption

➤ **501c3**
Non-Profit Organization

➤ **150+**
Members

➤ **51,000+**
Food Retail Locations

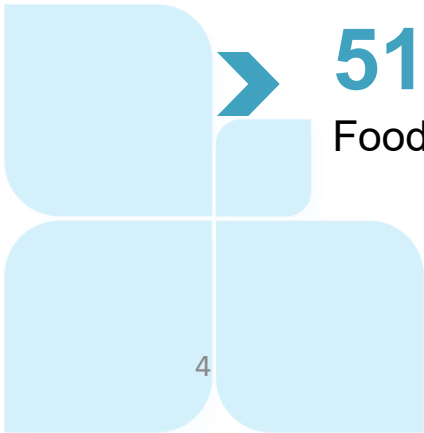
- Goals**
- **Build sustainable workforce**
 - Increase funding options
 - Increase education & awareness

Natural Refrigerants

Carbon Dioxide
R744

Propane
R290

Ammonia
R717



Need help? Look for NASRC staff!



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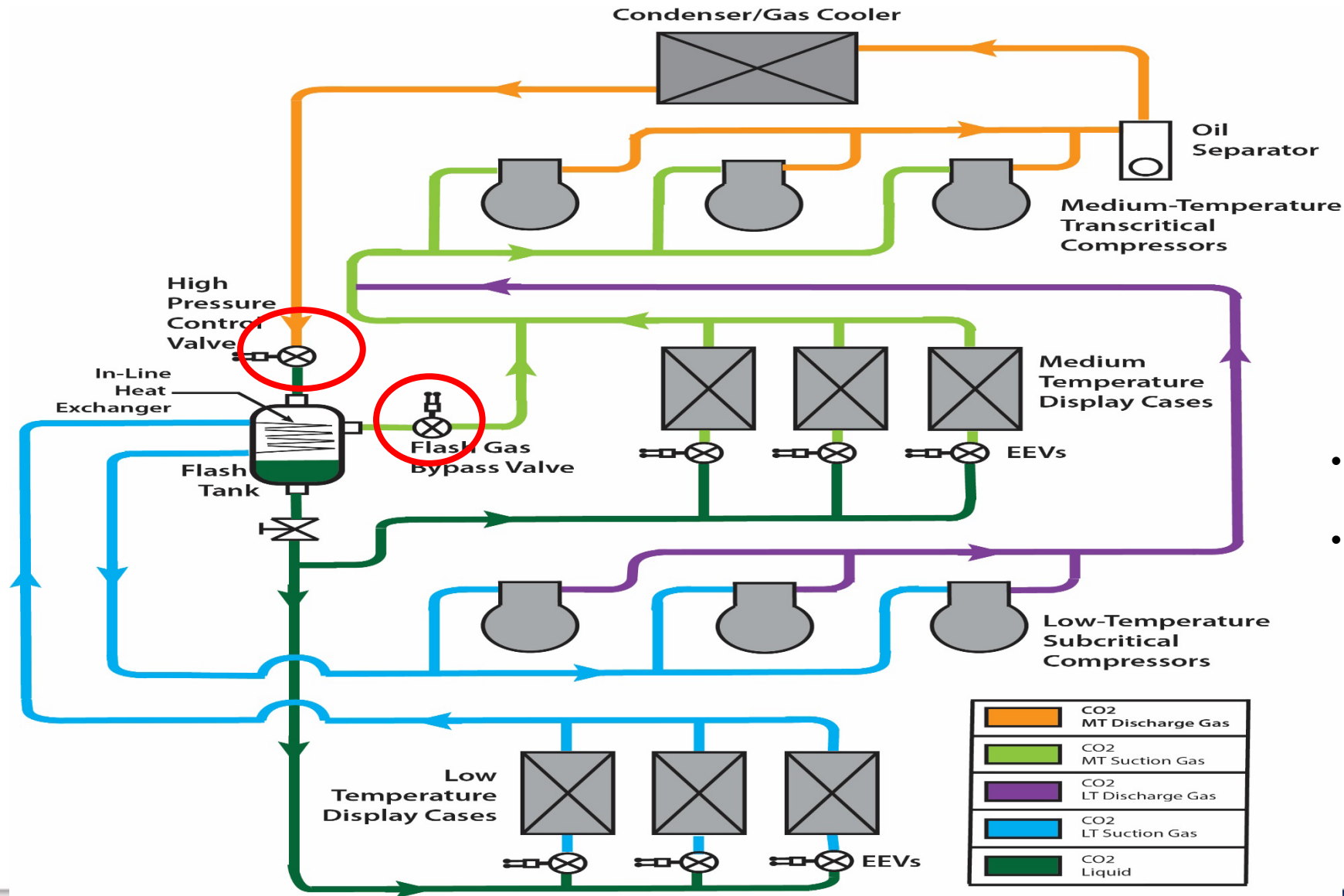
Troubleshooting the High Pressure Control Valve and Flash Gas Bypass Valve

Rusty Walker

Advansor R-744 Booster Refrigeration System

- Utilizes same vapor-compression refrigeration cycle as used in traditional refrigeration systems, including the same components.
- Since CO₂ has a high volumetric heat capacity, smaller diameter piping may be used for the system.
- The same refrigerant moves between the low- and medium-temperature compressors. The LT compressors discharge to the suction of the MT. In other words, the LT compressors serve as a **booster** to the MT compressors.
- Under some operating conditions (high ambient) the CO₂ can become supercritical. Thus a special type of condenser is utilized. A condenser that works as a gas cooler under higher ambient conditions

Advansor CO2 Booster System Diagram



3 Inputs

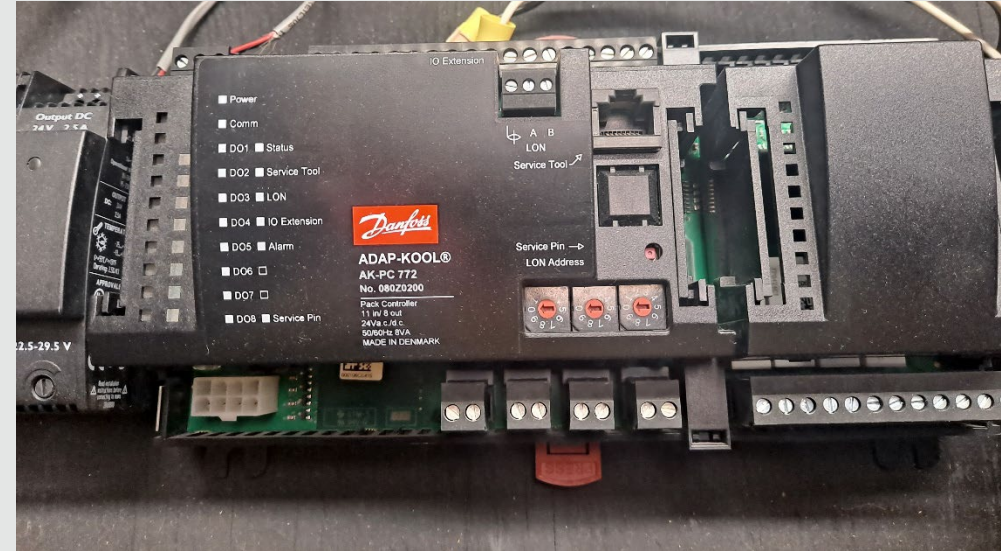
- Drop Leg Pressure
- Drop Leg Temperature at the outlet of the condenser/gas cooler
- Receiver Pressure

2 Outputs

- 0-10 VDC to operate the HPCV
- Four wire stepper valve to operate FGBV

	CO2 MT Discharge Gas
	CO2 MT Suction Gas
	CO2 LT Discharge Gas
	CO2 LT Suction Gas
	CO2 Liquid

Controllers for HPCV/FGBV



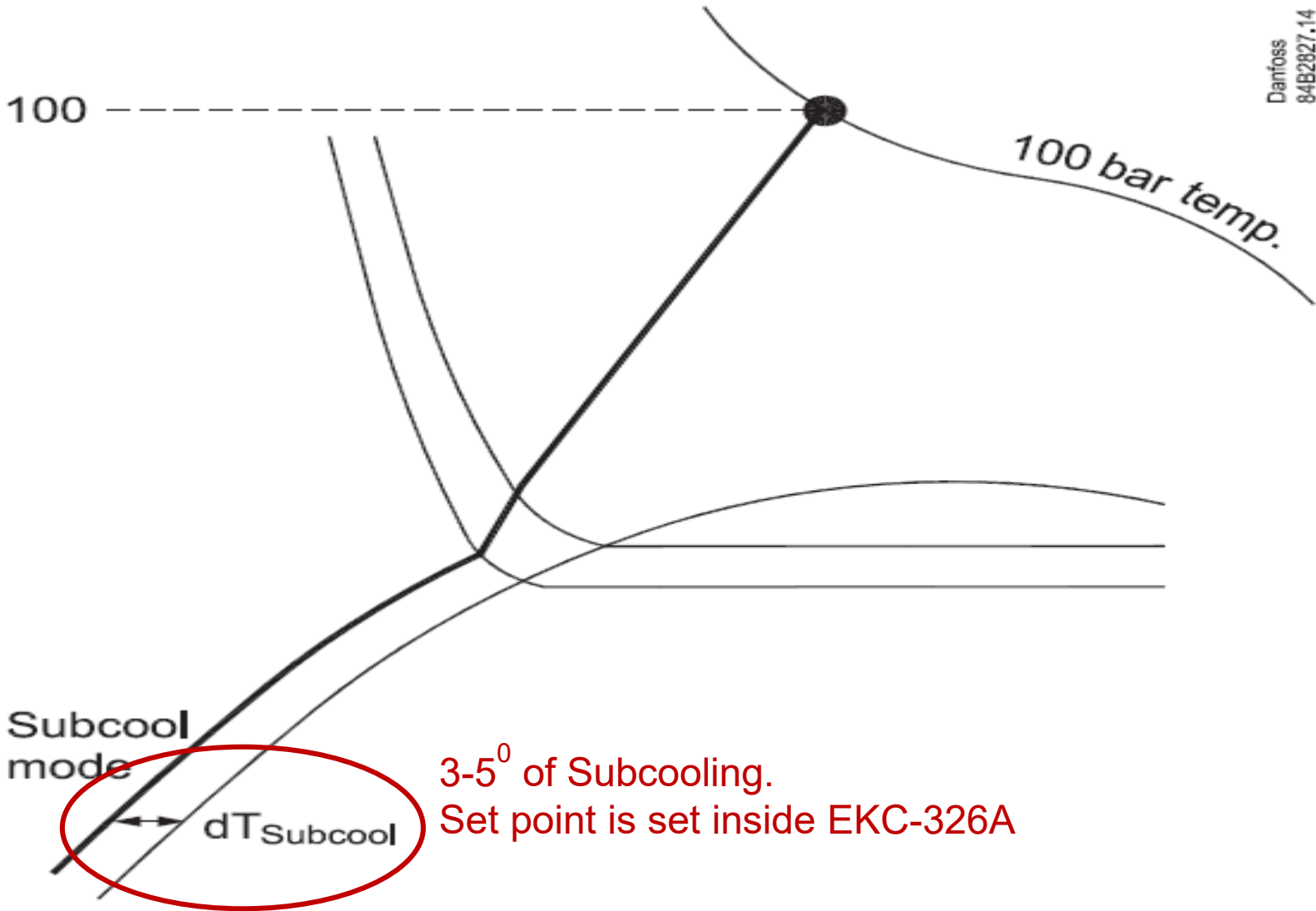
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ANTHONY®

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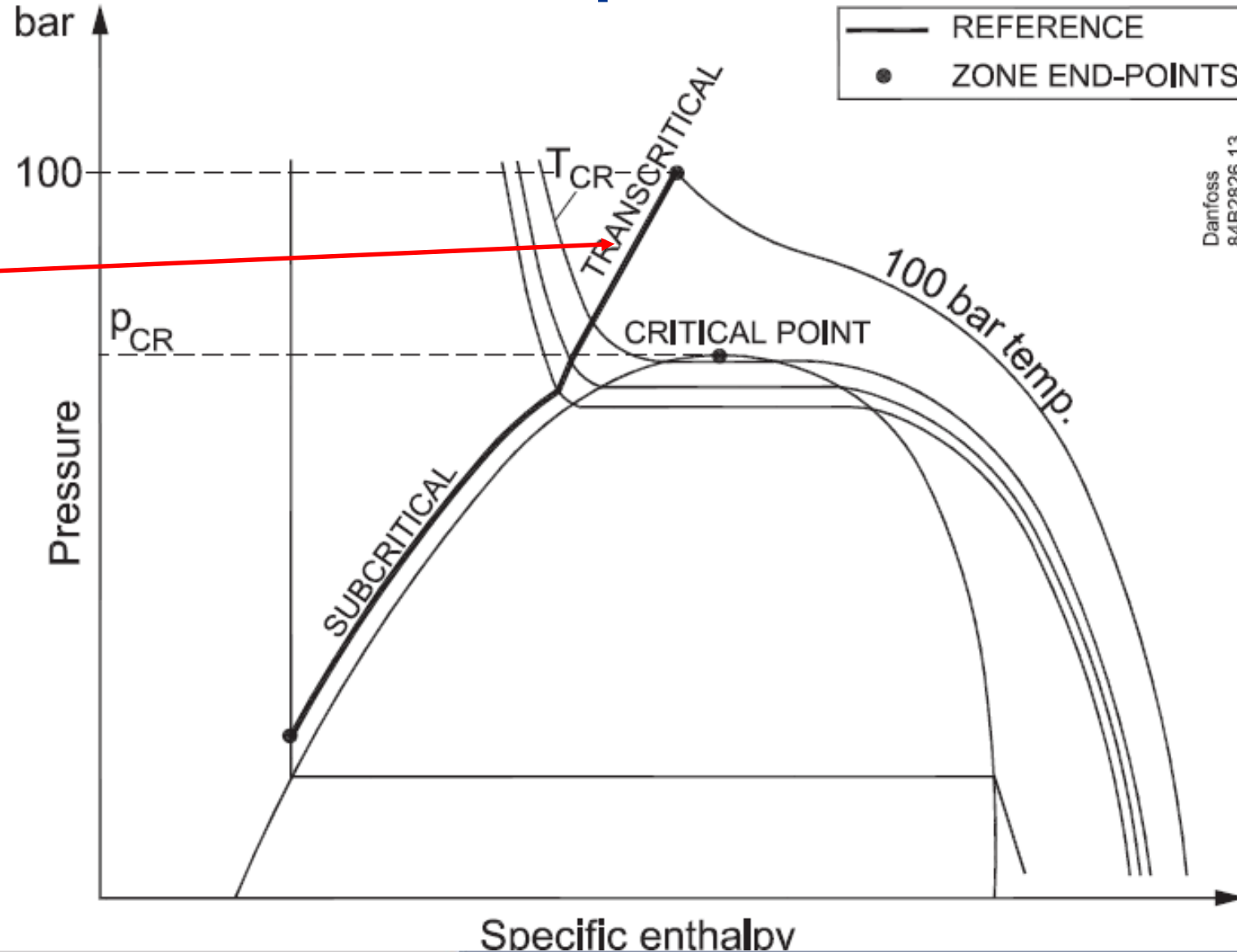
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Subcritical Operation



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



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Drain Leg Temp Sensor

IMPORTANT: Sensors must be installed according guidance below

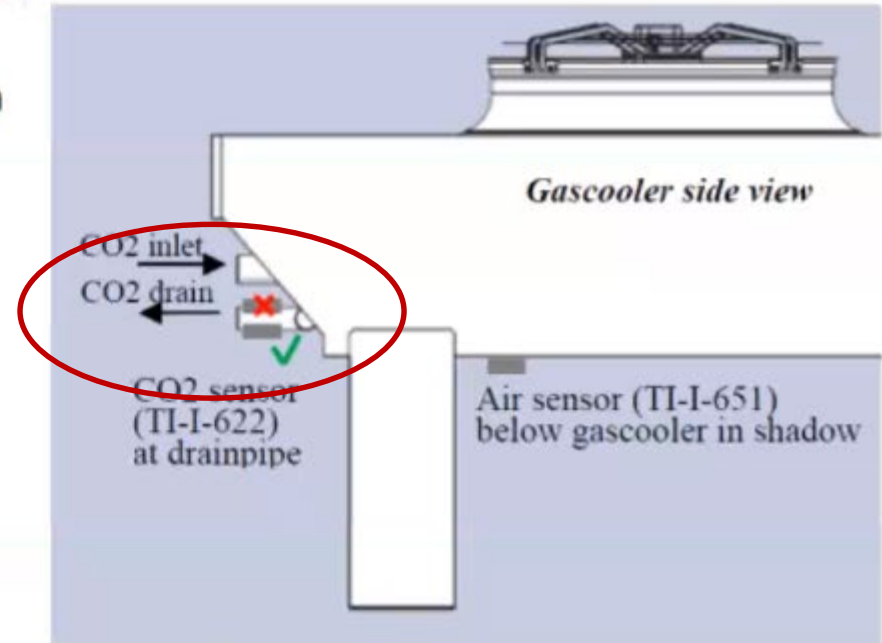
Mounting of CO2 and Air sensors on gascooler:

CO2 sensor(s) TI-I-622(A/B) must be mounted on drain from gascooler at 5 or 7 o'clock on horizontal pipe, min. 30 cm (12 inch) from the gascooler, as shown on sketch.

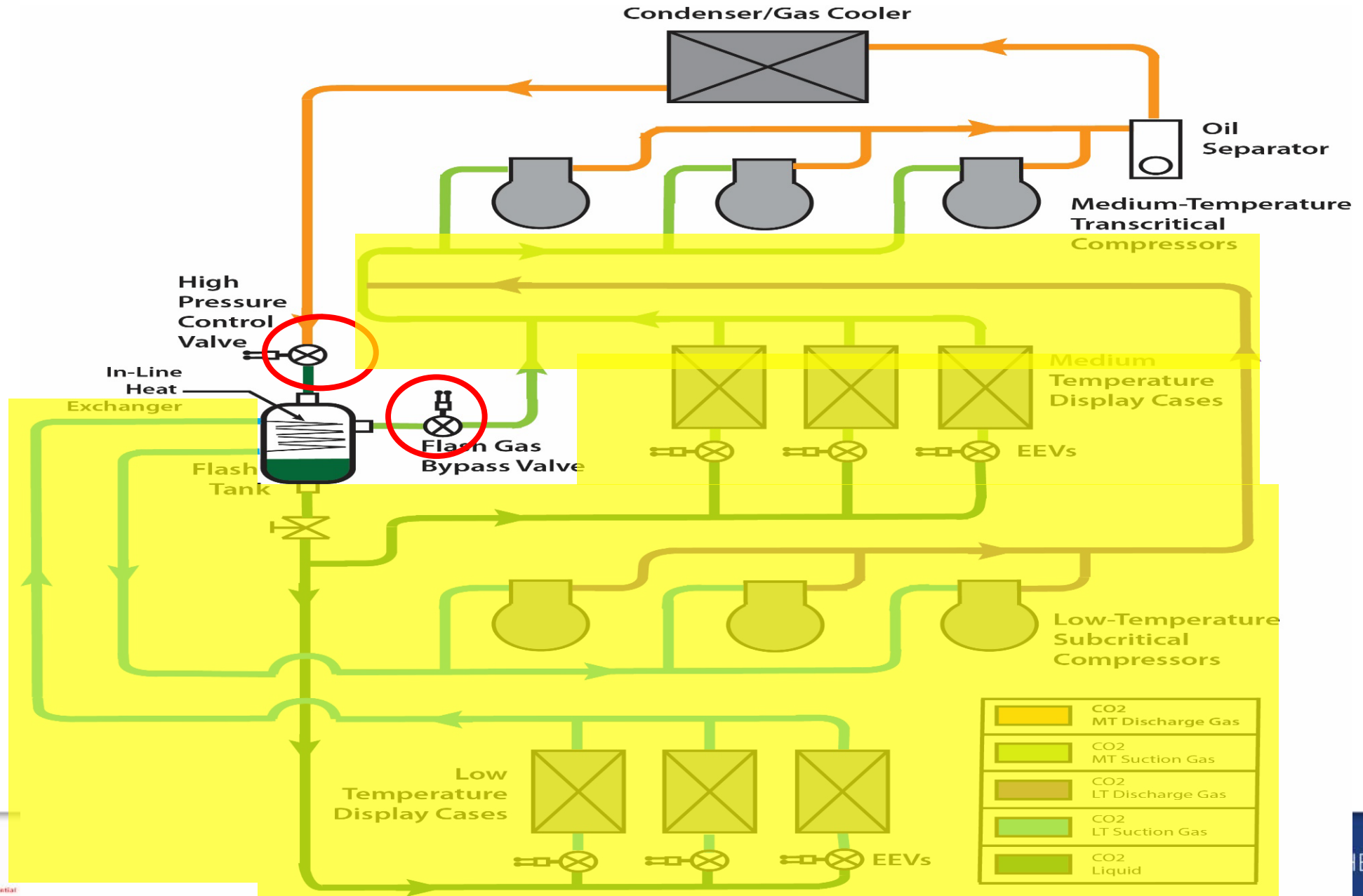
Air sensor TI-I-651 must be mounted in airstream in shadow below gascooler.

Materials to use:

- Metal clamps, thermal paste and waterproof insulation for CO2 sensor
- Branch for Air sensor

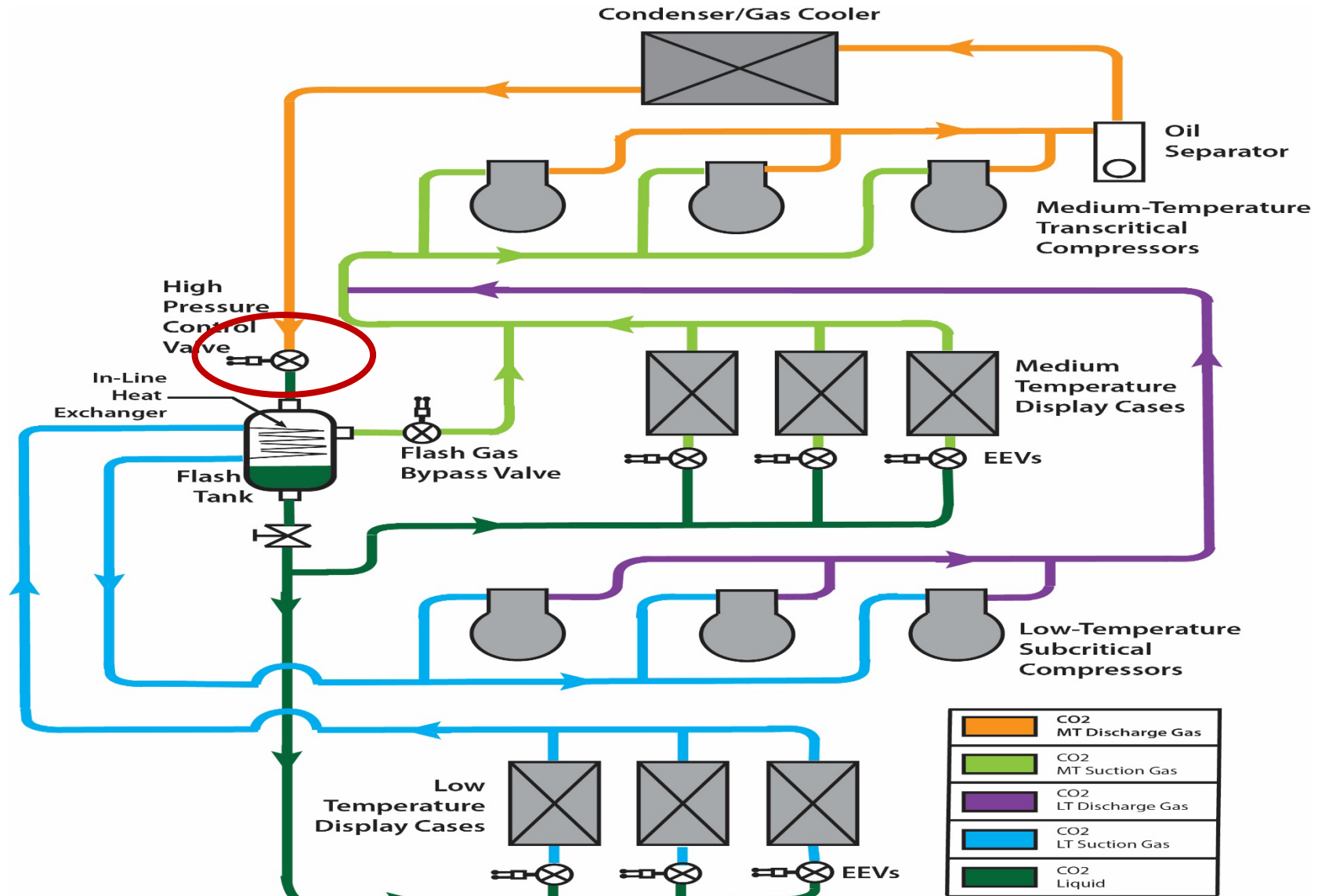


Advansor CO2 Booster System Diagram



High Pressure Control Valve

High Pressure Control Valve (ICMT)

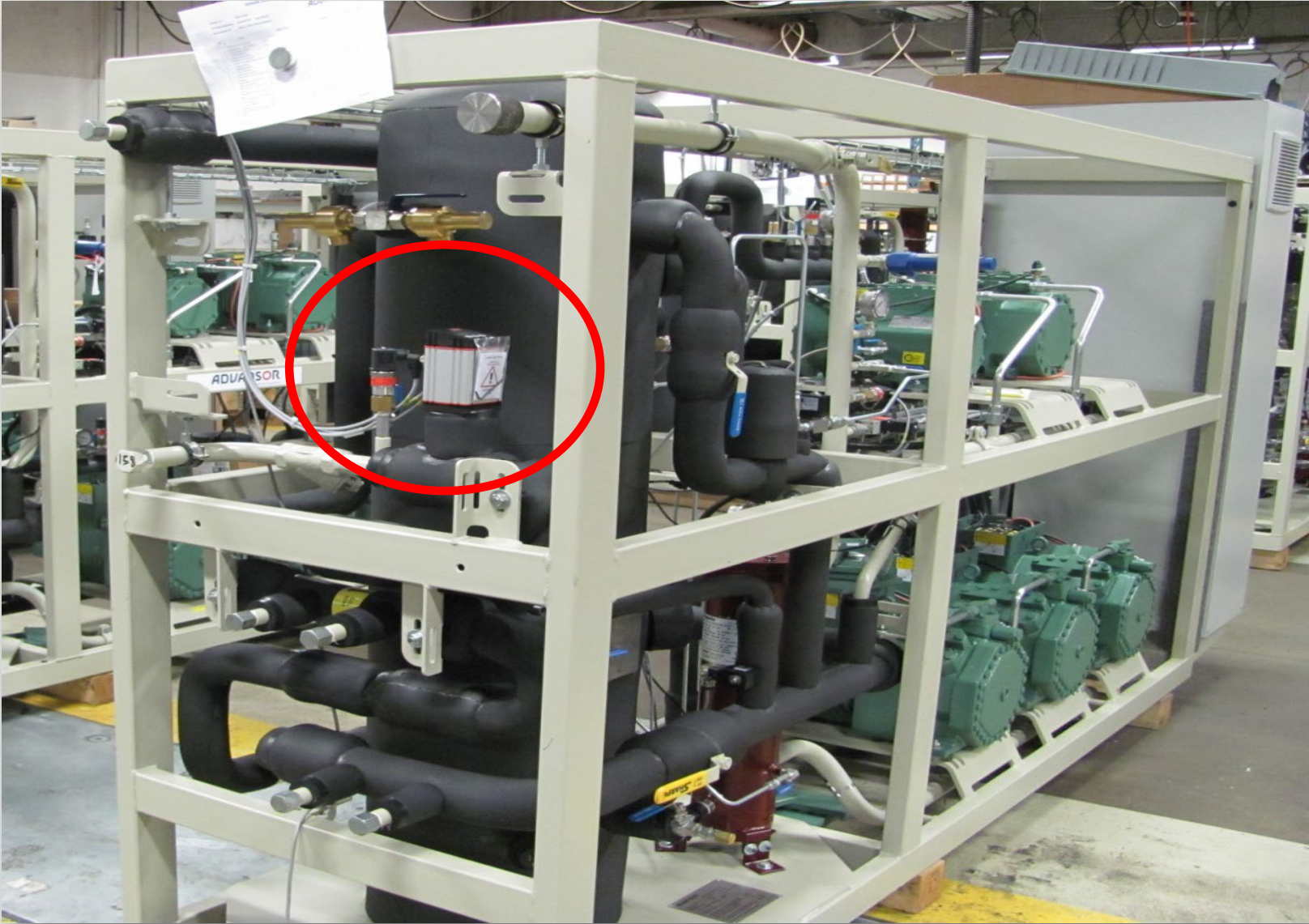


High Pressure Control Valve

- ❑ Subcritical - The ICMT valve controls subcooling to about 3-5⁰F
- Transitional - Between 72⁰F – 85⁰F
- Tries to maintain 3- 5⁰F Subcooling while the fans are controlled to 77⁰F
- ❑ Transcritical - Above 85⁰F ICMT work to drop the pressure of the supercritical gas to create a change of state



High Pressure Control Valve (ICMTS)



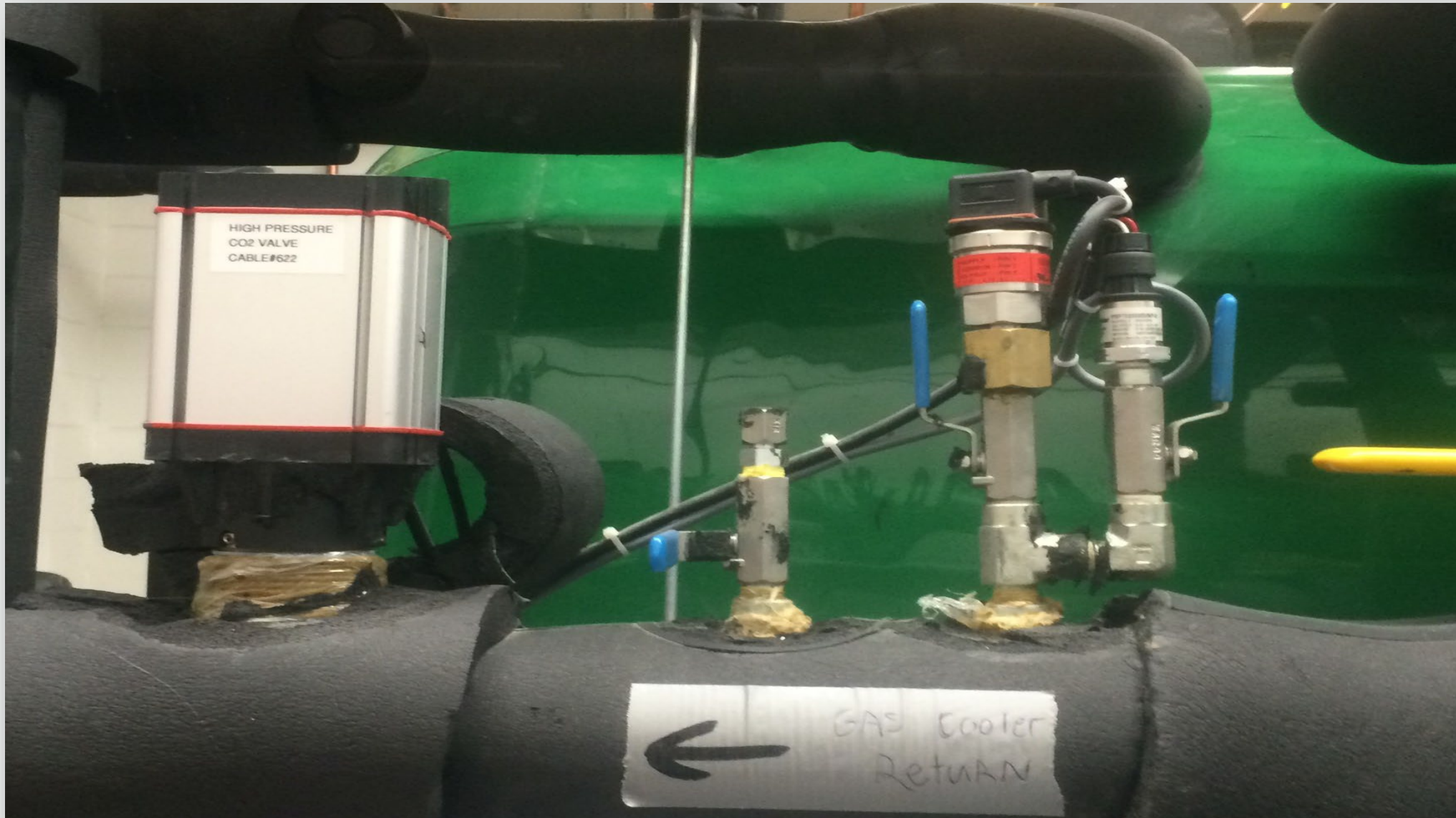
High Pressure Control Valve (ICMT)



High Pressure Control Valve (ICMT)



High Pressure Control Valve (ICMT)



High Pressure Control Valve (ICMT)



High Pressure Control Valve (ICMT)



High Pressure Control Valve ICMTS



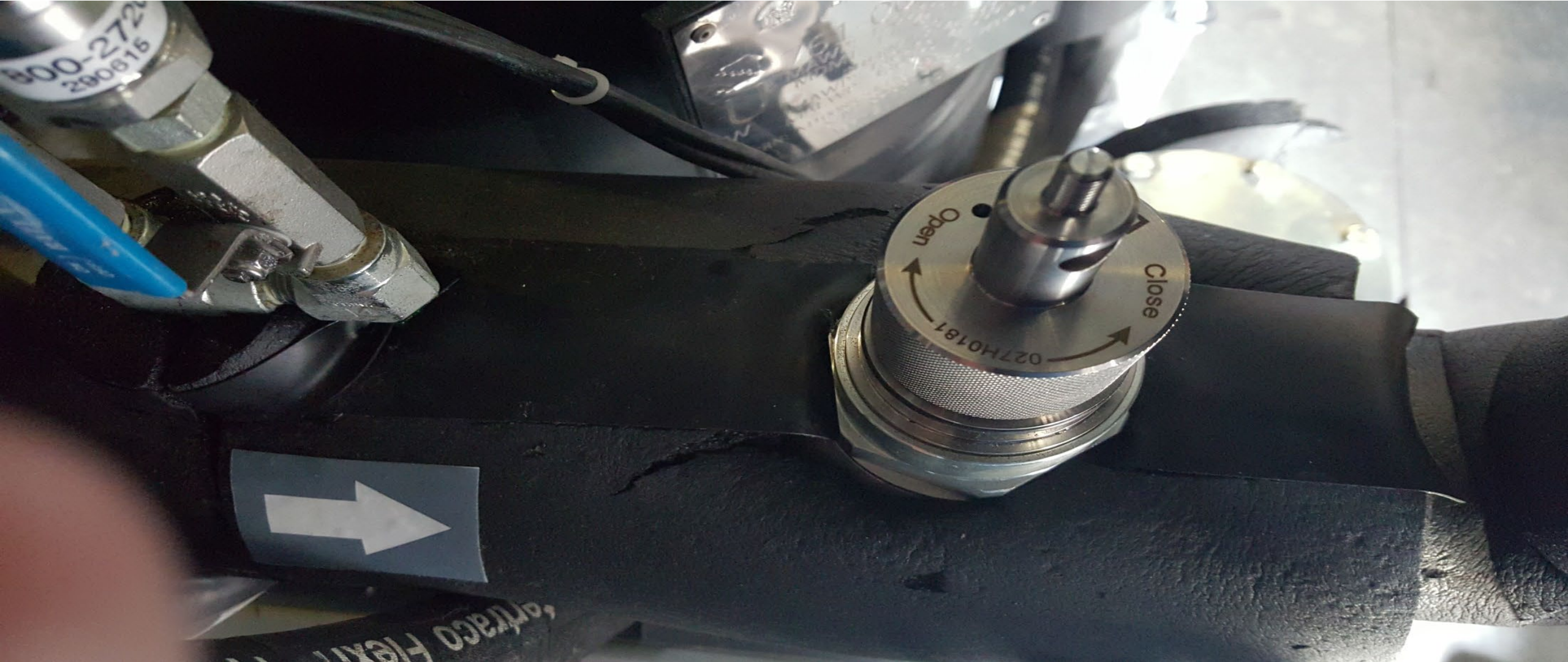
ICMT Valve Bad Gap



High Pressure Control Valve

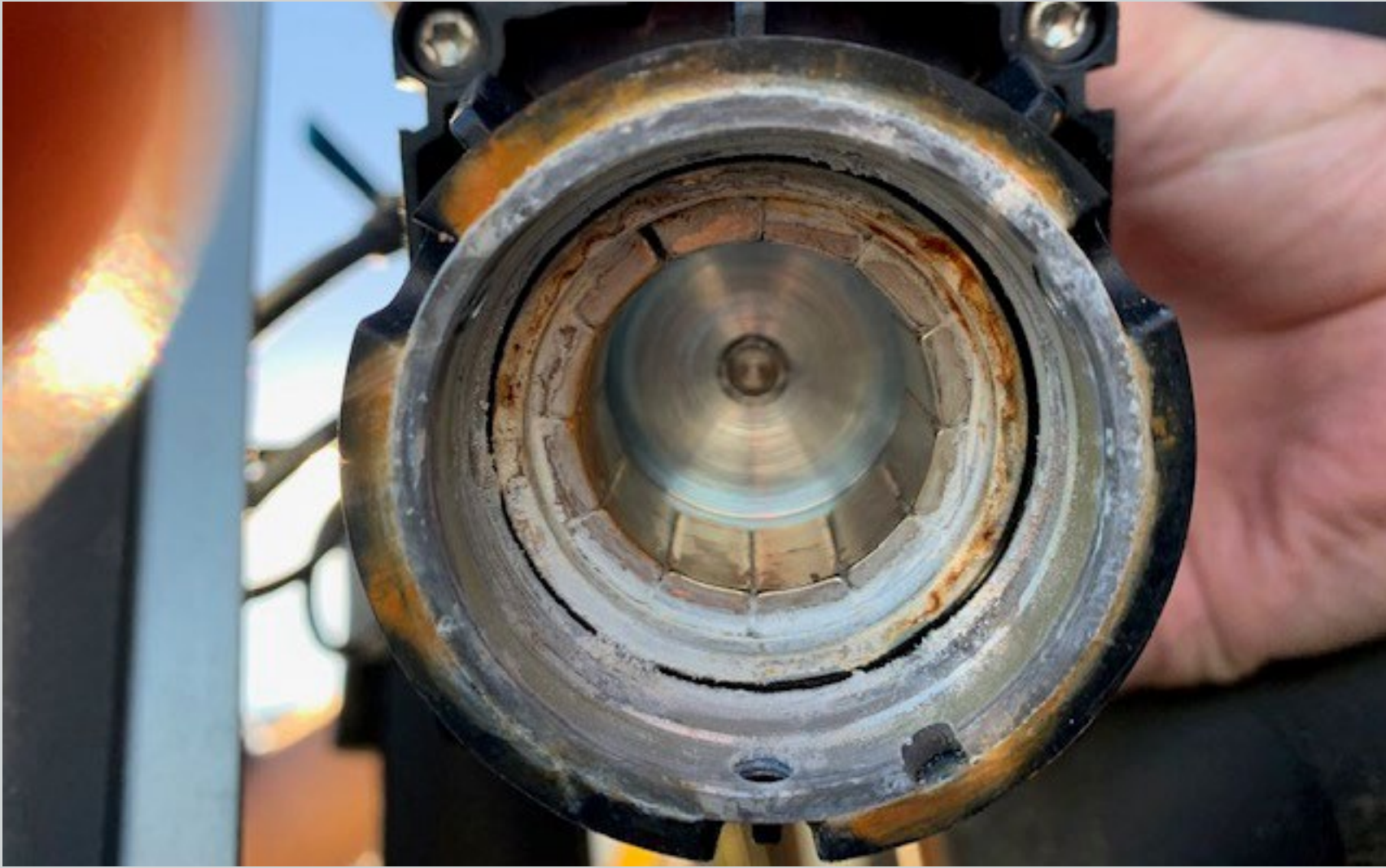


High Pressure Control Valve Manual Operation





ICMT Actuator



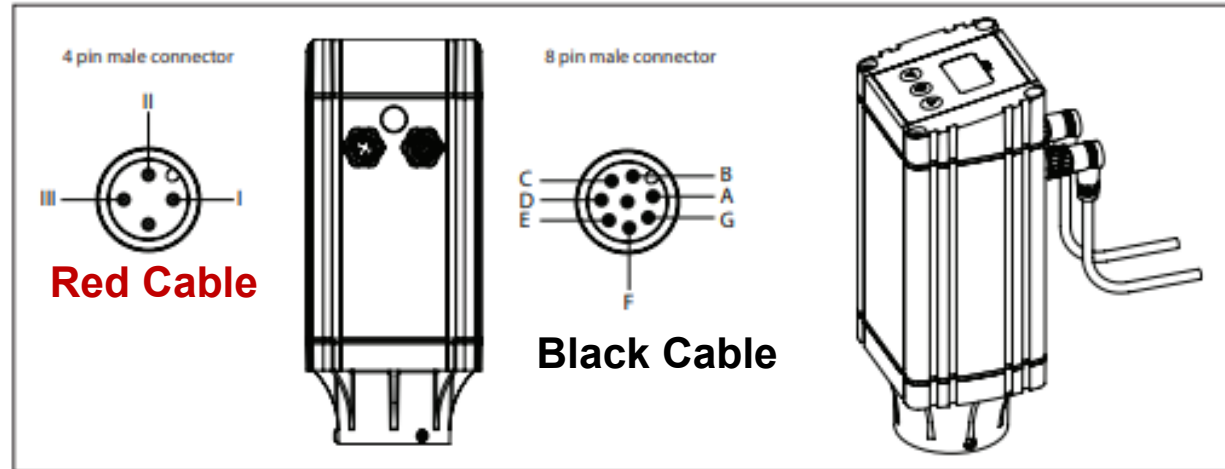
High Pressure Control Valve



High Pressure Control Valve Cable

Wiring the ICAD actuator

There are two cables which are connected to the ICAD motor with M12 connectors:



Communication connector / cable

Ref.	Color		Description
A	Black	-	Common Alarm
B	Brown	-	ICM fully open
C	Red	-	ICM fully closed
D	Orange	-	GND ground
E	Yellow	+	0/4 - 20 mA Input*
F	Green	+	0/2 - 10 V Input. Also used with GND (orange wire) as a digital input #1 for on-off operation or floating 3-point control
G	Blue	+	0/4 - 20 mA Output*

} Digital Output

Power connector/cable (3 wires)

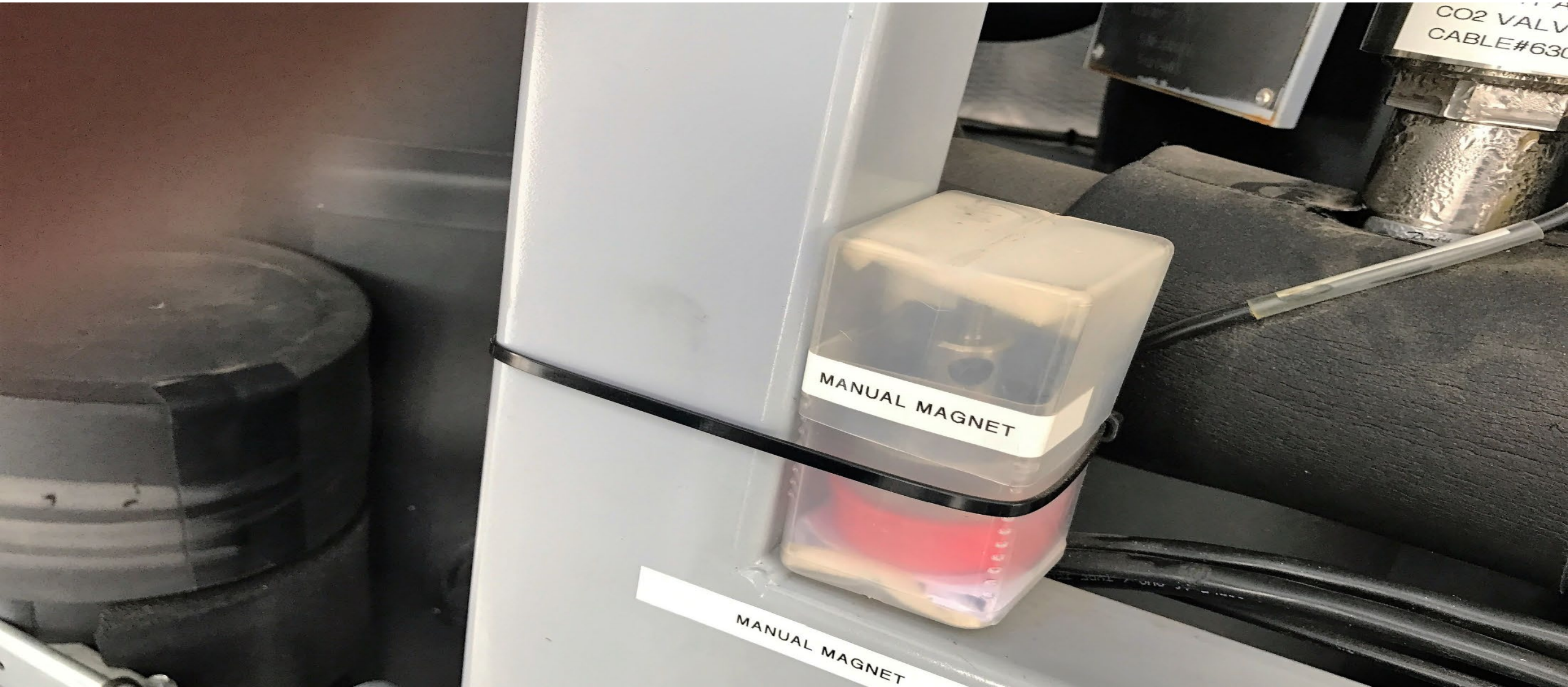
I	Black	+	Fail safe supply Battery / UPS (uninterruptable power supply) 19 V d.c.
II	White	+	Supply voltage
III	Brown	-	24 V d.c.

High Pressure Control Valve Alarms

Alarms

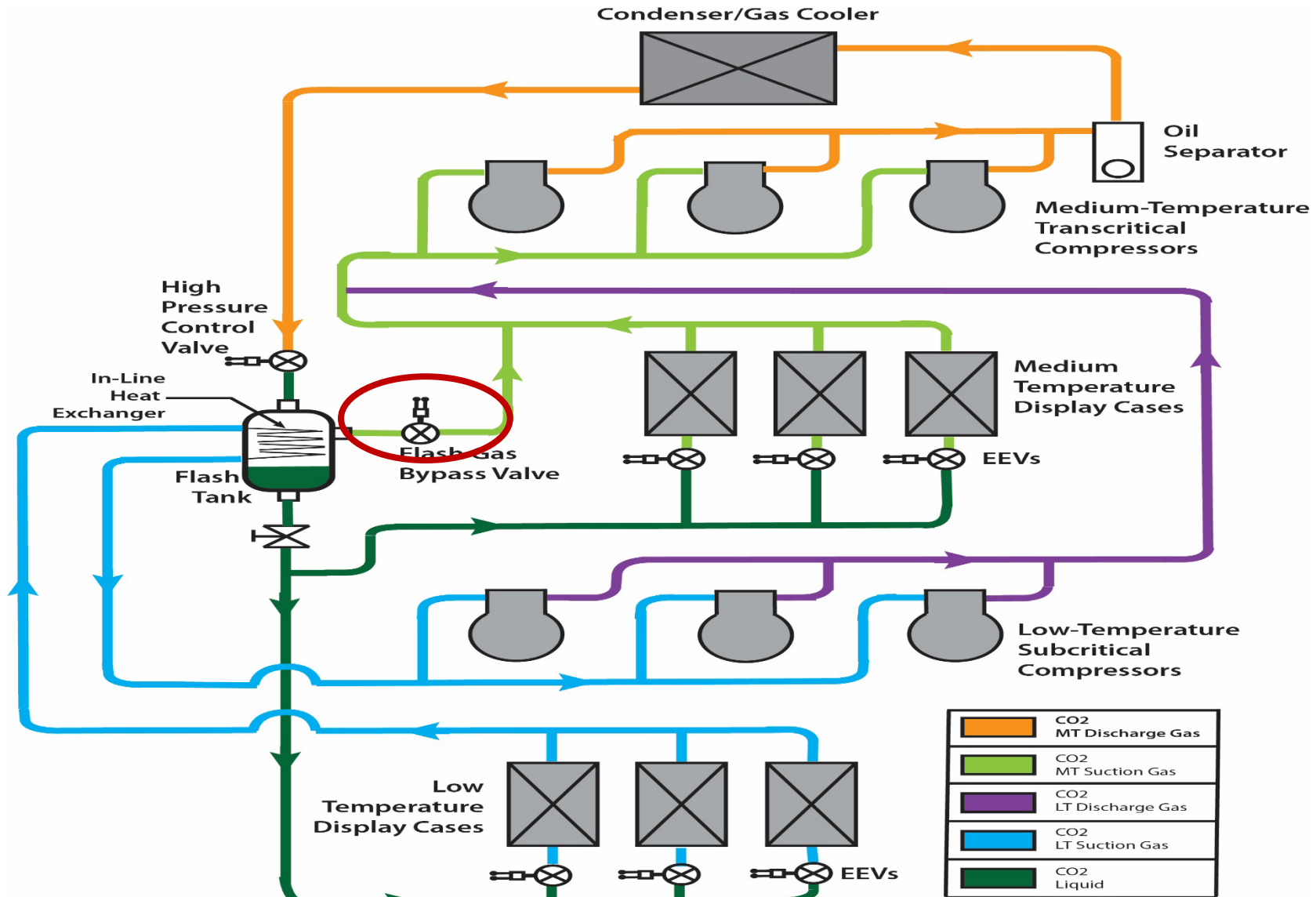
Description	ICAD alarm text	Definition of event	Comments
No Valve type selected	A1	Alarm ON	At start-up A1 will be displayed until parameter j26 is set
Controller fault	A2	Alarm ON	Internal fault inside electronics. Carry out: 1) Power OFF and Power ON If A2 still active. 2) Make a Reset to factory setting If A2 still active. Return ICAD to Danfoss
Analog input error	A3	Alarm ON	Not active if j01 = 2, or j02 = 2 When j03 = 1 and AI A > 22 mA When j03 = 2 and AI A > 22 mA or AI A < 2 mA When j03 = 3 and AI A > 12 V When j03 = 4 and AI A > 12 V or AI A < 1 V
Low voltage of fail safe Supply	A4	Alarm ON	If 5 V < fail safe supply < 18 V. Enabled by j08
Check supply to ICAD	A5	Alarm ON	If supply voltage < 18 V
Calibration extended failed	A6	Alarm ON	Check valve type selected. Check presence of foreign debris inside ICM valve
Thermal overload	A8	Alarm ON	ICAD stepper motor temperature too high
Valve locked	A9	Alarm ON	Only active if i16 = 1 If the ICM valve is locked for more than 15 seconds (unable to reach its requested position) A9 will flash in display. A9 alarm can only be reset by Power OFF/ON of ICAD

Magnet for High Pressure Control Valve

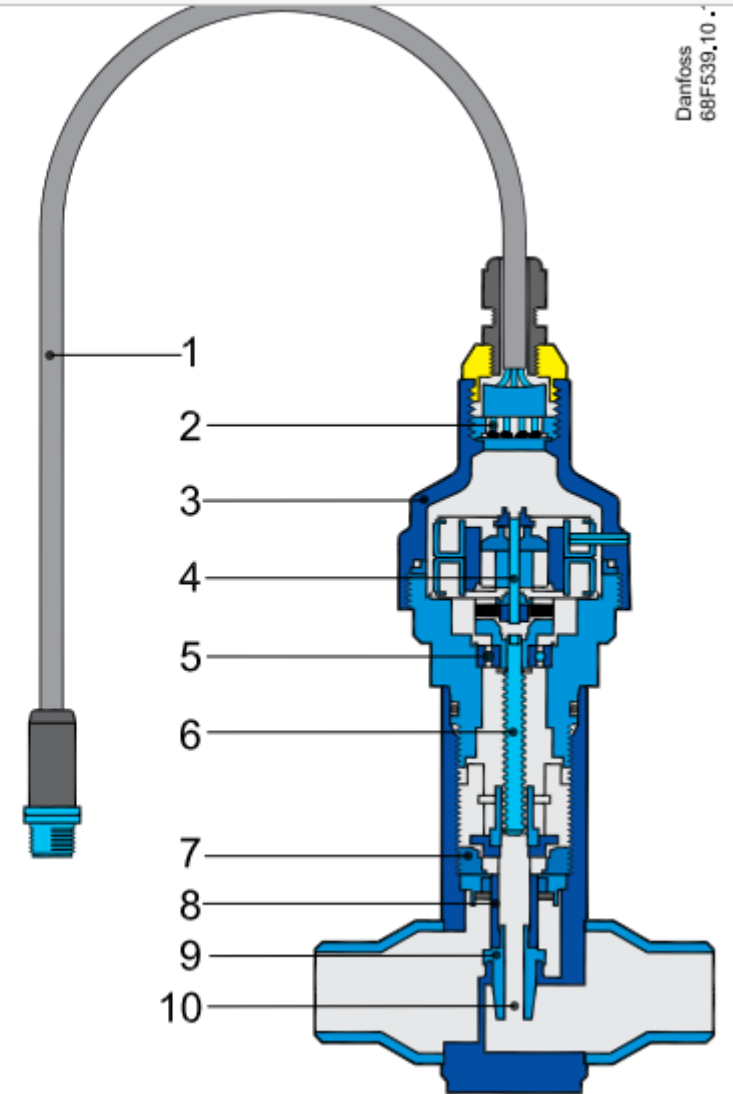


Flash Gas Bypass Valve

Flash Gas Bypass Valve (CCM)



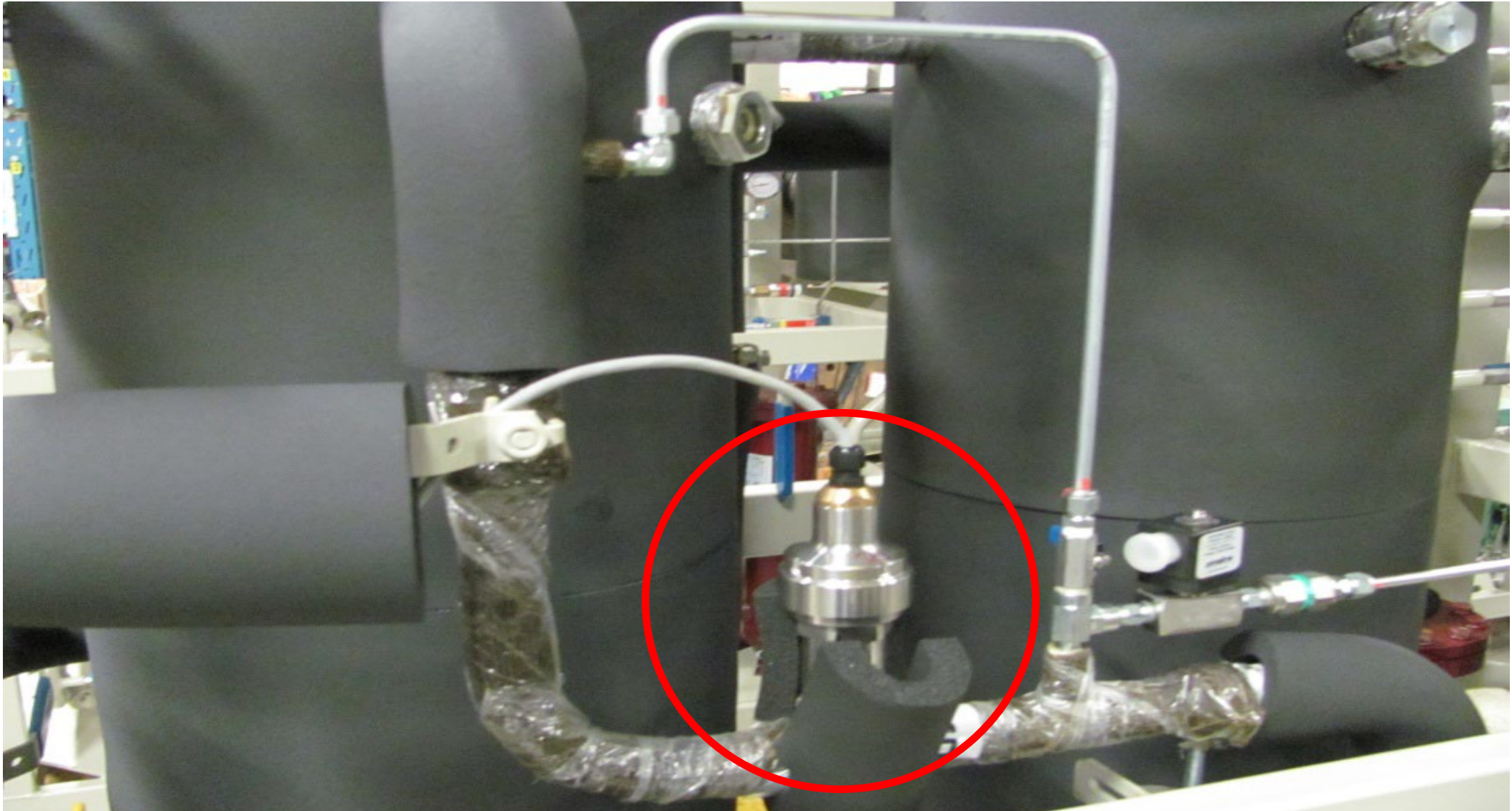
Flash Gas Bypass Valve (CCM)



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1. Cable
2. Glass seal
3. Motor housing
4. Stepper motor
5. Bearing
6. Spindle
7. Insert
8. Valve piston
9. Valve seat
10. Valve port

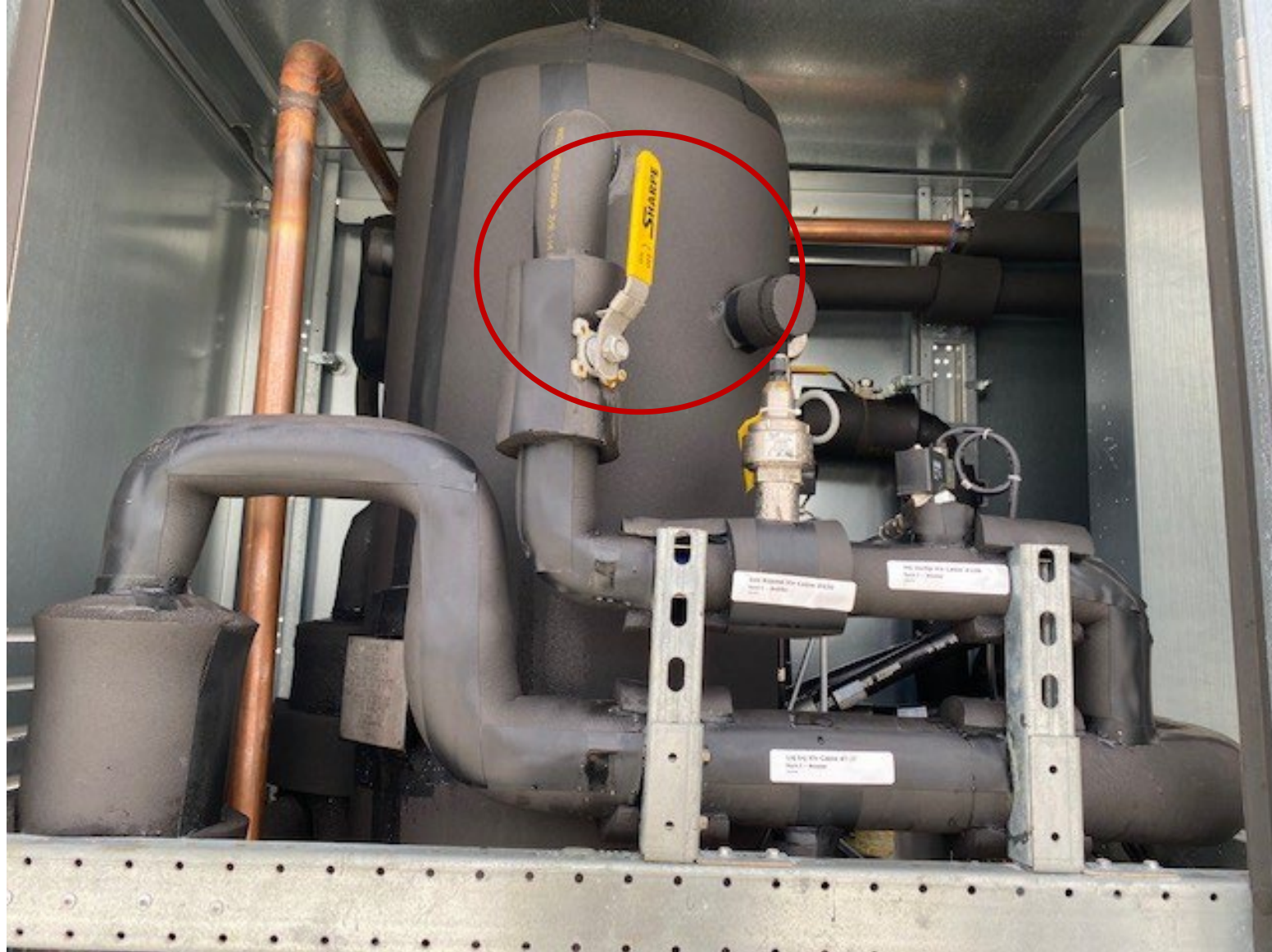
Flash Gas Bypass Valve (CCM) with Bypass Line



Flash Gas Bypass Line (Why???)



Flash Gas Bypass Valve (CCM) Isolation Valve



Flash Gas Bypass in Parallel



Flash Gas Bypass Valve (CCM) with Hot Gas Dump



Controller UPS

If rack losses power
UPS will keep power to
shut down the High
Pressure Control Valve
(HPCV) and Flash Gas
Bypass alve.



Questions?

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Troubleshooting HPCV/FGBV

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