

Transcritical CO₂ Oil Management System FAQs

What is the purpose of the oil level management system?

The purpose of the oil management system is to separate oil from the compressor discharge, transfer oil to the oil reservoir through an oil transfer solenoid, filter system oil, and supply oil to the compressors when needed. The compressor oil level control is responsible for maintaining the oil level in the compressors. Details on specific operation can be found in the oil control literature.

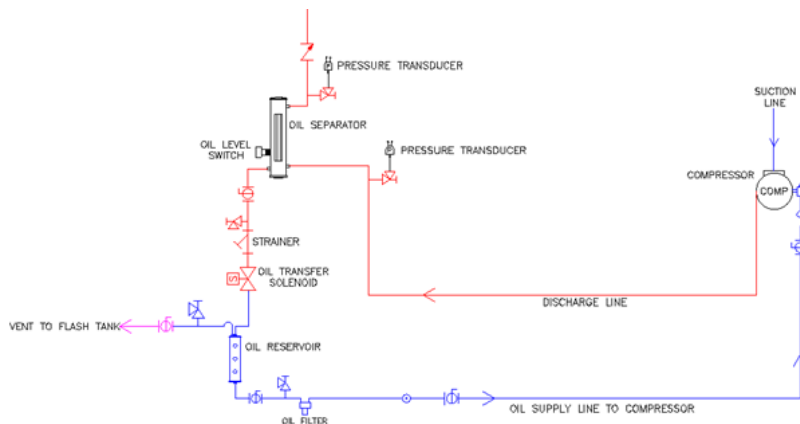
What are the basic components of the oil level management system?

1. Oil Separator
2. Oil Reservoir
3. Oil Transfer Solenoid
4. Oil Filter/Strainer
5. Level Eye/Switch

What is the sequence of events in the oil level management system?

- On Demand Operation
 - Oil transfer during normal operation is a demand based system.
 - The oil level is monitored in the oil separator by the oil level eye/switch. The controller sends a command to energize the oil solenoid for 40 seconds when the oil is sensed by the oil level eye/switch and a medium-temperature compressor operation. The pathway is open, and the higher pressure of the discharge gas pushes the oil from the oil separator into the oil reservoir when the oil transfer solenoid is energized. The oil reservoir is maintained at flash gas tank pressure, which is lower than the discharge pressure.
- Timed Operation
 - Newer stores include flex combiner programming that includes both demand operation and times operation.
 - Older stores may only include demand operation.
 - Oil transfer during timed operation is based on a fixed-time interval. The control sequence is programmed to operate in fixed-time intervals when at least one medium temperature compressor is in operation. A fixed-time interval is used to energize the oil transfer solenoid every three minutes for 40 seconds. This fixed time interval can be altered based on system capacity and characteristics as determined in the field and can be lowered to 1 or 2 minutes if the 3-minute duration is not enough.
- Oil Separator
 - The oil separator is a coalescent type that uses an element that the refrigerant gas and oil must pass through before entering the gas cooler. The oil is separated from the gas by the element and returned to the oil reservoir. The element is also effective against contaminants. The contaminants can cause a pressure drop across the element. The pressure drop can increase until there is an alarm. The increase in the pressure drop can cause the gasket to dislodge, creating a path for the discharge gas to bypass the element. The oil level at the rack will fall until it runs out of oil. A clean element will have a 1 - 10 psi pressure drop. The element will need to be changed for a pressure drop reading of higher than 10 psi.

Typical Schematic Diagram



How should normal operation look?

You should see a consistent pattern of oil detection and oil transfer in a functioning system (See Figure 1). If there are extremely large gaps in these functions and the reservoir oil level is low, troubleshoot the detection and transfer devices. The optical sensor has a red light when it is not indicating an oil level in the separator. When the indicator light is off it indicates the oil level is above the optical sensor and the solenoid is energized. The 2 pressure transducers used to measure oil separator pressure should be calibrated at the same time and read identical pressures when the compressors are not operating. CO₂ systems have more oil movement. To account for the oil fluctuations more oil than what is typically used in a similar size HFC system may be required.

Figure 1: Oil Detection and Oil Transfer



Note: The top signal (blue) is the oil solenoid output. The bottom signal (red) is the oil separator level switch. When the level switch is off (indicated by no illumination) it imitates an oil drain cycle.

Troubleshooting		
Error	Probable Cause	Solution
No oil in reservoir	Gasket on the oil separator element has dislodged, separator no longer separating	Replace element in oil separator with a new element
	Oil leak or logging in other parts of the system	Check for leaks
	Restricted oil transfer solenoid or strainer	Check for logging of oil in evaporators or suction lines
High or low oil level in compressor	Issue with the compressor oil level control	Investigate for failed components and replace defective components
Oil separator not functioning properly	Clogged or dirty oil separator element	troubleshoot the compressor oil level control
System is not functioning normally	Oil transfer components inoperable/defective	Replace separator element
		Investigate for failed components and replace defective components
Low pressure drop	Gasket/Filter blowout	Check system programming for proper sequence of operations
	Transducers not calibrated	Replace Gasket/Filter and service system
	Calibrate/repair transducers	
Preventative Maintenance		
Component	Service Interval	
All Components	Service all components if contamination is present.	
Oil	Test once a year for contamination	
Oil Separator	Replace element after 10 psi pressure drop is measured or annually, whichever comes first	
Oil Filter and Strainer	Service annually	

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