Oil Level Control System

INSTALLATION INSTRUCTIONS
SD-129 / 122015

DESIGNING THE OIL RETURN SYSTEM

Oil must be present to lubricate the compressor. However, oil becomes a detriment to system performance if present in large quantities in the evaporator. Therefore, it is necessary to control the distribution of oil within the system.

In multi-compressor parallel systems, oil levels must be maintained in each compressor regardless of the individual compressor's oil consumption rate. Oil pumped by compressors may vary considerably, depending on the compressor model, age and operating conditions.

When oil is pumped by the compressor, it flows through the common discharge header to an oil separator. The oil separator's function is to separate the oil from the discharge gases. In some systems, since the oil separator does not have a large holding capacity the oil is transferred to an oil reservoir.

As it passes from the oil separator to the oil reservoir, the oil is at high or discharge pressures. This pressure must be reduced to a pressure slightly higher than the compressor crankcase. The pressure in the oil reservoir is reduced by boiling the refrigerant in the oil (only if liquid is present), and relieving the pressure above the oil through a vent line to the suction header. The pressure in the oil reservoir is maintained, slightly above the suction header pressure, by means of an Oil Differential Check Valve installed in the vent line. At its reduced pressure the oil is then fed to the Oil Level Control which meters the oil to the compressor and maintains the oil level specified by the compressor manufacturer. The Oil Level Control functions by adding oil when the level is low – it cannot correct an oil level that is too high.

To obtain proper oil return, each of the oil system components must be selected according to the requirements of the overall oil control system.

OPERATION and APPLICATION

OIL RESERVOIR – TYPES POR-2, POR-3, POR-4

Oil Reservoir (POR-2, -3 or -4) contains the oil that is not within the crankcase, the oil separator, or in circulation. The POR-2, -3 or -4 has an inlet and an outlet service valve so it can be isolated from the rest of the system, or the oil supply from the oil reservoir to the Oil Level Control can be interrupted for servicing.

When adding an oil reservoir to an existing system or replacing an oil reservoir on an existing system, it should only be filled to the top of the lower sightglass. As the system is

POR-2, POR-3, POR-4 Oil Reservoir Features and Benefits

- Sightglass ports with float ball indicators for oil level monitoring
- 3/8″ male flare rotalock valves shipped with oil reservoir allow for easy adjustment when piping into system
- 3/8″ male flare vent port – for connection to the suction line
- Mounting studs and brackets
- Powder coating passes 500 hour ASTM salt spray

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UL Listed SORT-SA6386 for the USA and Canada with a Maximum Rated Pressure (MRP) of 500 psi (34 bar).

Underwriters Laboratories Inc. Listed Guide No. SROT, File No. SA6386 (N)

Type POR Specifications

MODEL NUMBER	TOTAL CAPACITY Gallons (Liters)	'A' CAPACITY Gallons (Liters)	'B' CAPACITY Gallons (Liters)	NUMBER OF SIGHTGLASSES	LENGTH Inches (mm)	SHELL DIAMETER Inches (mm)
POR-2	2 (7.6)	3/4 (2.8)	3/4 (2.8)	2	18 (457)	6.0 (152)
POR-3	3 (11.4)		1-1/2 (5.7)	3	23 (584)	
POR-4	4 (15.1)		2-3/4 (10.4)	3	36 (914)	

'A' capacity is the capacity to the first sightglass.
'B' capacity is the capacity between the two **sightglasses** *for the POR-2 and the* **top** *and* **bottom** *sightglasses for the POR-3 and POR-4.*

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placed into operation, the oil level should be observed. If the oil level rises above the upper sightglass, some oil should be drained from the reservoir.

The level of oil should never be allowed to drop below the bottom of the lower sightglass.

On new system start-ups the reservoir should be filled to the top of the upper sightglass. As the system runs, oil should be added to maintain a level between the two sightglasses for the POR-2. For the POR-3 and 4, the level should be somewhere between the top and middle sightglasses. This procedure may require several charges as the oil is absorbed in the refrigerant and coats the low side tubing.

OIL DIFFERENTIAL CHECK VALVE – TYPES OCV-5, OCV-10, OCV-20, OCV-30

OCV-20
All check valves have 3/8″ SAE connections, all brass construction.

The Sporlan Oil Differential Check Valve (OCV) is installed on the 3/8″ SAE fitting on the top of the POR-2, -3 or -4. It allows pressure to be relieved from the reservoir to the suction as required to maintain a pressure in the reservoir at a preset level above the suction pressure. The pressure differential created by the OCV assures oil flow from the reservoir to the Oil Level Control, providing there is adequate oil in the reservoir.

The OCV will only relieve pressure from the reservoir in excess of its fixed set point. Systems with fluctuating suction pressure, as a result of compressor unloaders, staging or other suction line controls, must be fitted with an OCV with a differential greater than the suction pressure fluctuation. This assures oil flow from the POR-2, -3 or -4 through the oil level control to the compressor crankcase.

Sporlan offers OCVs with a 5, 10, 20, and 30 psi (0.34, 0.68, 1.4, and 2.1 bar) fixed differential setting. However, Sporlan recommends the use of an OCV-20 on all field built-up applications. Equipment manufacturers may, after extensive tests, employ an OCV with a different pressure setting. Example: OCV-5

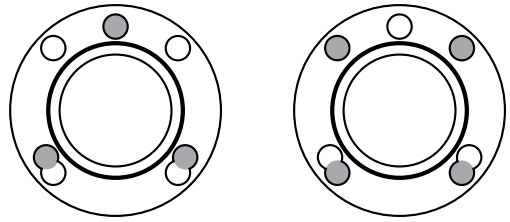
OIL LEVEL CONTROLS – INSTALLATION STEPS

1. Refer to the information on page 4 to determine the number of turns adjustment required on the Oil Level Control. The Oil Level Control is set at 3-1/2 turns down at the factory. If a different setting is required, then make that adjustment before installation. Do not force the adjustment screw above or below the adjusting stops. Maximum adjustment is 9 turns down.

OL-60FH
UL Recognized under SA5460-SFJQ2/SFJQ8 with a Maximum Rated Pressure (MRP) of 650 psi (45 bar).

2. See Figure 1, 7 Bolt Universal Mounting Flange and Oil Sightglass (S-OL). Note that the bolt holes for the 3 bolt mounting configuration are not equally spaced. Furthermore, the holes in the Oil Level Control flange are slightly oversized to permit a minor adjustment when leveling. During installation, the rack, compressors and Oil Level Controls should all be carefully leveled.

7 Bolt Universal Mounting Flange and Oil Sightglass (S-OL)



3 Bolt Configuration **4 Bolt Configuration**

Figure 1 Bolt

3. Remove the sightglass from the side of the compressor and install this sightglass on the proper arm of the Oil Level Control. Select either arm so that the sightglass is readily visible after installation. Both the sightglass and the Oil Level Control flange have grooves for a seal. In order to make a proper seal with this construction you should install an "O" ring in one groove and a square "quad" ring in the other groove. This will permit proper mating of the rubber seals for a good leak tight joint. Install with the 3/4" long cap screws and tighten fully; approximately 6 foot pounds (8.1 newton meters) torque.

4. Install the Oil Level Control on the side of the compressor. The Oil Level Control is supplied with an "O" ring and cap screws (1" / 25.4 mm long). However, it may be more appropriate to use the cap screws that are presently on the compressor.

5. If an adaptor is required between the Oil Level Control and the compressor, then refer to Figure 4 on page 5. Install the adaptor first and then attach the Oil Level Control to the adaptor. Note that in several instances the use of the adaptor requires re-using the "O" ring from the compressor. The 1-1/4" (31.8 mm) long cap screws are used to attach the adaptor to the Oil Level Control.

6. Attach the equalizer line if required. The flare equalizer connection on the side of the Oil Level Control can be adapted for a larger or smaller oil equalizer line if required. If an Oil Level Control with an equalizer fitting is installed on a system without an equalizer line, then simply cap the equalizer fitting on the control.

7. Follow the proper startup procedures as specified by the equipment manufacturer.

8. Allow at least an hour of operating time for the system to come to equilibrium before adjusting the oil charge or judging the performance of the Oil Level Control. You should expect the level in the sightglass to vary somewhat according to the operating cycle of the system. After shutdown the oil level in an idle compressor will frequently rise about 1/4" (6 mm). Maintain the oil level and oil charge as specified by the equipment manufacturer.

9. To diagnose a problem of poor level control keep in mind that system problems are frequently the cause, rather than a defective Oil Level Control. For example,

High oil level is caused by:

- Oil returning through the suction line.
- Oil that gets trapped in low spots will often return all at once during periods of high refrigerant velocity.
- Excess oil in the system/reservoir.
- Oil transferring through the equalizer line.
- Excessive pressure differential.

Low oil level is caused by:

- Insufficient oil in the system.
- A plugged oil filter.
- Oil being pulled out through the equalizer line.

Oil Level Control Selection & Specifications

MODEL NUMBER	ADJUSTMENT RANGE	FLANGE DESIGN FOR COMPRESSOR ATTACHMENT	NUMBER OF ARMS LENGTH	EQUALIZATION FITTING OPTION/PLACEMENT
OL-60CH	5 – 90 psi (0.34 – 6.2 bar) Differential	7 Bolt Universal Flange 3 Bolt Center 1.87″ / 47.60 mm 4 Bolt Center 1.97″ / 50.03 mm	Two arms – standard length	None
OL-60FH			Two arms – standard length	Yes – bottom of drill hole at centerline of sightglass
OL-60HH-6			One arm – standard length	None
OL-60NH-2			Two arms – standard length	Yes – fitting is 3/8″ (9.5 mm) above standard location
OL-60XH			Two arms – short length	Yes – bottom of drill hole at centerline of sightglass

NOTES: Model OL-60XH-1 is identical to OL-60XH but less equalization fitting.

Compressor Adaptor Requirements

COMPRESSOR MANUFACTURER	COMPRESSOR MODEL NUMBER	COMPRESSOR ATTACHMENT PATTERN	SPORLAN ADAPTOR KIT NUMBER	SEALING METHOD	SIGHTGLASS
Bitzer	2KC, 2JC, 2HC, 2GC, 2FC, 2EC, 2DC, 2CC, 4FC, 4EC, 4DC, 4CC	1-1/8″ Thread	AOL-MA/TE	Use seal provided	Use sightglass provided with adaptor
	4VC, 4TC, 4PC, 4NC	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	None	Use seal provided	Use sightglass from compressor
	4J, 4H, 4G, 6J, 6H, 6G, 6F	4 Bolt, 50 mm B.C.	None	Use seal provided with control	Use sightglass from compressor
	8GC, 8FC	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
Bock	F...	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
Carrier	06EA, 06ER	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
	06DA, 06DR, 5F, 5H	1-1/2″ – 18 Thread	AOL-C		Use sightglass provided with adaptor
Copeland	Over 5 Ton	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
	Under 5 HP*	1-1/8″ – 12 Thread	AOL-A	Use seal from compressor	Use sightglass provided with adaptor
	8R, 3D Front, 2D, 4D, 6D	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
	8D	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	Use control with standard length arms with AOL-R-1 adaptor. Use sightglass from compressor		
Dorin	4 cyc-15 HP	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	Contact Sporlan		
Dunham-Bush	Big 4	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
Frascold	All models	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
Maneurop	MT..., LT...	1-1/8″ – 18 Thread	AOL-MA/TE	Use seal provided	Use sightglass provided with adaptor
Tecumseh	P, R, S, PA, RA, SA, CK, CM, CH, CG	1-1/8″ – 12 Thread	AOL-A	Use seal from compressor	Use sightglass provided with adaptor
	—	1-1/8″ – 18 Thread	AOL-MA/TE	Use seal provided	
	VS	3/4″ – 14 Thread	AOL-K-1	Use seal provided	
Trane	M, R	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor
	K	3/4″ NPT	AOL-K-1	Use Teflon tape	Use sightglass provided with adaptor
York	GC, GS, JS	3 Bolt, 1-7/8″ B.C. (47.6 mm B.C.)	AOL-R-1	Use seal provided	Use sightglass from compressor

NOTE: Shipping weight is 4 lbs. (1.8 Kg) for oil level controls and 1 lb. (0.45 Kg) for adaptors.

*Some compressor models have a smaller diameter port than the arm diameter of the oil level control. This situation can mislead the control in the amount of oil that is actually in the compressor. It is advisable the selection and adjustment of the control be reviewed in this situation.

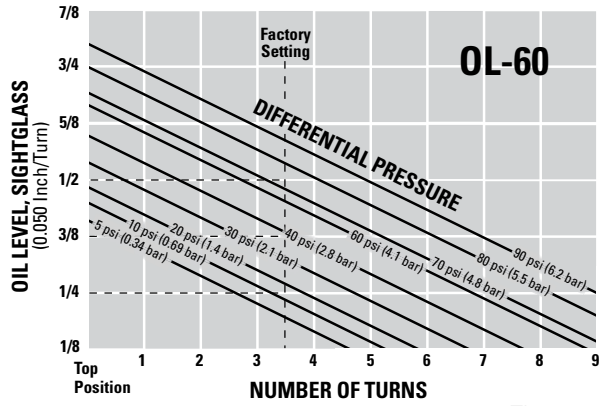


Figure 2

SETTING LEVEL

The following information must be considered before selecting the proper Oil Level Control for a system. See Figure 3 below, for pressure location.

Ⓐ Common suction header pressure – psig / bar

Ⓑ Differential Check Valve setting (OCV) – psi / bar

Ⓒ Oil Reservoir pressure (Sum of Ⓐ and Ⓑ) – psig / bar

Ⓓ Crankcase pressure (compressor on common header) – psig / bar

OR

Ⓔ Crankcase pressure (compressor on independent suction – if applicable) – psig / bar

The first step is to determine the pressure differential requirement of the Oil Level Control(s). This can be determined on compressors with a common suction header by subtracting the pressure in the compressor crankcase Ⓓ from the Oil Reservoir pressure Ⓒ.

For a compressor with independent suction, the differential requirement is determined by subtracting crankcase pressure Ⓔ from pressure Ⓒ.

Once Differential Pressure is Known

Look at Figure 2, based on the differential pressure, and see the range of level control possible. If desired compressor level is unattainable, adjust differential pressure valve on high pressure system. On low pressure oil management system, replace OVC with a model that allows for oil level desired. Adjust the control to proper oil level using Figure 2.

Adjustment

The Oil Level Control is factory set 3-1/2 turns clockwise from the top stop. To preset the oil level, remove the seal cap on top of the control. Turn the adjustment stem clockwise to lower and counter-clockwise to raise (level will change approximately 0.050 inch per turn). The proper adjustment can be determined from Figure 2. The oil level is given in eighths of the sightglass at various differential pressure conditions.

Under no circumstances adjust beyond 9 turns down from the top stop or the control may be damaged. With care a person can feel the top and bottom stops. One of the symptoms of over-adjustment of the Oil Level Control is a totally full sightglass.

Data obtained using POE lubricant at 75°F (24°C) with a one inch (25.4 mm) sightglass.

If a sudden load increase or system defrost causes a large amount of oil to return through the suction line the control will not prevent the oil level from rising above the control point.

To Verify Oil Level Setting

On a multiplex rack system, turn off power to the compressor in question. Close service valves on discharge and suction of the compressor and close off flow of oil to the Oil Level Control. Drop oil level in the Oil Level Control. Then allow oil to flow into the Oil Level Control. The oil will fill to the setting level. If adjustment is required, use known differential pressure and chart (see Figure 2) to set Oil Level Control.

Sporlan does not recommend adjusting the Oil Level Control on a running compressor. Adjustments made to a running compressor may not directly correlate to the oil level seen. Keep in mind oil is always returning through the suction line to a running compressor.

LOW PRESSURE OIL RETURN SYSTEM

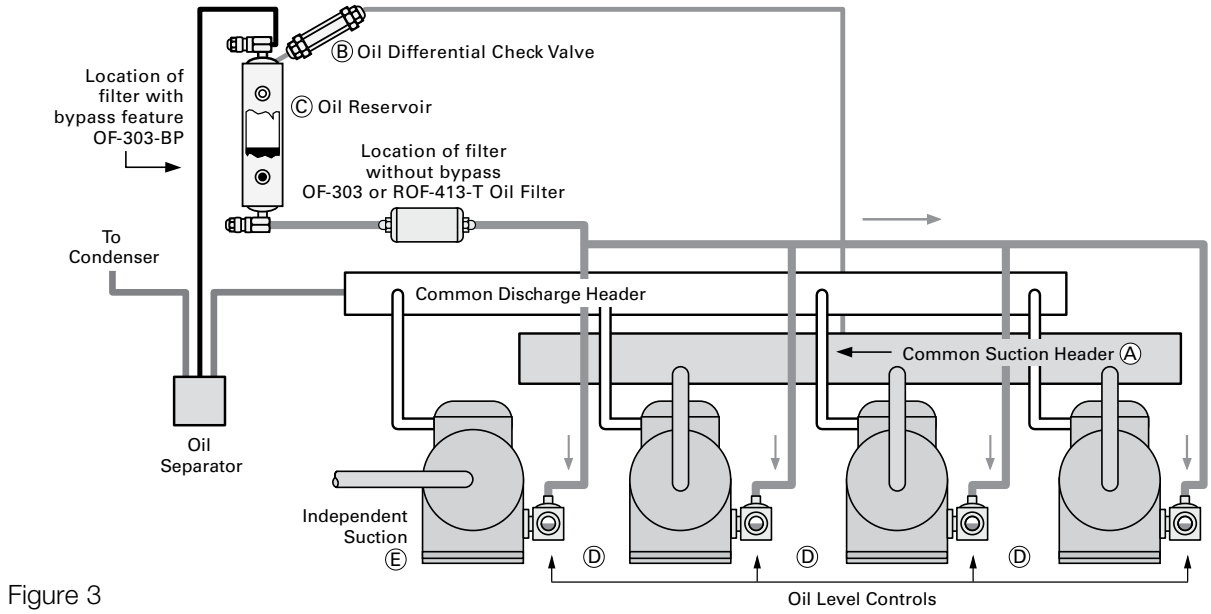
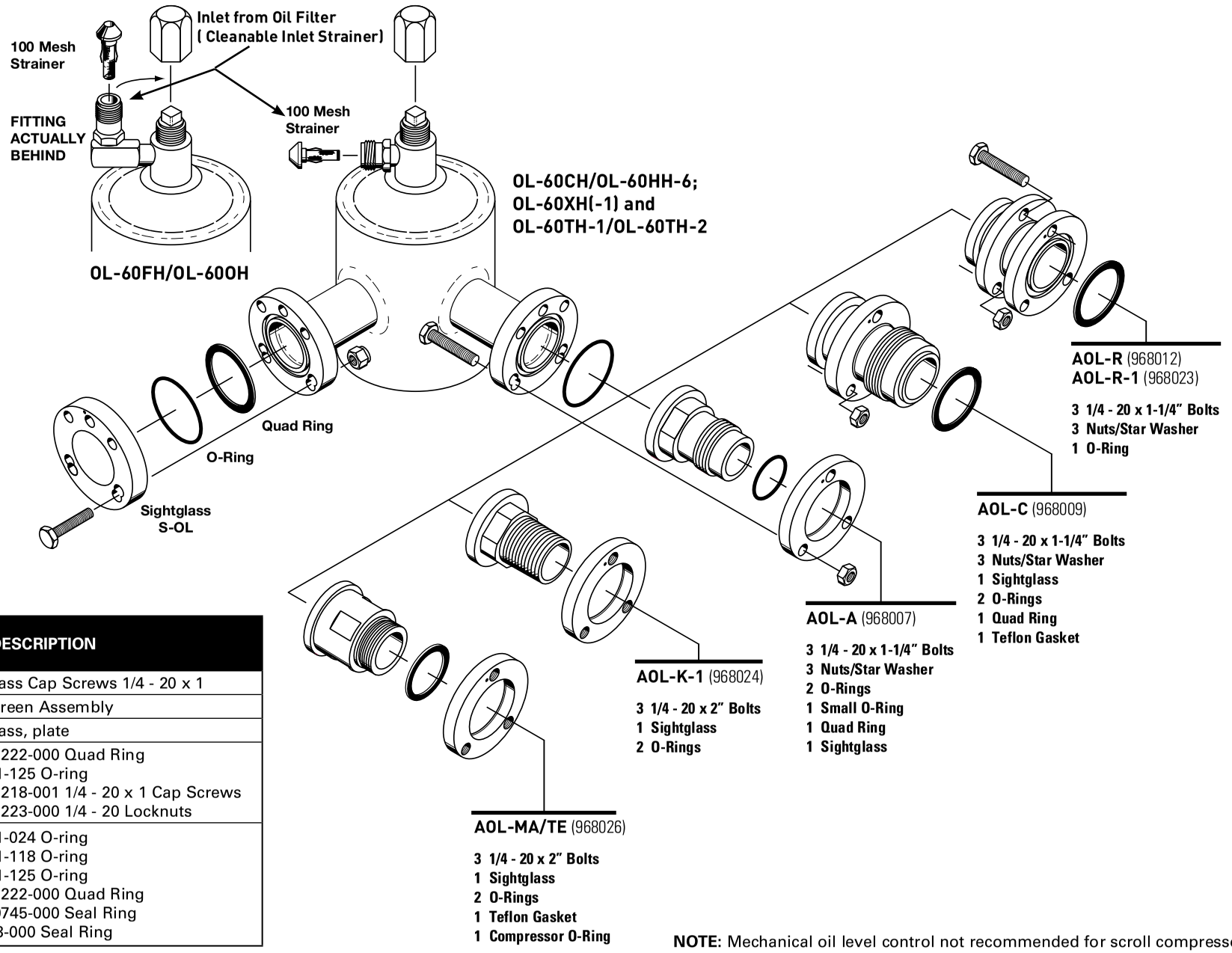


Figure 3

OIL LEVEL CONTROL ADAPTOR KITS

Figure 4



PART NUMBER	PART DESCRIPTION
JP-1218-001	Sightglass Cap Screws 1/4 - 20 x 1
JP-1215-000	Inlet Screen Assembly
S-OL	Sightglass, plate
K-OL-Parts-Kit (968031)	(2) JP-1222-000 Quad Ring (2) 0621-125 O-ring (4) JP-1218-001 1/4 - 20 x 1 Cap Screws (4) JP-1223-000 1/4 - 20 Locknuts
K-OL-Seal-Kit (968029)	(1) 0621-024 O-ring (1) 0621-118 O-ring (3) 0621-125 O-ring (1) JP-1222-000 Quad Ring (1) JP-0745-000 Seal Ring (1) 4238-000 Seal Ring

NOTE: Mechanical oil level control not recommended for scroll compressors.

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