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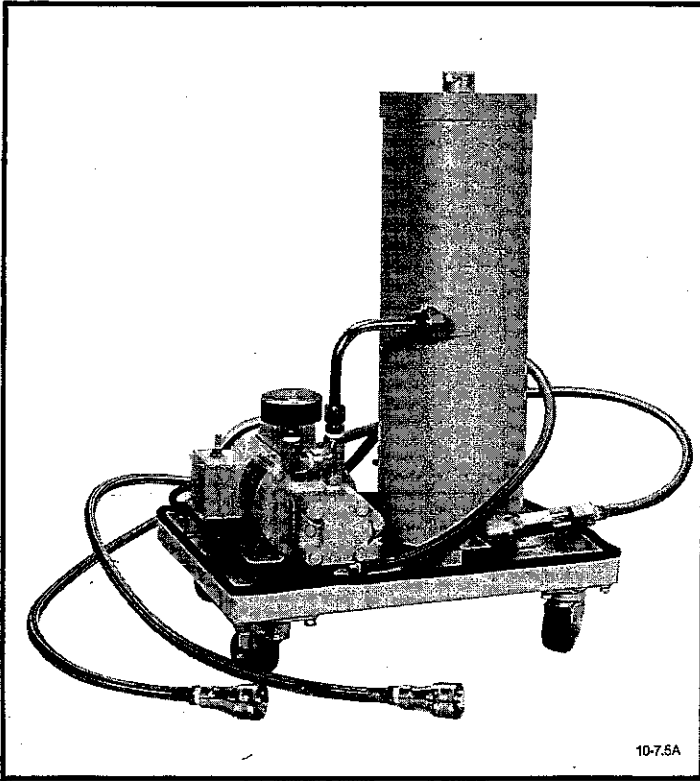
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LEYBOLD
VACUUM PRODUCTS INC.

Part Number 722-78-030 ■ Edition D

OF-3000 / OF-3000C Oil Filtering System MANUAL



Manufactured in the United States

⚠ WARNINGS:



Death or serious injury can result from the improper use or application of this oil filter. If the vacuum pump or oil filter will be exposed to toxic, explosive, pyrophoric, highly corrosive, or other hazardous process gases including greater than atmospheric concentrations of oxygen, contact Leybold for specific recommendations.



If you will be using perfluoropolyether (PFPE) oil, you must use one of the OF-3000 models that is prepared for PFPE. In addition, the vacuum pump, oil filtering system, hoses, and gear pump must be completely free of all hydrocarbons. See Section 6.4 & contact our factory for more information.



Ensure that your process gas is compatible with the OF-3000 materials. If the process gas isn't compatible, it could result in contaminated oil leaking out of the OF-3000 or air leaking into the OF-3000 and vacuum pump. See Tables 7-B and 7-C for a list of materials used in the OF-3000.



When sharing one oil filtering system among more than one vacuum pump, ensure that the oils in the vacuum pumps are compatible with each other and ensure that the contaminants or process gas from one vacuum pump won't have a dangerous reaction with the contaminants in the other vacuum pumps.



Before pumping pyrophoric gas, seal the vacuum pump's inlet, switch ON the OF-3000, and run the pump with nitrogen purging for ½ hour to allow all of the trapped air to be exhausted from the oil filter and vacuum pump.



Hazardous process gases can concentrate in the vacuum pump, its oil, and its filters. If the pump has been used on toxic, explosive, pyrophoric, corrosive, volatile, or other hazardous substances, take the proper safety precautions before opening the pump or filters, or before handling the oil. See Section 5 for proper safety precautions.



Use care when working near the sight glass. If you break this glass, oil and any contaminants will squirt out. Removing the lid from the OF-3000 canister while the OF-3000 is running could result in contaminated oil squirting out of the canister.



Disconnect the power before beginning installation, maintenance or repair work, or before interchanging the input leads when correcting the direction of rotation. Disconnecting the power also avoids an unexpected start-up from the automatically resetting thermal overload.

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Table I — Ordering Information and Technical Data for the OF-3000

Part Numbers of the Oil Filtering Systems (doesn't include filtering element or oil)	
OF-3000 (Standard)	898625
OF-3000 prepared for PFPE	899455
OF-3000C coated and prepared for PFPE	899450
Part Numbers of Filtering Elements	
Aluminum Oxide	.898523
Fullers Earth	.99 171 159
Hydrophilic	.898525
Particulate (pleated paper)	.898599
Particulate (fiberglass)	.99 171 158
Gear Pump Motor	1/6 hp, 115/208/230 volts, 3.6/1.8 amps, single phase, (A coated version is used with the OF-3000C.) 50/60 Hz, 1425/1725 rpm, with automatically resetting thermal overloads, wired for 115 volts.
Gear Pump	0.7 gpm at 1725 rpm
Pressure Gauge	0-100 psig (0-700 K Pa)
Oil Pressure	See Section 6.2 for a detailed explanation.
Initial*	0 psig
For room-temperature oil†	30 to 55 psig
For warm oil	5 to 30 psig
When element is clogged	>50 psig
Oil Capacity	3 gallons of hydrocarbon oil or 48 lbs. of perfluoropolyether
Flexible Hoses	6-feet long x 3/8" ID; Teflon with stainless steel braid
Dimensions	14" W x 18" L x 25 5/8" H
Maximum Run	The OF-3000 can operate 10 to 15 feet away from the vacuum pump horizontally. Vertically, it can operate up to 5 feet above the pump; there is no restriction on the distance it can operate below the pump.
Dry Weight w/o Filter Element	65 lbs.

*The pressure rises as soon as the oil displaces any air in the OF-3000.

†This pressure gradually decreases as the vacuum pump approaches its operating temperature.

Important:

Failure to comply with the following could cause premature failure of your oil filter or vacuum pump and void your warranty.

- Before connecting the OF-3000 to the vacuum pump, ensure that the oils in the vacuum pump and in the OF-3000 are compatible. If you mix hydrocarbon and perfluoropolyether (PFPE) oil, it will emulsify and damage the vacuum pump.
- Ensure that the OF-3000 hoses are connected to the correct oil ports on the vacuum pump (see Figure 2-2). If the hoses are connected to the wrong ports, the OF-3000 gear pump could be damaged from pumping air.
- Ensure that your power supply matches the OF-3000's power requirements (see Table I).
- Ensure that the OF-3000 gear pump is rotating in the correct direction; if the gear pump rotates in the wrong direction, it could be damaged from pumping air (see Section 2, Step 4).
- Change the filter element when the OF-3000's pressure exceeds 50 psig or when the oil appears contaminated (see Section 4.1).
- Don't allow the OF-3000 to sit for more than three days with contaminated oil in it or the gear pump may begin to corrode.
- If you must install new hoses, be sure to use teflon hoses with stainless steel braid and a conductive core (see Item 11 in Table 7-B). The current generated by the oil flow may arc and cause oil leaks in the standard hoses or fittings. The conductive core prevents this arcing.



1 — Introduction & Equipment Unpacking

The OF-3000 oil filtering system extends the life of the vacuum oil and of the vacuum pump by removing contaminants and heat from the oil. It can be used with TRIVAC “A” pumps or with the S100C, S160C, and S250C rotary vane pumps. With minor modifications, you can also use it with S400F and S630F pumps and with E and DK series rotary piston pumps (see Appendix A). Aluminum oxide, particulate, Fullers Earth, and hydrophilic filtering elements are available for use in the OF-3000. See Section 6 for a detailed description of the OF-3000 and Section 6.3 for information on selecting the correct filter element for your application.

There are three models of the OF-3000:

- The standard OF-3000 (P/N 898625),
- The OF-3000 (P/N 899455) that is prepared for perfluoropolyether oil, and
- The **coated** OF-3000C (P/N 899450) which is prepared for perfluoropolyether oil.

Unless noted otherwise, all references to the OF-3000 in this manual apply to all models of the oil filtering system.

Check the nameplate on the OF-3000's pan to determine which model you have. The top of the cover nut is painted brown on the OF-3000C model to make it easy to identify.

This manual has the information that you need to safely install, start, operate, maintain, troubleshoot, and order parts for your OF-3000 oil filtering system. We urge you to read Sections 1 through 4 before using your OF-3000.

“WARNING” statements are used in this manual to prevent injury to personnel and “CAUTION” statements are used to prevent damage to equipment.

Numbers in parentheses refer to item numbers of parts in the parts list (see Section 7).



WARNING!

Ensure that your process gas is compatible with the OF-3000 materials. If the process gas isn't compatible, it could result in contaminated oil leaking out of the OF-3000 or air leaking into the OF-3000 and vacuum pump. See Tables 7-B and 7-C for a list of materials used in the OF-3000. Contact our factory for more information.

1.1 Equipment Unpacking

The filtering element and vacuum oil aren't included with the OF-3000. You must purchase and install them before using the OF-3000 (see Section 2). See Section 6.3 for information on selecting the correct filtering element for your process.

Proceed as follows to unpack the OF-3000 and check for shipping damage.

1. Inspect the outside of the shipping container for shipping damage. If you will be making a damage claim, keep the shipping container and packing materials.
2. Carefully unpack the OF-3000.
3. Inspect the OF-3000 for damages.
4. If you find any evidence of damage, proceed as follows:
 - a. Save the shipping container, packing material, and damaged part for inspection.
 - b. Notify the carrier that made the delivery within 15 days of delivery in accordance with Interstate Commerce regulations.
 - c. File a claim with the carrier for the damage. Any damage in transit is the responsibility of the carrier because all equipment is transported from our factory by private carriers.
 - d. If it is necessary to replace the damaged part, contact the our Order Services department.

2 — Installing the OF-3000

WARNINGS:



If the vacuum pump and/or OF-3000 has been used on corrosive, toxic, hazardous, or volatile gases, take proper safety precautions to protect personnel a) before removing the plugscrews or inlet and exhaust lines from the vacuum pump, b) before removing the OF-3000 quick-connects, and c) before removing the lid from the OF-3000 canister. Proper precautions could include inert gas purging before and after you drain the oil to sweep hazardous gas from the vacuum pump or optional inlet and exhaust filters; gloves or protective clothing to avoid skin contact with toxic or highly corrosive substances; specially ventilated work areas; fume hoods; safety masks; breathing apparatus; etc.



If you will be using perfluoropolyether (PFPE) oil, you must use one of the OF-3000 models that is prepared for PFPE. In addition, the vacuum pump, oil filtering system, hoses, and gear pump must be completely free of all hydrocarbons. See Section 6.4 and contact our factory for more information.



Use care when working near the sight glass. If you break this glass, oil and any contaminants will squirt out.

You can special order longer hoses if you need to operate the OF-3000 farther than 6 feet away from the vacuum pump. With the longer hoses, the OF-3000 can operate as far as 10 to 15 feet horizontally away from the vacuum pump.

If the OF-3000 is 5 feet or more above the vacuum pump, it is sometimes necessary to prime its gear pump before it will start (see Section 3.1).

The filtering element and vacuum oil aren't included with the OF-3000. See Section 6.3 for information on selecting the correct filtering element for your process. See Step 1 on pages 8 and 9 for instructions on installing the filter element and oil.

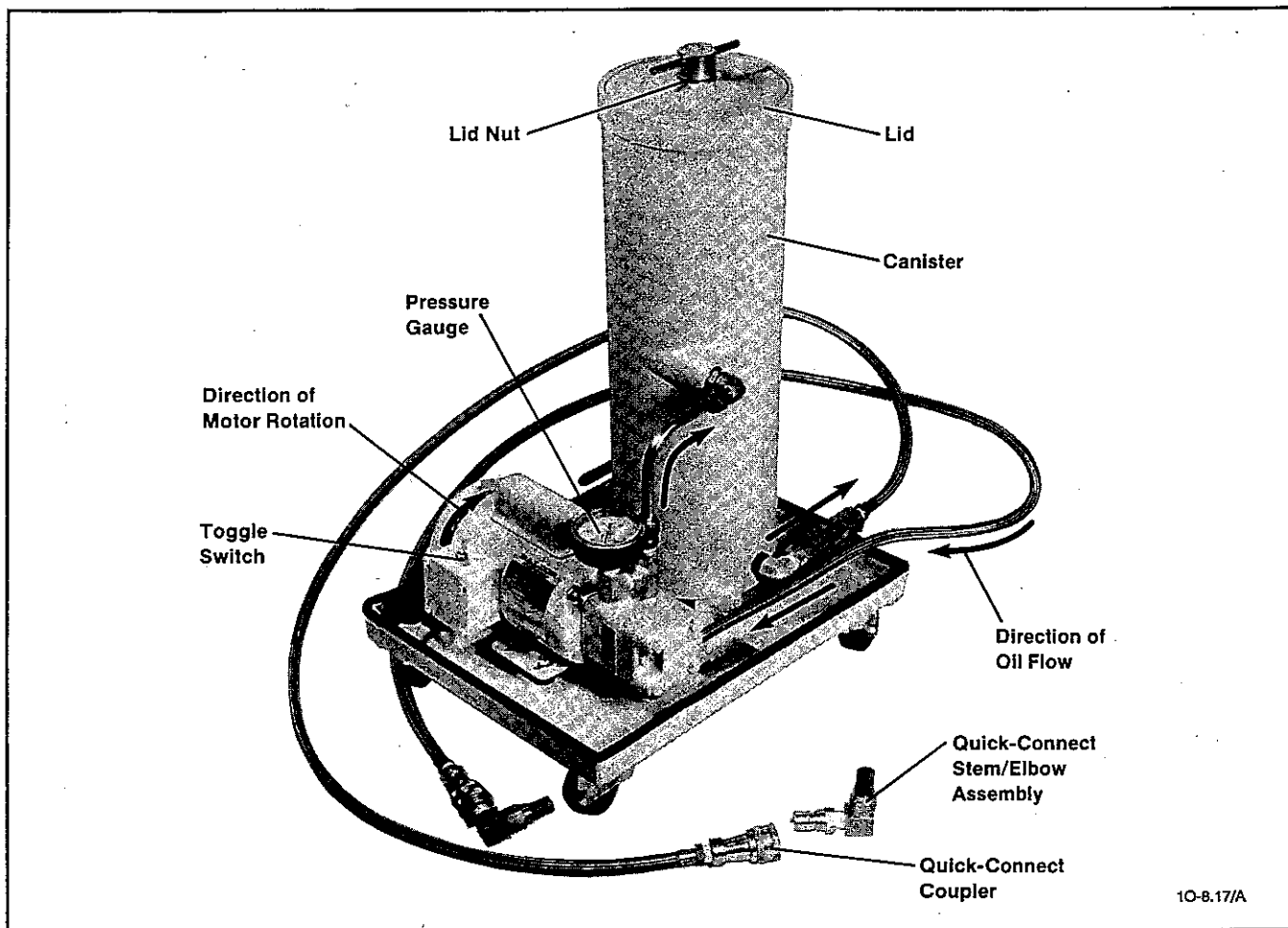


Figure 2-1. OF-3000 Oil Filtering System

Proceed as follows to install the OF-3000 onto a TRIVAC "A" or S100/160/ 250C vane pump. See Appendix A if you will be using the OF-3000 with an S400F or S630F Rotary Vane Pump or an E or DK Series Rotary Piston Pump.

1. If not already done, install a new filtering element and clean oil as follows:



WARNING!

Don't remove the lid from the canister unless the OF-3000 gear pump is turned off.

- a. After the pressure on the OF-3000 oil-pressure gauge drops to 0, unscrew the lid nut and remove the lid from the canister (see Figure 2-1).
- b. Install the correct filtering element (see Section 6.3) into the canister ensuring that the element is seated properly around the bottom ring of the canister. If the filtering element has a handle, the handle should face up.

- c. Pour the correct vacuum oil (see the pump identification plate or manual) into the center and outside of the filtering element until the oil level is just below the machined step in the canister (see Figure 7-3).
- d. Install the lid onto the canister as follows:
 - 1) A new O-ring for the lid comes with each filtering element. Coat the O-ring with the correct vacuum oil and install the new O-ring onto the rim of the lid; **the lid will be difficult to remove if the O-ring hasn't been coated with oil.**

IMPORTANT: Failure to seat the lid onto the filtering element could result in oil bypassing the filtering element. An improperly installed lid could also result in an oil leak.

- 2) Fit the lid onto the top of the canister and begin tightening the lid nut. The lid tilts slightly as it passes the lead-in chamfer of the canister. Straighten the lid and then continue tightening the nut. It may be necessary to straighten the lid several times before it is seated on the gasket on top of the filtering element. Tighten the lid hand-tight (see Figure 7-3); don't use a wrench or channel lock pliers to tighten the lid nut.

A properly installed lid will be approximately $\frac{1}{16}$ to $\frac{3}{16}$ inch below the top rim of the canister. If the lid is less than $\frac{1}{16}$ inch below the rim of the canister, it means that the filtering element isn't installed properly.

- e. Record the installation date onto the maintenance record page in the back of this manual.

2. Shutdown the vacuum pump.

3. NOTE: Connect the OF-3000 hoses to the vacuum pump as shown Figure 2-2 so that you get a good cross flow of oil through the vacuum pump. Don't connect the OF-3000 hoses to the vacuum pump so that the oil-fill hose is directly above the oil-drain hose; if the oil-fill and -drain hoses are connected on the same end of the vacuum pump, some of the filtered oil will be drawn directly back into the OF-3000 rather than circulating through the vacuum pump.

Proceed as follows to connect the OF-3000 hoses to the vacuum pump:

- a. Remove the oil-fill and oil-drain plugscrew and drain the oil from the vacuum pump.
- b. Install the quick-connect stem/elbow/gasket assembly (13/14/26) into the oil-drain port of the vacuum pump as follows (see Figure 2-1).
 - 1) Remove a quick-connect stem/elbow assembly (13/14) from one of the OF-3000 hoses by pulling back on the spring-loaded quick-connect coupler (12) and pulling the stem (13) away from the coupler (see Figure 2-1).
 - 2) Place a gasket (P/N 239-55-165) from the vacuum pump oil drain/fill plugscrew onto the elbow (14) on the quick-connect stem (13) (see Figure 2-1).

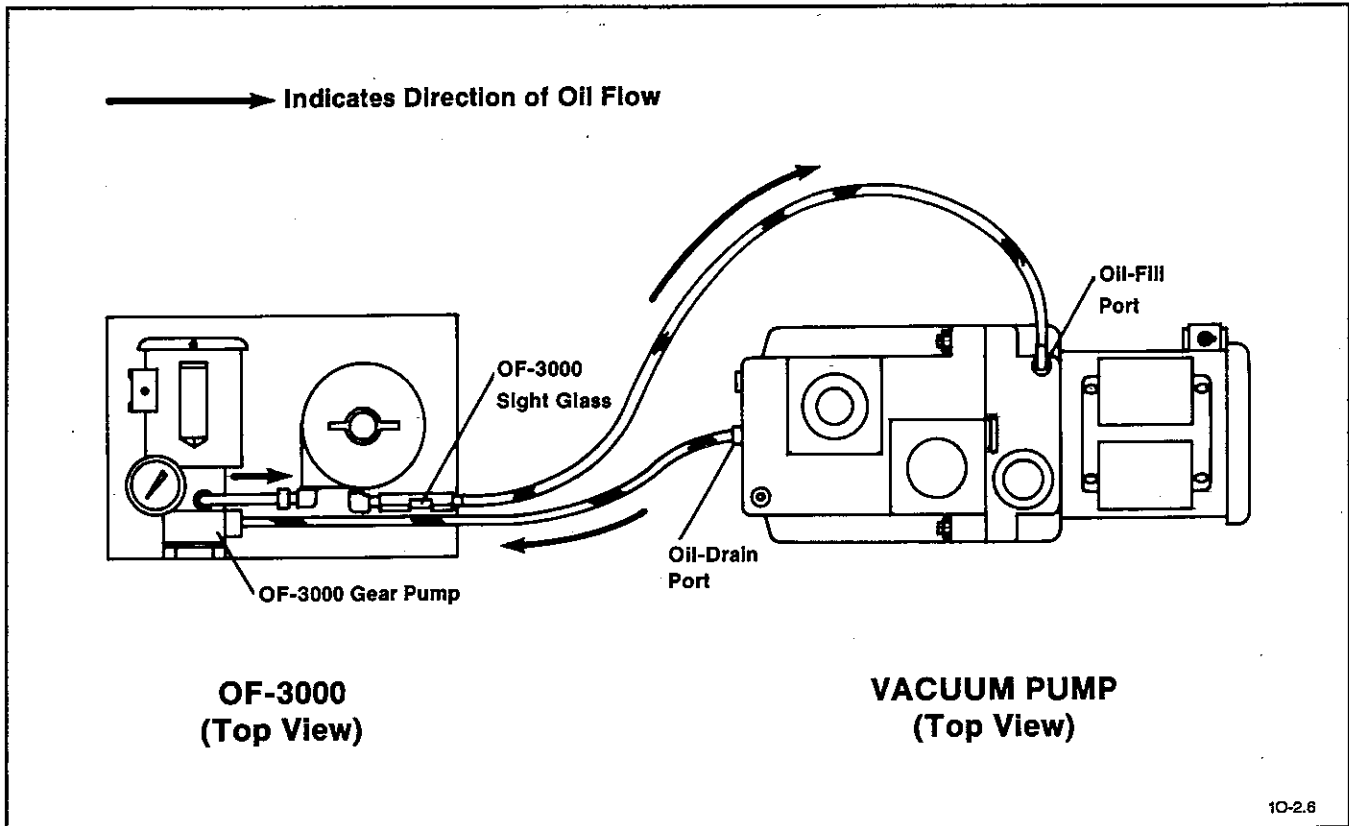


Figure 2-2. Sketch of the OF-3000 Connected to a Vacuum Pump

- 3) Screw the stem/elbow/gasket assembly into the vacuum pump's oil-drain port (see Figure 2-2).
- c. Pour the correct vacuum oil through the vacuum pump's oil-fill port until the oil level reaches the top of the vacuum pump's oil sight glass.
- d. Repeat Step 3b except install a quick-connect stem/elbow/gasket assembly into the vacuum pump's oil-fill port.

CAUTION: Failure to connect the OF-3000 hoses to the correct oil ports on the vacuum pump could result in the gear pump being damaged from pumping air.

- e. Connect the OF-3000 hoses as follows:
 - 1) Connect the hose with the sight glass to the quick-connect stem on the vacuum pump's oil-fill port (see Figure 2-2).
 - 2) Connect the other hose (the one that attaches to the bottom of the OF-3000 gear pump) to the quick-connect stem (13) on the vacuum pump's oil-drain port (see Figure 2-2).

4. NOTE: The standard single-phase motor on the gear pump can run at 115 or 208, 220/230 volts at 50 or 60 Hz.* To change the voltage of the motor, install the appropriate linecord and use the wiring diagram inside of the motor junction box to change the connections in the motor junction box.

CAUTION: Failure to check the direction of rotation of the gear-pump motor after making any changes to the electrical connections can result in a) overfilling of the vacuum pump, and b) the gear pump being damaged from pumping air.

WARNING!



Ensure that the incoming power to the OF-3000 is OFF before interchanging the input leads when correcting the direction of rotation.

Make the electrical connection and check the direction of motor rotation as follows (see Figure 2-1):

- a. Connect the OF-3000 to a power outlet that matches the voltage requirements of the gear-pump motor (see motor nameplate).
- b. Switch ON the OF-3000 momentarily to check the direction of rotation; looking from the fan end of the gear-pump motor, the motor fan should turn counterclockwise.
- c. If the fan rotates clockwise, disconnect the power and correct the rotation by reversing two of the input leads in the motor junction box (see the motor nameplate tag).

*A gear pump with an explosion proof motor can also be supplied on request.

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WARNINGS:



Death or serious injury can result from the improper use or application of this oil filtering system. If the oil will be exposed to toxic, explosive, pyrophoric, highly corrosive, or other hazardous process gases including greater than atmospheric concentrations of oxygen, contact Leybold for specific recommendations.



Process gas is often entrained in the vacuum oil. If the process gas is hazardous, you must take special safety precautions when handling the oil (see Section 4). If an oil leak develops, repair it immediately to prevent the contaminated oil from leaking from the vacuum pump or oil filtering system.



Ensure that your process gas is compatible with the OF-3000 materials. If the process gas isn't compatible, it could result in contaminated oil leaking out of the OF-3000 or air leaking into the OF-3000 and vacuum pump. See Tables 7-B and 7-C for a list of materials used in the OF-3000. Contact our factory for more information.



Removing the lid from the canister while the OF-3000 is running could result in contaminated oil squirting out of the canister.

Use care when working near the sight glass. If you break this glass, oil will squirt out. If the vacuum pump is exposed to hazardous gas, the oil could also be hazardous.

CAUTION: Don't allow the OF-3000 to sit for more than three days with contaminated oil in it or the gear pump may begin to corrode.

3.1 Start-Up

WARNING!



After installing a new filtering element, oil displaces air trapped in the element. This air bubbles through the OF-3000 sight glass and then into the vacuum pump before being expelled from the pump's exhaust port. Normally, this entrapped air doesn't cause a problem. However, if you are pumping pyrophoric gases, it could react with the pyrophoric gas and cause an explosion or fire. Before pumping pyrophoric gas, seal the pump's inlet, switch ON the OF-3000, and run the pump with nitrogen purging for ½ hour to allow all of the trapped air to be exhausted from the oil filter and vacuum pump.

If the OF-3000 is 5 feet or more above the vacuum pump, it is sometimes necessary to prime the OF-3000's gear pump before it will start. To prime the gear pump, remove the pressure gauge, fill the gear pump with the correct vacuum oil, and reinstall the pressure gauge (see Figure 2-1).

The oil pressures change as follows during start-up.

- | | |
|---------------|--|
| 0 psig | On cold start-up, the OF-3000 oil-pressure gauge reads 0 psig and then increases as air in the OF-3000 is displaced by oil. |
| 30 to 50 psig | Once the air is displaced, the pressure is 30 to 50 psig as the OF-3000 filters room temperature oil; then, the oil pressure decreases as the oil warms and its viscosity decreases. |
| 5 to 30 psig | When the pump reaches operating temperature, the normal oil pressure is in the 5 to 30 psig range. |
| >50 psig | If the pressure then increases above 50 psig, it means that the filter element is clogged and should be changed or that flow is restricted downstream of the gear pump. |

Proceed as follows to start the system:

1. Ensure that the OF-3000 hoses are connected correctly (see Figure 2-2).

CAUTION: Don't start the OF-3000 without oil in the vacuum pump or in the OF-3000 canister.

2. Switch ON the OF-3000 using the toggle switch on the gear pump motor (see Figure 2-1).
3. Check the OF-3000 canister for oil leaks. If there is any leakage, tighten the lid nut by hand until the leak stops (see Figure 2-1).
4. As air is displaced from the OF-3000, the oil level in the vacuum pump decreases.

Once the pressure on the OF-3000 gauge reaches 30 to 50 psig, add oil to the vacuum pump as follows:

- a. Ensure that the vacuum pump is off and then remove the extra oil-fill plug from the top of the vacuum pump.
 - b. Pour the correct vacuum oil (see vacuum pump identification plate or manual) into the vacuum pump oil-fill port until the oil level reaches the middle of the vacuum pump sight glass.
 - c. Reinstall the oil-fill plug and switch ON the vacuum pump.
 - d. After the vacuum pump has run for 30 minutes, recheck the oil level in the vacuum pump's sight glass. The oil level should be near the middle of the sight glass while the vacuum pump is running.
 - e. If the oil level is low, turn off the vacuum pump and repeat Steps 4a through 4c to add some additional oil.
5. Switch ON the vacuum pump.

3.2 *Monitoring the Oil Pressure and Color*

Check the pressure reading on the OF-3000 oil-pressure gauge and check the appearance of the oil through the OF-3000 sight glass every day (see Figure 2-2).

If the oil pressure is in the 50 to 55 psig range while the pump is at operating temperature, it usually means that the filtering element is clogged and should be changed (see Section 4). See Section 3.1 for a listing of the normal pressure changes during start-up.

If the pressure reading is low but the oil has an unusual color or odor, is dark, contains particles, or appears dirty or turbid, change the filtering element (see Section 4). When using the Activated Alumina or Fullers Earth filtering element, it is normal for the oil to become lighter in color over time.

You can continue to operate the OF-3000 after the pump is shutdown to thoroughly regenerate the oil.

An incorrectly adjusted bypass valve can also cause the oil pressure to stay low even though the oil is contaminated. See Symptom 5c of the troubleshooting chart for instructions on adjusting the bypass valve.

3.3 *Gas Bubbles in the Oil During Operation*

During normal operation, gas bubbles may appear in the OF-3000 sight glass. An occasional spurt of bubbles (several seconds apart) may come from exhaust gases or process gases entrained in the vacuum oil. This is common with the TRIVAC "A" vane pump because of the churning action of its oil slinger. To determine if entrainment is the source of the bubbles, switch off the OF-3000 for a few minutes and check if foam is visible above the oil level in the vacuum pump's sight glass. If foam is visible, then entrainment is the source of the bubbles.

Continuous bubbles in the OF-3000 sight glass indicates an air leak in the OF-3000 hose connected to the vacuum pump's oil-drain port or in the suction side connections of the OF-3000 gear pump. If air won't react with the process gases, then there is no danger in allowing the bubbles to continue to flow. If the vacuum pump is exposed to pyrophoric gases, you must immediately disconnect the OF-3000 from the process and eliminate the air leak.

Table 3-A — Part numbers for the Quick-Connect Stem, Elbow, & Adapters

Item No.	Pump Model	Qty. Needed for Each Additional Pump	Description	Material	Part Number
13	All Models	2	$\frac{3}{8}$ " FPNT quick-connect stem	Steel	721-52-001
				Stainless Stl	725-54-024
14	TRIVAC and newer S Series* pump models	2	$\frac{3}{8}$ " NPT to M16 x 1.5 mm swivel elbow adapter	Stainless Steel	725-54-304
N/A	Older S100C, S160C, & S250C pump models only (see Appendix A.3)	1*	$\frac{3}{8}$ " NPT to M30 x 1.5 mm adapter	Steel	721-03-001
		1	$\frac{3}{8}$ " NPT to M16 x 1.5 mm swivel elbow adapter	Stainless Steel	725-54-304
N/A	E & DK, S400/630F, (see Appendix A)	2	$\frac{3}{8}$ " NPT close nipple	Stainless Steel	725-57-0001

*The older S100C, S160C, and S250C pump models have only an M30 oil-fill port; the more recent S100C, S160C, & S250C pump models have an M16 oil-fill port in addition to the M30 oil-fill port.

3.4 Using One OF-3000 to Service Several Vacuum Pumps



WARNING!

When sharing one oil filtering system among more than one vacuum pump, ensure that the oils in the vacuum pumps are compatible with each other and ensure that the contaminants or process gas from one vacuum pump won't have a dangerous reaction with the contaminants in the other vacuum pumps. In addition, if you mix hydrocarbon oil with PFPE oil, it will damage the pump.

If filtering requirements allow time-sharing of the OF-3000 among more than one vacuum pump, proceed as follows:

1. Attach a quick-connect stem/elbow/gasket assembly (13/14/26) to the oil-fill and oil-drain ports of each extra vacuum pump (see Figure 2-1 and Section 2, Steps 2 and 3). See Table 3-A for part numbers.
2. Attach the OF-3000 hoses to the stem/elbow/gasket assemblies on one of the vacuum pumps (see Section 2, Step 3e).

3. Start the OF-3000 (see Section 3.1) and allow it to operate until the oil in the first pump is free of contamination.
4. Switch off the OF-3000 and disconnect the OF-3000 hoses from the first vacuum pump; because the vacuum pump has quick-connect stem assemblies, it isn't necessary to turn off the vacuum pump when connecting or disconnecting the OF-3000.
5. Snap the OF-3000 hoses onto the stem/nipple/adaptor assemblies of another vacuum pump that has contaminated oil.
6. Switch ON the OF-3000 and allow it to remove the contaminants from the oil in this vacuum pump before repeating Steps 4, 5, and 6 for additional vacuum pumps.

4 — Routine Maintenance

WARNINGS:



If the vacuum pump and/or OF-3000 has been used on corrosive, toxic, hazardous, or volatile gases, take proper safety precautions to protect personnel a) before removing the plugscrews or inlet and exhaust lines from the vacuum pump, b) before removing the OF-3000 quick-connects, and c) before removing the lid from the OF-3000 canister. Proper precautions could include inert gas purging before and after you drain the oil to sweep hazardous gas from the vacuum pump or optional inlet and exhaust filters; gloves or protective clothing to avoid skin contact with toxic or highly corrosive substances; specially ventilated work areas; fume hoods; safety masks; breathing apparatus; etc.



Removing the lid from the canister while the OF-3000 is running could result in contaminated oil squirting out of the canister.



Use care when working near the sight glass. If you break this glass, oil will squirt out. If the vacuum pump is exposed to hazardous gas, the oil could also be hazardous.

If you must install new hoses, be sure to use teflon hoses with stainless steel braid and a conductive core (see Item 11 in Table 7-B). The static generated by the oil flow may arc and cause oil leaks in the standard hoses or fittings. The conductive core prevents this arcing.



Before sending an oil filtering system or pump to our factory or to one of our service centers, notify us of any toxic or other harmful products that may be in the pump, its oil, or its filters.

Table 4-A — Maintenance Schedule

Maintenance	Frequency	Reference Section
Checking the Oil for Contamination	Daily	4.1
Changing the Filtering Element	As required	4.2
Changing the Oil	As required	4.3
Checking the Oil Level	Daily*	4.4

*You may need to check the oil level more frequently when the vacuum-pump throughput is high, and less frequently when the throughput is low.

4.1 Checking the Oil for Contamination

Check the OF-3000's oil-pressure gauge and the appearance of the oil through the OF-3000's sight glass every day.

The pressure range of the gauge is 0 to 100 psig. This is NOT the fully usable range of the filtering element. When the gauge reads 50 to 55 psig while the pump is at operating temperature, it usually means that the filtering element is clogged and should be changed (see Section 4.2). See Section 4 for a listing of the normal pressure changes during start-up.

If your process doesn't generate large amounts of particulates, watch for other indicators to determine when to change the filtering element. For example, if your process generates acids but very few particulates, the oil pressure reading could be low even though the neutralizing capacity of the filtering element is exceeded. To determine when to change the OF-3000 filtering element in these cases, observe the appearance of the oil through the OF-3000 sight glass and/or test the oil. A high ultimate pressure for the vacuum pump is another indication that the filtering element may need to be changed.

The OF-3000 filtering element needs to be changed if the oil in the OF-3000 sight glass has an unusual color or odor, is dark, contains particles, or appears dirty or turbid (see Section 4.2).

Use either the neutralization number test (ASTM Method D 664 or D 974) or the INLAND test kit* to test your oil for acidity. The INLAND test tells you whether or not the oil is too acidic; whereas, the neutralization number test quantifies the exact acidity of the oil. To obtain a good sample for testing, turn off the OF-3000 gear pump, disconnect the hose from the vacuum pump's oil-fill port and catch the few drops of oil that drip out of the quick-connect coupler (12) (see Figure 4-1). If the neutralization number of hydrocarbon oil exceeds 1 mgKOH/gram, it should be changed.

An incorrectly adjusted bypass valve can also cause the oil pressure to stay low even though the oil is contaminated. See Symptom 5c of the troubleshooting chart for instructions on adjusting the bypass valve.

*The INLAND test kits are available from Inland Vacuum Industries, Inc. Churchville, NY.

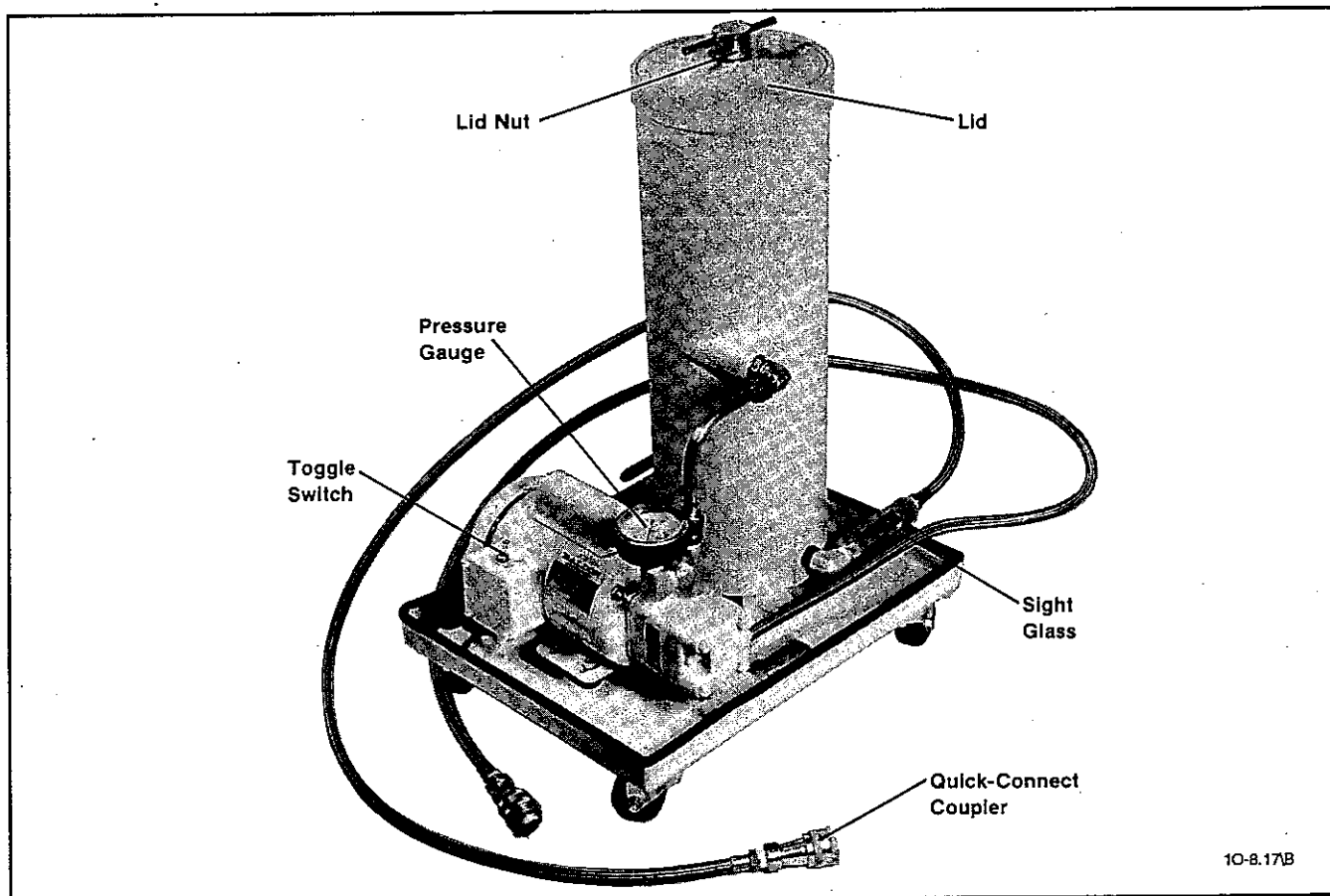


Figure 4-1. OF-3000 Oil Filtering System

4.2 Changing the Filtering Element

WARNINGS:

See the warnings at the beginning of Section 4 before proceeding.



After installing a new filtering element, oil displaces air trapped in the element. This air bubbles through the OF-3000 sight glass and then into the vacuum pump before being expelled from the pump's exhaust port. Normally, this entrapped air doesn't cause a problem. However, if you are pumping pyrophoric gases, it could react with the pyrophoric gas and cause an explosion or fire. Before pumping pyrophoric gas, seal the pump's inlet, switch ON the OF-3000, and run the pump with nitrogen purging for 1/2 hour to allow all of the trapped air to be exhausted from the oil filter and vacuum pump.

See Section 4.1 to determine if the filtering element needs to be changed.

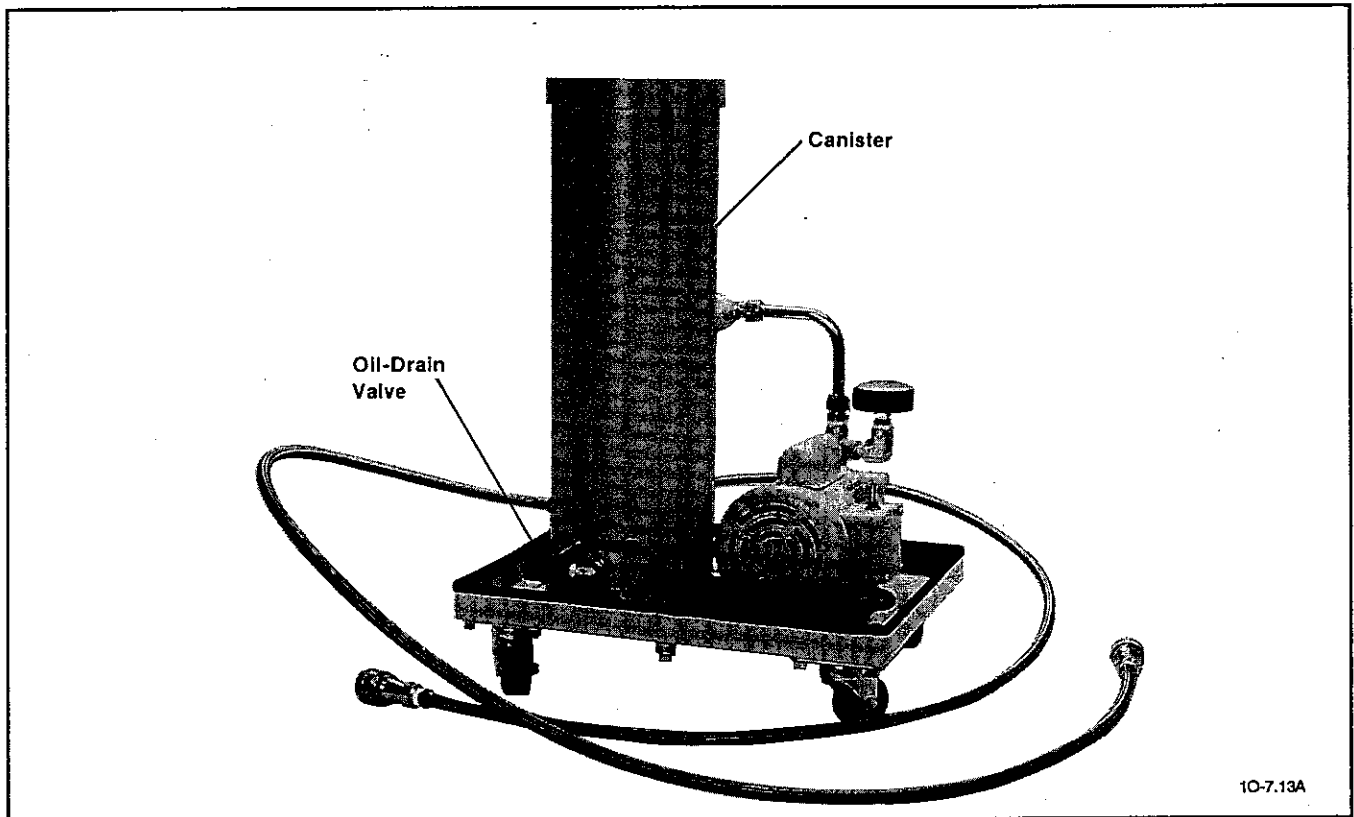


Figure 4-2. OF-3000 Back View Showing the Oil-Drain Valve

Proceed as follows to change the filtering element:

1. Switch off the OF-3000's gear-pump motor (see Figure 4-1).
2. Using the quick-connect fittings, disconnect the OF-3000 hoses from the vacuum pump. If you don't disconnect the hoses from the vacuum pump and the vacuum pump is above the OF-3000, the oil may drain from the vacuum pump into the OF-3000 and overflow as you remove the lid. If you don't disconnect the hoses and the OF-3000 is above the vacuum pump, the oil could drain from the OF-3000 into the vacuum pump as you remove the OF-3000 lid.

CAUTION: Don't allow the canister to sit for more than three days with contaminated oil or it may begin to corrode.

3. Proceed as follows to install a new filtering element (see Figure 4-1).
 - a. Allow the pressure on the OF-3000 gauge to reach 0 psig (see Figure 4-1) and then unscrew the lid nut (H4) and remove the lid (H2) from the canister.
 - b. If you need to change the oil, drain the oil from the canister by removing the pipe plug from the OF-3000's oil-drain valve, attaching a drain line to the threaded port, and opening the drain valve (see Figure 4-2). After the oil has drained, shut the valve; then, reinstall the pipe plug to prevent accidental opening.

- c. Lift the filtering element from the canister; oil will drain from the element as it is being removed.
- d. If necessary, rinse or clean the canister with a suitable solvent before installing a new filtering element.
- e. Insert a new filtering element (see Section 6.3) into the canister. If the element has a wire handle, the handle should face up.
- f. Pour the correct vacuum oil into the center and outside of the filtering element until the oil level is just below the machined step in the canister (see Figure 7-3).
- g. Replace the used lid O-ring with the new O-ring that came with the filtering element. Be sure to coat the new O-ring with the correct vacuum oil before installing it; **the lid will be difficult to remove if the O-ring hasn't been coated with oil.**
- h. **IMPORTANT:** Failure to seat the lid onto the filtering element could result in oil bypassing the element. An improperly installed lid could also result in an oil leak.

Fit the lid onto the top of the canister and begin tightening the lid nut. The lid tilts slightly as it passes the lead-in chamfer of the canister. Straighten the lid and then continue tightening the nut. It may be necessary to straighten the lid several times before it is seated on the gasket on top of the filtering element. Tighten the lid hand-tight (see Figure 7-3); don't use a wrench or channel lock pliers to tighten the lid nut.

A properly installed lid will be approximately $\frac{1}{16}$ to $\frac{3}{16}$ inch below the top rim of the canister. If the lid is less than $\frac{1}{16}$ inch below the rim of the canister, it means that the filtering element isn't installed properly.

- i. Record the installation date on the maintenance record page in the back of this manual.
 - j. Do the steps in Section 4 to start the OF-1000 and adjust the oil level.
 - k. Check the canister for oil leaks. If there is any leakage, tighten the lid nut by hand until the leak stops (see Figure 4-1).
4. If not already done, reconnect the OF-3000 hoses to the vacuum pump; the hose with the sight glass connects to the vacuum pump's oil-fill port (see Figure 2-2).

4.3 Changing the Oil

WARNINGS:



See the warnings at the beginning of Section 4 before proceeding.



If you will be using perfluoropolyether (PFPE) oil, you must use one of the OF-3000 models that is prepared for PFPE. In addition, the vacuum pump, oil filtering system, hoses, and gear pump must be completely free of all hydrocarbons. See Section 6.4 and contact the factory for more information.

NOTE: For E- and DK- pump models only, drain the oil from the pump using the procedure outlined in the E-and DK-manual. Use the steps in this section to drain the oil from the OF-3000.

Change the oil in the vacuum pump as follows:

1. Shutdown power to the vacuum pump and to the OF-3000.
2. Remove the quick-connect stem/elbow/gasket/hose assembly totally from the oil-fill port of the vacuum pump (see Figure 2-1).
3. Hold the OF-3000 hose over an empty container; the container must be large enough to hold the oil from the OF-3000 as well as the oil from the vacuum pump.

CAUTION: Prolonged dry running will cause the OF-3000 gear pump to seize.

4. Restart the OF-3000, allow it to run until the flow of oil begins to slow, and then immediately switch it off. The OF-3000 pulls the oil from the vacuum pump and empties itself.
5. Discard the used oil in accordance with environmental regulations.
6. Change the filter element using the steps in Section 4.2.
7. Recharge the vacuum pump with the correct vacuum oil.
8. Reconnect the hose assembly to the vacuum pump and do the steps in Section 2 to restart the system and adjust the oil level.

4.4 Checking the Oil Level

WARNING:

See the warnings at the beginning of Section 4 before proceeding.

Occasionally check the oil level by looking through the vacuum pump's sight glass. If the level is in the lower portion of the vacuum-pump sight glass while the pump is running, add oil.

Proceed as follows to add oil.

1. Shutdown the vacuum pump and remove its oil-fill plug.
2. Pour the correct oil into the vacuum pump's oil-fill port until the oil level is in the middle of the pump's sight glass while the OF-3000 is running.
3. Reinstall the oil-fill plug into its port in the top of the vacuum pump.

5 — Troubleshooting

WARNINGS:



If the vacuum pump and/or OF-3000 has been used on corrosive, toxic, hazardous, or volatile gases, take proper safety precautions to protect personnel a) before removing the plugscrews or inlet and exhaust lines from the vacuum pump, b) before removing the OF-3000 quick-connects, and c) before removing the lid from the OF-3000 canister. Proper precautions could include inert gas purging before and after you drain the oil to sweep hazardous gas from the vacuum pump or optional inlet and exhaust filters; gloves or protective clothing to avoid skin contact with toxic or highly corrosive substances; specially ventilated work areas; fume hoods; safety masks; breathing apparatus; etc.

Process gas is often entrained in the vacuum oil. If the process gas is hazardous, you must take special safety precautions when handling the oil (see Section 4). If an oil leak develops, repair it immediately to prevent the contaminated oil from leaking from the vacuum pump or oil filtering system.

Use care when working near the sight glass. If you break this glass, oil will squirt out. If the vacuum pump is exposed to hazardous gas, the oil could also be hazardous.

If you must install new hoses, be sure to use teflon hoses with stainless steel braid and a conductive core (see Item 11 in Table 7-B). The current generated by the oil flow may arc and cause oil leaks in the standard hoses or fittings. The conductive core prevents this arcing.

When replacing parts on the OF-3000 model that is prepared for PFPE, ensure that the replacement parts are free of all hydrocarbons. Completely degrease all metal parts with Freon except for the special PFPE-prepared gear pump which has already been degreased at our factory. Contact the Leybold main office for more information.

Before sending any equipment to our factory or to one of our service centers, notify us of any toxic or other harmful products that may be in the pump, its oil, or its filters.

Table 5-A has instructions for troubleshooting the OF-3000 if a malfunction occurs. To use the table, first observe the symptom, then locate the trouble area, and perform the recommended corrective action. The repair steps column refers to Sections or Steps in this manual that are helpful in making the repair.

Contents of Troubleshooting Chart

Symptom	Page
1. Oil is leaking from the OF-3000	29
2. Abnormal running noise	29
3. The OF-3000 starts but the pressure gauge reads 0 even though the oil is cold	30
4. The oil pressure on the gauge doesn't drop after the oil is warm	31
5. Oil in the OF-3000 sight glass is dirty or dark even though the gauge reading is less than 50 psig	31
6. Oil level in the vacuum pump drops after start-up	31
7. OF-3000 won't start	32
8. Oil isn't circulating sufficiently through the OF-3000	32
9. The ultimate pressure of the vacuum pump is deteriorating	32
10. Gas bubbles are visible in the oil through the OF-3000 sight glass	32

Table 5-A — Troubleshooting Chart

Symptoms	Trouble Area	Probable Cause	Recommended Corrective Action	References*
1. Oil is leaking from the OF-3000†.	a. Canister	Lid isn't seated properly on the filtering element.	Seat lid on filtering element.	Sec. 2, Step 1d.
		Lid isn't tightened enough.	Evenly tighten the lid nut.	Sec. 2, Step 1d
		Lid O-ring is damaged.	Replace lid O-ring (H5).	
		Filtering element isn't seated properly.	Install filtering element properly.	Sec. 2, Step 1b
	b. Gear pump (2).	Seals are worn.	Install new mechanical seal in gear pump (2).	Appendix B
	c. Fittings	Fittings aren't sealed properly.	Tighten fittings. If tightening doesn't solve the problem, replace the fitting that is leaking.	
	d. Hoses	Puncture or other damage.	Install new hoses. Use only teflon hoses with stainless steel braid and the conductive core.	Sec. 2. Table 7-B, Item 11
e. Oil-drain valve	Valve lever isn't shut tightly.	Shut valve tight.		
	Valve (H16) is worn out.	Replace ball valve (H16)		
2. Abnormal running noise	a. Canister	Vibration	Tighten nuts securing the canister to the pan; tighten nuts securing motor in place.	
	b. Gear pump (2)‡	Dirt buildup in the gear pump (2).	Disassemble and clean the gear pump (2). Use new gasket set and mechanical seal.	Appendix B & Table 7-A.
	c. Motor	Motor bearing malfunctioning.	Repair or replace the motor. Use 12 to 15 ft-lb torque for the 4 bolts holding the gear pump to the motor.	

*This column contains Sections or Steps in this manual that are helpful in making the repair.

† It is normal for a few drops of oil to drip out of the quick-connects just after they are disconnected.

‡It is normal if a small amount of air trapped in the OF-3000 makes some noise.

Table 5-A — Troubleshooting Chart

<i>Symptoms</i>	<i>Trouble Area</i>	<i>Probable Cause</i>	<i>Recommended Corrective Action</i>	<i>References*</i>
3. The OF-3000 starts but the pressure gauge reads 0 even though the oil is cold†.	a. OF-3000	Air is trapped in the OF-3000.	Allow the OF-3000 to run for 30 minutes so that the oil has time to displace the air.	Sec. 3.1, Step 4
		OF-3000 doesn't contain oil.	Add oil to the vacuum pump until the oil level in the vacuum pump is stabilized.	Sec. 3.1, Step 4
	b. Vacuum Pump	Vacuum pump doesn't contain oil.	Add oil to the vacuum pump.	Sec. 3.1, Step 4
	c. Filtering Element	No filtering element in the canister.	Install filtering element.	Sec. 2, Step 1
		Filtering element isn't installed correctly.	Correctly install filtering element.	Sec. 2, Step 1
	d. OF-3000 Motor	OF-3000 motor is running backwards.	Looking toward the fan end of the OF-3000 motor, the fan should rotate counterclockwise. If it is rotating clockwise, disconnect the power and reverse two of the input leads in the motor junction box.	Sec. 2, Step 4
	e. Hose Connections	The OF-3000 connecting hoses are switched.	Ensure that the OF-3000 hose that has the sight glass is connected to the vacuum pump's oil-fill port.	Sec. 2, Step 3e
	f. Location of the OF-3000.	OF-3000 is greater than 5 feet above the vacuum pump.	Lower the OF-3000 or raise the vacuum pump. Prime the gear pump (2).	Sec. 3.1

*This column contains Sections or Steps in this manual that are helpful in making the repair.

† It is normal for the pressure gauge (6) to read 5 to 30 psi when the oil is warm. The pressure should read higher than 30 psi when the oil is cold.

Table 5-A — Troubleshooting Chart

Symptoms	Trouble Area	Probable Cause	Recommended Corrective Action	References*
4. The pressure reading on the oil-pressure gauge (6) doesn't drop after the oil is warm †.	a. Filtering element	Element is clogged.	Install new element.	Sec. 4.2
	b. Hoses, fittings, quick-connects	Blockage in OF-3000 downstream from the gauge (6).	Locate and clear blockage.	
		Customer replaced standard quick-connects (12/13).	Use only the standard quick-connect fittings; other fittings may reduce the flow and increase the pressure.	Items 12 & 13 in Section 7
c. If pressure is 60 psi† or greater – Gear Pump	Gear pump bypass is set too high.	Ensure that the OF-3000 hose is connected to the vacuum pump's oil-drain port. Then, disconnect the OF-3000 hose from the vacuum pump's oil-fill port and switch ON the gear pump. Remove the cap nut from the bottom of the gear pump (2) and adjust the setscrew until the OF-3000 pressure reads approximately 55 psi. The setscrew should extend out about 5/8 inch from the gear pump.		
5. Oil in the OF-3000 sight glass is dirty or dark even though the gauge reading is <50 psi.	a. Filter element	Acid neutralizing capacity of element is spent but element isn't clogged.	Install new element.	Sec. 4.2
		Wrong filtering element if being use.	Contact our factory for recommendations for correct filtering element for your application.	Sec. 6.3
	b. Lid	Lid isn't seated properly on filter element.	Ensure filtering element is installed properly.	Sec. 2, Step 1
	c. Gear pump bypass valve	The bypass valve is set too low.	See Symptom 4c.	
d. Sight glass	Sight glass is dirty.	Clean sight glass.		
6. Oil level in the vacuum pump drops after start-up.	a. OF-3000	Entrapped air was displaced by oil causing the oil level to decrease.	Add the correct oil to the vacuum pump until the level stabilizes in the middle of the vacuum pump's sight glass. Sec. 3.1, Step 4	Sec. 3.1, Step 4
	b. Oil leak	See Symptom 1.	See Symptom 1.	

*This column contains Sections or Steps in this manual that are helpful in making the repair.

†The oil pressure gauge (6) should read >30 psi when the oil is at room temperature and most of the air is displaced from the OF-3000.

Table 5-A — Troubleshooting Chart

Symptoms	Trouble Area	Probable Cause	Recommended Corrective Action	References*
7. OF-3000 won't start.	a. Gear pump motor (2).	Motor isn't plugged in or switched ON.	Plug in or switch ON gear pump motor.	
		Voltage of power supply is different from rated voltage of motor.	Change wiring of motor (see instructions inside of motor junction box) or replace gear pump (2) with one that is rated for correct voltage.	Sec. 2, Step 4
		Motor bearing malfunctioning.	Repair or replace the motor. Use 12 to 15 ft-lb torque for the 4 bolts holding the gear pump to the motor.	
		Motor windings are malfunctioning.	Contact your electrician to repair the motor.	
	b. Oil	Oil is too cold or too viscous.	Heat oil. Or install the lid (H2) just far enough for the O-ring (H5) to seal; then, start the OF-3000. After the warm oil from the vacuum pump enters the OF-3000, tighten down the lid.	
c. Gear pump (2)	See Symptom 2b.	See Symptom 2b.		
8. Oil isn't circulating sufficiently through the OF-3000	See Symptoms 2b, 3d, 4a, 4b, and 7a.	See Symptoms 2b, 3d, 4a, 4b, and 7a	See Symptoms 2b, 3d, 4a, 4b, and 7a	
9. The ultimate pressure of the vacuum pump is deteriorating.	a. OF-3000 filtering element & oil.	Oil is contaminated.	Change OF-3000 filtering element and oil.	Sec. 4.1, 4.2, and 4.3
	b. Vacuum pump	See manual that came with pump.	See manual that came with pump.	
10. Gas bubbles are visible in the oil through the OF-3000 sight glass.	a. Vacuum pump	Exhaust or process gas is entrained in oil.	No corrective action is needed. Gas entrainment is normal especially in a TRIVAC "A" dual-stage pump.	Section 3.3
	b. Hose or fittings on suction side of OF-3000 gear pump.	Air leak	Repair leak if air has an undesirable reaction with process gas.	

*This column contains Sections or Steps in this manual that are helpful in making the repair.

6 — Description And Principles Of Operation

Contents

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6.2	Oil circulation	35
6.3	Filtering elements	36
6.4	Perfluoropolyether (PFPE) Oil	36

6.1 General Description

The OF-3000 oil filtering system extends the life of the vacuum oil and of the vacuum pump by removing contaminants and heat from the oil.

The OF-3000 can be used with TRIVAC® “A” pumps and with the S100C/S160C/S250C rotary vane pumps. With minor modifications to the pump, you can also use it with S400F/630F pumps and with E & DK Rotary Piston Pumps (see Appendix A).

The OF-3000 consists of a gear pump with motor, a pressure gauge, and an aluminum canister mounted on a steel pan (see Figure 6-1). Four swivel casters allow you to easily move the OF-3000.

The OF-3000 hoses have quick-connects for easy installation and removal. A sight glass on the return hose allows you to observe the flow and clarity of the filtered oil. The hoses are teflon with stainless-steel braid and an inner conductive core.

There are three OF-3000 models:

- **The standard OF-3000 (P/N 898625).**
- **The OF-3000 which is prepared for perfluoropolyether (PFPE) oil** — This model (P/N 899455) is degreased to ensure that it is free of hydrocarbons which would emulsify with perfluoropolyether oil and could have a dangerous reaction with aggressive process gases.
- **The coated OF-3000C which is prepared for PFPE oil** — The OF-3000C (P/N 899450) is chemically treated with a fluorocarbon material to resist corrosion. After the metal surfaces are prepared, the fluorocarbon is sprayed and then baked onto the internal surfaces of the filter housing, gear pump, fittings, and the quick-connects so that it won't peel off. The OF-3000C is also degreased to ensure that it is free of hydrocarbons.

See Table I in the front of this manual for specifications; see Figure 6-1 for a photograph of the OF-3000.

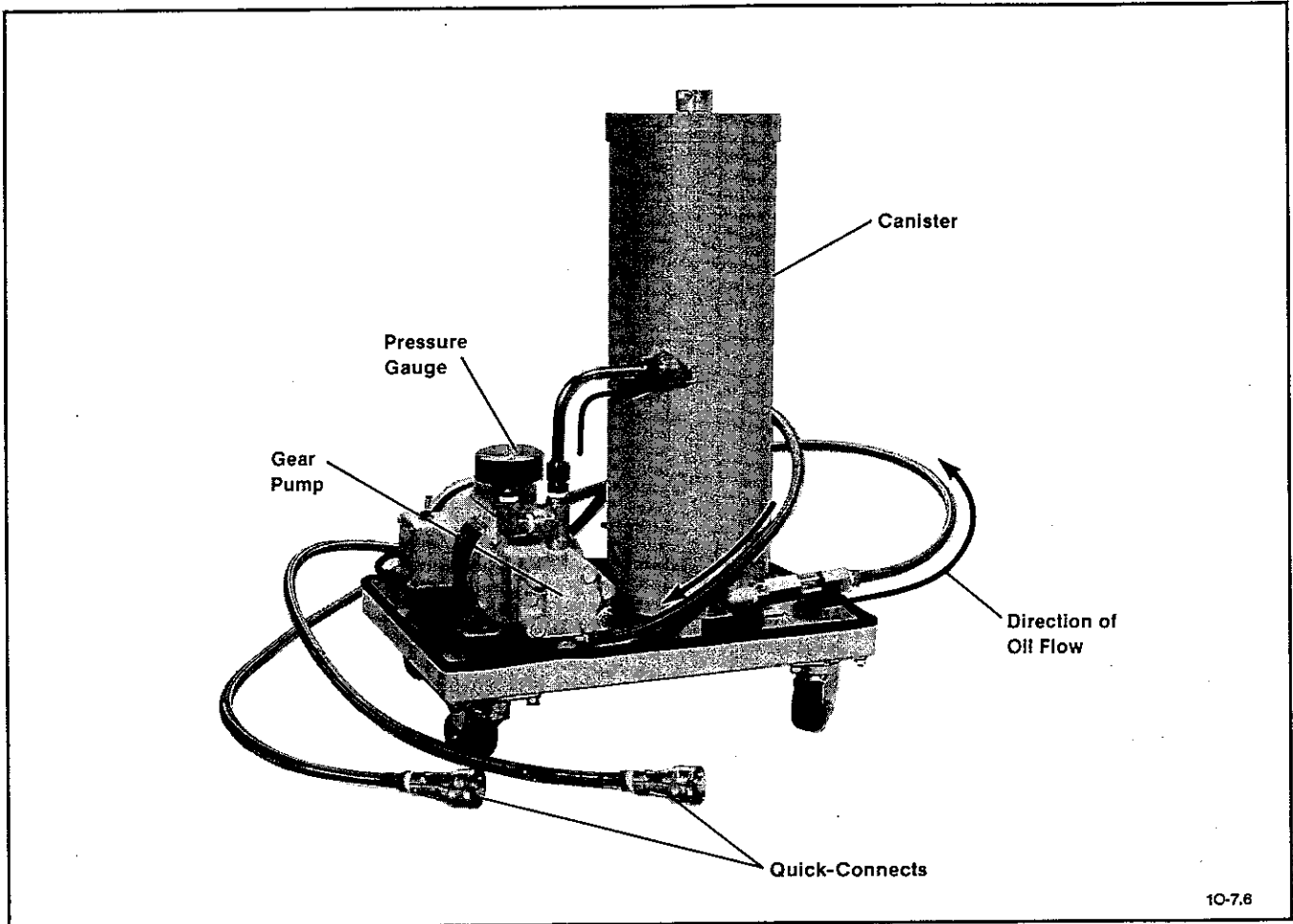


Figure 6-1. OF-3000 Oil Filtering System

6.2 Oil Circulation

During operation the OF-3000 recycles oil as follows (see Figure 6-1).

1. Contaminated vacuum oil is drawn from the vacuum pump's oil reservoir through the OF-3000 hose, and into the OF-3000 gear pump.
2. The OF-3000 gear pump provides the pressure to circulate the oil through the OF-3000 system. The gear pump has an internal bypass valve that diverts part or all of the oil back into the inlet chamber of the gear pump if the pressure through the filter system exceeds approximately 55 psig.
3. An oil-pressure gauge mounted on the OF-3000 gear pump indicates the pressure of the oil flowing through the filter element.

0 psig	The gauge will read 0 psi until the oil displaces any air that may be in the OF-3000.
30 to 55 psig	The pressure will rise to 30 to 55 psi while the OF-3000 is filtering room temperature oil. This pressure will gradually decrease as the vacuum pump approaches its operating temperature.
5 to 30 psig	The normal operating pressure after the OF-3000 is warm is 5 to 30 psig.
>50 psig	If the pressure is above 50 psig when the system is at its operating temperature and has a new filtering element and relatively clean oil, it means that the filtering element may be partially clogged or that there may be a flow restriction downstream of the gauge.

4. The OF-3000 gear pump forces the contaminated oil through the tubing (4) and into the side of the canister.
5. Inside of the canister, the oil is forced inward through the filtering element (see Section 6.3), then up the center of the canister to the top where it flows through the four holes in the lid nut, and finally down through the center tube (see Figure 7-3). Forcing all of the oil to the top of the canister ensures that any air trapped there is removed.
6. The clean oil then flows out near the bottom of the canister, through the OF-3000 sight glass, and then returns through the OF-3000 hose to the vacuum pump's oil-fill port.

The OF-3000 sight glass gives a visual indication of flow and allows you to monitor the color and appearance of the filtered oil.

6.3 Filtering Elements

You have a choice of Aluminum Oxide, Hydrophilic, Fullers Earth, or Particulate filtering elements.

The **Aluminum Oxide** filter (P/N 898523) effectively degasses the oil and is an outstanding particulate filter. It also removes Lewis acids, polar compounds, solvents, and mineral acids such as HCl and HF.

The fiberglass **Particulate** element (P/N 99-171-158) traps particulates as small as 10 microns.

The pleated paper **Particulate** element (P/N 898599) also traps particulates as small as 10 microns. The pleated paper element has an inner and outer shell made of perforated sheet metal.

The **Hydrophilic** element (P/N 898525) is best for removing particulates, water, and mild acids. This element works by absorbing moisture and any substance associated with the moisture. However, moisture must be present for the hydrophilic element to be effective.

The **Fullers Earth** element (P/N 99-171-159) adsorbes acids.

6.4 Perfluoropolyether (PFPE) Oil

Perfluoropolyether (PFPE) is an inert vacuum oil used when pumping extremely corrosive or reactive gases. If contaminants mix with the PFPE, the resultant mixture has poor vapor pressure and lubricating qualities. If Lewis acids contaminate PFPE at high temperatures, the oil will break down. The Activated Alumina filtering element removes Lewis acids in addition to removing corrosive contaminants.

The standard OF-3000 can't be used with PFPE because it hasn't been degreased at our factory. The OF-3000C is ideal for PFPE oil because it is free of all hydrocarbons and because its internal parts are coated to protect it from corrosion.

When using PFPE oils, the vacuum pump and OF-3000C must be kept **completely** free of all hydrocarbon oils, solvents, greases, and other hydrocarbon substances for the following reasons:

- Hydrocarbons could react with the process gas to create a fire or explosion hazard, and
- PFPE and hydrocarbon oils emulsify when they come in contact with each other.

The filter housing, gear pump, fittings and the quick-connects on the OF-3000C are chemically treated with a fluorocarbon material to resist corrosion. After preparing the metal, the fluorocarbon is sprayed and then baked onto the metal surfaces so that it won't peel off.

See "Engineering Notes on Vacuum Pump Oils" or the LHK publication "Perfluorized Polyethers for Vacuum Pumps" (GA 7.009) for more information on PFPE vacuum oils.

7 — Parts List

Table 7-A has information for ordering spare gaskets and filtering elements, and for ordering the complete oil filtering system.

Table 7-B is a lists of replacement parts for the OF-3000.

Table 7-C has the part numbers for all the parts that make up the canister assembly.

Use Figures 7-1, 7-2, and 7-3 to help identify the part you need. The numbers called out on the figures correspond to the item numbers listed for each part in the first column of the parts list. For example, the first column on Page 41 lists "1" for the canister assembly. On Figure 7-2, the number "1" is pointing to a drawing of the canister.

Unless noted otherwise, the part numbers listed in the parts list apply to all OF-3000 models. The items marked "OF-3000C" apply only to the corrosive OF-3000C model.



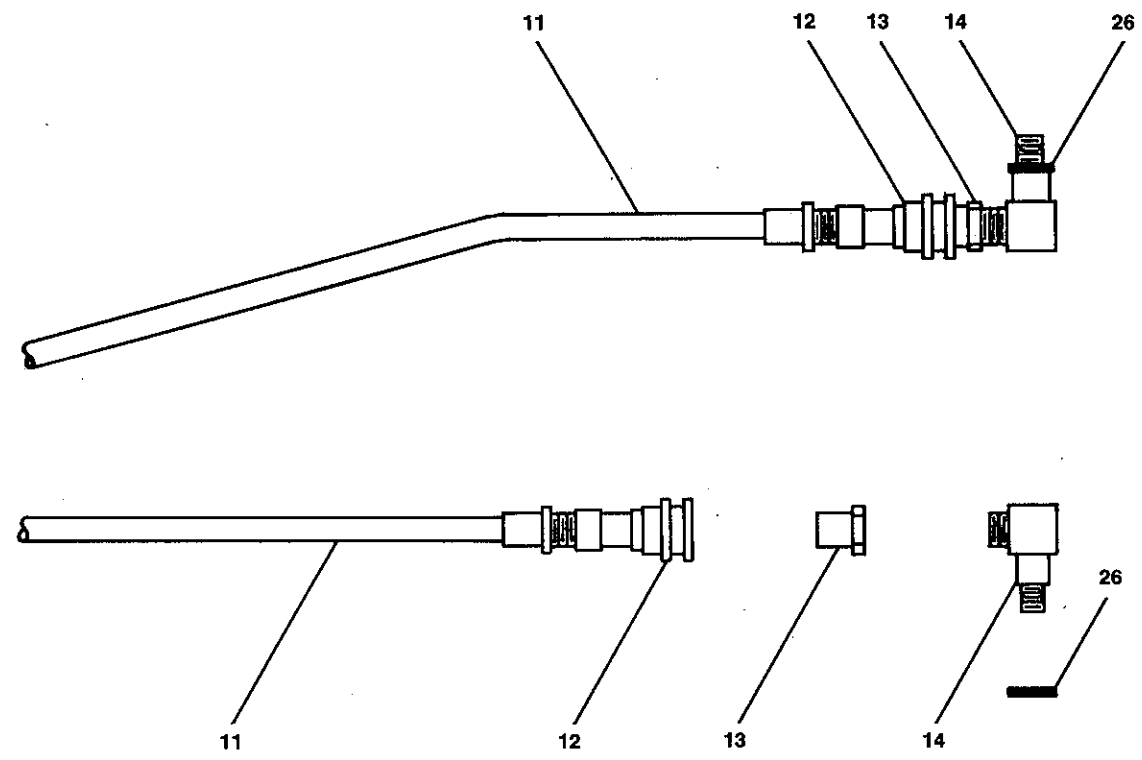
WARNING!



When replacing parts on the OF-3000 model that is prepared for PFPE, ensure that the replacement parts are free of all hydrocarbons. Completely degrease all metal parts with Freon except for the special PFPE-prepared gear pump which has already been degreased at our factory. Contact the Leybold main office for more information.

Contents

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Figure 7-1. Hose/Quick-Connect/Swivel Elbow Assembly

Table 7-A — Parts List for Spare Gaskets and Filtering Elements

Table 7-A

Item No.	Quantity	Description	Dimensions (mm)	Material	Part Number	Remarks
N/A		OF-3000 Oil Filtering System	14W x 18L x 25 5/8H		898625	Doesn't include filter element or oil.
		OF-3000 Oil Filtering System Prepared for PFPE	14W x 18L x 25 5/8H		899455	
		Coated OF-3000C Oil Filtering System Prepared for PFPE	14W x 18L x 25 5/8H		899450	
H5	1	Lid O-ring	6.48 ID x 0.139 Thk	Buna-N	725 81 004	See Figure 7-3.
N/A	1 Set	Gasket Set for Gear Pump		Viton	720 19 018	Includes relief valve seal
N/A	1	Mechanical Seal for Gear Pump		Viton	720 19 020	The mechanical seal isn't included in the gasket set.
N/A	1	Filtering Elements:				See Section 6.3
		Aluminum Oxide		Activated Al2O3	898523	
		Fullers Earth		Fullers Earth	99 171 159	
		Hydrophilic			898525	
		Particulate		Pleated paper	898599	
		Particulate		Fiberglass	99 171 158	
26	2	Flat Gasket for Elbows	22mm x 1.5 mm	Viton	239 55 165	This gasket seals the vane pump oil-fill & oil-drain ports.
13	2	OF-3000 Quick-Connect Stem	3/8 FNPT	Steel with Viton seals	721 52 001	Low ΔP design.
	2	OF-3000C Quick-Connect Stem	3/8 FNPT	Stainless Steel with Viton Seals	725 54 024	Coated with a fluorocarbon for use with PFPE oil in extreme- corrosive service.
14	2	Swivel Elbow Adapter	3/8 NPT to M16 x 1.5 mm	Stainless steel	725 54 304	

Spare Gaskets & Filters

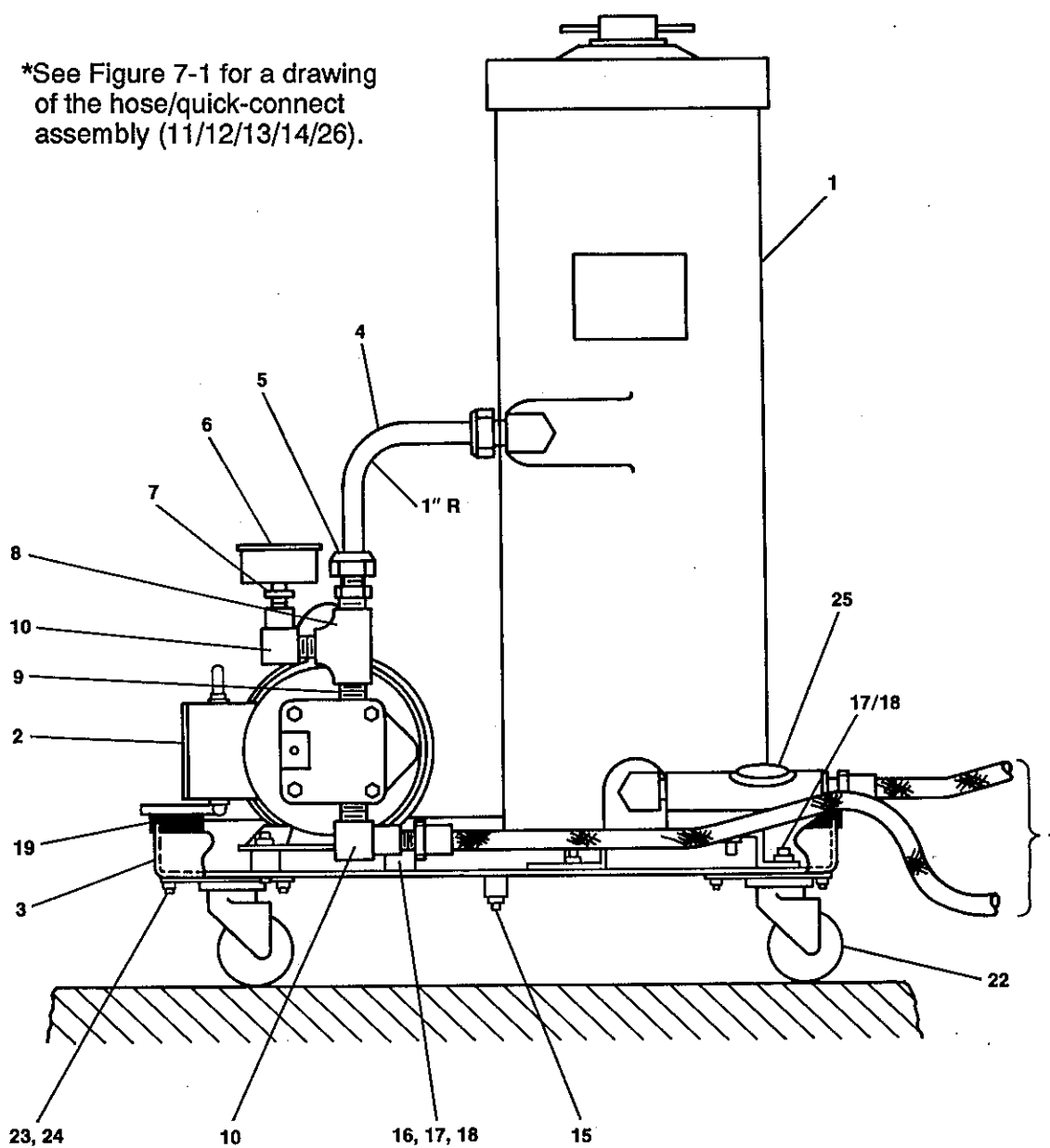


Figure 7-2. OF-3000 Oil Filtering System, Side View

Table 7-B — Complete List of Parts for the OF-3000 System*

Item No.	Quantity	Description	Dimensions (mm)	Material	Part Number	Remarks
1	1	OF-3000 Canister Assembly	22 5/8 x 13 1/2		720 19 187	See Table 7-C for spare parts for the canister.
	1	OF-3000C Coated Canister Assembly†			720 19 217	Coated with a fluorocarbon.
2	1	OF-3000 Gear pump with motor		Viton seals	722 92 002	
	1	OF-3000 Gear pump with motor (prepared for use with PFPE)		Viton seals	722 93 006	Prepared for use with PFPE
	1	OF-3000C Coated Gear pump w motor†		Viton seals	720 19 029	Pump coated with fluorocarbon
2A	1	OF-3000 Gear pump		Viton seals	722 93 000	
	1	OF-3000 Gear pump (for use with PFPE)		Viton seals	722 93 004	Doesn't include motor.
	1	OF-3000C Coated Gear pump†		Viton seals	722 93 005	
2B	1	Motor without gear pump (1/6 Hp, 1725 rpm, TEFC, 1 phase)	50/60 Hz, 115/208/230V, 3.6/1.8 amps		722 60 017	An explosion-proof motor is also available.
	1	Motor without gear pump (1/6 Hp, 1725 rpm, TEFC, 3 phase.)	50/60 Hz, 230/460V, 0.74/0.37 amps.		722 60 021	
3	1	Pan	14 x 18 x 1 1/2	Steel	720 19 192	
4	11 inches	Tubing	1/2 inch	Stainless steel	724 71 014	
5	1	Swivel adapter union	3/8-inch NPT	Stainless steel	725 54 052	
6	1	Pressure gauge	1/4 NPT		722 14 006	0-100 psi, 0-700 K Pa.
7	1	OF-3000 Bushing	Reducing 3/8 - 1/4	Plated steel	725 58 200	
	1	OF-3000C Bushing†	Reducing 3/8 - 1/4	Stainless steel	725 54 026	
8	1	OF-3000 Street Tee	3/8" NPT	Plated steel	725 58 401	
10	1	OF-3000 Street elbow	3/8 NPT, 90°	Steel	725 58 300	
	1	OF-3000C Street elbow†	3/8 NPT, 90°	Stainless steel	725 54 303	
11	2	Hose with 3/8-NPT threaded steel ends	13/32 x 6 ft, 3/8 MNPT	Teflon with ss braid	724 35 008	See Figure 7-A.
12	2	OF-3000 Quick-Connect Coupler	3/8 NPT	Steel w Viton O-ring	721 52 000	See Figure 7-A.
	2	OF-3000 Quick-Connect Coupler†	3/8 NPT	Stainless Steel	725 54 025	Includes Viton O-ring
13	2	OF-3000 Quick-Connect Stem	3/8 FNPT	Steel w Viton seals	721 52 001	Low ΔP design. See Figure 7-A.
	2	OF-3000C Quick-Connect Stem†	3/8 NPT	Stainless Steel with Viton O-ring	725 54 024	
14	2	Swivel Elbow Adapter	3/8 NPT to M16 x 1.5	Stainless steel	725 54 304	See Figure 7-A.
15	1	Pipe plug, square head	1/4 NPT	Steel	725 56 052	
16	4	Foot	3/4D x 5/8H, 1/4-20	Rubber	721 00 007	
17	7	Hex Nut, HFX, regular SAE	10-32	Steel	96 159 1000	
18	7	Flat Washer, SAE. #10		Steel	96 162 1000	
19	1	Rubber Trim	3/32", 64" long	Rubber	724 85 002	
20	1	Nameplate			722 48 082	Not shown
21	4	Drive screw	2 x 3 mm	Steel	241 11 114	Not shown
22	4	Swivel Caster	2 dia x 1 W, 100 lbs.		725 47 014	
23	16	Lock washer	1/4" ID	Steel	96 163 1100	
24	16	Hex Nut	1/4-20	Steel	96 159 1100	
25	1	OF-3000 Sight glass		Al & Glass	721 44 003	
26	2	Flat Gasket	22 x 1.5	Viton	239 55 165	See Figure 7-A.

*See Table 7-A for the part number for ordering the complete oil filtering system.

†For use with PFPE oil in extreme-corrosive service.

Table 7-B

Complete List of OF-3000 Parts

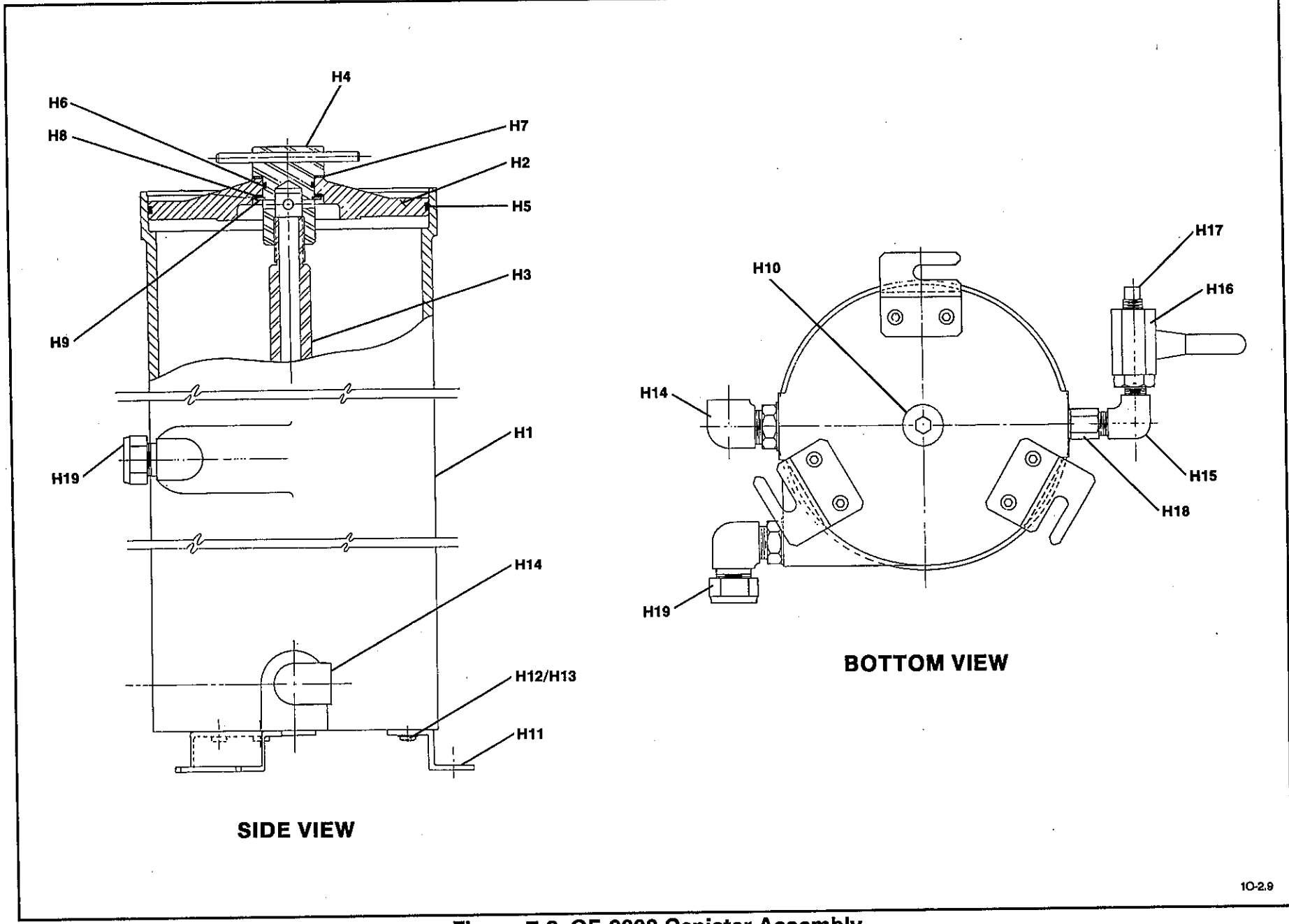


Figure 7-3. OF-3000 Canister Assembly

Table 7-C — Complete List of Parts for the OF-3000 Canister

Table 7-C

Item No.	Quantity	Description	Dimensions (mm)	Material	Part Number	Remarks
H1	1	OF-3000 Canister	7 1/8 x 20 5/8	Aluminum A356	720 19 184	includes H10.
	1	OF-3000C Coated Canister†	7 1/8 x 20 5/8	Aluminum A356‡	720 19 216	
H2	1	OF-3000 Lid	7-1/16 Diameter	Aluminum A356	720 19 003	
	1	OF-3000C Lid†	7-1/16 Diameter	Aluminum A356‡	720 19 025	
H3	1	Center Tube		Steel	720 19 183	The coated center tube is sold only as part of the coated canister (H1)
H4	1	OF-3000 Lid Nut		Plated steel	720 19 017	The pin (P/N 720 19 012) is part of the nut assy.
	1	OF-3000C Lid Nut†		Plated steel‡	720 19 034	
H5	1	O-ring	6.484 ID x 0.139 Thk.	Buna-N	725 81 004	
H6	1	O-ring	0.862 ID x 0.103 Thk.	Viton A	725 91 003	
H7	1	Washer	1,544 OD x 1.086 ID x 0.048 Thk.	Teflon	725 49 010	
H8	1	Washer	1.561 OD x 1.064 ID x 0.032 Thk.	Steel	725 32 004	
H9	1	Snap Ring	1-1/16 diameter		720 19 035	
H10	1	Hex plug with O-ring				Can't be replaced; cemented at assembly,
H11	3	Slotted Foot		Aluminum	720 19 007	
H12	6	Lock Washer	1/4 ID	Steel	96 163 1100	
H13	6	Socket Head Cap Screw	1/4-20 x 1/2 Lg.	Steel plated	725 02 043	
H14	1	OF-3000 Street Elbow	90°, 3/8NPT x 3/4-16	w Viton O-ring	725 58 301	
	1	OF-3000C Street Elbow†	90°, 3/8NPT x 3/4-16	Stainless steel	725 54 301	
H15	1	Male Elbow	1/4 NPT	Plated steel	725 58 304	
H16	1	Ball Valve	1/4 NPT	Steel	723 50 000	
H17	1	Pipe plug	1/4" socket head	Stainless steel	725 54 202	
H18	1	OF-3000 Adapter	9/16-18 to 1/4 FNPT	Plated steel	725 52 012	
	1	OF-3000C Adapter†	9/16-18 to 1/4 FNPT	Stainless steel	725 54 069	
H19	1	Elbow	3/4-16 x 1/2" tube	Stainless steel w Viton O-ring	725 54 320	

**See Table 7-A for the part number for ordering the complete oil filtering system and filtering elements.

† For use with PFPE oil in extreme-corrosive service.

‡ Coated with a fluorocarbon.

Complete List of Canister Parts

Appendix A — Connecting to E & DK or S Series

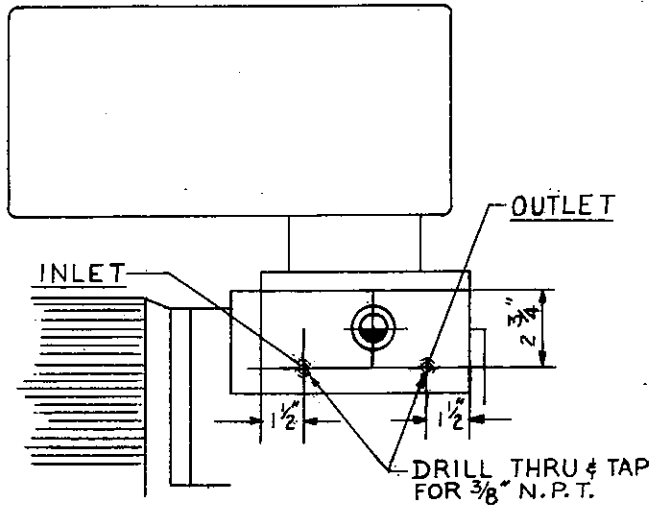
A.1 Connecting the OF-3000 to an E- or DK- Rotary Piston Vacuum Pump

You need two $\frac{3}{8}$ -inch NPT close nipples (P/N 725-57-001) to attach the OF-3000 hoses to the holes that you drill and tap on the E or DK vacuum pump.

Proceed as follows to modify an E or DK pump for using an OF-3000.

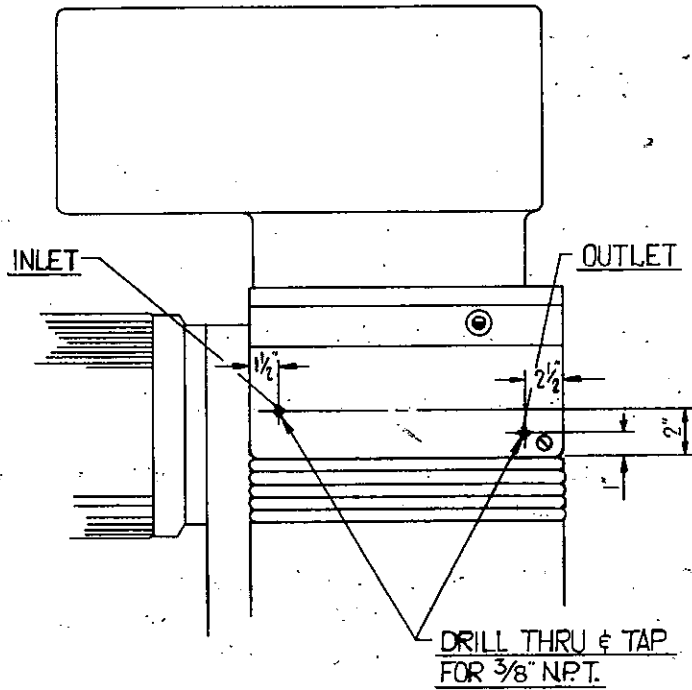
1. Drain the oil from the pump (see pump manual).
2. Remove the exhaust box from the E or DK pump.
3. Drill and tap holes in the E or DK pump as follows:
 - a. Mark the hole locations shown in Figure A-1.
 - b. Drill the pilot holes.
 - c. Drill and tap the pilot holes for the $\frac{3}{8}$ -inch NPT nipples.
 - d. Clean the drill filings from the E or DK pump's exhaust valve housing.
4. Install the quick-connect stem onto the E or DK pump as follows:
 - a. Remove the quick-connect stem/elbow assemblies (13/14) from the OF-3000 hoses (see Figure 7-1).
 - b. Remove the elbows (14) from the quick-connect stems.
 - c. Place Teflon tape on the male threads of two $\frac{3}{8}$ -inch NPT close nipples (P/N 725-57-001) and screw one end of each nipple into a quick-connect stem (13).
 - d. Screw the stem/nipple assembly into the tapped holes in the E or DK pump housing (see Figure A-1).
5. Reinstall the exhaust box onto the E or DK pump and recharge it with the correct vacuum oil (see pump manual).
6. The OF-3000 hose leading from the canister attaches to the hole labeled "INLET" in Figure A-1. The OF-3000 hose leading from the OF-3000 gear pump attaches to the hole labeled "OUTLET".

Proceed with normal installation and start-up procedures (see Section 2 and 3.1).



DK-50, DK-100, or DK-200 Pump Model

10-4.87



E-75, E-150, or E-250 Pump Model

10-4.8

Figure A-1. Location for Drilling the Inlet and Outlet Ports on the E & DK Pump Models for Connecting the OF-3000 Hoses

A.2 Connecting the OF-3000 to an S400F or S630F Rotary Vane Pump

See Appendix A.3 for the adapter needed to connect the OF-3000 to an older S100C, S160C, or S250C vacuum pump.

You need two $\frac{3}{8}$ -inch NPT close nipples (P/N 725-57-001) to attach the OF-3000 hoses to the holes that you drill and tap on the S400/630F vacuum pump.

Proceed as follows to modify an S400/630F pump for using an OF-3000.

1. Drain the oil from the S400/S630F pump.
2. Remove the noise enclosure from the S400/S630F pump.
3. Drill and tap holes in the S400/S630F pump as follows:
 - a. Mark the hole locations as shown in Figure A-2.
 - b. Drill the pilot holes.
 - c. Drill and tap the pilot holes for the $\frac{3}{8}$ -inch NPT nipples.
 - d. Clean the drill filings from the pump.
4. Install the quick-connect stems onto the pump as follows:
 - a. Remove the quick-connect stem/elbow assemblies (13/14) from the OF-3000 hoses.
 - b. Remove the elbow (14) from the quick-connect stems.
 - c. Place teflon tape on the male threads of the $\frac{3}{8}$ -inch NPT close nipples (P/N 725-57-001) and screw one end of each nipple into a quick-connect stem.
 - d. Screw the nipple/stem assembly into the tapped holes in the pump housing.
5. Recharge the pump with the correct vacuum oil.
6. Make holes in the pump's noise enclosure as necessary for the oil filters hoses; then reinstall the noise enclosure.
7. The OF-3000 hose leading from the canister attaches to the hole labeled "Clean Oil Return Port" in Figure A-2. The OF-3000 hose leading from the gear pump attaches to the hole labeled "Contaminated Oil Drain Port".

Proceed with normal installation and start-up procedures (see Section 2 and 3.1).

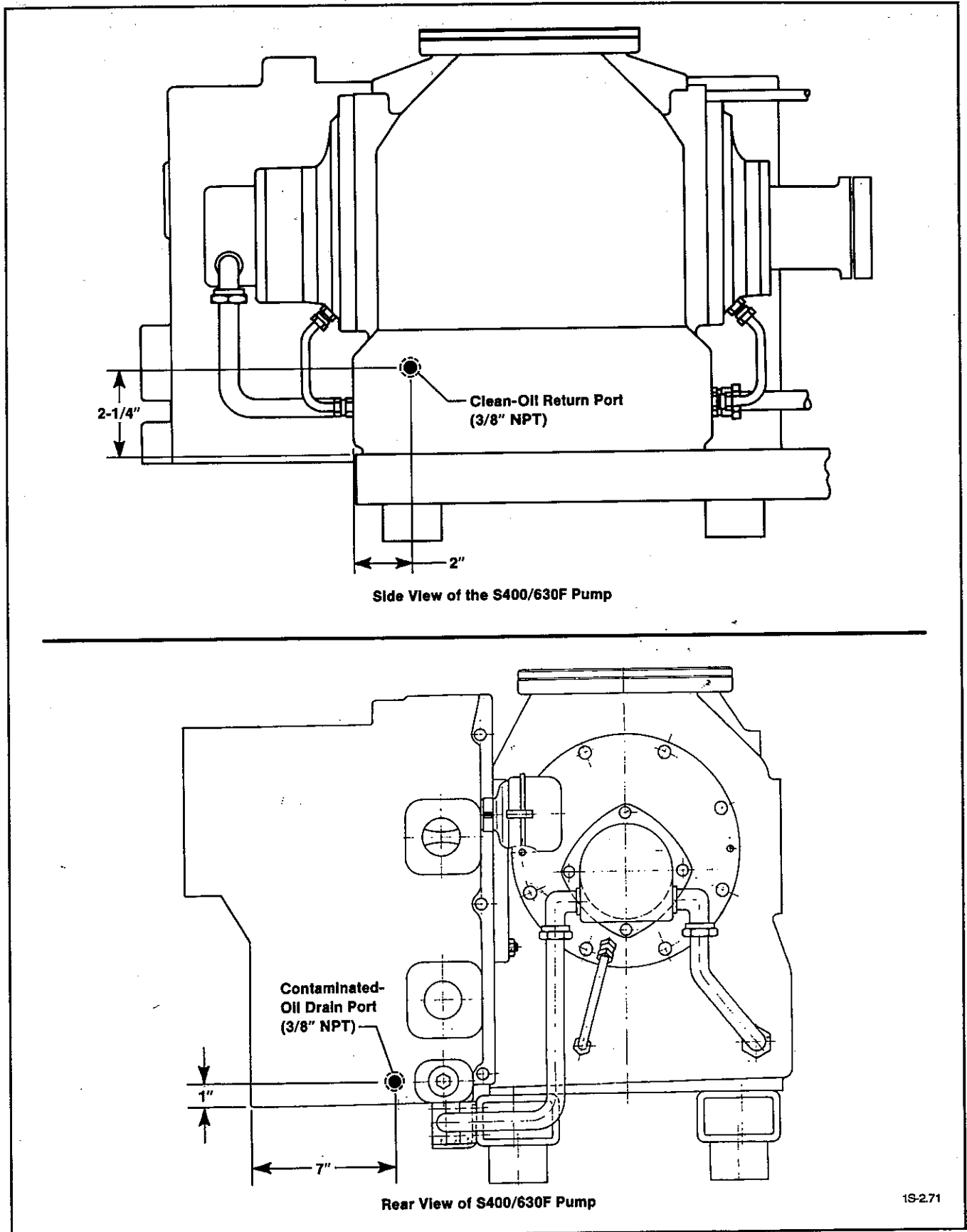


Figure A-2. Location for Drilling the Fill & Drain Ports on the S400/630F Pump Models for Connecting the OF-3000 Hoses

Appendix A

1S-271

A.3 Connecting the OF-3000 to an Older S100C, S160C, or S250C Pump

Newer S100C, S160C, and S250C Rotary Vane Pump models have both an M30 and M16 oil-fill port. It isn't necessary to modify these pump models since the standard OF-3000 connects to an M16 oil-fill port. Add oil as necessary through the M30 oil-fill port.

Older S Series pump models have only an M30 oil-fill port. To attach the OF-3000 hose to this oil-fill port, use a $\frac{3}{8}$ -inch to M30 adapter. Remove the elbow (14) from the OF-3000 oil-return hose and replace it with the adapter. The part number of the $\frac{3}{8}$ -inch to M30 adapter is 721-03-001.

Appendix B — Installing a New Gear-Pump Seal

WARNING!

See the warnings at the beginning of Section 5 before proceeding.

The mechanical seal is the most likely cause of OF-3000 gear-pump leaks. The instructions in this appendix are for replacing the mechanical seal; it isn't necessary to completely disassemble the gear pump to replace the mechanical seal.

If you need to completely disassemble the gear pump, order the gasket set in addition to the mechanical seal kit (see Table 7-A). If you remove the bypass valve, ensure that is adjusted to extend $\frac{5}{8}$ -inch out from the gear pump on reassembly. If the needle bearings are worn, the gear pump should be scrapped.

Required Tools:

- $\frac{1}{2}$ -inch wrench,
- $\frac{1}{8}$ -inch allen wrench,
- Small flat-blade screwdriver,
- Wrench for tubing fittings,
- Rubber hammer.

Required Materials:

- Mechanical seal kit (P/N 720-19-020)
- Vacuum pump oil (use the same type that will be used in the OF-3000)

Proceed as follows to remove the old mechanical seal assembly from the gear pump:

1. Switch off the OF-3000 gear-pump motor and use the quick-connects to remove the OF-3000 hoses from the vacuum pump.
2. Allow the pressure on the OF-3000 pressure gauge to reach 0 psi.
3. Remove the gear pump/motor assembly from the OF-3000 pan.
4. Remove the gear pump from its motor as follows:
 - a. Remove the four $\frac{1}{2}$ -inch hex bolts that secure the gear pump to the motor.
 - b. Pull the gear pump from the motor; you may have to tap it with a hammer to loosen it.

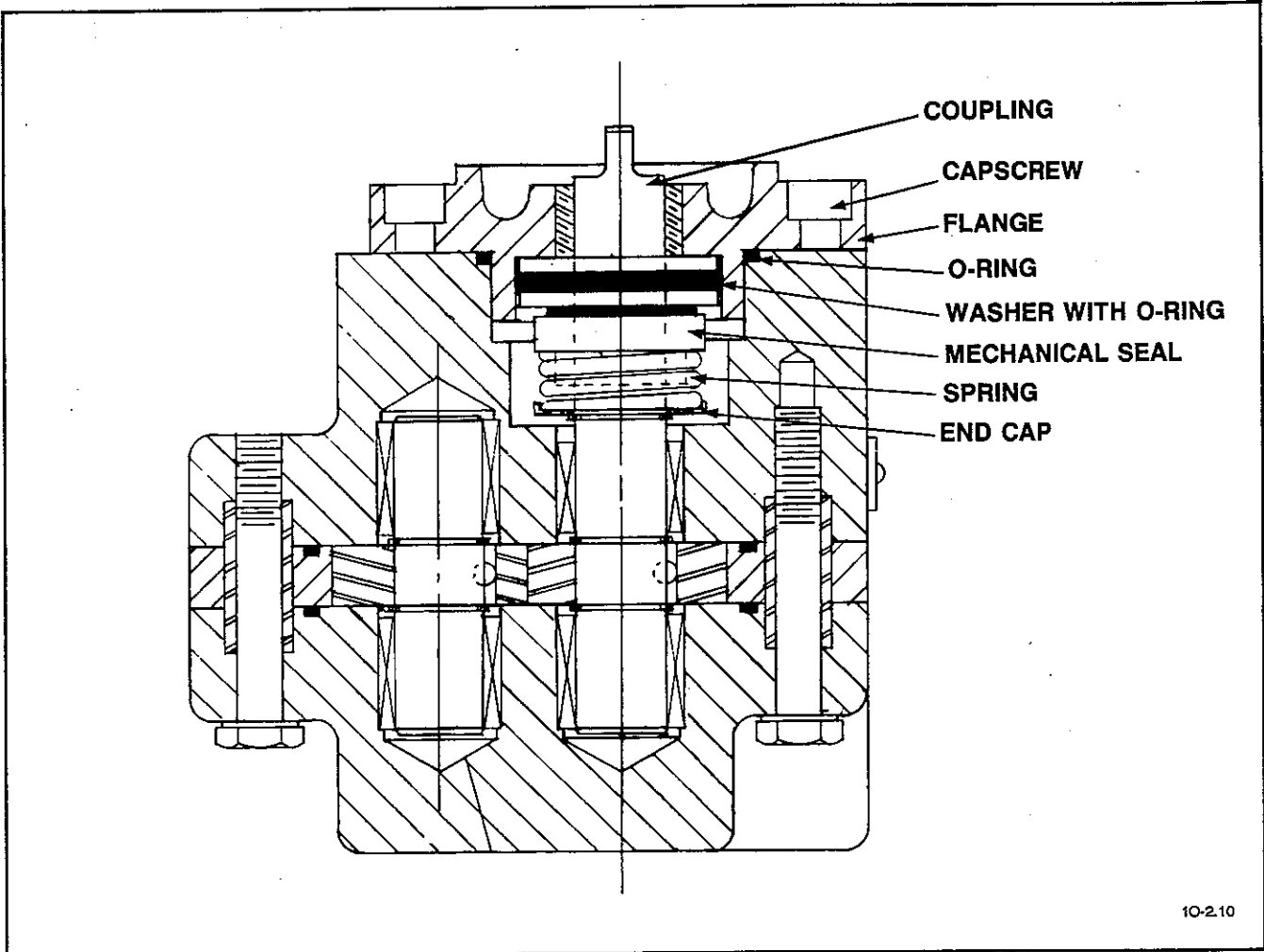


Figure B-1. Cross Section of the Gear Pump

CAUTION: Use extreme care to avoid scratching the shaft or flange when prying the seals from the gear pump.

5. Remove the mechanical seal from the gear pump as follows (see Figure B-1):
 - a. Set the gear pump on its end so that the coupling is facing up.
 - b. Use an $\frac{1}{8}$ -inch allen wrench to remove the two capscrews.
 - c. Remove the flange from the gear pump.
 - d. Use a screwdriver to carefully pry the washer with O-ring from the flange.
 - e. Use a small screwdriver to pry the mechanical seal out of the gear pump.
 - f. Remove the spring and its end cap from the gear pump.
6. Install the new seals as follows (see Figure B-1):
 - a. Wet the seals and the inside of the gear pump with the same vacuum pump oil that will be used in the OF-3000.
 - b. Ensure that the sealing surface on the flange ID is free of nicks or scratches; then, press the new washer with O-ring into the flange so that the polished shiny side of the washer is facing you.
 - c. Insert the new end cap and then the new spring into into gear pump.
 - d. Ensure that the gear pump's shaft is free of burrs, nicks, or grooves that could damage the mechanical seal on installation.
 - e. The mechanical seal contains a black seal about $\frac{1}{8}$ -inch thick that fits loosely into the wider end of the metal seal housing. One side of this seal has a raised rim; ensure that the side of this seal with the raised rim is facing out and that it is free from nicks and scratches.
 - f. Wet the new mechanical seal with the correct vacuum pump oil and work it down the shaft; the wider end of the mechanical seal faces up.
 - g. Place the flange onto the gear pump so that the side with the O-ring faces the center of the gear pump; use the two allen head capscrews to secure the flange in place.
7. Reinstall the the gear pump onto the motor as follows:
 - a. Place the flat gasket against the motor,
 - b. Align the couplings and position the gear pump in place against the motor so that the OF-3000 pressure gauge is facing up.
 - c. Install the four hex-head screws and cross-tighten them ensuring that they are torqued evenly to 12 to 15 ft-lb.

Maintenance Record

<i>Date</i>	<i>Maintenance</i>

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Seller warrants to the original purchaser that the equipment to be delivered pursuant to this Agreement will be as described herein and will be free from defects in material or workmanship. Minor deviations which do not affect the performance of the equipment shall not be deemed to constitute either a failure to conform to the specifications or a defect in material or workmanship.

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If the equipment contains components from another manufacturer and are subject to the manufacturer's warranty, then Seller's liability shall be limited to the extent of the warranty which Seller received from the manufacturer or supplier of the equipment component parts. Seller's liability shall be no greater than the liability of the manufacturer or supplier as determined by a final judgment by the Buyer against the manufacturer or supplier of such components. Seller will cooperate with Buyer in such legal action but at Buyer's expense.

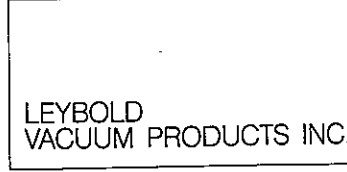
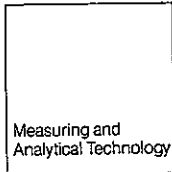
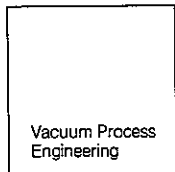
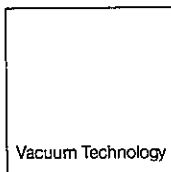
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