



Welch Rietschle Thomas

A Thomas Industries Company

OWNER'S MANUAL FOR DIRECTORR® DIRECT-DRIVE VACUUM PUMP MODELS:

8905
8907
8912
8917
8920
8925



WARNING

Do not block the exhaust port. Pressure will build up with the potential of oil case bursting with possible injury to personnel.



WARNING

Pumps being run continuously above 1 torr should use an exhaust oil recycler.



WARNING

Pumps not recommended for filtration, aspiration or drying electrophoresis gels.

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Part No. 67-1483R1.7
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**INSTRUCTION
WARNING AND CAUTION
PLEASE READ BEFORE OPERATION**

While reading your manual, please pay close attention to areas labeled:

WARNING AND CAUTION.

The description of each is found below.

WARNING

Warnings are given where failure to observe instruction could result in injury or death to people.

CAUTION

Cautions are found where failure to observe the instruction could result in damage to the equipment, associated equipment and process.

These units conform to the SI International system of units of measurement.

The following symbols (with recommendation of IEC1010) of warning will be found on the pump.



Caution - refer to accompanying documents



Caution - risk of electrical shock



Caution - hot surface

WARNING

Motor includes a self resetting thermal cutout and the pump could restart without actuation under fault condition.

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Section 1: INSTALLATION

1.01 Unpacking

Carefully remove the pump from the shipping carton. Keep all paperwork and inspection tags for future reference. If shipping damage has occurred, a claim must be filed with the carrier immediately; keep the shipping container for inspection by the carrier.

1.02 Pump Mounting

Rubber bumpers are supplied with the pump base. They isolate noise and eliminate creeping. For more rigid mounting requirements the pump base can be bolted directly to a surface by removing the bumpers from the base and using the mounting holes and slots featured on the base.

1.03 Pump Location / Environmental Conditions

The pump should be located in a clean and well-ventilated area and adequate space should be provided wherever possible for routine maintenance such as oil changes. For best performance, the pump should be located as closely as possible to its system. Determining factors for pump location should include length and size of connections, the number of bends, and the type of exhaust connections.

Altitude 2000m , Max.relative humidity of 80% for temperatures up to 31C decreasing linearly to 50% at 40C , Supply Voltage +/- 10% , Pollution Degree 2 , Installation Category II.

1.04 Exhaust Provisions

Exhaust connections will be determined by the type of system to be exhausted and the desired cleanliness of the air surrounding the pump. Under normal pumping conditions the optional exhaust filter will be adequate. Refer to Section 9, Accessories for available exhaust filters. Where extreme exhaust conditions are encountered, it is best to pipe the exhaust out of the building. Always use thick walled rubber vacuum hose, wire reinforced PVC tubing or metal pipe for exhaust lines to avoid the possibility of the line becoming crimped or collapsing resulting in dangerous exhaust line blockage.

The exhaust connection is a 1"-20 threaded port for all Models except 8905 which is 3/4"-20. The port is located on top of the oil reservoir. See section 9.02 Exhaust Filters to find the correct filter for each pump. If a hose nipple is preferred for the exhaust port, use part number 1393K for models 8907, 8912 and 8917. Call Welch customer support (847) 676-8800, ext. 1, prior to start-up if you have any questions.



WARNING

Never block or impede air flow from the exhaust port. High pressure can build up within the oil reservoir if the exhaust port is blocked. Check frequently, especially if exhaust is piped out of the building.

1.05 Electric Power

For Model 8905

Compare the pump motor rating, printed on a label on the side of the motor and on the serial number tag, to the power source, to be sure they agree in voltage, phase, and frequency. Pump installation must comply with local electrical codes which dictate appropriate protection devices such as fuses or circuit breakers. Know the location of the circuit breaker protecting the electrical outlet for the pump.

For Models 8907, 8912 & 8917

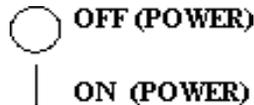
Compare the pump motor rating, printed on a label on the side of the motor and on the serial number tag, to the power source, to be sure they agree in voltage, phase, and frequency. Pump installation must comply with local electrical codes which dictate appropriate protection devices such as fuses or circuit breakers. Know the location of the circuit breaker protecting the electrical outlet for the pump.

Only the Models 8907C, 8912C and 8917C have “global motors” that operate over a wide range of voltages (100-120V, 200-30V). They also operate at frequencies of 50Hz and 60 Hz. Power is single phase.

For Models 8920 & 8925

Compare the pump motor rating, printed on a label on the side of the motor and on the serial number tag, to the power source, to be sure they agree in voltage, phase, and frequency. Pump installation must comply with local electrical codes which dictate appropriate protection devices such as fuses or circuit breakers. Know the location of the circuit breaker protecting the electrical outlet for the pump.

Identification Symbols:



CAUTION

Make certain the power settings on the pump match your power source before attempting to operate the pump. (Additional information can be found in section 4: Motor Power).

1.06 Vacuum Connections

The pump inlet is equipped with a UNIBARB hose fitting. See table in section 3 for UNIBARB sizes and I.D. hoses needed for each pump. The inlet is located next to the pump handle. It contains a screen to collect any debris from getting into the pump. An extensive line of vacuum pump ISO fittings, hoses, traps, etc. is available from Welch to meet the requirements of most vacuum systems. Welch offers a number of different types of vacuum tubing and connectors. See Section 9 - Accessories or call Welch customer support (847) 676-8800, Extension 1.

The choice of connections and fittings can have a very marked effect on the pumping speed at the vacuum chamber. Any connection placed between the pump and the vacuum chamber creates an impedance to the flow of gas. This is particularly true at low pressures in the millitorr range where the gas flow is substantially molecular in character. The gas flow is then dependent upon the kinetic activity of the molecules to bring it to the pump intake. This impedance is described by the term “conductance”.

The conductance of a tube is proportional to the cube of its diameter and inversely proportional to its length. Therefore, connecting lines should be as large in diameter and as short in length as practical. For best results the diameter of the connecting tube should be at least as large as the diameter of the pump intake. To avoid a large reduction in pumping speed at the vacuum chamber, the conductance of the line must be considerably greater than the speed of the pump. Sharp bends in vacuum lines also contribute to conductance. To avoid reductions in pumping speed, minimize the number of 90° angles in the vacuum system.

1.07 Vacuum Gauges

The type of vacuum gauge to be used in a system is determined largely by the pressure range to be measured. A thermocouple or pirani gauge is recommended for measuring pressures in the range produced by these pumps. See Website or call for additional information.



WARNING

The vacuum pump is shipped without oil inside to prevent possible spillage during shipment. Oil must be added prior to use.

1.08 Vacuum Pump Oil

Filling with Fresh Oil

Be sure the pump is filled with oil to the level indicated on the oil fill window. When additional oil is required, use only DIRECTORR® Premium or Gold Vacuum Pump Oil; pump performance is not guaranteed with other brands of oil. Do not overfill the pump, and be sure to replace the oil fill plug. Remove the oil fill plug located on the top of the oil case and add the oil supplied in a bottle packaged with each pump.



WARNING

Use only Welch DIRECTORR® Premium or Gold Vacuum Pump Oil.

The fill plug has a raised middle section and a center slot for easy turning either by hand or with a screwdriver. After the pump has been running for at least 15 minutes, check the oil level again. The oil level should be maintained at the “full” mark on the oil level window while the pump is operating. Do not overfill; excess oil tends to be splashed out the pump exhaust.

Guidelines for the frequency of oil changes and the oil changing procedure can be found in Section 6-2: Oil Change.

Section 2: PUMP FEATURES AND PRINCIPLES OF OPERATION

2.01 General Description

All of the Welch Vacuum Pumps are two-stage, rotary-vane, oil sealed vacuum pumps. These Vacuum Pumps offer a number of features that improve performance, or protect the pump or vacuum system under specific operating conditions.

2.02 Principles of Vacuum Pump Operation

The main purpose of a vacuum pump is to reduce the pressure in a vessel or a closed system. The degree of pressure reduction is dependent upon the requirements of the application and the type of vacuum pump employed. Rotary vane, oil-sealed vacuum pump operation is described in this section.

Pressure reduction in a closed system is accomplished by repeatedly removing a portion of the original volume of gas contained in the system. Removal is performed by the action of the rotating elements of the pump which cause a given space to be successfully enlarged and diminished. Figure 2.1 illustrates a section through a typical stage of rotary-vane pump. Note that this figure is not intended to illustrate exactly the internal components of the pumps; its purpose is to illustrate the general operating principles of vacuum pumps.

The rotary action of the pump creates a hollow space of chamber (1) which expands as the pump rotates. As the chamber expands, the pressure in the chamber decreases. As a result, gas is drawn into the chamber due to the difference in pressure between the chamber and the inlet (4) to the chamber. (The inlet is the only place where gas can flow into the chamber.) Once the vane (3) moves past the inlet (4), it seals the inlet against the chamber (1) and the gas becomes trapped between the vanes (2 and 3). The chamber (1) formed by the enclosed space between the vanes then begins to decrease in volume as the rotor revolves, compressing the gas. The pressure of the compressed gas becomes greater than atmospheric pressure. When the vane (2) moves past the exhaust port (5) the compressed gas in the chamber is forced out through the exhaust port.

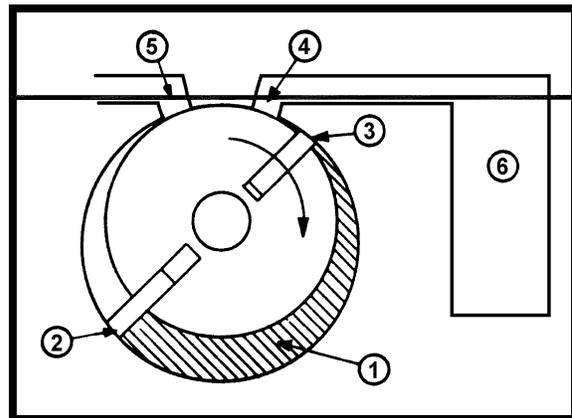


Figure 2.1
Typical Rotary Vane
Pump, Schematic Diagram

This expansion/compression cycle constitutes one complete cycle of the pump operation. This cycle is repeated as the vane (2) passes the intake port and seals it against the atmosphere. Therefore, two pump cycles are performed during each revolution of the pump rotor.

2.03 Effects of Continued Pressure Reduction

The quantity of gas in the vessel (6) is reduced with each evacuation cycle. The gas remaining in the vessel expands to fill the vessel and consequently with each cycle the pressure in the vessel is reduced. This is a manifestation of Boyle's Law which states that, for a constant temperature, the volume of a body of gas is inversely proportional to its pressure; i.e., if the volume is enlarged the pressure must be reduced.

As the amount of gas in the vessel is steadily diminished, its pressure is correspondingly reduced. The action of the pump must therefore compress a successively smaller quantity of gas with each cycle to something greater than atmospheric pressure in order to expel it from the pump.

At the beginning of an evacuation sequence, the compression ratio is very small. In the first cycle of operation the pump draws in a volume of gas at atmospheric pressure and expels it at approximately atmospheric pressure. In contrast, near its ultimate pressure, a pump draws in gas at (for example) 30 millitorr and must compress it to more than 760,000 millitorr (atmospheric pressure) in order to expel it from the pump. Since the exhaust valve is generally spring loaded to provide a good seal, the pressure required to open it is somewhat greater than atmospheric pressure. Therefore, at an ultimate pressure of 1.3×10^{-4} mbar 0.1 millitorr, (1×10^{-4} Torr) the compression ratio performed by the pump is greater than 1,000,000 to 1.

2.04 Ultimate Pressure

As described previously, a quantity of gas is removed from the system with each cycle of the pump. Therefore, the pressure of the gas remaining in the system is reduced with each pump cycle. Since the pump can remove only a small portion of the gas with each pump cycle, it is obvious that this method of evacuation can never completely remove all the gas in the vessel. In addition to this, all the components of the system contain minute sources of gas leakage which are impossible to seal completely against atmospheric pressure. Outgassing of materials within the system provide additional sources of gas.

As a result, after prolonged pumping, a state of equilibrium is reached in which the gas introduced from all the leakage sources is balanced by the ability of the pump to remove gas from the system. This state of equilibrium is referred to as the ultimate pressure or blankoff pressure of the pump and its system. No matter how much additional pumping time is provided, no further reduction in system pressure will be accomplished once ultimate pressure is attained.

2.05 Pump Mechanism Description

The Vacuum Pumps incorporate two in-line rotary-vane stages with interconnecting ports. When in operation, the intake stage is at lower pressure and the exhaust stage is at higher pressure relative to each other. Each stage contains a rotor assembly consisting of a rotor with two vanes and a stator. The two rotors are combined on one shaft, and the two stators are combined in a common housing. The pump shaft turns the rotors, causing the vanes in each section to sweep the surface of their stators. The vanes are pressed against the stators by centrifugal force. Each stage has an exhaust valve. Gas expelled from the first stage exhaust passes through an interstage port to the intake of the second stage. The second stage compresses the gas further, then expels it from the second stage exhaust valve to the atmosphere.

An adjustable gas ballast valve is located in the pump's exhaust stage. The purpose of the gas ballast is to reduce or eliminate vapor condensation in the pump. The function of the gas ballast valve is described later in this section.

The pump is mounted inside an oil case which is a reservoir for the oil that lubricates the pump. The electric motor shaft drives the pump shaft via a coupling. There is a coupling body on the end of each shaft; a coupling spider between the two coupling bodies transfers the power from the motor shaft to the pump shaft.

2.06 Intake Anti-Suckback Protection

When power to the pump is turned off, this valve closes automatically, maintaining vacuum in the system being evacuated. When the pump is turned on, the plunger opens the valve to allow gas to flow into the pump intake.

Please Note: Pump model 8925 does not have the anti-suckback protection if the gas ballast is open.

The system vacuum will not be maintained.

2.07 Pump Lubrication

To ensure efficient operation and proper maintenance, and to minimize noise and oil vapors, it is important to use the correct type and quantity of oil. Welch DIRECTORR® Premium or Gold Vacuum Pump Oil has been developed to have the proper viscosity, low vapor pressure, and chemical stability needed to produce peak pumping efficiency. The ultimate vacuum guarantee on Welch pumps applies only when this oil is used. Therefore, DIRECTORR® Premium or Gold Oil is the only oil recommended for use with these pumps. Each pump is supplied with a bottle of oil sufficient for filling. Additional oil is available. See Section 9 - Accessories.

2.08 Exhaust Filter

Any oil-sealed vacuum pump tends to discharge oil mist from its exhaust port when the pump operates under high-flow conditions, such as when the pump's intake is at or near atmospheric pressure. Typically, oil mist in the form of a white puff of "smoke" can be seen from the exhaust port when no filter is used. Once the vacuum level and the corresponding air flow through the pump are reduced, very little, if any, oil mist will be emitted.

An optional exhaust filter is recommended for any vacuum pump installation where the pump operates at high intake pressures for a prolonged period of time. Oil droplets entrained in the pump's exhaust are removed by the exhaust filter element. Use of an exhaust filter typically reduces or baffles pump noise as well. Exhaust filters are sometimes referred to as Oil Mist Eliminators. See Section 9 - Accessories.

2.09 Gas Ballast Valve

The gas ballast valve can increase the pump's water vapor tolerance. (The gas ballast valve is sometimes referred to as a vented exhaust valve.) In many vacuum pump applications the gases being pumped from a system are a combination of permanent gases and undesirable vapors such as water vapor. Under some conditions, the vapors condense in the second stage of the pump and contaminate the oil. The gas ballast valve reduces oil contamination by decreasing or eliminating vapor condensation. Vapor condensation usually takes place in the compression stroke of the second stage of the vacuum pump when the compression ratio between the initial pressure and the end pressure is high. Opening the gas ballast valve will admit air to the second stage of the vacuum pump thereby reducing the partial pressure of any vapor in the gas mix (Dalton's Law). Diluting the vapor with air increases the condensation pressure. Depending on the amount of air added, condensation of the vapor is either entirely avoided or substantially reduced. When the gas ballast valve is open, the pump has to work a little harder, resulting in a slight increase in operating temperature. The increase in temperature is small, however, and is not harmful to the pump. Also, the pump is slightly noisier, and the pump's ultimate pressure is somewhat reduced. Therefore, the gas ballast valve should be kept closed when it is not needed. Note that the gas ballast is not equally effective on all vapors, so it does not always eliminate condensation completely.

2.10 UNIBARB™ Intake Fitting - Simplifies Small Hose Connections

The UNIBARB™ intake fitting allows the user to be able to use 2 sizes of ID hose to connect to this system. However, the choice of hose size can have a very marked difference on pumping speed. It is the best to have the largest connection I.D.(internal diameters) as possible. However, we recognize many lab appliances use hose barbs accepting small I.D. hose. The conductance of a tube is proportional to the cube of its diameter and inversely proportional to its length. Therefore, connecting line should be as large in diameter and short in length as practical. Included is a free hose clamp to hold the hose in place.

Section 3: PUMP SPECIFICATIONS

3.01 Specification Chart

Model	8905	8920	8925
Free Air Displacement CFM (L/min) @60Hz (L/min)m3/h @50Hz	1.8 (52) (43) 1.5	7.7 (218) (182) 10.8	11.3 (320) (266) 16.0
Nominal Pumping Speed CFM (L/min) @60Hz (L/min)m3/h @50Hz	1.5 (43) (36) 1.3	7.4 (210) (175) 10.5	10.0 (283) (236) 14.2
Guaranteed Ultimate Pressure* Torr	2x10 ⁻³ Torr	3x10 ⁻⁴	4x10 ⁻⁴
Water Vapor Tolerance, Torr Water Vapor Capacity, gm/hr	6 30	15 180	15 180
Sound Level dBA	56	54	55
Motor/Pump Speed rpm @ 60Hz rpm @ 50Hz	3450 2875	1725 1425	1725 1425
Voltage 50/60Hz Single Phase Current @ 115V (230V) @ 60Hz Current @ 230V @ 50Hz	3.8A (1.9A) 1.2 A	6.8A (3.4A) 3.4 A	10.0A (5.0A) 5.0 A
Motor Horsepower	1/4	1/2	3/4
Oil Capacity, quarts (liters)	0.42 (0.4)	1.3 (1.2)	1.2 (1.1)
Intake Connection	3/16" & 7/16" Unibarb removable, threaded 3/4-20 UNEF-2	9/16" & 13/16" Unibarb removable, threaded 1-20 UNEF-2	9/16" & 13/16" Unibarb removable, threaded 1-20 UNEF-2
Tubing Needed I.D. in inches (mm)	3/16 or 7/16 (5 or 11)	9/16 or 13/16 (14 or 20)	9/16 or 13/16 (14 or 20)
Exhaust Connection	3/4"-20 Thread	1"-20 Thread	1"-20 Thread
Gas Ballast Connection	10-32 Thread	10-32 Thread	10-32 Thread
Weight, lbs. (kg)	24.5 (11.1)	58.5 (26.6)	69 (31.3)
Overall Dimensions L in (cm) W in (cm) H in (cm)	14.5 (36.8) 5.1 (13) 8.4 (21.3)	20.8 (52.8) 7.1 (17.9) 11.0 (27.9)	22.2 (56.4) 7.1 (17.9) 11.0 (27.9)
Shipping Weight, lbs. (kg)	26 (11.8)	71 (32.2)	77 (34.6)
Shipping Carton Dimensions L in (cm) W in (cm) H in (cm)	21 (53.3) 6.5 (16.5) 11.2 (28.6)	29 (73.7) 10 (25.4) 14 (35.6)	29 (73.7) 10 (25.4) 14 (35.6)
Exhaust Filter (Optional) Cat. No.	1416B 1417	1417P-10 1416C	1417P-10 1416C
Oil Type Cat. No.	8995P 8995G	8995P 8995G	8995P 8995G

* Partial measurement based upon the American Vacuum Society Test Procedure No. AVS 5.1-1963 using a trapped McLeod Gauge.

Model	8907	8912	8917
Free Air Displacement CFM (L/min) @60Hz (L/min)m ³ /h @50Hz	2.6 (70) (5.6) 3.68	3.8 (108) (86) 5.37	6.1 (173) (138) 8.63
Nominal Pumping Speed CFM (L/min) @60Hz (L/min)m ³ /h @50Hz	2.3 (64) (53) 3.2	3.4 (96) (80) 4.78	5.3 (150) (125) 7.51
Guaranteed Ultimate Pressure* Torr	1x10 ⁻⁴ Torr	1x10 ⁻⁴ Torr	1x10 ⁻⁴ Torr
Water Vapor Tolerance, Torr	19	12	12
Sound Level dBA	50	50	50
Motor/Pump Speed rpm @ 60Hz rpm @ 50Hz	1725 1425	1725 1425	1725 1425
Voltage 50/60Hz Single Phase Current @ 115V (230V) @ 60Hz Current @ 230V @ 50Hz	4.6 A (2.3 A) 2.1 A	4.6 A (2.3 A) 2.1 A	4.6 A (2.3 A) 2.1 A
Motor Horsepower	1/2	1/2	1/2
Oil Capacity, quarts (liters)	1.0 (0.95)	0.9 (0.86)	0.8 (0.76)
Intake Connection	7/16" & 13/16" Unibarb removable, threaded 1-20 UNEF-2	7/16" & 13/16" Unibarb removable, threaded 1-20 UNEF-2	7/16" & 13/16" Unibarb removable, threaded 1-20 UNEF-2
Tubing Needed I.D. in inches (mm)	7/16 or 13/16 (11 or 20)	7/16 or 13/16 (11 or 20)	7/16 or 13/16 (11 or 20)
Exhaust Connection	1"-20 Thread	1"-20 Thread	1"-20 Thread
Gas Ballast Connection	10-32 Thread	10-32 Thread	10-32 Thread
Weight, lbs. (kg)	40 (18)	41 (18)	48 (22)
Overall Dimensions L in (cm) W in (cm) H in (cm)	18.8 (47.7) 6.5 (16.6) 9.6 (24.4)	18.8 (47.7) 6.5 (16.6) 9.6 (24.4)	18.8 (47.7) 6.5 (16.6) 9.6 (24.4)
Shipping Weight, lbs. (kg)	46 (21)	46 (21)	53 (24)
Shipping Carton Dimensions L in (cm) W in (cm) H in (cm)	28.9 (73.5) 10.8 (27.5) 13.7 (35.0)	28.9 (73.5) 10.8 (27.5) 13.7 (35.0)	28.9 (73.5) 10.8 (27.5) 13.7 (35.0)
Exhaust Filter (Optional) Cat. No.	1417P 1416C	1417P 1416C	1417P-7 1416C
Oil Type Cat. No.	8995P 8995G	8995P 8995G	8995P 8995G

* Partial measurement based upon the American Vacuum Society Test Procedure No. AVS 5.1-1963 using a trapped McLeod Gauge.

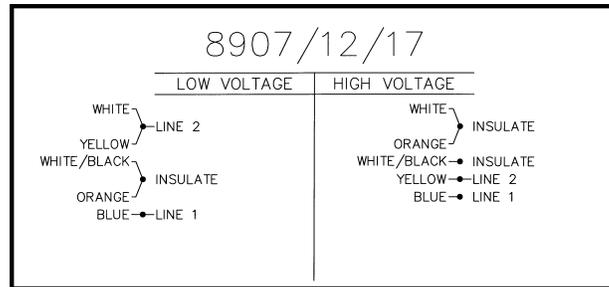
Section 4: MOTOR POWER SPECIFICATIONS / FEATURES

4.01 Motor Specification Chart

Cat. No.	Voltage	Freq.	Phase	H.P.	Factory Wired for	Special Feature	Approval
8905A	115/230	60	1	1/4	115V, 60Hz	Standard Model	CSA
8905C-01	115/230	60	1	1/4	115V, 60Hz	With 230V US Line Cord Plug	CSA
8905C-02	230	50	1	1/4	230V, 50Hz	With European "Schuko" Cord Plug	CE
8905C-10	115/230	60	1	1/4	230V	With European "Schuko" Cord Plug	CSA
8907A	115/230	60	1	1/2	115V, 60Hz	Standard Model	CSA
8907C-02	230	50	1	1/2	230V, 50Hz	With European "Schuko" Cord Plug	CE
8907C-05	100	50/60	1	1/2	100V	For Japan with US Line Cord Plug	
8912A	115/230	60	1	1/2	115V, 60Hz	Standard Model	CSA
8912C-02	230	50	1	1/2	230V, 50Hz	With European "Schuko" Cord Plug	CE
8912C-05	100	50/60	1	1/2	100V, 50/60Hz	For Japan with US Line Cord Plug	
8917A	115/230	60	1	1/2	115V, 60Hz	Standard Model	CSA
8917C-02	230	50	1	1/2	230V, 50Hz	With European "Schuko" Cord Plug	CE
8917C-05	100	50/60	1	1/2	100V, 50/60Hz	For Japan with US Line Cord Plug	
8917W	115	60	1	1/2	115V, 60Hz	To be wired by qualified electrician	-
8920A	115/208-230	50/60	1	3/4	115V, 60Hz	Standard Model	CSA
8920C-01	115/208-230	50/60	1	3/4	230V, 60Hz	With 230V US Line Cord Plug	CSA
8920C-02	115/208-230	50/60	1	3/4	230V, 50Hz	With European "Schuko" Cord Plug	CE
8925A	115/208-230	50/60	1	3/4	115V, 60Hz	Standard Model	CSA
8925C-01	115/208-230	50/60	1	3/4	230V, 60Hz	With 230V US Line Cord Plug	CSA
8925C-02	115/208-230	50/60	1	3/4	230V, 50Hz	With European "Schuko" Cord Plug	CE
8925W	115	60	1	1/2	115V, 60Hz	To be wired by qualified electrician	-

4.02 Changing the Voltage Setting on 8907, 8912 and 8917 “A”-Models

The pumps are set for low voltage (LV) 115 volts 60 Hz. They may also be set for high voltage (HV) 230 volts 60 Hz. To change the voltage setting, see the wiring diagram below.



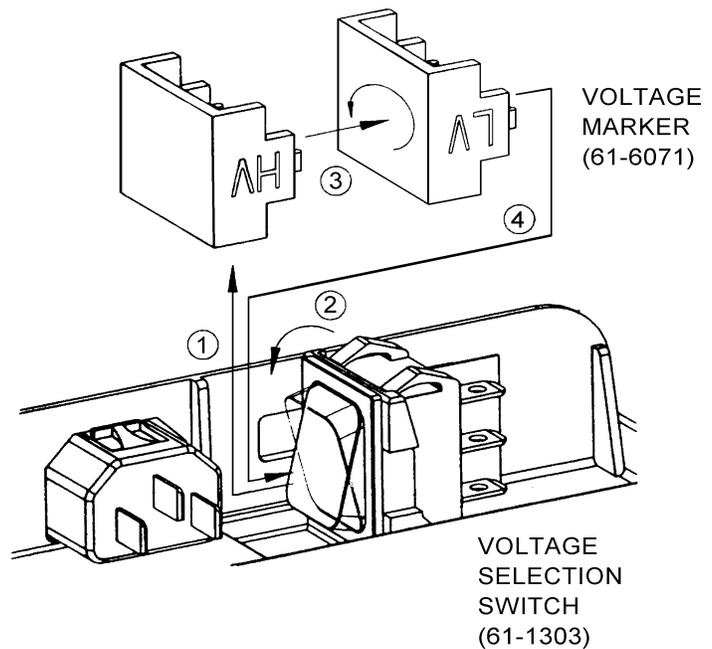
CAUTION
Make certain that the voltage setting (LV or HV) is in the correct range for your power before plugging in.

4.03 Changing the Voltage Setting on 8907, 8912 and 8917 “C”-Models with Global Motor Option

The voltage setting is permanently displayed in a small window on the pump motor electrical box. The window is located next to the power cord connection and displays either LV for 100-120V or HV for 200-230V.

To change VOLTAGE setting:

1. Disconnect the electrical power cord.
2. Open the motor electrical box by removing the four screws and removing the cover.
3. Locate the voltage selection switch next to the external electrical power cord connector.
4. Remove the voltage marker (61-6071).
The switch is very tightly installed.
To remove, place index and middle finger along the top edge and pull backwards.
5. Change the voltage selection switch (61-1303) to the opposite position.
6. Rotate the voltage marker, 180° and insert into previous location. The voltage marker is keyed to the switch setting so that it can only display the correct setting. The selected voltage setting can be seen through the window in the electrical box.
7. Replace the electrical box cover before reconnecting the power cord.



Section 5: OPERATION

5.01 Starting Procedure

Before using the pump for the first time, it is a good idea to spend a few minutes inspecting the pump and its electrical and vacuum connections. Review Section 1: Installation as required.

Check the AC power outlet to be sure that it is the same voltage and phase as the pump motor. Connect the power cord to the power outlet and recheck the oil level.

Close off the pump intake and the gas ballast valve, and run the pump at blankoff for a few minutes. The gurgling noise should go away after a few minutes of running; it is caused by the high volume of air that flows through the pump when the pump is first turned on. If the gurgling noise does not stop, check the oil level to see if it is low, and check the pump intake fitting to be sure that it is tight. Once proper pump operation has been verified, the pump intake can be opened to the vacuum system.

After running the pump for a few minutes, check the oil level again. If the level is too high or too low, stop the pump and add or remove oil as needed. Stop the pump and vent it to the atmosphere before adjusting the pump fluid level.

Before starting the pump when connection to the vacuum system, check all vacuum connections.

5.02 High Pressure Operation

The Vacuum Pumps are designed to be most efficient when operated at or near their ultimate blankoff pressure. When operated at elevated pressures for long periods of time, the pump will run hotter. Additional cooling may be required for both the pump and the motor. At elevated ambient temperatures under these conditions, the thermal protection switch may cut out. The oil may tend to thin out at these temperatures, losing its ability to lubricate effectively.

During operation at these pressures, oil mist may be generated at the exhaust port. The mist has the appearance of a small cloud of smoke. Use of an Exhaust Filter with coalescing element is required. An exhaust filter with an oil drain back feature is highly recommended. See Section 9: Accessories.

NOTE: If operating this pump for prolonged periods of time at or above 10 Torr, contact the Welch Vacuum Technical Service Department for further information and precautions.

5.03 Shutdown Procedures

A few simple precautions are necessary before performing a pump shutdown. If a gauge is connected to the system, first isolate the gauge, then turn off the power to the pump and open the system to the atmosphere.

NOTE: The intake isolation valve will automatically close when power to the pump is turned off. This will maintain vacuum in the system (if the pump remains connected to the rest of the system). For Model 8925, if the gas ballast is open, the system will not maintain vacuum (same as section 2.06).

If the pump is disconnected from the system for any length of time, cover the pump intake with a rubber stopper or other suitable cover to protect the pump against contamination. An intake screen is furnished to prevent loose particles from entering.

If the exhaust port is open, that should also be covered. If the pump oil is contaminated and the pump is going to be stored for a prolonged period, the oil should be changed before the pump is stored. Even if a pump is stored for a long period with oil initially in good condition, check the oil when the pump is restarted, and change the oil if necessary.

Section 6: MAINTENANCE

6.01 Vacuum Problems

Inability to attain sufficient vacuum in a system is usually due to leakage, contamination, or unusual outgassing. A system must be thoroughly clean and free from leaks to operate efficiently. If the system is found to be clean and leak-free, but vacuum problems still exist, the pump should be checked. A simple way to test the pump is to measure its ultimate pressure capability. This can be done by disconnecting the pump from the rest of the system and connecting a pressure gauge directly to the pump intake. (Be sure to seal the pump intake from the atmosphere, and be sure the gas ballast valve is closed.) The gauge can be any type that is suitable for the pressure levels expected. Run the pump until the gauge indicates no further reduction in pressure, and compare the pressure reading to the pump's ultimate pressure rating.

If the pump meets its ultimate pressure specifications only when disconnected from the rest of the system, the fault must be elsewhere in the system. If the pump's ultimate pressure is unusually high, the pump may be badly contaminated, low on oil, or mechanically defective. However, if the pressure is only slightly higher than the pump's guaranteed pressure, an oil change may be all that is needed to bring performance up to specifications. Be sure to use only DIRECTORR® Premium or Gold Oil in vacuum pumps; the ultimate pressure guarantee does not apply if other types of oil are used.

The most common cause of efficiency loss in a vacuum pump is contamination of the oil, which is usually caused by foreign particles and/or condensed vapors. The condensate emulsifies with the oil, and when the oil is recirculated, the condensate evaporates. The resulting vapor then reduces the ultimate vacuum attainable in the system. Some foreign particles and vapors form sludges with the oil. The presence of sludge in the oil impairs its sealing and lubricating properties, and eventually could cause pump seizure. Therefore, periodic oil changes are necessary to maintain efficient operation of the system. The interval at which oil changes are required is different for each set of operating conditions; experience will help you determine the proper interval for your system and process.

6.02 Oil Change

The best time to change the oil is when the pump is warm and the oil is less viscous. Before attempting an oil change, the pump must be disconnected from the power outlet.



WARNING
The drain oil is hot and can cause burns.
Operating temperature of the oil is typically 140 degrees Fahrenheit or higher. Avoid skin contact with the oil.

Changing the Oil for 8907, 8912 & 8917

To drain old oil, rotate the drain valve counter-clockwise until the handle will no longer turn. A 6-12 in. length of 3/8" I.D. tubing can be fitted on the oil drain nipple to direct the flow of oil neatly into a bottle or other container. When the old oil has been removed, close the drain valve by rotating it clockwise until the handle will no longer turn.

Changing the Oil for 8905, 8920 & 8925

Oil Removal: Drain the oil into a container by removing the plastic plug located below and to the left of the oil sight glass. The pump may be tilted to remove residual oil out of the oil reservoir.

Oil Fill: Replace the oil drain plug, remove the plastic oil fill plug located on the top of the oil reservoir. Fill the pump with vacuum oil until the level reaches the FULL mark of the label next to the oil sight glass. Do not overfill the pump. The excess oil tends to splash out of the exhaust. Replace the oil fill plug. Check the oil level again after the pump warms up to its normal operating temperature. Add or remove oil as needed. It is normal for the oil level to change upon initial start up.

Frequency of Oil Changes

The oil change interval is completely dependent upon the running conditions of temperature, operating pressure, hours of daily operation, and upon the materials pumped. Clean, dry air at pressures below 50 mtorr are the most forgiving conditions. To determine your own oil change interval, visually monitor the pump oil conditions at regular intervals. If you suspect harsh operating conditions, daily visual checks are recommended. When the oil becomes cloudy, dark or includes particles of solids, it is time to change the oil. Oil may be visually checked through the oil level window. However, a much better check is to use the drain to draw out 20-50 ml into a small glass beaker and view the oil with a light behind it. Clean oil can be returned to the pump through the oil fill port.

Be sure to use only DIRECTORR® Premium or Gold Oil.
The ultimate pressure guarantee applies only if those oils are used.

6.03 Developing A Maintenance Schedule

After studying many examples of pump failure, Welch has found the most common reason is poor condition of the oil. This is why a regular maintenance schedule for the oil is critical to obtain the longest service life out of your Vacuum Pump. Welch recommends that you examine the condition of the oil on a daily basis in the early days of a new process or experiment. Look for discoloration of the oil and whether the oil level is rising. The discoloration can indicate deterioration of the oil, and a rising oil level can indicate condensation of vapors is occurring in the pump. Once you have determined how long it takes for the oil to break down in your application, or become contaminated, choose your oil change interval, so that the pump always operates with good quality, uncontaminated oil.

6.04 Lip Seal/Gasket Change

Changing the Lip Seal and Gasket for 8905

When the shaft seal in the mounting plate shows signs of excessive oil leakage, it should be replaced. Before attempting replacement of the seal, the pump must be disconnected from the vacuum system and from the power outlet. New lip seal (P/N 41-2988) and new gasket (P/N 61-2149B) or seal replacement kit (Cat. No. 8905K-03) should be available before attempting repair.

1. DRAIN OIL by opening the drain plug. The pump may be tilted to remove residual oil out of the oil case.
2. SEPARATE BASE from the pump by removing four socket head screws, 10-32x5/8.
3. SEPARATE THE PUMP FROM THE MOTOR ASSEMBLY by removing four socket head screws #10-32x1 from the motor adapter plate. The isolator valve coil should be slipped off by removing nut, name plate and large washer from valve projecting from the inside of the mounting plate. Set aside the motor assembly with isolator coil placed next to it.
4. REMOVE OIL CASE from the pump by placing it on its mounting plate side and unscrew four socket headscrews 10-32x3/4.
5. REMOVE COUPLING from the pump shaft by loosening the setscrew. Separate pump module from the mounting plate by unscrewing three socket head screws #10-32x1/2 and three split lock washers. Discard the gasket.
6. PUSH OUT LIP SEALS out of the wear plate with a blunt edge of a screwdriver blade. Discard the lip seal. Older models will have lip seal installed in the mounting plate.
7. INSTALL NEW SHAFT SEAL with flat side of the seal toward the motor. Use a little oil on the lip seal outside periphery. The seal is located 0.09 in. from the coupling end inside the bore. Seal assembly tool 61-2172A used to install and locate the lip seal.
8. PLACE THE PUMP MODULE on a table with shaft up. Slide shaft insertion tool 61-2170A over the shaft end and place the new gasket over the modular assembly.
9. MOISTEN THE LIP SEAL, shaft and the tool with oil prior to the assembly. Slip the mounting plate over the shaft of the modular pump.
10. ADJUST GASKET in proper angular location and then tighten gradually the 3 screws #10-32x1/2 with lock washers.
11. ASSEMBLE COUPLING BODY to pump shaft all the way to the shaft shoulder and tighten the setscrew.
12. ATTACH OIL CASE to the mounting plate using four socket head screws 10-32x3/4 with 4 lock washers. Tighten screws gradually.
13. Insert two dowel pins to the mounting plate and put the coupling spider in place.
14. ATTACH MOTOR ASSEMBLY to the mounting plate using four socket head screws #10-32x1 with lock washers. Watch for wires from the isolator valve coil to be placed in groove of motor adapter plate during assembly. After carefully fitting all parts together cross tighten the four screws gradually.
15. ATTACH THE COIL TO ISOLATOR VALVE mechanism by first slipping on the coil shoulder and then the coil with name plate. Tighten the coil nut (name plate should turn freely).
16. ATTACH BASE to the mounting plate by means of four socket head screws 10-32x5/8 long.
17. FILL PUMP WITH OIL, DIRECTORR® Premium or Gold Oil and is ready to be inspected for its performance.

Changing the Lip Seal and Gasket for 8907, 8912 and 8917

When the shaft seal in the mounting plate shows signs of excessive oil leakage, it should be replaced. Before attempting replacement of the seal, the pump must be disconnected from the vacuum system and from the power outlet. New lip seal (P/N 61-6042) and new gasket (P/N 41-0643) or seal replacement kit (Cat. No. 8917K-03) should be available before attempting repair.

1. DRAIN OIL by turning the valve handle counterclockwise in the horizontal position. The pump may be tilted to remove residual oil from the oil case.
2. REMOVE THE HANDLE of the pump by removing 2 M8 screws.
3. REMOVE THE TOP AND SIDE COVER, The top cover (located under the handle) and Side Panels can now be removed by removing two size M3 screws from each.
4. REMOVE THE BASE by removing four M8 screws. Wipe up any oil in the base. If the Dip Pad is saturated with oil, replace it.
5. REMOVE THE ELECTRICAL BOX The Electrical Box Cover is removed by unscrewing four Philips-head screws.
6. DISCONNECT the green quick disconnect located in the electrical box.
7. DISCONNECT MOTOR, Motor can be disconnected by removing four motor mounting screws.
8. REMOVE THE COUPLING from the pump shaft (1 set screw)
9. REMOVE THE THREE SCREWS attaching lip seal housing.



CAUTION

Don't lose the woodruff key that sits in the key slot of the coupling; it can drop out. If the key has any burrs (caused by previous tightening of the coupling screws), sand it smooth.

NOTE: If the lip seal gasket (under the lip seal in the lip seal housing) looks intact, there may be no need to replace it.

IMPORTANT: Note the position of the arrow and "UP" on the housing surface. After you replace the Lip Seal, be sure the arrow on this coupling again points in the same direction (so that other components will be properly aligned).

10. REPLACE THE LIP SEAL
 - a) Place the lip seal housing in a vise (place a rag against the surfaces to protect against scratching). Gently hammer a screwdriver against the lip seal at opposite sides until it pops out.
 - b) Before inserting the new lip seal, use your finger to add a thin coating of pump oil around its periphery.
 - c) Place the new lip seal in the coupling. It is essential that it be positioned perfectly flat on the bottom inner flange. For best results, use a hand press. Place the coupling upright with the new seal on the hand press. Then place a block of wood or metal having a very flat surface on top of the Lip Seal. Turn the hand press lever until the Lip Seal is seated.
 - d) To be sure the seal is completely seated, use a round tool having a slightly smaller diameter than the seal to hammer the seal completely down to the bottom.
 - e) As for the lip seal gasket, even if you decide it's not necessary to replace it, clean the coupling surfaces that the gasket rests on.

11. REPLACE THE LIP SEAL HOUSING

a) It is recommended that you use 3 lockwashers to secure the LIP SEAL HOUSING. Uniform tightness is important. Repeatedly finger-tight the 3 screws in sequence. Then lastly, turn them very tight.

b) Replace the Woodruff Key in its slot. Use your small finger or a thin tool to hold it in place as you replace the motor coupling housing. Be sure the key *stays* in position. If it should fall even a little distance, use a screwdriver to push it back up in the key slot. Then tighten the set key screw—very tight.

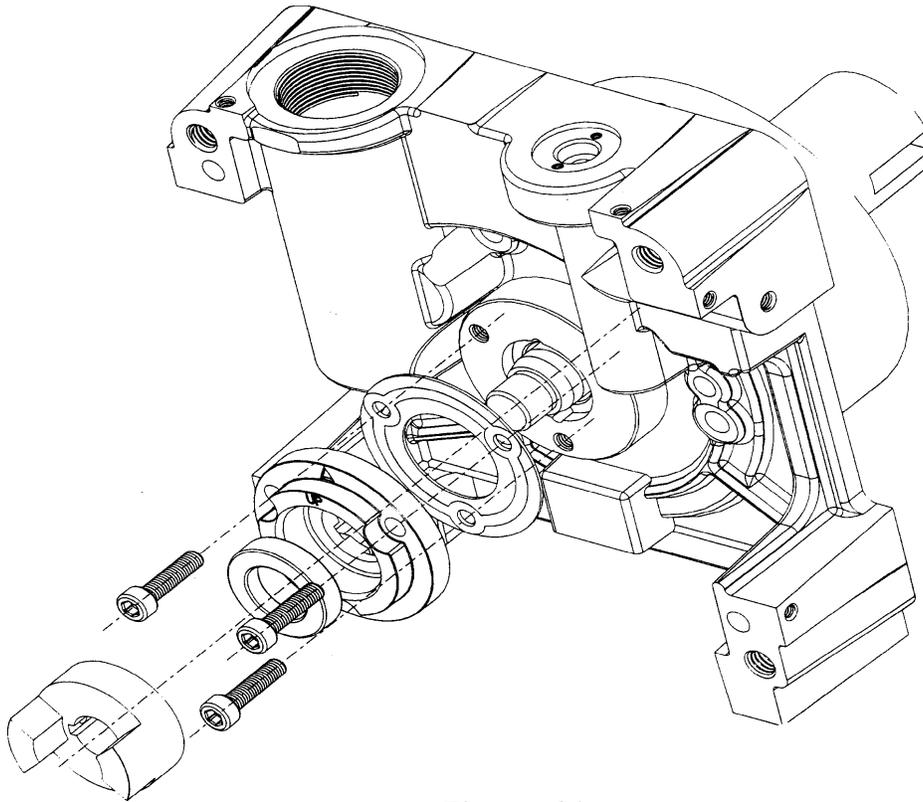


Figure 6.1

12. REPLACE OTHER COMPONENTS, then reassemble the motor and other components.

Changing the Lip Seal and Gasket for 8920 and 8925

When the shaft seal in the mounting plate shows signs of excessive oil leakage, it should be replaced. Before attempting replacement of the seal, the pump must be disconnected from the vacuum system and from the power outlet. New lip seal (P/N 61-8378A) and new gasket (P/N 41-0643) or seal replacement kit (for Model 8920: Cat. No. 8915K-06, for Model 8925: Cat. No. 8925K-03) should be available before attempting repair.

1. **DRAIN OIL** by opening the drain plug. The pump may be tilted to remove residual oil out of the oil case.
2. **SEPARATE THE BASE** the pump may be turned on its oil case face and **REMOVE BASE** with four socket head screws 5/16-18x1.
3. **SEPARATE THE PUMP FROM THE MOTOR ASSEMBLY** by removing four socket head screws 5/16-18x1-1/4 and washers from the motor adapter plate and carefully separate the pump from the motor subassembly. Set aside the motor assembly with the coupling sleeve.
4. **REMOVE COUPLING** and woodruff key from the pump shaft by loosening the setscrew. Next unscrew three socket head screws #10-32x7/8 and three split lock washers holding outer lip seal assembly to the mounting plate. Remove and discard outer lip seal assembly and gasket.
5. **WIPE OIL AND CLEAN** the shaft surface and gasket sealing area. Inspect all sealing surfaces. These must be thoroughly cleaned and free of any scratches.
6. **ASSEMBLE OUTER LIP SEAL ASSEMBLY WITH GASKET.** Use a little oil on seal and shaft.
IMPORTANT: Assemble the part with the mark “up” in proper position.
Tighten gradually the three socket head screws #10-32x7/8 and washers.
7. **ATTACH COUPLING BODY** to the pump shaft end by means of a woodruff key and a setscrew.
Tighten setscrew lightly.
8. **PLACE COUPLING SLEEVE** inside pump coupling body.
9. Insert two dowel pins into the mounting plate and place motor assembly over the mounting plate.
IMPORTANT: Check and adjust the coupling on pump shaft to insure 0.03 in. minimum total clearance between coupling elements. Tighten setscrews on both coupling bodies. It is important that no axial thrust is transmitted through the coupling from motor shaft.
10. **SECURE MOTOR TO THE PUMP** by using four socket head screws 5/16-18x1-1/4 and four lock washers.
11. **ATTACH THE BASE** by means of four-socket head screws 5/16-18x1-1/4 and four lock washers.
12. **SCREW IN DRAIN PLUG** with o-ring to oil case and fill oil.

Section 7: TROUBLE SHOOTING

7.01 Leak Detection

The importance of eliminating all leaks in a vacuum system is obvious when it is realized that a leak into the system, at atmospheric pressure, expands in volume by a factor of 750,000 to 10,000,000 or more. The pump must remove this added volume to maintain the desired vacuum. Fortunately a number of effective techniques for leak detection have been developed:

Large Leaks

Locate by pressurizing the system and painting the suspected area with a thick soap solution. Escaping air will produce soap bubbles.

7.02 Troubleshooting Guide

Condition	Probable Cause	Recommended Corrective Action
Pump will not start	<ol style="list-style-type: none"> 1. Power off. 2. Coupling damaged or coupling ser-screw loose. 3. Room is too cold. 4. Pump mechanism is seized. 	<ol style="list-style-type: none"> 1. Check switches and fuses 2. Check coupling. 3. Drain and refill pump with warm oil. 4. Pump to be repaired.
Pump does not reach ultimate pressure	<ol style="list-style-type: none"> 1. Pump is contaminated. 2. Pump is not filled with oil, or has low oil level. 3. Pump has wrong oil in it. 4. Leak in vacuum system. 5. Dirty foreline trap. 6. Gas ballast is open. 	<ol style="list-style-type: none"> 1. Flush and change pump oil. Use a foreline trap. 2. Add recommended pump oil. 3. Flush and refill with recommended oil. 4. Locate and eliminate leak source. 5. Clean out cold traps and replace elements in coaxial and molecular sieve traps. 6. Close gas ballast.
Excessively noisy pump	<ol style="list-style-type: none"> 1. Intake or exhaust lines are restricted. 2. Coupling damaged. 3. Slapping noise at ultimate pressure is typical for some pumps. 4. Inside mechanism damaged. 	<ol style="list-style-type: none"> 1. Clear and straighten out lines and check oil level. 2. Examine coupling/replace. 3. Clean orifice/air passage. 4. Pump to be repaired.
Pump generates excessive smoke or oil mist from exhaust port	<ol style="list-style-type: none"> 1. Pump overfilled with oil. 2. Pump operating continuously above its maximum operation pressure. 	<ol style="list-style-type: none"> 1. Drain excess pump oil 2. Use larger capacity pump or modify your vacuum system.
Pump oil is dark, has an unusual color, or is dirty	<ol style="list-style-type: none"> 1. Pump oil contaminated by process gases, or other foreign material ingested by pump. 2. Pump oil has degraded. 	<ol style="list-style-type: none"> 1. Flush and change oil. Use a foreline trap in future. Consider using an oil filtration system or insert pump oils. 2. Pump was run too low on oil. The recommended oil was not used. Pump is running continuously above maximum operation pressure.
Pump does not achieve its rated pumping speed	<ol style="list-style-type: none"> 1. Pump is running too cold. 2. Exhaust or intake line is too narrow. 3. Pump oil is contaminated 4. Very dirty trap or intake line. 	<ol style="list-style-type: none"> 1. Allow pump to run until it warms up to its operation temperature. 2. Install larger inner diameter tubing. 3. Flush and change pump oil. Use a foreline trap in future. 4. Clean out cold traps and replace elements in coaxial and molecular sieve traps. Clean or replace vacuum piping.
Motor is excessively noisy	<ol style="list-style-type: none"> 1. Voltage selection is incorrect. 	<ol style="list-style-type: none"> 1. Convert motor to be compatible with electrical supply. See section: 4.03 / 4.04 Changing voltage setting.

Section 8: REPAIR KITS

8.01 Shaft Seal Replacement

When the shaft seal in the mounting plate shows signs of excessive oil leakage, it should be replaced. Before attempting replacement of the seal, the pump must be disconnected from the vacuum system and from the power outlet.

A seal replacement kit is available. This kit contains the outer lip seal assembly and gasket, which can be replaced in the field.

Model	8905	8907	8912	8917	8920	8925
Seal Kit	8905K-03	8917K-03	8917K-03	8917K-03	8915K-03	8925K-03

8.02 Minor Repair Kits

A minor repair kit is available that provides a group of parts that can easily be replaced in the field.

Model	8905	8907	8912	8917	8920	8925
Minor Repair Kit	8905K-02	8917K-02	8917K-02	8917K-02	8915K-02	8925K-02

8.03 Major Factory Repair

With proper care, Welch direct drive pumps will give many years of service. The basic working parts of vacuum pumps are machined to close tolerances and require assembly on fixtures, with special tools, by mechanics who are highly skilled at this work. Should major repairs involving the pump mechanism become necessary, we strongly recommend that the pump be returned to the factory, or to a Welch Vacuum Repair Center, for repair. Obtain a Returned Goods Number from Welch Vacuum before returning any vacuum pump.

These facilities are well-equipped and staffed with experts to insure prompt reconditioning of all returned pumps. Broken, worn, scored or corroded parts are replaced with new parts, and the pump is thoroughly evaluated and tested to determine that it meets the performance requirements.

For warranty or non-warranty repairs, an RMA (Return Materials Authorization) number is needed prior to shipping product to Welch. An RMA number is obtained by filling out a Safety Service Form located on the Welch web site: www.welchvacuum.com

A Welch customer service representative will then call you with the RMA number and shipping instructions.

The reason for the Safety Service Form is that it contains information on what chemicals may have been ingested into the pump during its use. Worker safety rules require this information prior to a repairman examining the pump.

SECTION 9: ACCESSORIES

9.01 Pump Oil

Quantity	1 Liter	1 Gallon	5 Gallon	55 Gallon
Directorr® Premium	8995P-11	8995P-15	8995P-20	8995P-25
Directorr® Gold	8995G-11	8995G-15	8995G-20	8995G-25

Directorr® Premium Vacuum Pump Oil is the oil recommended for use with Welch Direct Drive pumps. This is the oil furnished with each new pump. The vacuum guarantee for these pumps applies only when the recommended oil is used. Use of other types of oil in these pumps can cause inferior performance, both in pumping speed and ultimate vacuum attained, and may eventually cause permanent pump damage.

Directorr® Gold Vacuum Pump Oil. A specially formulated mineral oil for direct drive pumps. It has an exceptionally low oil vapor, which results in a lower ultimate total pressure, less backstreaming and faster system pumpdown. It is resistant to oil breakdown, especially at high temperatures. As a result less frequent oil changes are required. The pump will give better vacuum stability over long periods of time. This oil can be used in mildly corrosive applications in direct drive pumps where a hydrocarbon oil is not recommended.

9.02 Exhaust Filters

Model	8905	8907	8912	8917	8920	8925
Exhaust Filter	1417	1417P	1417P	1417P-7	1417P-10	1417P-10
Replacement Element	1417L	1417Q	1417Q	1417R	1417G	1417G

NOTE:

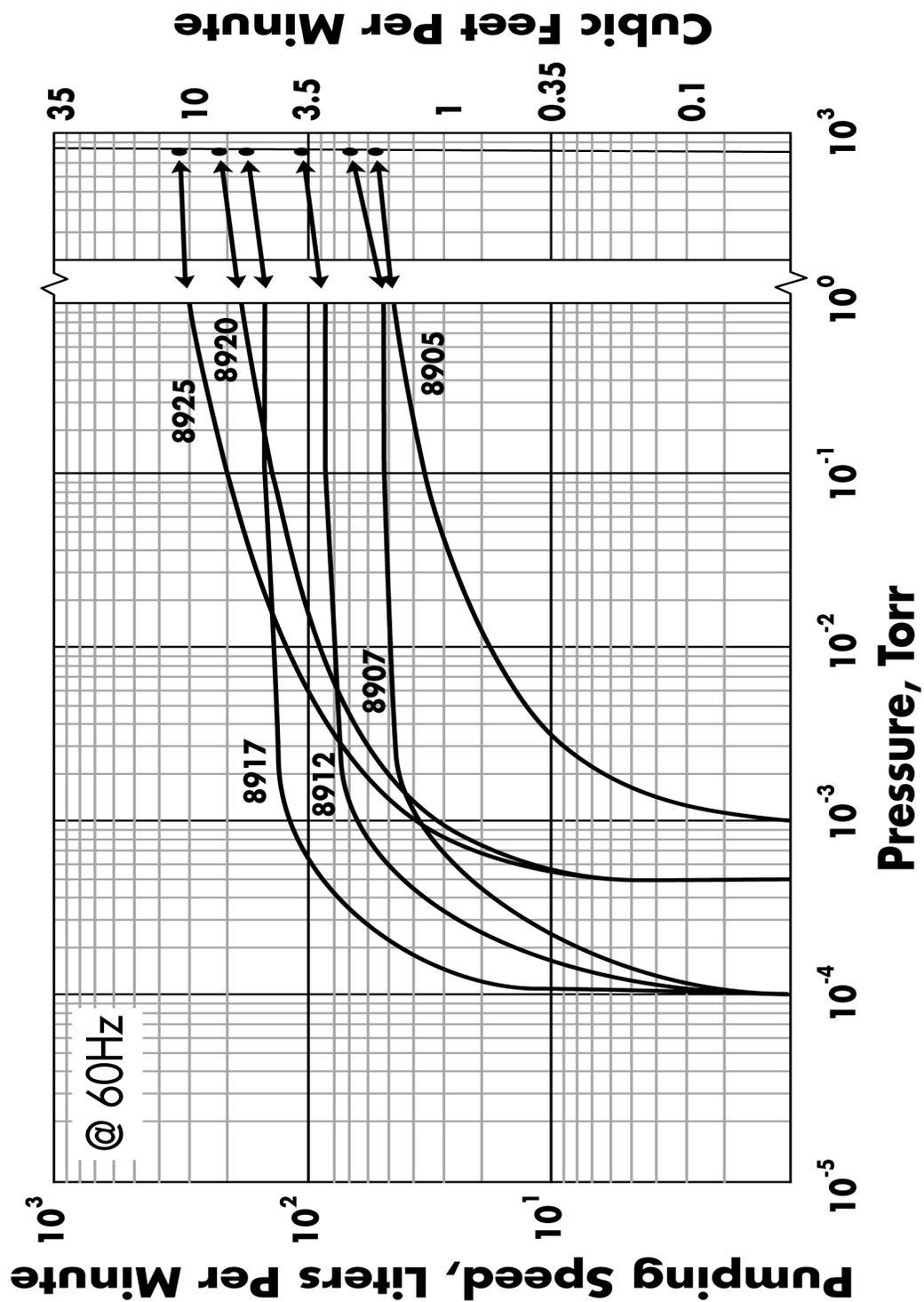
**For additional information on Accessories, Parts or Products, please consult:
Welch Vacuum's Laboratory Products Catalog**

or

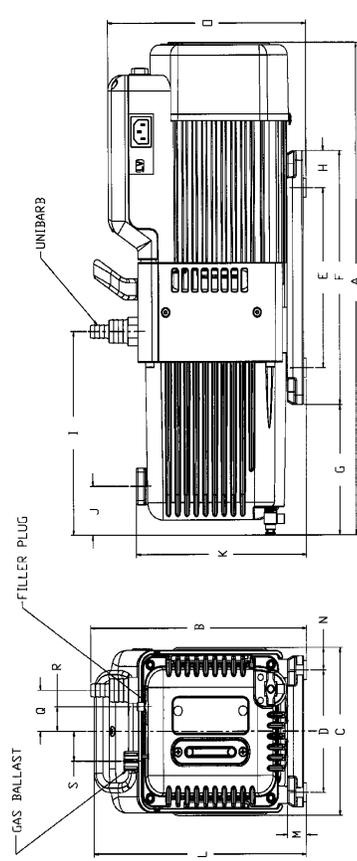
Welch's website at www.Welchvacuum.com

Section 10: PUMPING SPEED CURVES / DIMENSIONAL DRAWINGS

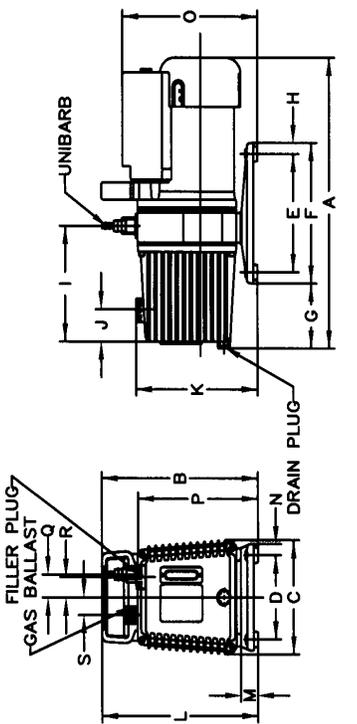
10.01 Pumping Speed Curves



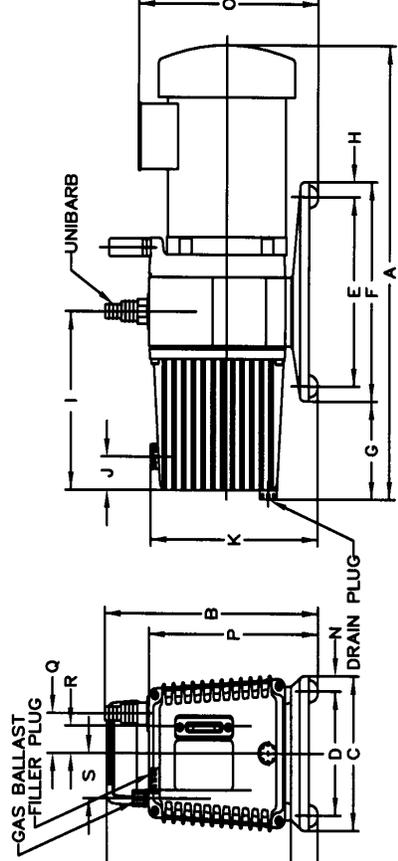
10.02 Dimensional Drawings



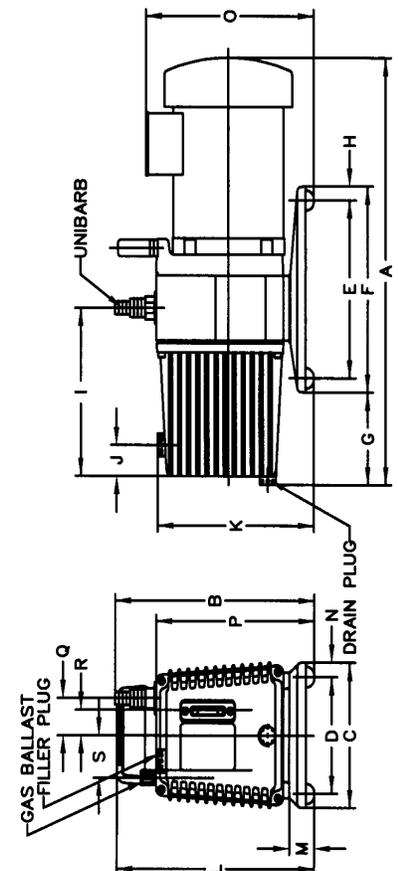
8907/8912/8917



8905



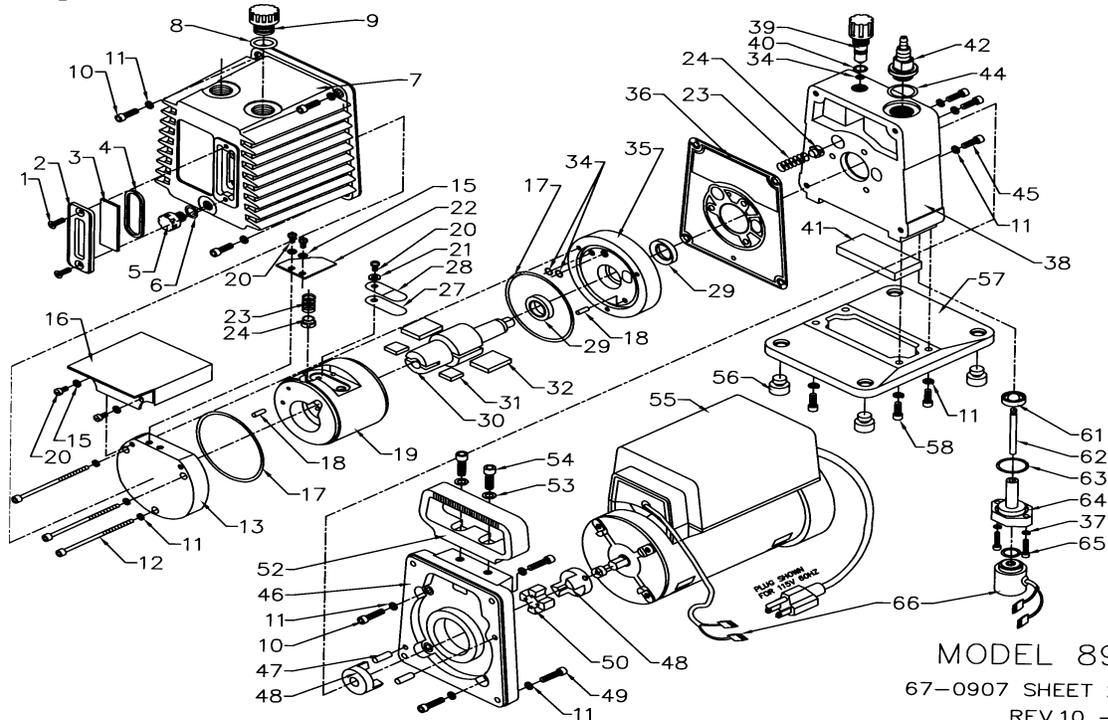
8925



8920

Pump Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
8905A	14.13	8.70	5.52	4.07	5.73	6.81	3.16	0.54	5.58	1.56	6.76	8.70	0.95	0.54	7.50	6.68	1.10	0.98	0.85
8905C-02	14.13	8.70	5.52	4.07	5.73	6.81	3.16	0.54	5.58	1.56	6.76	8.70	0.95	0.54	7.50	6.68	1.10	0.98	0.85
8907A	18.90	9.60	6.54	4.76	7.00	9.88	5.05	1.44	7.92	1.90	7.60	9.45	0.87	0.89	8.78	-	1.61	0.94	1.18
8912A	18.90	9.60	6.54	4.76	7.00	9.88	5.05	1.44	7.92	1.90	7.60	9.45	0.87	0.89	8.78	-	1.61	0.94	1.18
8917A	18.90	9.60	6.54	4.76	7.00	9.88	5.05	1.44	7.92	1.90	7.60	9.45	0.87	0.89	8.78	-	1.61	0.94	1.18
8920A	21.00	10.40	6.14	3.86	8.90	10.40	-	0.75	7.85	1.60	8.60	10.30	1.00	1.10	9.40	8.20	1.82	1.25	2.07
8920C-02	21.00	10.40	6.14	3.86	8.90	10.40	-	0.75	7.85	1.60	8.60	10.30	1.00	1.10	9.40	8.20	1.82	1.25	2.07
8925A	20.40	10.40	6.14	3.86	8.90	10.40	-	0.75	7.85	1.60	8.60	10.30	1.00	1.10	9.40	8.20	1.82	1.25	2.07
8925C-02	20.40	10.40	6.14	3.86	8.90	10.40	-	0.75	7.85	1.60	8.60	10.30	1.00	1.10	9.40	8.20	1.82	1.25	2.07

10.03 Exploded Views & Parts List



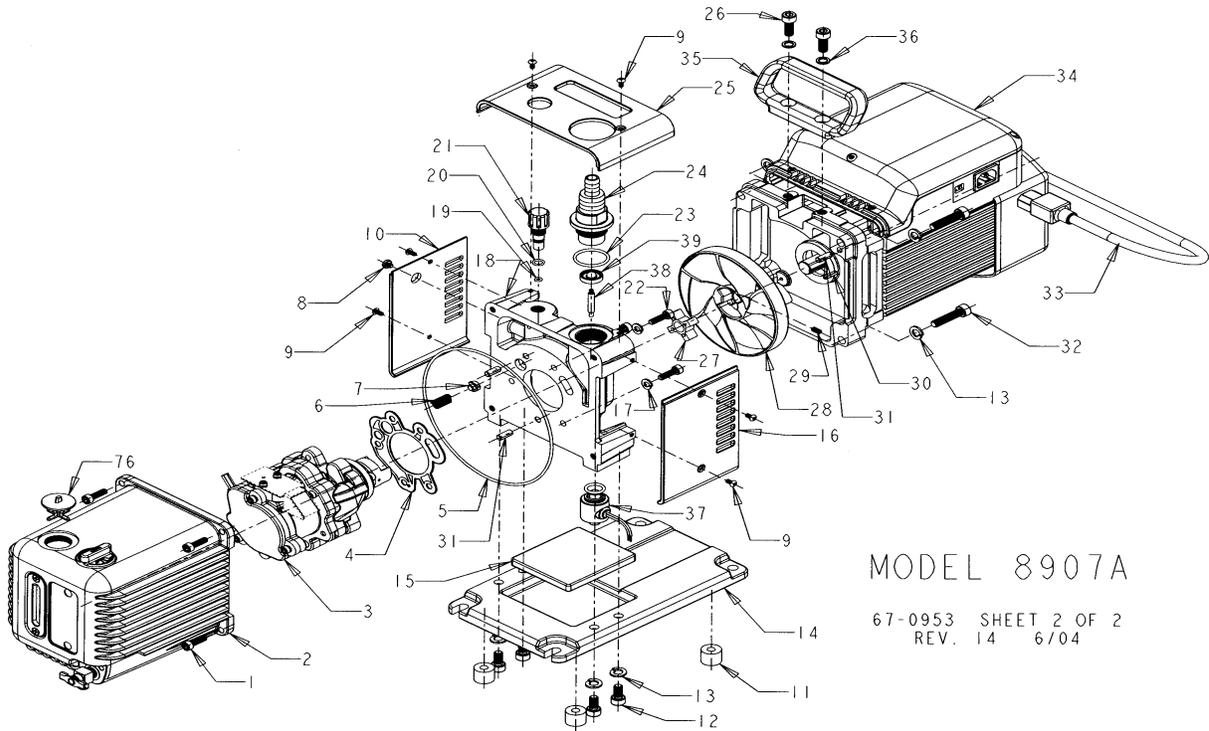
PARTS LIST FOR 8905A

ITEM	QTY	P/N	A*	B*	DESCRIPTION	ITEM	QTY	P/N	A*	B*	DESCRIPTION
01	2	62-1014			Screw, Flathead, #8-32x3/8	35	1	61-2214B			Wear Plate
02	1	61-2370			Window Holder	36	1	61-2149B	1		Gasket
03	1	61-2229A			Window Glass	37	2	2-62-0432			Lockwasher #6
04	1	66-0304	1		O-Ring, Fluoroelast. #127	38	1	61-2351			Mounting Plate
05	1	61-2413			Drain Plug	39	1	61-6324			Gas Ballast Valve Assembly
06	1	61-2158A	1		O-Ring, Fluoroelast. #110	40	1	61-9282A	1		O-Ring, Fluoroelast. #011
07	1	61-2355			Oil Case	41	1	61-9479A	1		Drip Pad
08	1	61-2130A			O-Ring, Fluoroelast. #115	42	1	61-2358			Intake Adapter
09	1	61-2372			Filler Plug	44	1	61-2159A	1		O-Ring, Fluoroelast. #116
10	8	2-00-6712			Screw, Sockethead, #10-32x3/4	45	3	2-00-6708			Screw, Sockethead, #10-32x1/2
11	22	2-62-0793			Lock Washer #10	46	1	61-2316			Motor Adapter Plate
12	3	62-0003			Screw, Sockethead, #10-32x3	47	2	4-21-5010			Dowel Pin, 3/16"x5/8"
13	1	61-2417			End Plate	48	2	41-2693			Coupling Body
15	4	2-69-6108			Lock Washer #8	49	4	2-00-6716			Screw, Sockethead, #10-32x1
16	1	61-2415			Baffle Assembly	50	1	41-2694	1		Coupling Rubber
17	2	61-2128A	2		O-Ring, Fluoroelast. #145	52	1	61-2377			Handle
18	2	4-21-3006			Dowel Pin, 1/8"x3/8"	53	2	2-61-1165			Washer 1/4
19	1	61-2416			Stator	54	2	2-01-6112			Screw, Sockethead, 1/4-20x3/4
20	5	2-10-2605			Screw, Roundhead, #8-32x5/16	55	1	61-2039C			Motor Assembly 1/4 H.P. (115V,60Hz)
21	1	2-68-5632			Washer #8	55	1	61-2318			Motor Assembly 1/4 H.P. (230V,60Hz)
22	1	61-2017A			Exhaust Valve Bracket Assembly	55	1	61-9813			Motor 1/4 H.P. (100-120/200-240V)
23	2	61-2119A	2		Valve Spring	56	4	61-2123A	4		Rubber Bumper
24	2	61-2118A	2		Valve	57	1	61-2271C			Base
27	1	61-1123A	1		Intake Valve	58	4	2-00-6812			Screw, Sockethead, #10-32x5/8
28	1	61-1128A	1		Backer Valve	61	1	61-2139A	1		Disc Assembly, Isolator Valve
29	2	41-2988	2		Lip Seal	62	1	61-2216A			Plunger
30	1	61-2177B			Rotor	63	1	61-2155A	1		O-Ring, Fluoroelast. #020
31	2	61-2179A			Exhaust Vane	64	1	61-2212A			Adapter, Isolator Valve
32	2	61-2178A			Intake Vane	65	2	2-00-6410			Screw, Sockethead, #6-32x5/8
34	3	61-2157A	2		O-Ring, Fluoroelast. #007	66	1	61-2308			ISO Operator Assembly w/O-Ring

A*: MAJOR REPAIR KIT CAT # N/A

B*: MINOR REPAIR KIT CAT # 8905K-02

67-0907
Sheet 1 of 2
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MODEL 8907A

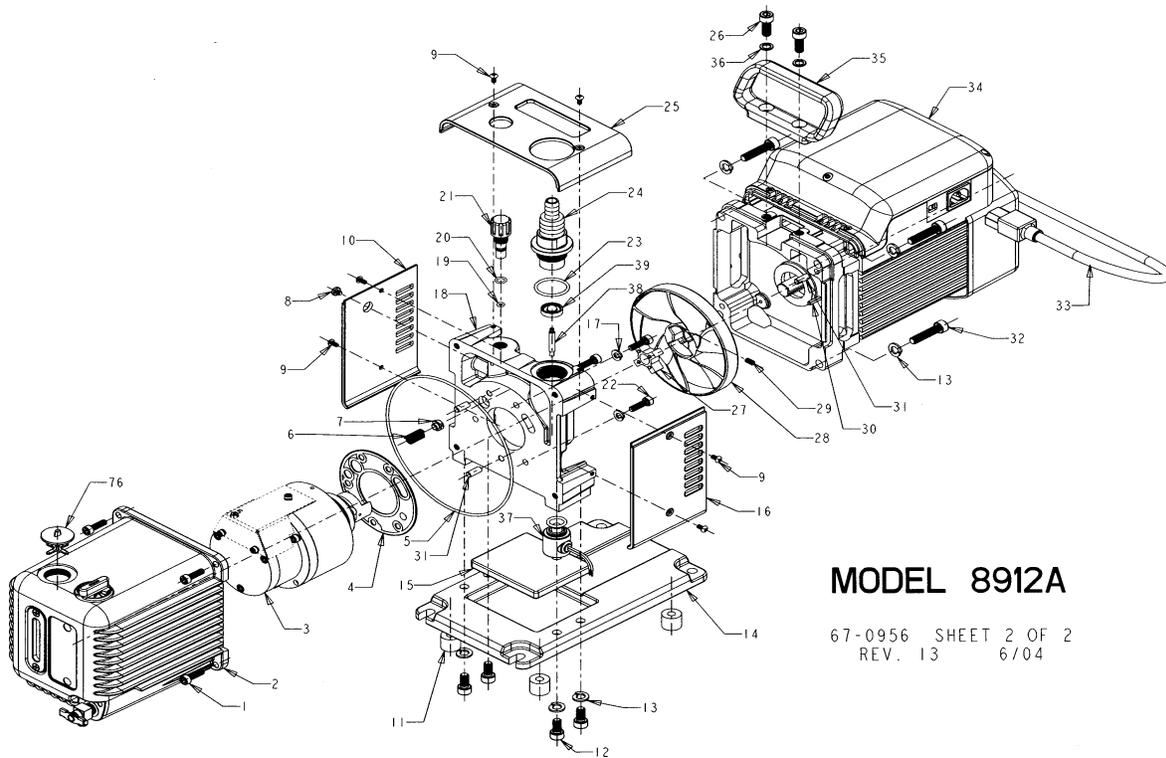
67-0953 SHEET 2 OF 2
REV. 14 6/04

PARTS LIST FOR 8907A

ITEM	QTY	P/N	A*	B*	DESCRIPTION	ITEM	QTY	P/N	A*	B*	DESCRIPTION
01	4	62-0325			Screw, Sockethead, M6x20 Blk.	21	1	61-6324			Gas Ballast Assembly
02	1	61-6443			Oil Case Assembly	22	3	62-0270			Screw, Sockethead, M6x20
03	1	61-6354			Pump Module	23	1	66-0200			O-Ring, Fluoroelast. #216
04	1	61-6385			Gasket	24	1	61-6325			Intake Fitting Assembly
05	1	66-0194			O-Ring, Fluoroelast. #164	25	1	61-6395			Cover, Top
06	1	61-2204A			Spring, Gas Ballast	26	2	62-0331			Screw, Sockethead, M8x20 Blk.
07	1	61-2118A			Valve, Gas Ballast	27	1	61-6038			Coupling, Rubber
08	1	61-9429			Screw w/ O-Ring	28	1	61-6024			Fan
09	6	62-0265			Screw, Buttonhead, M4x8 Blk.	29	1	62-0286			Locking Set Screw #10-32x3/8
10	1	61-6129			Cover, Left	30	1	61-6081			Key
11	4	66-0211			Rubber Feet	31	4	61-9280A			Dowel Pin, 1/4"
12	4	62-0349			Screw, Sockethead, M8x16	32	4	62-0346			Screw, Sockethead, M8x35
13	8	2-63-0356			Lock Washer 5/16	33	1	62-0344			Line Cord
14	1	61-6111			Base	34	1	61-6404			Motor Assembly 1/2 H.P.
15	1	61-6084			Drip Aid	35	1	61-6011			Handle
16	1	61-6127			Cover, Right	36	2	41-2363			Washer
17	3	2-63-0193			Lock Washer 1/4	37	1	61-6304			Solenoid Valve Assembly
18	1	61-6322			Mounting Plate	38	1	61-6279			Plunger
19	1	61-2157A			O-Ring, Fluoroelast. #007	39	1	61-9793			Isolator Disc Assembly
20	1	61-9282A			O-Ring, Fluoroelast. #011	76	1	61-6076			Exhaust Plug

A*: MAJOR REPAIR KIT CAT # N/A
B*: MINOR REPAIR KIT CAT # 8917K-02

67-0953
Sheet 1 of 2
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MODEL 8912A

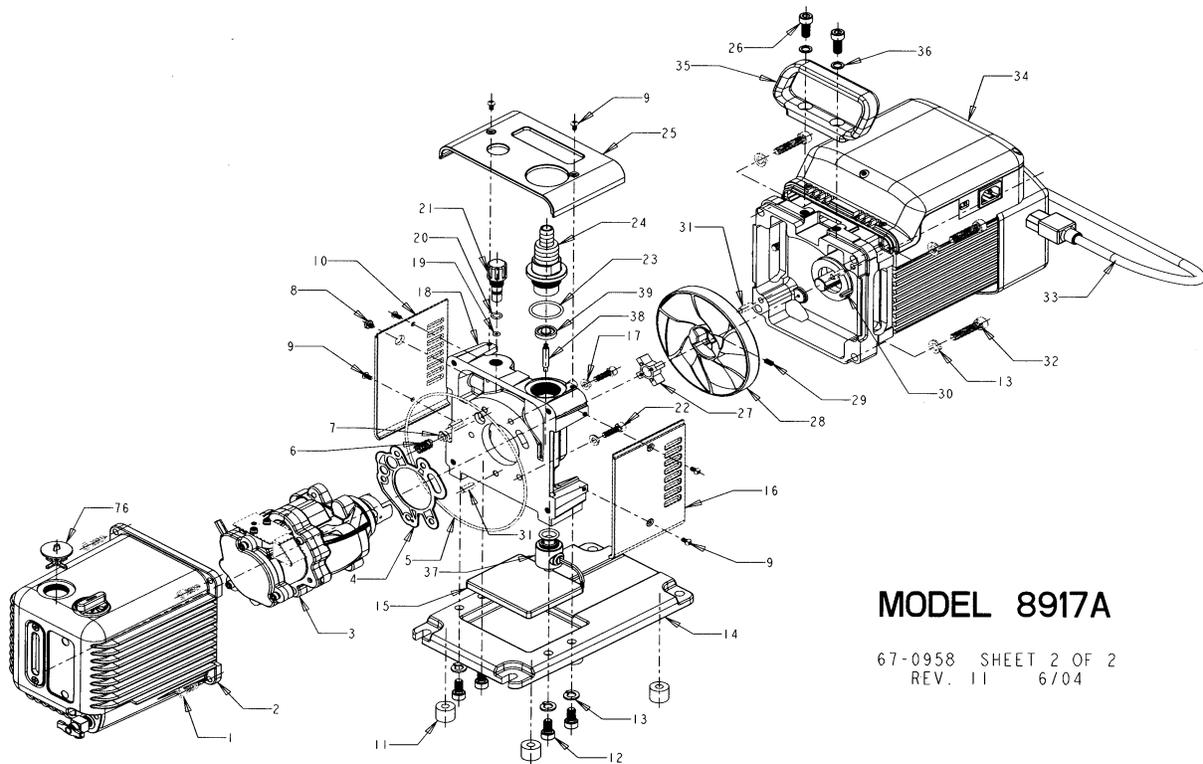
67-0956 SHEET 2 OF 2
REV. 13 6/04

PARTS LIST FOR 8912A

ITEM	QTY	P/N	A*	B*	DESCRIPTION	ITEM	QTY	P/N	A*	B*	DESCRIPTION
01	4	62-0325			Screw, Sockethead, M6x20 Blk.	21	1	61-6324			Gas Ballast Assembly
02	1	61-6443			Oil Case Assembly	22	3	62-0270			Screw, Sockethead, M6x20
03	1	61-6168			Pump Module	23	1	66-0200			O-Ring, Fluoroelast. #216
04	1	66-0199			Gasket	24	1	61-6325			Intake Fitting Assembly
05	1	66-0194			O-Ring, Fluoroelast. #164	25	1	61-6395			Cover, Top
06	1	61-2204A			Spring, Gas Ballast	26	2	62-0331			Screw, Sockethead, M8x20 Blk.
07	1	61-2118A			Valve, Gas Ballast	27	1	61-6038			Coupling, Rubber
08	1	61-9429			Screw w/ O-Ring	28	1	61-6024			Fan
09	6	62-0265			Screw, Buttonhead, M4x8 Blk.	29	1	62-0286			Locking Set Screw #10-32x3/8
10	1	61-6142			Cover, Left	30	1	61-6081			Key
11	4	66-0211			Rubber Feet	31	4	61-9280A			Dowel Pin, 1/4"
12	4	62-0349			Screw, Sockethead, M8x16	32	4	62-0346			Screw, Sockethead, M8x35
13	8	2-63-0356			Lock Washer 5/16	33	1	62-0344			Line Cord
14	1	61-6111			Base	34	1	61-6404			Motor Assembly 1/2 H.P.
15	1	61-6084			Drip Aid	35	1	61-6011			Handle
16	1	61-6141			Cover, Right	36	2	41-2363			Washer
17	3	2-63-0193			Lock Washer 1/4	37	1	61-6304			Solenoid Valve
18	1	61-6322			Mounting Plate	38	1	61-6279			Plunger
19	1	61-2157A			O-Ring, Fluoroelast. #007	39	1	61-9793			Isolator Disk Ass'y
20	1	61-9282A			O-Ring, Fluoroelast. #011	76	1	61-6076			Exhaust Plug

A*: MAJOR REPAIR KIT CAT # N/A

B*: MINOR REPAIR KIT CAT # 8917K-02



MODEL 8917A

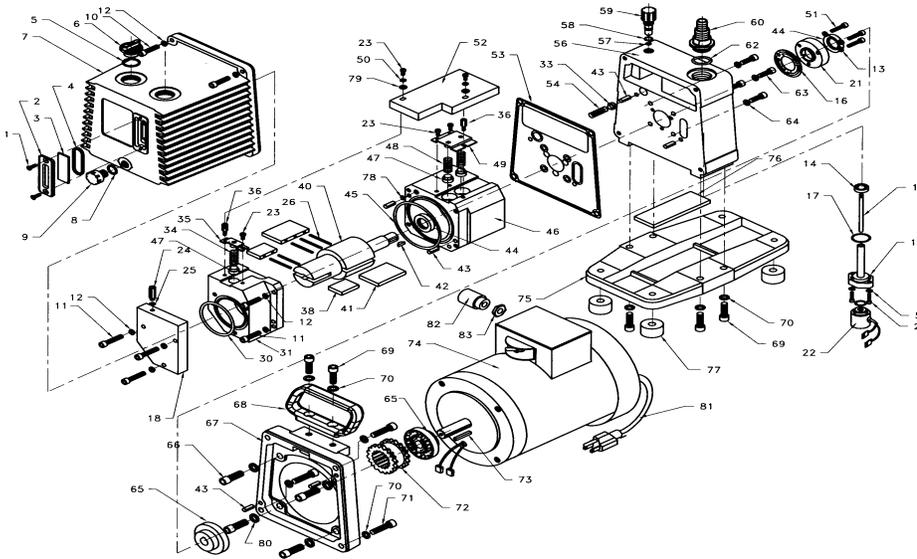
67-0958 SHEET 2 OF 2
REV. 11 6/04

PARTS LIST FOR 8917A

ITEM	QTY	P/N	A*	B*	DESCRIPTION	ITEM	QTY	P/N	A*	B*	DESCRIPTION
01	4	62-0325			Screw, Sockethead, M6x20 Blk.	21	1	61-6324			Gas Ballast Assembly
02	1	61-6443			Oil Case Assembly	22	3	62-0270			Screw, Sockethead, M6x20
03	1	61-6435			Pump Module	23	1	66-0200			O-Ring, Fluoroelast. #216
04	1	61-6385			Gasket	24	1	61-6325			Intake Fitting Assembly
05	1	66-0194			O-Ring, Fluoroelast. #164	25	1	61-6395			Cover, Top
06	1	61-2204A			Spring, Gas Ballast	26	2	62-0331			Screw, Sockethead, M8x20 Blk.
07	1	61-2118A			Valve, Gas Ballast	27	1	61-6038			Coupling, Rubber
08	1	61-9429			Screw w/ O-Ring	28	1	61-6024			Fan
09	6	62-0265			Screw, Buttonhead, M4x8 Blk.	29	1	62-0286			Locking Set Screw #10-32x3/8
10	1	61-6144			Cover, Left	30	1	61-6081			Key
11	4	66-0211			Rubber Feet	31	4	61-9280A			Dowel Pin, 1/4"
12	4	62-0349			Screw, Sockethead, M8x16	32	4	62-0346			Screw, Sockethead, M8x35
13	8	2-63-0356			Lock Washer 5/16	33	1	62-0344			Line Cord
14	1	61-6111			Base	34	1	61-6404			Motor Assembly 1/2 H.P.
15	1	61-6084			Drip Aid	35	1	61-6011			Handle
16	1	61-6143			Cover, Right	36	2	41-2363			Washer
17	3	2-63-0193			Lock Washer 1/4	37	1	61-6304			Solenoid Valve
18	1	61-6322			Mounting Plate	38	1	61-6279			Plunger
19	1	61-2157A			O-Ring, Fluoroelast. #007	39	1	61-9793			Isolator Disc
20	1	61-9282A			O-Ring, Fluoroelast. #011	76	1	61-6076			Exhaust Plug

A*: MAJOR REPAIR KIT CAT # N/A
B*: MINOR REPAIR KIT CAT # 8917K-02

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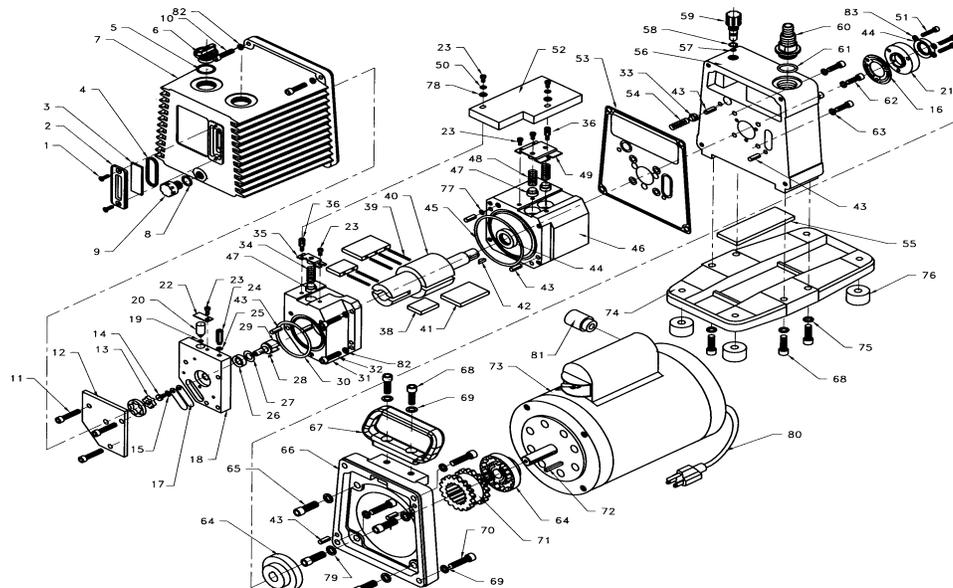
Model 8920A

67-0912
Sheet 2 of 2
Rev. 11 6/04

PARTS LIST FOR 8920A

ITEM	QTY	P/N	A* B*	DESCRIPTION	ITEM	QTY	P/N	A* B*	DESCRIPTION
01	2	62-1014		Screw, Flathead, #8-32x3/8	45	1	61-9526		O-Ring, Fluoroelast. #151
02	1	61-2370		Window Holder	46	1	61-9597D		Intake Stage
03	1	61-2229A		Window Glass	47	3	61-9560A		Bypass Valve
04	1	66-0304		O-Ring, Fluoroelast. #127	48	2	61-9582A		Bypass Valve Spring
05	1	66-0212		O-Ring, Fluoroelast. #119	49	1	61-9516A		Intake Valve Cover
06	1	61-6020		Oil Fill Plug	50	4	2-69-6108		Lock Washer #8
07	1	61-9367D		Oil Case	51	3	2-00-6814		Screw, Sockethead, #10-32x7/8
08	1	61-2130A		O-Ring, Fluoroelast. #115	52	1	61-9640A		Valve Cover Assembly
09	1	61-2372		Filler Plug	53	1	61-9609B		Gasket
10	4	2-01-6116		Screw, Sockethead, 1/4-20x1	54	1	61-2204A		Spring, Gas Ballast
11	7	2-01-6114		Screw, Sockethead, 1/4-20x7/8	56	1	61-5257		Mounting Plate
12	11	2-63-0193		Lock Washer 1/4	57	1	61-2157A		O-Ring, Fluoroelast. #007
13	3	2-62-0793		Lock Washer #10	58	1	61-9282A		O-Ring, Fluoroelast. #011
14	1	61-9793		Isolator Disk	59	1	61-6324		Gas Ballast Valve Assembly
15	1	61-9450A		Plunger	60	1	61-9943		Intake Adapter Assembly
16	1	41-0643		Gasket	62	1	66-0200		O-Ring, Fluoroelast. #216
17	1	62-0211		O-Ring, Fluoroelast. #023	63	4	2-01-6114		Screw, Sockethead, 1/4-20x7/8
18	1	61-9539B		End Plate	64	4	62-1071		Lock Washer 1/4 Small
19	1	61-9795		Adapter, Isolator Disc	65	2	41-3072		Flange Coupling
20	2	2-00-6410		Screw, Sockethead, #6-32x5/8	66	4	2-01-6516		Screw, Sockethead, 3/8-16x1
21	1	61-8104A		Shaft Seal Housing	67	1	61-9746		Motor Adapter Plate
22	1	61-9935		ISO Operator Assembly	68	1	61-6011		Handle
23	5	2-00-2604		Screw, Fillisterhead, #8-32x1/4	69	6	2-01-6316		Screw, Sockethead, 5/16-18x1
24	1	62-0274		Orifice .014"	70	10	41-2363		Washer
25	1	41-3175		Gasket, Nylon	71	4	2-01-6320		Screw, Sockethead, 5/16-18x1-1/4
26	5	41-2996		Vane, Spring	72	1	41-3073		Coupling Sleeve
30	1	61-9527		O-Ring, Fluoroelast. #137	73	1	41-2637		Motor Shaft Key (Suppl. w/Motor)
31	1	61-9598D		Exhaust Stage	74	1	61-5258		Motor Assembly 1/2 H.P.*
33	1	61-2118A		Valve, Gas Ballast	75	1	61-5259		Base
34	1	61-9561A		Exhaust Valve Spring	76	1	61-9742		Drip Pad
35	1	61-9580A		Exhaust Valve Cover	77	4	61-9607A		Rubber Bumper
36	2	61-9478		Stand Off Spacer	78	1	41-3005		O-Ring, Fluoroelast. #008
38	2	61-9615A		Exhaust Vane	79	2	2-68-5632		Washer #8
40	1	61-9595C		Rotor	80	4	2-63-0593		Lock Washer 3/8
41	2	61-9616B		Intake Vane	81	1	41-2753		Cord Set
42	1	41-0624		Woodruff Key	82	1	41-3470		Cord Strain Relief
43	6	61-9280A		Dowel Pin, 1/4"	83	1	62-0241		Lock Nut 1/2 NPT
44	2	41-3390		Lip Seal, 3/4"					

* Includes items Pc.No. 81 & 82

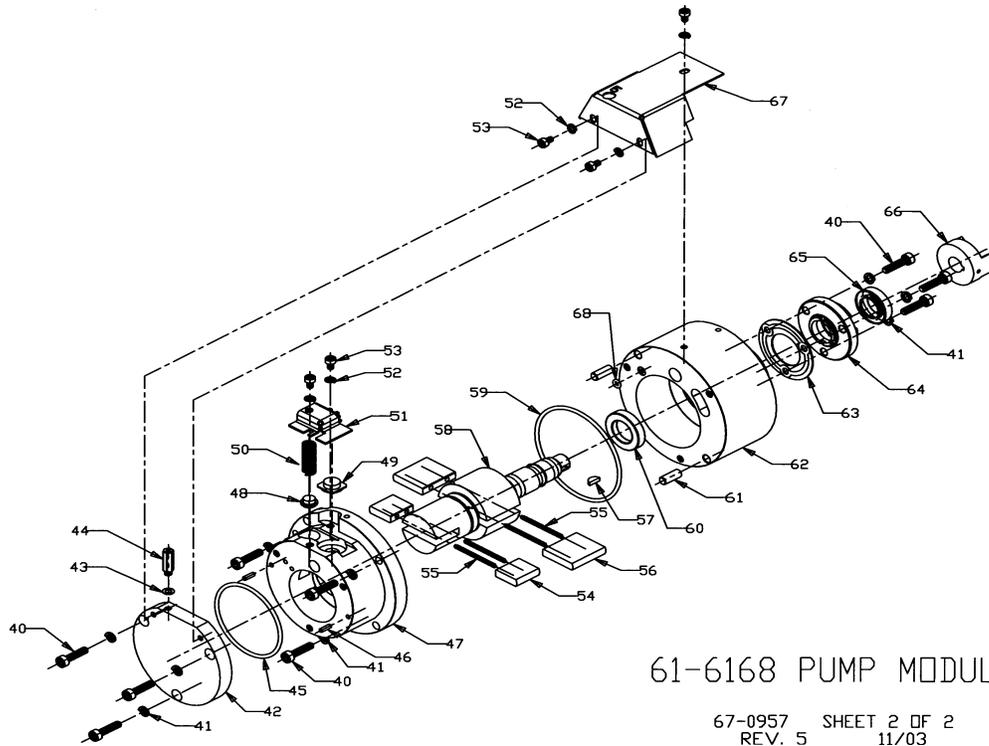


Model 8925A

67-0913
Sheet 2 of 2
Rev. 11 6/04

PARTS LIST FOR 8925A

ITEM	QTY	P/N	A* B*	DESCRIPTION	ITEM	QTY	P/N	A* B*	DESCRIPTION
01	2	62-1014		Screw, Flathead, #8-32x3/8	43	8	61-9280A		Dowel Pin, 1/4"
02	1	61-2370		Window Cover	44	2	41-3390		Lip Seal, 3/4"
03	1	61-2229A		Window Glass	45	1	61-9378		O-Ring, Fluoroelast. #152
04	1	66-0304		O-Ring, Fluoroelast. #127	46	1	61-9572D		Intake Stage
05	1	66-0212		O-Ring, Fluoroelast. #119	47	3	61-9560A		Bypass Valve
06	1	61-6020		Oil Fill Plug	48	2	61-9582A		Bypass Valve Spring
07	1	61-9367D		Oil Case	49	1	61-9516A		Intake Valve Cover
08	1	61-2130A		O-Ring, Fluoroelast. #115	50	2	2-69-6108		Lock Washer #8
09	1	61-2372		Drain Plug	51	3	2-00-6814		Screw, Sockethead, #10-32x7/8
10	4	2-01-6116		Screw, Sockethead, 1/4-20x1	52	1	61-9640A		Valve Cover Assy
11	3	2-21-6120		Screw, Sockethead, 1/4-20x1-1/4	53	1	61-9609B		Gasket
12	1	61-9375B		Cover Plate	54	1	61-2204A		Gas Ballast Spring
13	1	41-3036		Gerotor	55	1	61-9742		Drip Pad
14	1	2-07-1705		Screw, Binderhead, #10-32x5/16	56	1	61-5260		Mounting Plate
15	1	H-0554		Washer #10	57	1	61-2157A		O-Ring, Fluoroelast. #007
16	1	41-0643		Gasket	58	1	61-9282A		O-Ring, Fluoroelast. #011
17	2	61-9483A		Oil Relief Valve	59	1	61-6324		Gas Ballast Valve Assy
18	1	61-9374C		End Plate	60	1	61-9943		Intake Adapter Assy.
19	1	41-2963		Tetraseal, Fluoroelast. #005	61	1	66-0200		O-Ring, Fluoroelast. #216
20	1	61-6091		Plunger, Oil Feed, Exhaust	62	4	2-01-6114		Screw, Sockethead, 1/4-20x7/8
21	1	61-8104A		Shaft Seal Housing	63	4	62-1071		Lock Washer 1/4 Small
22	1	41-2784		Retainer	64	2	41-3072		Flange Coupling
23	6	2-00-2604		Screw, Fillisterhead, #8-32x1/4	65	4	2-01-6516		Screw, Sockethead, 3/8-16x1
24	1	62-0274		Orifice .014"	66	1	61-9746		Motor Adapter Plate
25	1	41-3175		Gasket, Nylon	67	1	61-6011		Handle
26	1	41-2962		Lip Seal, 3/8"	68	6	2-01-6316		Screw, Sockethead, 5/16-18x1
27	1	41-2678		Thrust Washer	69	6	41-2363		Washer
28	1	62-0014		Woodruff Key #202	70	4	2-01-6320		Screw, Sockethead, 5/16-18x1-1/4
29	1	61-9410B		Extension Shaft	71	1	41-3073		Coupling Sleeve
30	1	61-9379		O-Ring, Fluoroelast. #139	72	1	41-2637		Motor Shaft Key (Suppl. w/Motor)
31	1	61-9573D		Exhaust Stage	73	1	61-5265		Motor Assembly 3/4 H.P.
32	4	2-01-6114		Screw, Sockethead, 1/4-20x7/8	74	1	61-5259		Base
33	1	61-2118A		Valve, Gas Ballast	75	4	2-63-0356		Lock Washer 5/16
34	1	61-9561A		Exhaust Valve Spring	76	4	61-9607A		Rubber Bumper
35	1	61-9580A		Exhaust Valve Cover	77	1	41-3005		O-Ring, Fluoroelast. #008
36	2	61-9478		Stand Off Spacer	78	2	2-68-5632		Washer #8
38	2	61-9570A		Exhaust Vane	79	4	2-63-0593		Lock Washer 3/8
39	5	41-2996		Vane, spring	80	1	41-2753		Cord Set
40	1	61-9574C		Rotor	81	1	41-3470		Cord Strain Relief
41	2	61-9571B		Intake Vane	82	8	2-63-0193		Lock Washer 1/4
42	1	41-0624		Woodruff Key	83	3	2-62-0793		Lock Washer #10



61-6168 PUMP MODULE

67-0957 SHEET 2 OF 2
REV. 5 11/03

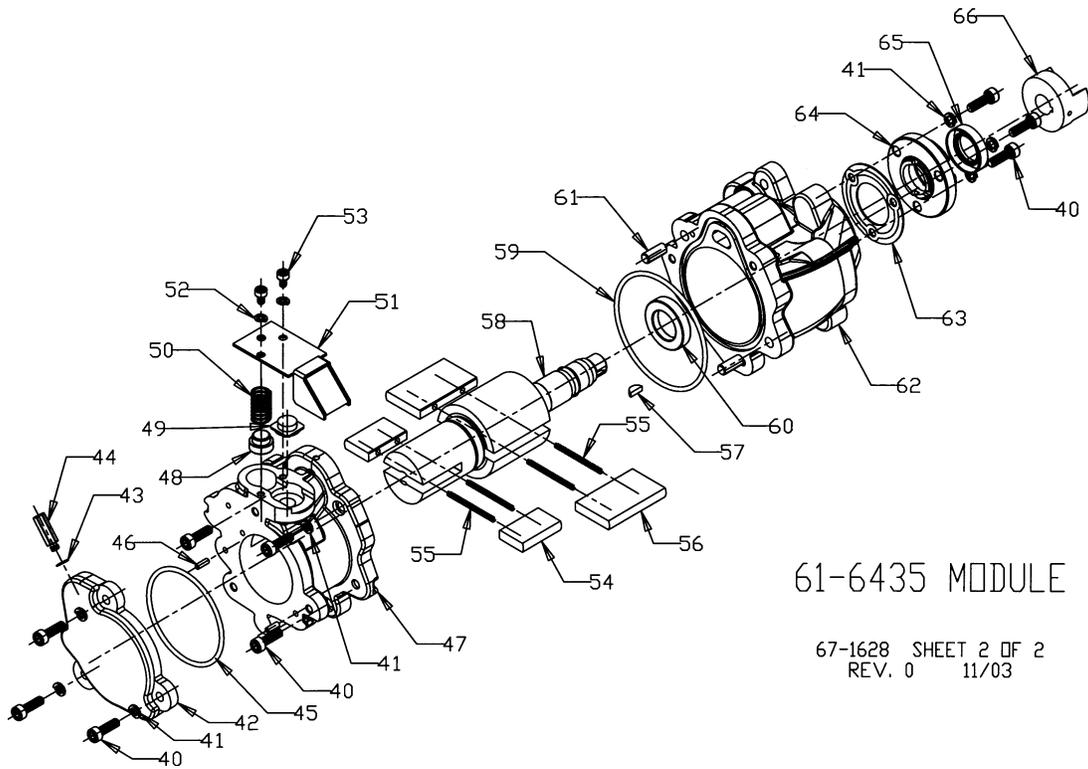
PARTS LIST FOR 61-6168 PUMP MODULE

ITEM	QTY	P/N	A*	B*	DESCRIPTION	ITEM	QTY	P/N	A*	B*	DESCRIPTION
40	9	62-0262			Screw, Sockethead, M5x20	55	4	41-2996			Vane, Spring
41	9	2-62-0793			Lock Washer #10	56	2	61-6050			Vane, Intake
42	1	61-6165			Cover Plate	57	1	41-2732			Key Coupling
43	1	41-3175			Nylon Gasket	58	1	61-6040			Rotor
44	1	62-0274			Orifice	59	1	66-0203			O-Ring, Fluoroelast. #151
45	1	66-0204			O-Ring, Fluoroelast. #141	60	1	41-3390			Lip Seal, 3/4"
46	2	4-21-3006			Dowel Pin, 1/8"	61	2	61-9280A			Dowel Pin, 1/4"
47	1	61-6167			Exhaust Stage	62	1	61-6166			Intake Stage
48	1	61-6058			Exhaust Valve	63	1	41-0643			Gasket
49	1	61-6057			Bypass Valve	64	1	61-6055			Lip Seal Housing
50	1	61-6305			Exhaust Valve Spring	65	1	61-6042			Lip Seal .669"
51	1	61-6164			Exhaust Valve Holder	66	1	41-2730			Coupling
52	5	2-69-6108			Lockwasher, #8	67	1	61-6123			Cover
53	5	62-0271			Screw, Sockethead, M4x6	68	1	61-2157A			O-Ring, Fluoroelast. #007
54	2	61-6053			Vane, Exhaust						

Used on:
- 8912A

A*: MAJOR REPAIR KIT CAT # N/A
B*: MINOR REPAIR KIT CAT # N/A

67-0957
Sheet 1 of 2
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61-6435 MODULE

67-1628 SHEET 2 OF 2
REV. 0 11/03

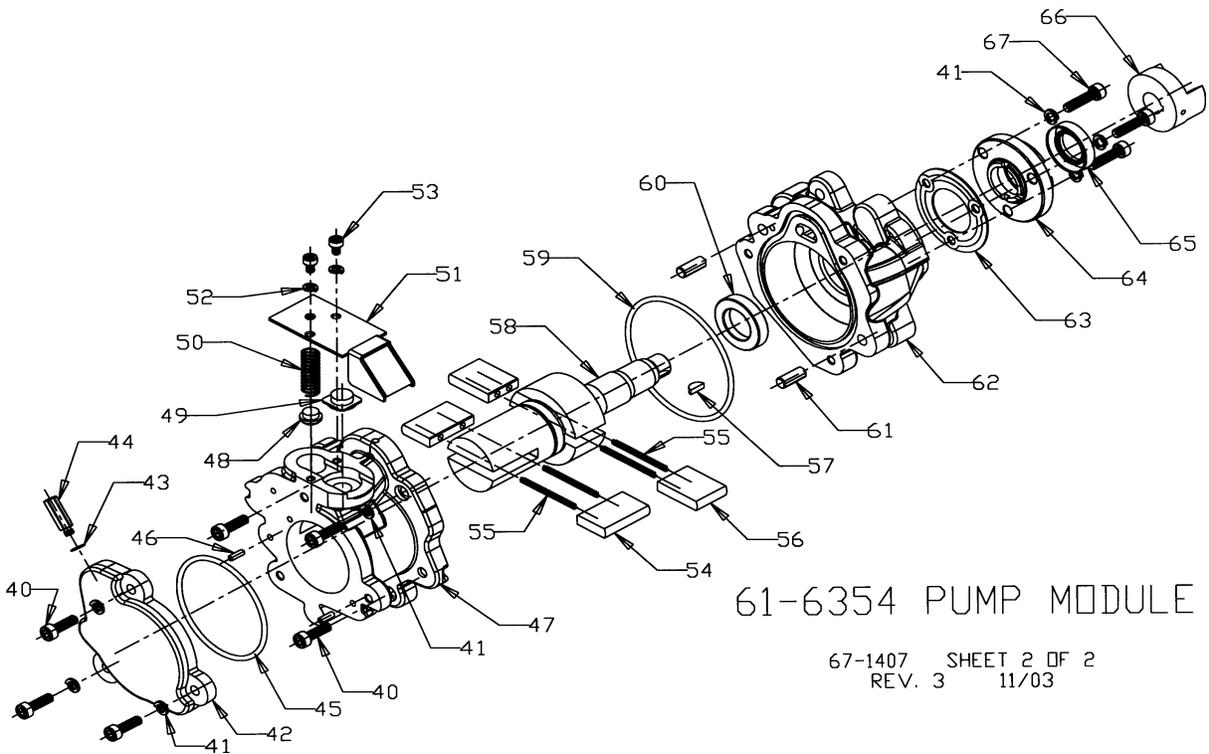
PARTS LIST FOR 61-6435 PUMP MODULE

ITEM	QTY	P/N	A*	B*	DESCRIPTION	ITEM	QTY	P/N	A*	B*	DESCRIPTION
40	9	62-0177			Screw, Sockethead, M5x16	54	2	61-6052			Vane, Exhaust
41	9	2-62-0793			Lock Washer #10	55	4	41-2996			Vane, Spring
42	1	61-6318			Cover Plate	56	2	61-6049			Vane, Intake
43	1	41-3175			Gasket, Nylon	57	1	41-2732			Key Coupling
44	1	62-0274			Orifice .014"	58	1	61-6426			Rotor
45	1	66-0204			O-Ring, Fluoroelast. #141	59	1	66-0207			O-Ring, Fluoroelast. #149
46	2	4-21-3006			Dowel Pin, 1/8"	60	1	41-3390			Lip Seal, 3/4"
47	1	61-6429			Exhaust Stage	61	2	61-9280A			Dowel Pin, 1/4"
48	1	61-9560A			Exhaust Valve	62	1	61-6427			Intake Stage
49	1	61-6057			Bypass Valve	63	1	41-0643			Gasket
50	1	61-9561A			Exhaust Valve Spring	64	1	61-6055			Lip Seal Housing
51	1	61-6432			Exhaust Valve Holder	65	1	61-6042			Lip Seal .669"
52	2	2-69-6108			Lockwasher #8	66	1	41-2730			Coupling
53	2	62-0271			Screw, Sockethead, M4x6						

Used on:
- 8917A

A*: MAJOR REPAIR KIT CAT # N/A
B*: MINOR REPAIR KIT CAT # N/A

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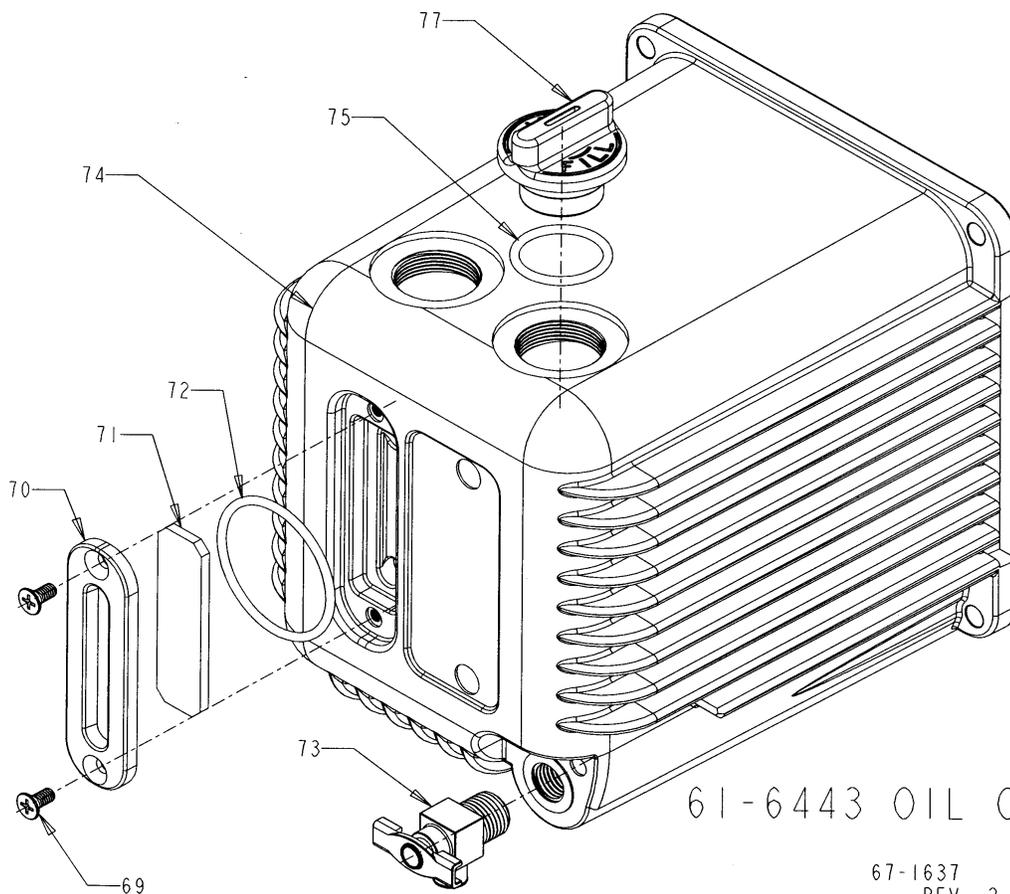


PARTS LIST FOR 61-6354 PUMP MODULE

ITEM	QTY	P/N	A*	B*	DESCRIPTION	ITEM	QTY	P/N	A*	B*	DESCRIPTION
40	6	62-0177			Screw, Sockethead, M5x16	54	2	61-6052			Vane, Exhaust
41	9	2-62-0793			Lock Washer #10	55	4	41-2996			Vane, Spring
42	1	61-6318			Cover Plate	56	2	61-6051			Vane, Intake
43	1	41-3175			Gasket, Nylon	57	1	41-2732			Key Coupling
44	1	62-0274			Orifice .014"	58	1	61-6039			Rotor
45	1	66-0204			O-Ring, Fluoroelast. #141	59	1	66-0207			O-Ring, Fluoroelast. #149
46	2	4-21-3006			Dowel Pin, 1/8x3/8	60	1	41-3390			Lip Seal, 3/4"
47	1	61-6350			Exhaust Stage	61	2	61-9280A			Dowel Pin, 1/4"
48	1	61-6058			Exhaust Valve	62	1	61-6316			Intake Stage
49	1	61-6057			Bypass Valve	63	1	41-0643			Gasket
50	1	61-6305			Spring, Exhaust Valve	64	1	61-6055			Lip Seal Housing
51	1	61-6348			Holder, Exhaust Valve	65	1	61-6042			Lip Seal .669"
52	2	2-69-6108			Lock Washer #8	66	1	41-2730			Coupling
53	2	62-0271			Screw, Sockethead, M4x6	67	3	62-0262			Screw, Sockethead, M5x20

Used on:
- 8907A

A*: MAJOR REPAIR KIT CAT # N/A
B*: MINOR REPAIR KIT CAT # N/A



61-6443 OIL CASE ASSEMBLY

67-1637 SHEET 2 OF 2
REV. 2 6/04

PARTS LIST FOR 61-6443 OIL CASE ASSEMBLY

ITEM	QTY	P/N	DESCRIPTION
69	2	62-1014	Screw, Countersunk, 8-32 x 3/8"
70	1	61-6009	Window Holder
71	1	61-6027	Window Glass
72	1	66-0305	O-Ring, Fluoroelast. #130
73	1	61-2278	Drain Valve
74	1	61-6442	Oil Case
75	1	62-0212	O-Ring, Fluoroelast. #119
77	1	61-6020	Oil Fill Plug

Used on:
- 8907A
- 8912A
- 8917A

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Rev. 2 6/04

SECTION 11: WARRANTY / MATERIAL SAFETY DATA SHEETS

11.01 Warranty

This Welch Vacuum product is warranted to be free from defects in material and workmanship. This liability of Welch Vacuum, Thomas Industries, Inc. under this warranty is limited to servicing, adjusting, repairing or replacing any unit or component part which in the judgment of Welch Vacuum, Thomas Industries, Inc. has not been misused, abused or altered in any way or damaged by ingestion of foreign material causing impaired performance or rendering it inoperative. Foreign material includes solids, liquids, corrosive gases and recondensed water or solvent vapor. No other warranties are expressed or implied. The method of executing this warranty: servicing, adjusting, repairing or replacing shall be at the discretion of Welch Vacuum, Thomas Industries, Inc. Vacuum pumps that have been operated within a vacuum system, or other system, for any period, however short, will be repaired under this warranty rather than replaced.

The warranty is effective for one year from the date of original purchase when:

1. The warranty card has been completed and returned.
2. The product is returned to the factory or other designated service centers, freight prepaid.
3. The product in our judgment is defective through no action or fault of the user.

If the product has become defective through misuse, abuse, alteration or ingestion of foreign materials, repairs will be billed regardless of the age of the product. In this event, an estimate of the repair costs will be submitted and authorization of these charges will be required before the product is repaired and returned.

11.02 Material Safety Data Sheet for 8995P



MATERIAL SAFETY DATA SHEET

DIRECTORR® 8995P Premium Vacuum Pump Oil

HMIS Rating: Health: 0 Flammability: 1 Reactivity: 0 Special: X

SECTION 1 - IDENTIFICATION

Chemical Name: Severely Hydrotreated Paraffinic Oil

Synonyms: DIRECTORR® 8995P Premium Vacuum Pump Oil (Improved)

Formula: N/A (Product is refined naturally occurring mixture)

Manufacturer's Name: Welch Rietschle Thomas
7301 North Central Ave.
Skokie, IL 60077

Date Prepared: February 10, 2004

Telephone Number for General Information: (847) 676-8800

SECTION 2 - HAZARDOUS INGREDIENTS/IDENTITY

Exposure Limits in Air

<u>Component</u>	<u>CAS No.</u>	<u>OSHA PEL</u>	<u>ACGIH TVL</u>
Synthetic Hydrocarbon	64742-65-0	NO	NO

To the best of our knowledge, the above listed component is not hazardous according to OSHA (1910.1200) or one or more state right-to-know lists.

SECTION 3 - PHYSICAL AND CHEMICAL CHARACTERISTICS

Appearance and Odor: Light Yellow, Mild Odor

Specific Gravity @ 22°C (72°F) (Water = 1): 0.87

Vapor Pressure, Torr @ 25°C: 1x10⁻⁶

Vapor Density (Air = 1): N/A

Water Solubility: Insoluble

Boiling Point (ASTM D-86 Method): 445°F

Reactivity in Water: N/A

Melting Point: N/A

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH, BUT NO WARRANTY, EXPRESS OR IMPLIED, IS MADE.

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SECTION 4 - FIRE AND EXPLOSION HAZARDS DATA

Flash Point: 475°F 245°C
 Method Used: COC
 Flammable Limits: Upper: N/D Lower: N/D
 Extinguishing Media: CO2, Dry Chemical, Foam and Water Fog.

Special Fire Fighting Procedures: For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment. This may include self-contained breathing apparatus to protect against the hazardous effects of normal products of combusting and Oxygen deficiency.

Unusual Fire and Explosion Hazards: Normal combustion forms Carbon Dioxide and water vapor. Incomplete Combustion can produce Carbon Monoxide.

CAUTION: DO NOT USE PRESSURE TO EMPTY DRUM, OR EXPLOSION MAY RESULT.

SECTION 5 - PHYSICAL HAZARDS (REACTIVITY DATA)

Stability: Product is stable under normal conditions.
 Hazardous Polymerization: Will not occur.
 Conditions to Avoid: None known at this time.
 Incompatibility (Materials to Avoid): May react with strong oxidizing agents such as Chlorates, Nitrates, Peroxides, etc...
 Hazardous Decomposition Products: Carbon Monoxide and other unidentified organic compounds may be formed upon combustion.

SECTION 6 - HEALTH HAZARD DATA

Eyes: This substance is not expected to cause prolonged or significant eye irritation. This hazard evaluation is based on data from similar materials
 Skin: This substance is not expected to cause prolonged or significant skin irritation. This hazard evaluation is based on data from similar materials
 Inhalation: If inhaled, this substance is considered practically non-toxic to internal organs. This hazard evaluation is based on data from similar materials
 Ingestion: If swallowed, this substance is considered practically non-toxic to internal organs. This hazard evaluation is based on data from similar materials

Chemical Listed as Carcinogen or Potential Carcinogen:

IARC Monographs: No OSHA: No National Toxicology Program: No

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SIGNS AND SYMPTOMS OF EXPOSURE

Primary Routes of Exposure: Inhalation, skin or eye contact, and ingestion.

FIRST AID MEASURES

Inhalation: This material is not expected to be an immediate inhalation problem. No First Aid procedures are required.

Eyes: Immediately flush eyes with plenty of cool water for 15 minutes. Remove contact lenses if worn. Do not let victim rub eyes. No First Aid procedures are required.

Skin: No First Aid procedures are required. As precaution, wash skin thoroughly with soap. Remove and wash contaminated clothing.

Ingestion: If swallowed, give water or milk to drink and telephone Medical advice. Consult Medical Personnel before inducing vomiting. If Medical advice cannot be obtained, take person and product container to the nearest Medical Emergency Treatment Center or hospital.

SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE

Precaution to be taken in Handling and Storage: Minimum feasible handling temperatures should be maintained. Periods of exposure to high temperature should be minimized. Water contamination should be avoided.

Steps to be taken in Case of Release or Spill: Stop source of leak. Clean up as soon as possible. Contain liquid to prevent further soil, surface water, or ground water contamination. Clean-up small spills using appropriate techniques such as Sorbing materials or pumping. Where feasible and appropriate, remove contaminated soil. Follow prescribed procedures for larger releases.

Waste Disposal Method: It is the responsibility to the user of products to determine at the time of disposal whether product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixture, processes, etc. may render the resulting material hazardous.

SECTION 8 - CONTROL MEASURES

Respiratory Protection: None required if exposures are within permissible concentrations of 5.0mg/m3 of air for mineral oil mist average over an eight-hour daily exposure (ACGIH 1984-85). Ventilation: Normal.

Protective Gloves: Impervious gloves when prolonged contact cannot be avoided.

Eye Protection: Chemical type goggles/face shield.

Protective Clothing: Impervious gloves when prolonged contact cannot be avoided.

Other Protective Measures: None considered necessary at this time.

Work/Hygienic Practices: Employees should exercise reasonable personal cleanliness.

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SECTION 9 – ENVIROMENTAL DATA

Section 313 – Toxic Chemicals

This product does not contain toxic chemicals of Section 313 of Title III of Supervened Amendments and Reauthorization Act of 1986 (SARA) and 40 CFR Part 372.

Section 311 – Hazard Catagories

- | | | |
|----|-----------------------------------|-----|
| 1. | Not Applicable | Yes |
| 2. | Acute (Immediate Health Hazard) | No |
| 3. | Chronic (Delayed Health Hazard) | No |
| 4. | Fire Hazard | No |
| 5. | Sudden Release of Pressure Hazard | No |
| 6. | Reactive Hazard | No |

Section 302(A) – Extremely Hazardous Substances

(RQ = Reportable Quantity)

(TPQ = Threshold Planning Quantity)

This product does not contain extremely hazardous substances of Section 302(A)

Clean Water Act

Under Section 311(b)(4) of the Clean Water Act, discharges of crude oil and petroleum products in any kind or form to surface waters must be immediately reported to the National Response Center:

1-800-424-8802

Comprehensive Environmental Response Compensation & Liability (Act CERCLA)

Section 102 Hazardous Substances 42 U.S.C. 9602

Petroleum and petroleum fractions are excluded from the list of CERCLA hazardous substances by Section 101(14) of CERCLA.

Federal Regulations

Reported in TSCA Inventory

Product: Yes

Components: Not Applicable

Information given herein is offered in good faith as accurate, but without guarantee. Conditions of use and suitability of product for particular uses are beyond our control; all risks of use of the product are therefore assumed by the user and **we expressly disclaim all warranties of every kind of nature, including warranties of merchantability and fitness for a particule purpose in respect to the use or suitability of the product.** Nothing is intended as a recommendation for uses which infringe valid patents or as extending license under valid patents. Appropriate warnings and safe-handling procedures should be provided to handlers and users.

ATTENTION: Misuse of empty containers can be hazardous. Empty containers can be hazardous if used

to store toxic, flammable, or reactive materials. Cutting or welding of empty containers might cause fire, explosion or toxic fumes from residues. Do not pressurize or expose to open flame or heat. Keep container closed and drum bungs in place.

REGULATION INFORMATION:	D.O.T. SHIPPING NAME:	N/A
	D.O.T. HAZARD CLASS:	N/A
	D.O.T. IDENTIFICATION NUMBER:	N/A

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OWNER'S MANUAL
For
DIRECTORR® DIRECT-DRIVE VACUUM PUMPS
MODELS 8905, 8907, 8912, 8917, 8920 & 8925
Part No. 67-1483R1.7

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