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WELCH

A Gardner Denver Product

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

8905
8907
8912
8917
8920
8925

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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.

Gardner Denver Welch Vacuum Technology, Inc.
5621 W. Howard Street
Niles, IL 60714
Phone: (847) 676-8800
Fax: (847) 677-8606 (Technical Support)
E-Mail: welchvacuum@gd-thomas.com
Web-Page: www.welchvacuum.com

For outside of U.S. and Canada, contact your local Gardner Denver sales office, see back page

Part No. 67-1483R2.5
Printed in USA

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 confirm 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.

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.



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™ 7/16" and 13/16" hose fitting. 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. For the best vacuum, use a hose clamp in conjunction with a vacuum hose to hose nipple connections. 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 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 90º 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.

1.08 Vacuum Pump Oil



WARNING
The vacuum pump is shipped witout oil inside to prevent possible spillage during shipment. Oil must be added prior to use.

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® Gold Vacuum 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 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.

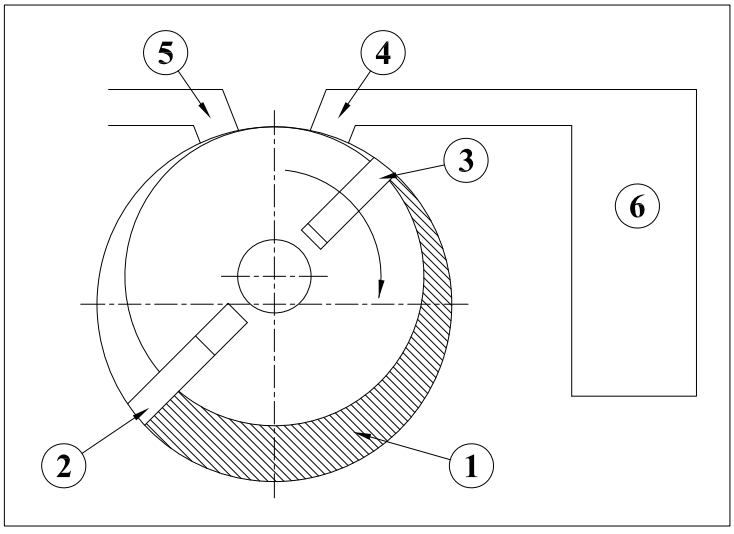


Figure 2.1
Typical Rotary Vane
Pump, Schematic Diagram

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 x 10-4 mbar 0.1 millitorr, (1 x 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

This vacuum pump incorporates 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 Antisuckback Protection

When power to the pump is turned off, this device closes automatically, maintaining vacuum in the system being evacuated, and vents the inside of the pump to atmospheric pressure.

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. DIRECTORR® Gold Vacuum Oil has been especially 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® Gold Vacuum Oil is the only oil recommended for use with these pumps. Each pump is supplied with sufficient oil 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 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 is most likely to take place when the gas compression ratio is high, i.e. when the pump compresses a relatively large volume of gas to a small volume. Whether or not condensation takes place is dependent upon several factors, including the proportion of permanent gases to vapors at the pump intake. If the gases being pumped consist entirely of vapors, condensation will definitely occur unless the gas ballast valve is opened. The gas ballast valve adds a small amount of air at atmospheric pressure to the gas being compressed in the second stage. This reduces the compression required to push the gas out past the exhaust valve (less reduction in volume is required), and therefore reduces or eliminates condensation.

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 diffrent types of chemical vapors, so it may 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 either 7/16" or 13/16" 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

SPECIFICATION	8905	8920	8925
Free Air Displacement CFM (L/min) @ 60Hz (L/min) m3h @ 50Hz	 1.8 (52) (43) 1.5	 7.7 (218) (182) 10.8	 11.3 (320) (266) 16.0
Normal Pumping Speed CFM (L/min) @ 60Hz (L/min) m3h @ 50Hz	 1.5 (43) (36) 1.3	 7.4 (210) (175) 10.5	 10.0 (283) (236) 14.2
Guaranteed Ultimate Pressure* Torr	2×10^{-3}	3×10^{-4}	4×10^{-4}
Water Vapor Tolerance (capacity), Torr Water Vapor Tolerance (capacity), g/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
Motor Voltage 50/60Hz Single Phase Current 115V (230V) @ 60Hz Current 230V @ 50Hz	 3.8A (1.9A) 1.2A	 6.8A (3.4A) 3.4A	 10.0A (5.0A) 5.0A
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	Unibarb for 3/16" and 7/16" I.D. Hose, Threaded for 3/4"-20	Unibarb for 9/16" and 13/16" I.D. Hose, Threaded for 1-1/8"-20	Unibarb for 9/16" and 13/16" I.D. Hose, Threaded for 1-1/8"-20
Tubing needed, I.D. in inches in 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
Pump Weight lbs. Kg.	 24.5 11.1	 58.5 26.6	 63 31.3
Overall Dimensions Length (inch / cm) Width (inch / cm) Height (inch / 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 Length (inch / cm) Width (inch / cm) Height (inch / 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.

SPECIFICATION	8907	8912	8917
Free Air Displacement CFM (L/min) @ 60Hz (L/min) m3h @ 50Hz	 2.6 (70) (56) 3.68	 3.8 (108) (86) 5.37	 6.1 (173) (138) 8.63
Normal Pumping Speed CFM (L/min) @ 60Hz (L/min) m3h @ 50Hz	 2.3 (64) (53) 3.2	 3.4 (96) (80) 4.78	 5.3 (150) (125) 7.51
Guaranteed Ultimate Pressure* Torr	1×10^{-4}	1×10^{-4}	1×10^{-4}
Water Vapor Tolerance (capacity), Torr Water Vapor Tolerance (capacity), g/hr	19 -	12 -	12 -
Sound Level dBA	50	50	50
Motor/Pump Speed RPM @ 60Hz RPM @ 50Hz	 1725 1425	 1725 1425	 1725 1425
Motor Voltage 50/60Hz Single Phase Current 115V (230V) @ 60Hz Current 230V @ 50Hz	 4.6A (2.3A) 2.1A	 4.6A (2.3A) 2.1A	 4.6A (2.3A) 2.1A
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	Unibarb for 7/16" and 13/16" I.D. Hose, Threaded for 1-1/8"-20	Unibarb for 7/16" and 13/16" I.D. Hose, Threaded for 1-1/8"-20	Unibarb for 7/16" and 13/16" I.D. Hose, Threaded for 1-1/8"-20
Tubing needed, I.D. in inches in 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
Pump Weight lbs. Kg.	 40 18	 41 18	 48 22
Overall Dimensions Length (inch / cm) Width (inch / cm) Height (inch / 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 Length (inch / cm) Width (inch / cm) Height (inch / 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.	1416C / 1417P-7	1416C / 1417P-7	1416C / 1417P-7
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.

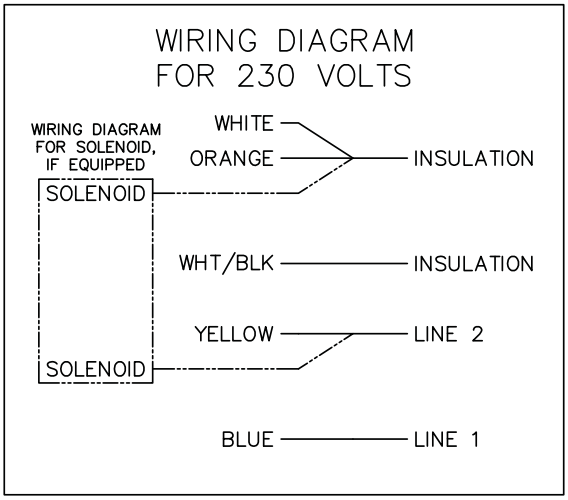
Section 4: MOTOR SPECIFICATIONS, POWER / FEATURES

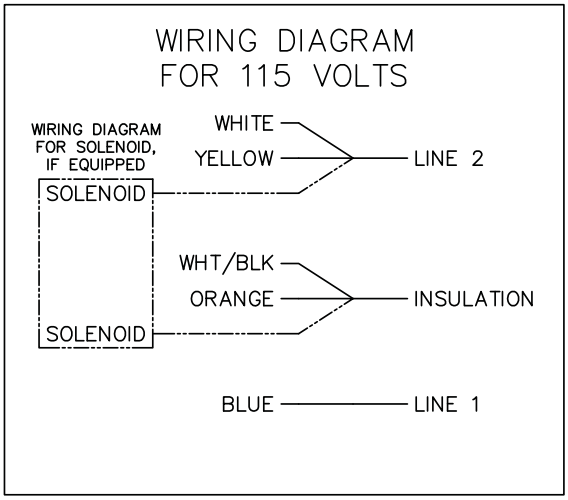
4.01 Motor Specification Chart

Cat. No.	Voltage	Freq.	Ph.	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	230V US Cord Plug	CSA
8905C-02	230	50	1	1/4	230V 50Hz	European "Schuko" Cord Plug	CE
8905C-10	115 / 230	60	1	1/4	230V 60Hz	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	European "Schuko" Cord Plug	CE
8907C-05	100	50/60	1	1/2	100V	For apan with US Cord Plug	-
8912A	115 / 230	60	1	1/2	115V 60Hz	Standard Model	CSA
8912C-02	230	50	1	1/2	230V 50Hz	European "Schuko" Cord Plug	CE
8912C-05	100	50/60	1	1/2	100V	For apan with US Cord Plug	-
8917A	115 / 230	60	1	1/2	115V 60Hz	Standard Model	CSA
8917C-02	230	50	1	1/2	230V 50Hz	European "Schuko" Cord Plug	CE
8917C-05	100	50/60	1	1/2	100V	For apan with US 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	230V US Cord Plug	CSA
8920C-02	115 / 208-230	50/60	1	3/4	230V 50Hz	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	230V US Cord Plug	CSA
8925C-02	115 / 208-230	50/60	1	3/4	230V 50Hz	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 only

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.







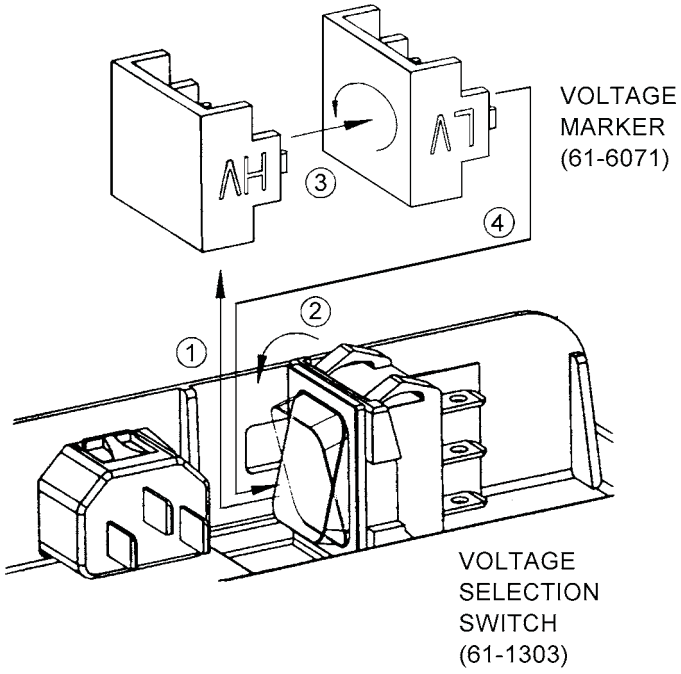
CAUTION
Make certain that the voltage setting (LV or HV) is in the correct range for your power before plugging in.

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.

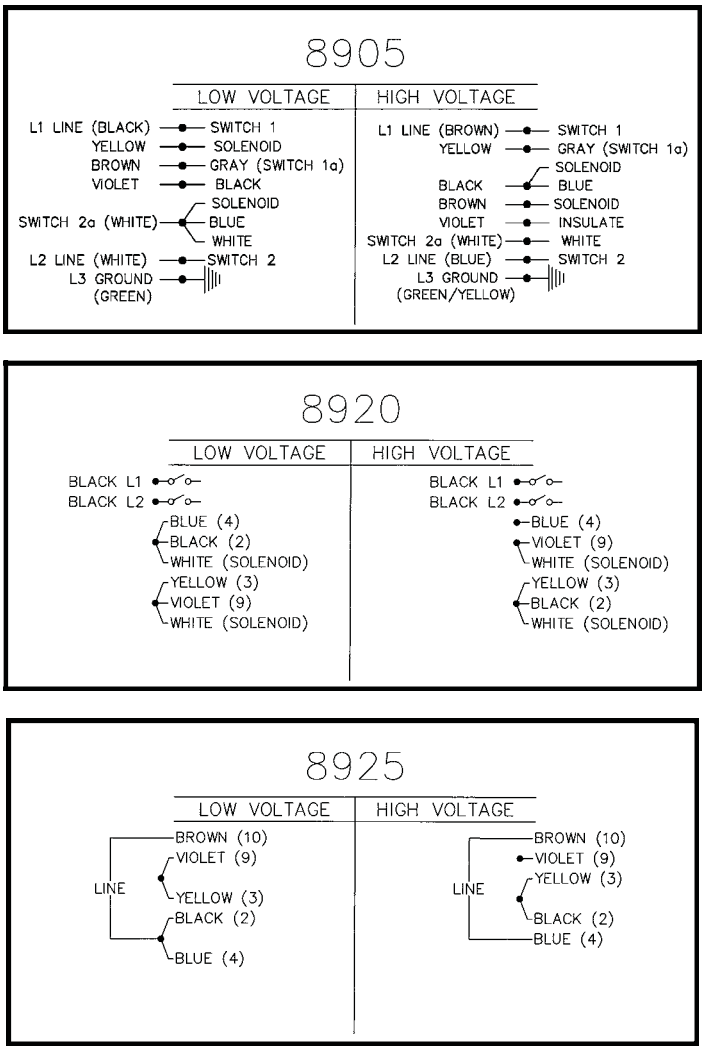
To change VOLTAGE setting:

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 been seen through the window in the electrical box.
7. Replace the electrical box cover before reconnecting the power cord.
8. Attach solenoid valve leads. One lead of the solenoid valve to orange motor wire, and one lead to yellow motor wire.



4.04 Changing the Voltage Setting on 8905, 8920 and 8925 "A"- Models only

The vacuum pump motor is factory wired to for 115 V for models which operate at 60 Hz, and 230 V for models which operate at 50 Hz. The motor wiring can easily be changed for operation at a voltage different than that set at the factory. Models can be rewired to operate at either the low (115 V) or high (220 V) voltage. Follow the motor wiring schematic located below, or on the motor shield. A line cord plug suitable for 115 V connection (blades parallel) or 220 V connection (blades coplanar) is furnished which complies with United States electrical codes. When changing the factory wiring, or when using outside of the United States, replace the line cord plug with one suitable for the voltage connection which meets the voltage to which the motor now is wired to require to operate.



4.05 Other Electrical Configurations

Other electrical configurations of Welch pumps may be available. Check with Welch for 3-Phase, Explosion Proof and other motor configurations.

4.06 Explosion Proof Pumps (Explosion Proof Pumps must be ordered special)

Due to the added safety features of an explosion proof pump, the pump's electrical supply must be connected onsite by a trained electrician. Since there are numerous scenarios for connection, the manufacturer does not provide guidelines or advice in electrical hookups. Of course we will assist in choosing the correct explosion proof pump, but for safety reasons, we resist the temptation to advise what cannot be seen.

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).

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
Hot oil can cause burns. Operating temperarue of the oil is typically 140 degrees Fahrenheit or higher. Avoid skin contact with oil.

6.02.1 Changing the Oil on Models 8907, 8912 and 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.

6.02.2 Changing the Oil on Models 8905, 8920 and 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.

6.02.3 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.

6.02.4 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 then 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® Oil (Premium or Gold) 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 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.

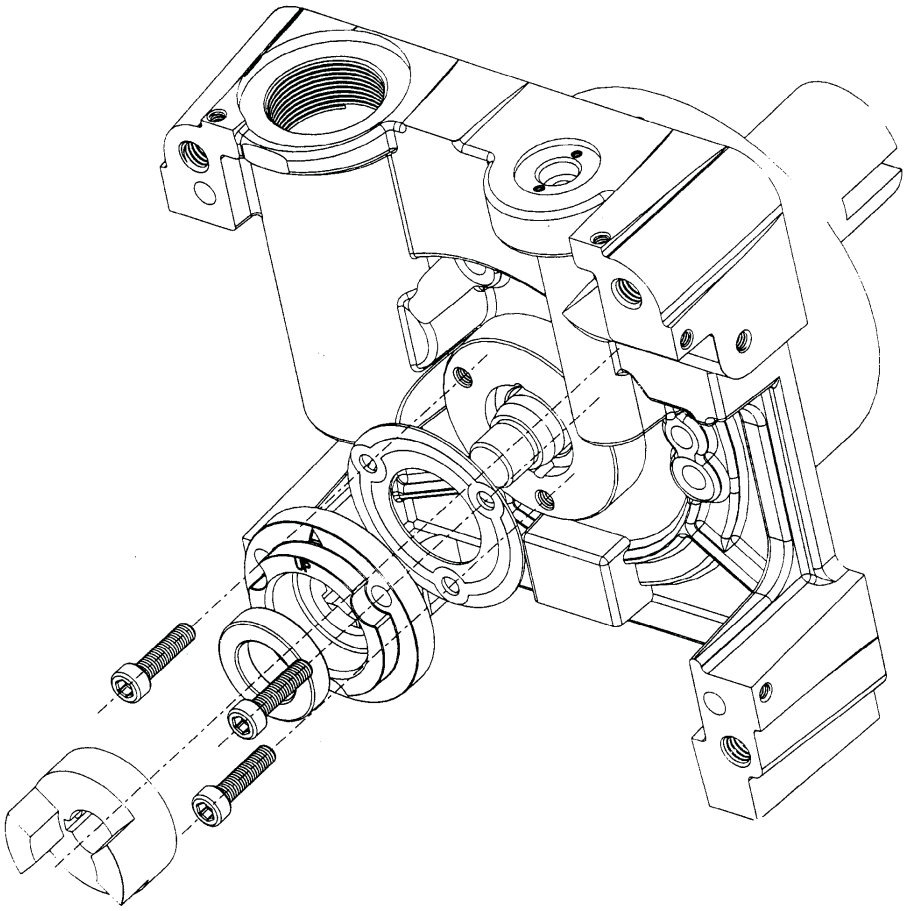
IMPORTANT
Note the position of the arrow and "UP" on the housing surface. After you replace the Lip Seal, be sure the arrow on this coupling again points in the same direction (so that other components will be properly aligned).

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.



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 titled 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 Problems

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 Trouble Shooting Guide

Condition	Probable Cause	Recommended Corrective Action
Pump will not start	1. Power off.	1. Check switches and fuses.
	2. Coupling damaged or coupling set screw loose.	2. Check coupling and set screw.
	3. Room is too cold.	3. Drain and refill pump with warm oil.
	4. Pump mechanism is seized.	4. Pump to be repaired.
Pump does not reach ultimate pressure	1. Pump is contaminated.	1. Flush and change pump oil. Use a foreline trap.
	2. Pump is not filled with oil, or has low oil level.	2. Add recommended pump oil.
	3. Pump has wrong oil in it.	3. Flush and refill with recommended pump oil.
	4. Leak in vacuum system.	4. Locate and eliminate leak source.
	5. Dirty foreline trap.	5. Clean out cold traps and replace elements in coaxial and molecular sieve traps.
	6. Gas ballast open.	6. Close gas ballast.
Excessively noisy pump	1. Intake or exhaust lines are restricted.	1. Clean and straighten out lines and check oil level.
	2. Coupling damaged.	2. Examine coupling / replace.
	3. Slapping noise at ultimate pressure is typical for some pumps.	3. Clean orifice air passage.
	4. Inside mechanism damaged.	4. Pump to be repaired.
Pump generates excessive smoke or oil mist from exhaust port	1. Pump overfilled with oil.	1. Drain excess pump oil.
	2. Pump operating continously above its maximum operation pressure.	2. Use larger capacity pump, or modify your vacuum system.
Pump oil is dark, has an unusual color, or is dirty	1. Pump oil contaminated by process gases, or other foreign material ingested by pump.	1. Flush and change pump oil. Use foreline trap in futher. Consider using a oil filtration system or inert pump oils.
	2. Pump oil has degraded.	2. Pump has run too low on oil. The recommended oil was not used. Pump is running continously above its maximum operation pressure.
Pump does not achieve its rated pumping speed	1. Pump is running too cold.	1. Allow pump to run until it warms up to its operating temperature.
	2. Exhaust or intake line its too narrow.	2. Install larger inner diameter tubing.
	3. Pump oil is contaminated.	3. Flush and change pump oil. Use a foreline trap in futher.
	4. Very dirty trap or intake line.	4. Clean out cold traps and replace elements in coaxial and molecular sieve traps. Clean or replace vacuum piping.
Motor is excessively noisy	1. Voltage selection is incorrect.	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 it's use. Worker safety rules require this information prior to a repairman examining the pump.

Section 9: ACCESSORIES

9.01 Pump Oil

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.

Quantity	1 Liter	1 Gallon	5 Gallon	55 Gallon
Directorr® Premium	8995P-11	8995P-15	8995P-20	8995P-25
Directorr® Gold	8995G-11	899GP-15	899GP-20	8995G-25

9.02 Exhaust Filter

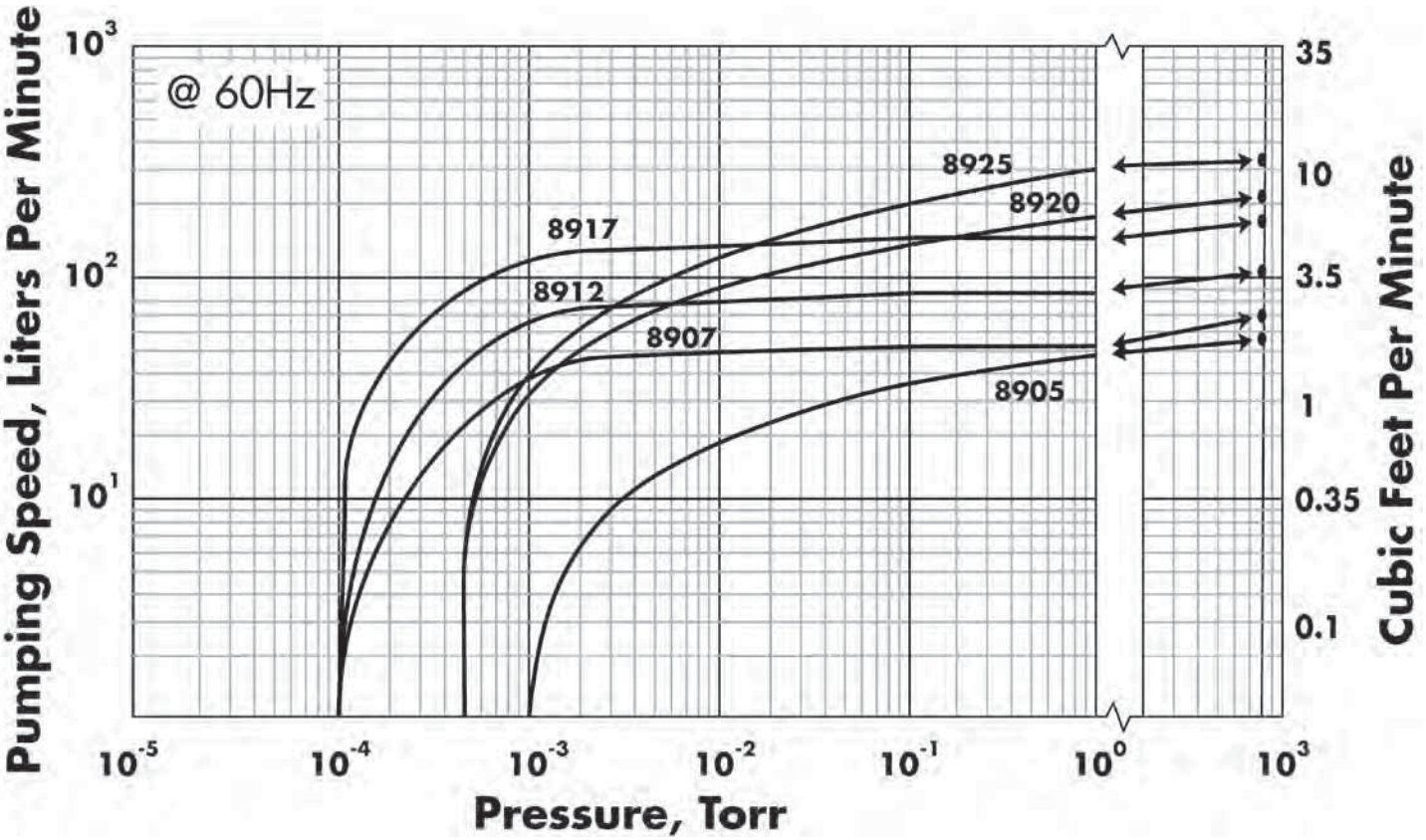
A minor repair kit is available that provides a group of parts that can easily be replaced in the field.

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

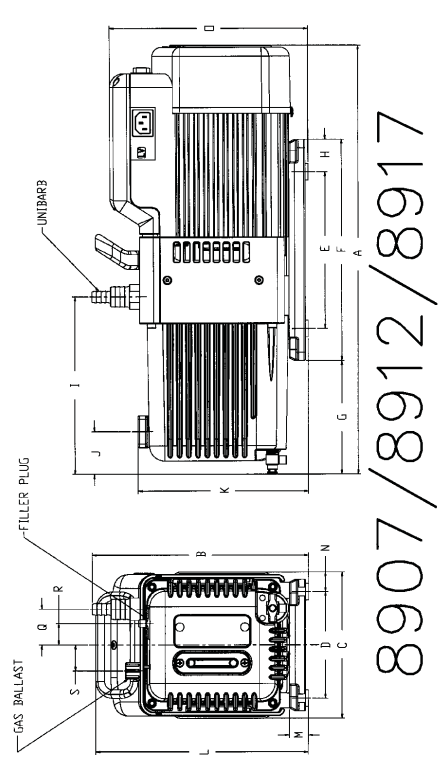
NOTE:
For additional information on Accessories, Parts or Products, please consult:
Welch Vacuum's Laboratory Products Catalog
or
Welch's website at www.welchvacuum.com

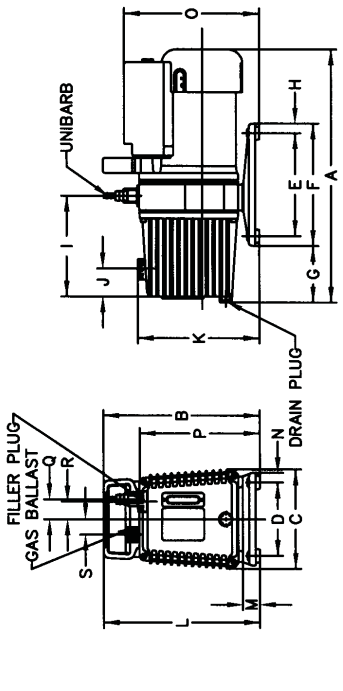
Section 10: DRAWINGS AND SPEED CURVE

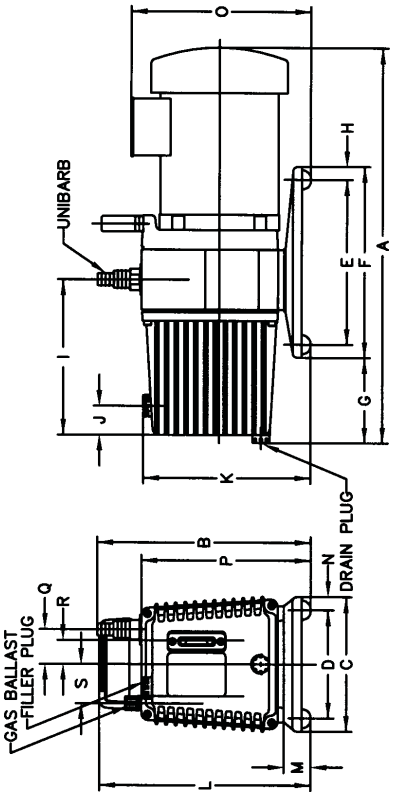
10.10 Speed Curve

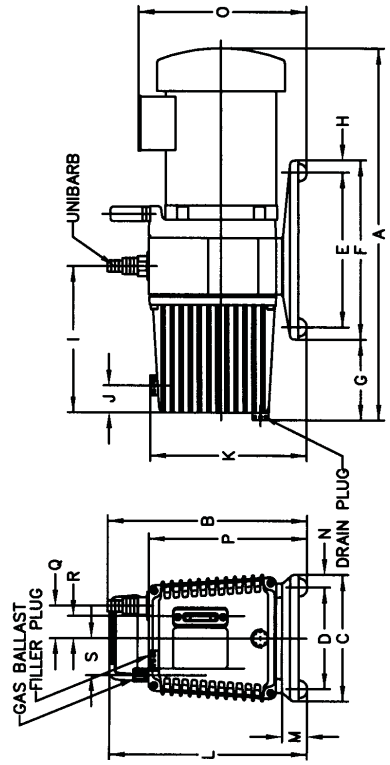


10.20 Dimensional Drawing



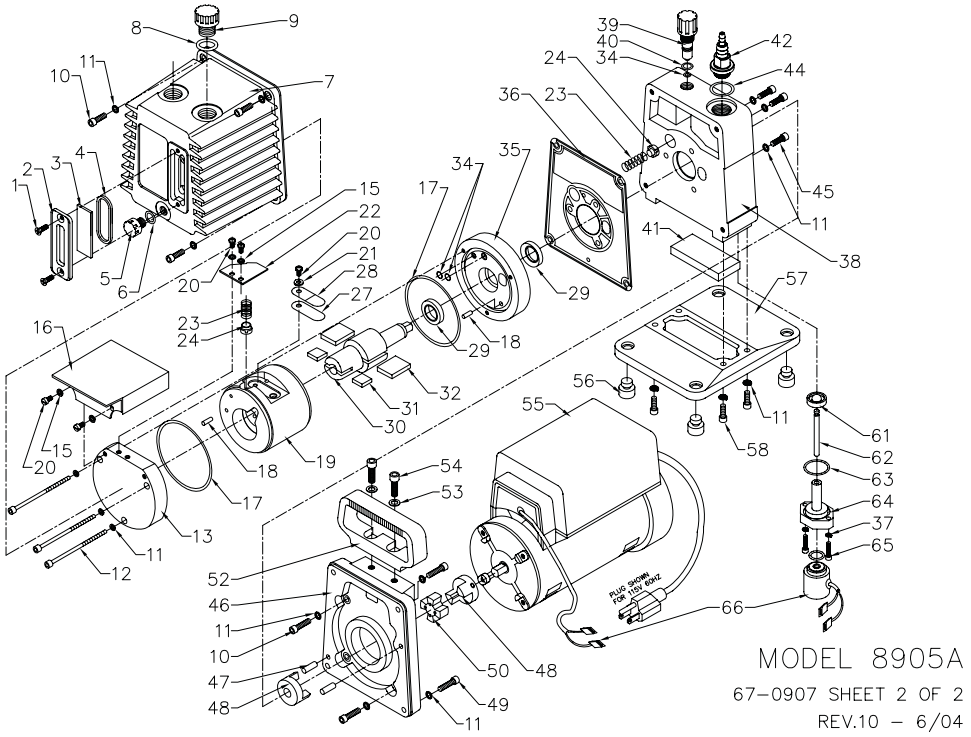






Pump Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
8905A	14.13	8.70	5.52	4.07	5.73	6.81	3.16	0.54	5.58	1.56	6.76	8.70	0.95	0.54	7.50	6.68	1.10	0.98	0.85
8905C-02	14.13	8.70	5.52	4.07	5.73	6.81	3.16	0.54	5.58	1.56	6.76	8.70	0.95	0.54	7.50	6.68	1.10	0.98	0.85
8907A	18.90	9.60	6.54	4.76	7.00	9.88	5.05	1.44	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

10.30 Exploded Views and Parts List for 8905A

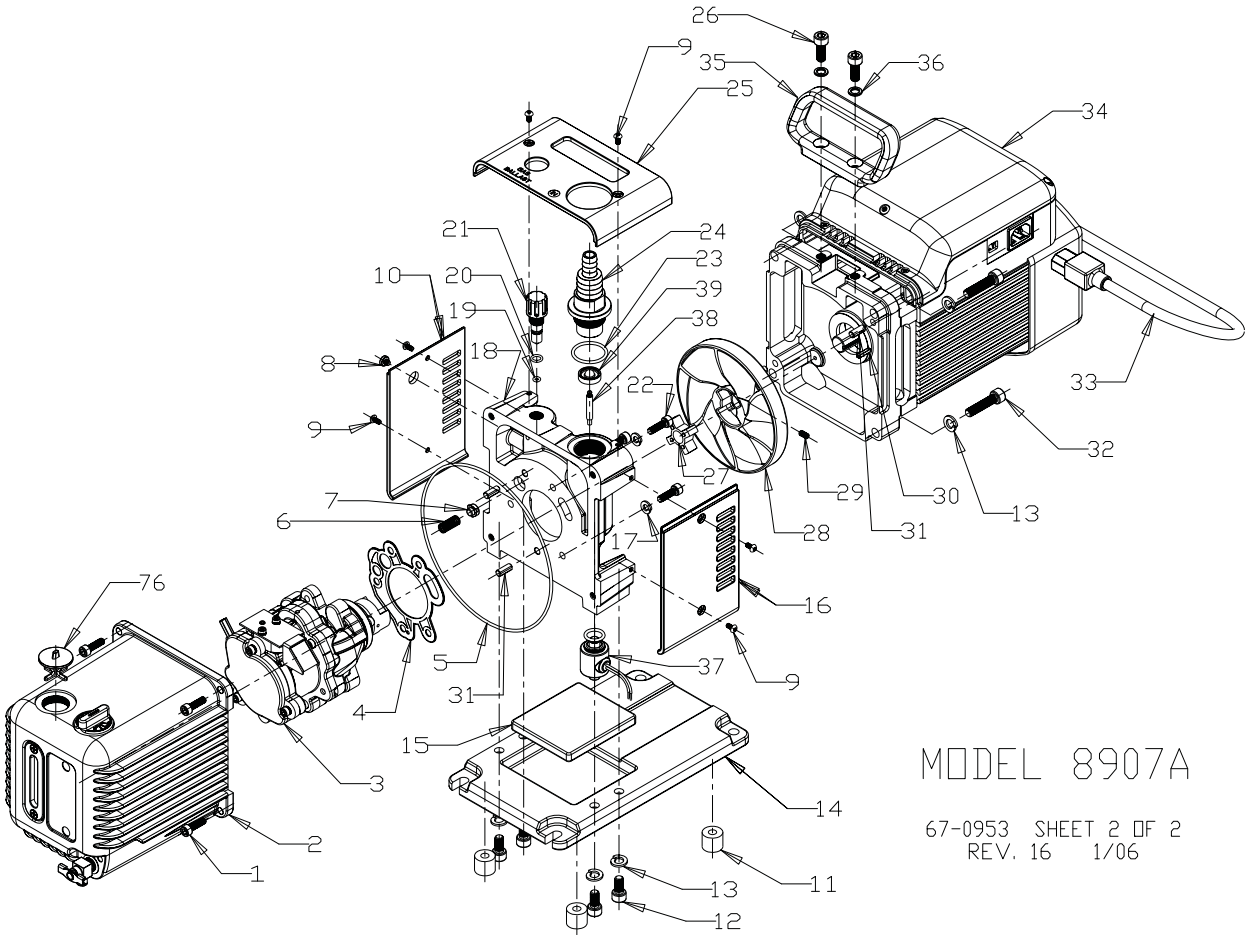


Item #	Qty.	P/N	Note A*)	Description
1	2	62-1014		Screw, Flat Hd #32x3/8
2	1	61-2370		Window Holder
3	1	61-2229A		Window Glass
4	1	66-0304	1	O-ring, Fluoroelast. #127
5	1	61-2413		Drain Plug
6	1	61-2158A	1	O-ring, Fluorelast. #110
7	1	61-2355		Oil Case
8	1	61-2130A		O-ring, Fluorelast. #115
9	1	61-2372		Filler Plug
10	8	2-00-6712		Screw, Socket Hd. #10-32x3/4
11	20	2-62-0793		Lock Washer #10
12	3	62-0003		Screw, Socket Hd. #10-32x3
13	1	61-2417		End Plate
15	6	2-69-6108		Lock Washer #8
16	1	61-2415		Baffle Assembly
17	2	61-2128A	2	O-ring, Fluorelast. #145
18	2	4-21-3006		Dowel Pin, 1/8”x3/8”
19	1	61-24-16		Stator
20	5	2-10-2605		Screw Round Hd #8-32x5/16
21	1	2-68-5632		Washer #8
22	1	61-2117A		Exhaust Valve Bracket Ass’y
23	2	61-2119A	2	Valve Spring
24	2	61-2118A	2	Valve
27	1	61-1123A	1	Intake Valve
28	1	61-1128A	1	Backer Valve
29	2	41-2988	2	Lip Seal
30	1	61-2177B		Rotor
31	2	61-2179A		Exhaust Vane
32	2	61-2178A		Intake Vane
34	3	61-2157A	2	O-ring, Fluoroleast. #007

Item #	Qty.	P/N	Note A*)	Description
35	1	61-2214B		Wear Plate
36	1	61-2149B	1	Gasket
37	2	2-62-0432		Lock Washer #6
38	1	61-2406		Mounting Plate
39	1	61-6324		Gas Ballast Assembly
40	1	61-9282A	1	O-ring, Fluoroelast. #011
41	1	61-9743	1	Drip Pad
42	1	61-2357		Intake Adapter
44	1	61-2159A	1	O-ring, Fluoroelast. #116
45	3	2-00-6708		Screw, Socket Hd. #10-32x-1/2
46	1	61-2401		Motor Adapter Plate
47	2	4-21-5010		Dowel Pin, 3/16”x5/8”
48	2	41-2693		Coupling, Body
49	4	2-00-6716		Screw, Socket Hd #10-32x1
50	1	41-2691	1	Coupling, Rubber
52	1	61-2377		Handle
53	2	2-61-1165		Washer 1/4”
54	2	2-01-6112		Screw, Socket Hd. 1/4-20x3/4”
55	1	61-5356		Motor Ass’y 1/4 HP (115V, 60Hz)
55	1	61-6460		Motor Ass’y 1/4 HP (230V, 60Hz)
55	1	61-6461		Motor Ass’y 1/4 HP (Multi voltage)
56	4	66-0102	4	Rubber Bumper
57	1	61-2400		Base
58	4	2-00-6812		Screw, Socket Hd. #10-32x5/8”
61	1	61-2139A	1	Disc Ass’y, Isolator Valve
62	1	61-2216A		Plunger
63	1	61-2155A	1	O-ring, Fluoroelast. #020
64	1	61-2212A		Adapter, Isolator Valve
65	2	2-00-6400		Screw, Socket Hd. #6-32x5/8
66	1	61-2308		Iso Operator Ass’y with O-ring

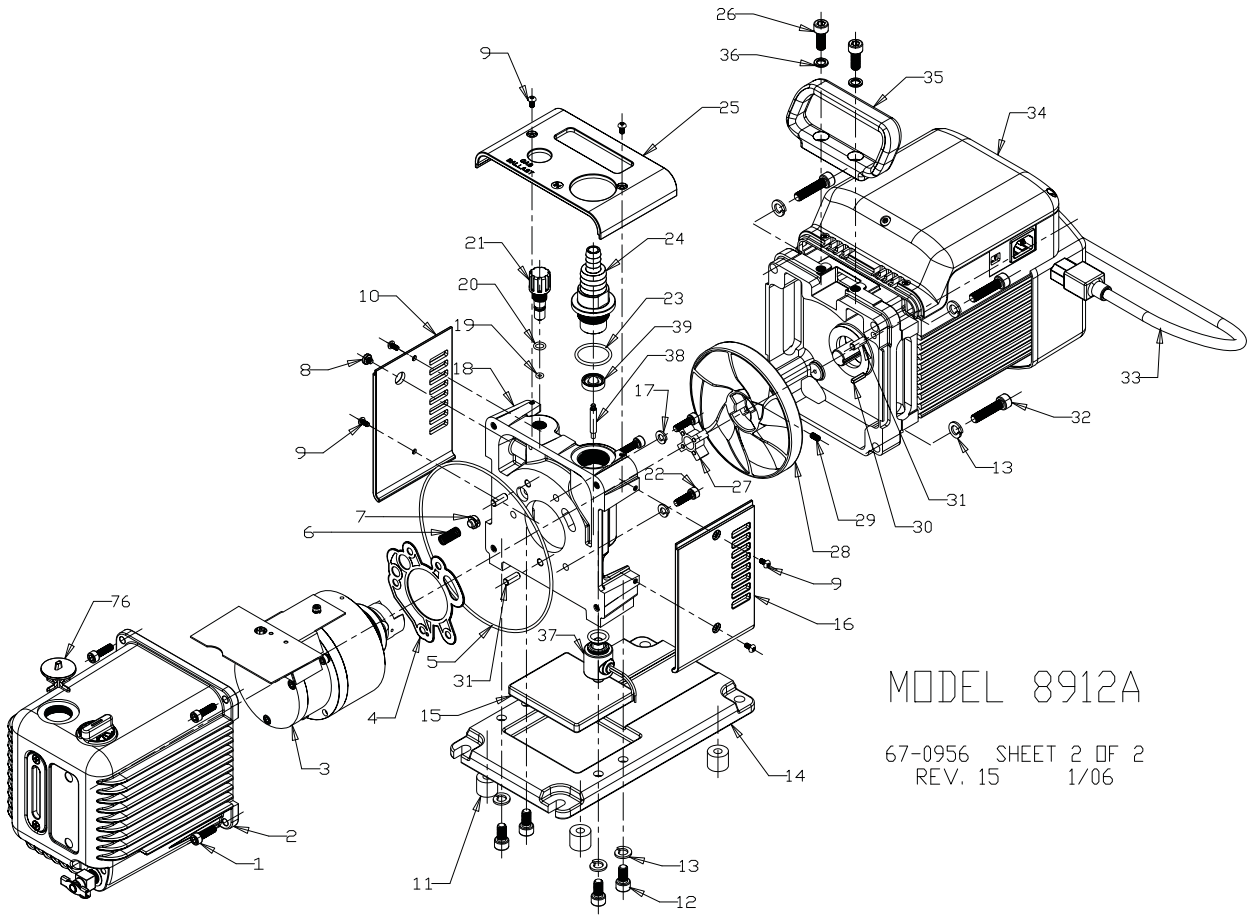
Note A*) Denotes parts included in Minor Repair Kit #8905K-02

10.31 Exploded Views and Parts List for 8907A



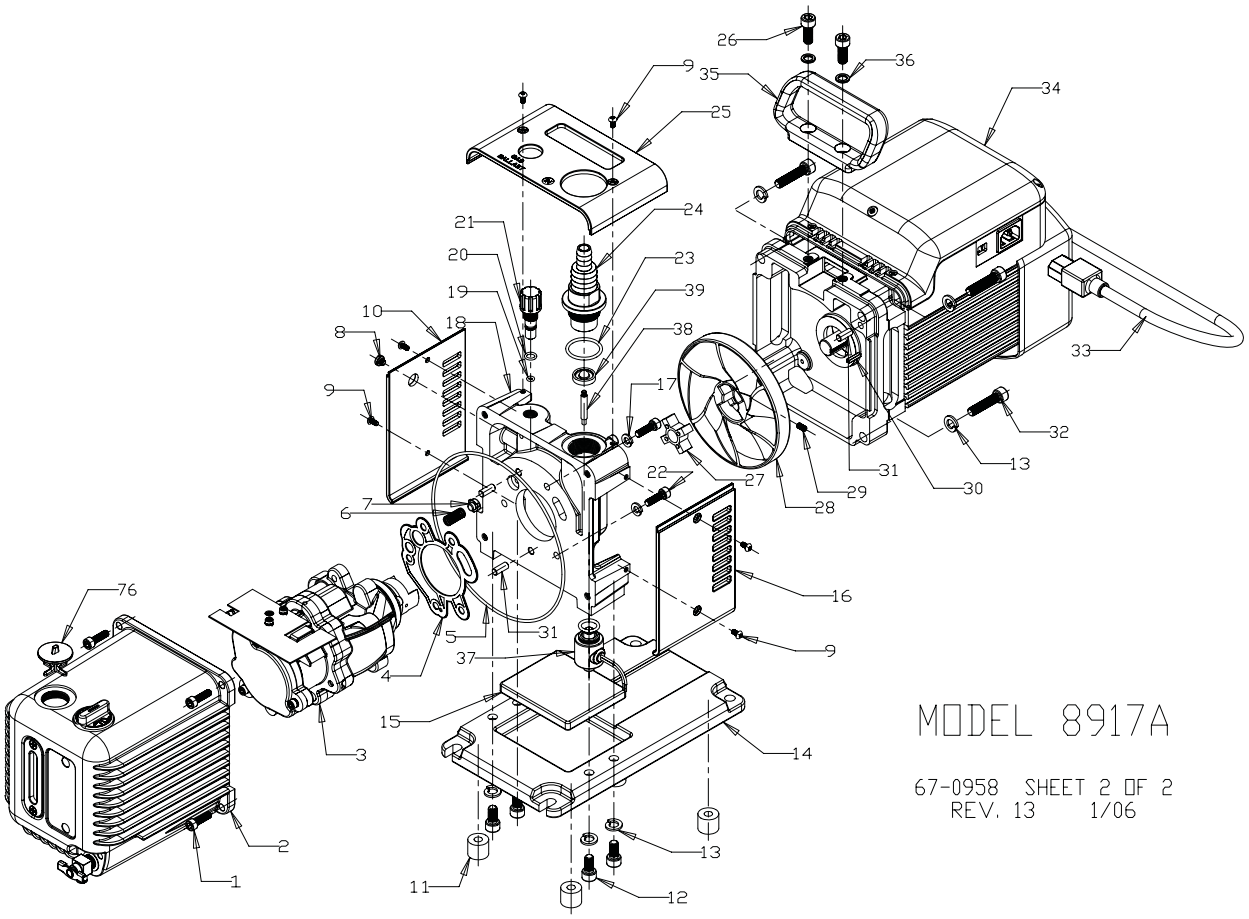
Item #	Qty.	P/N	Description	Item #	Qty.	P/N	Description
1	4	62-0325	Screw, Socket Hd. M6x20 Blk.	21	1	61-6324	Gas Ballast Assembly
2	1	61-6443	Oil Case Assembly	22	3	62-0270	Screw, Socket Hd. M6x20
3	1	61-6354	Pump Module	23	1	66-0200	O-ring, Fluoroelast. #216
4	1	61-6385	Gasket	24	1	61-6323	Intake Fitting Assembly
5	1	66-0194	O-ring, Fluoroelast. #164	25	1	61-6360	Top Cover
6	1	61-6305A	Spring, Gas Ballast	26	2	62-0331	Screw, Socket Hd. M8x20 Blk.
7	1	61-2118A	Valve, Gas Ballast	27	1	61-6038	Coupling, Rubber
8	1	61-9429	Screw w/O-ring	28	1	61-6024	Fan
9	6	62-0265	Screw, Button Hd. M4x8 Blk.	29	1	62-0286	Set Screw #10--32
10	1	61-5353	Left Cover	30	1	61-6081	Key
11	4	66-0211	Rubber Feet	31	4	61-9280A	Dowel Pin, 1/4”
12	4	62-0349	Screw Socket Hd. M8x16	32	4	62-0346	Screw, Socket Hd. M8x35
13	8	2-63-0356	Lock Washer 5/16”	33	1	62-0344	Line Cord
14	1	61-6306	Base	34	1	61-6460	Motor Assembly 1/2 H.P.
15	1	61-6084	Drip Pad	35	1	61-6011	Handle
16	1	61-5352	Right Cover	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
20	1	61-9282A	O-ring, Fluoroelast. #011	76	1	61-6076	Exhaust Plug

10.32 Exploded Views and Parts List for 8912A



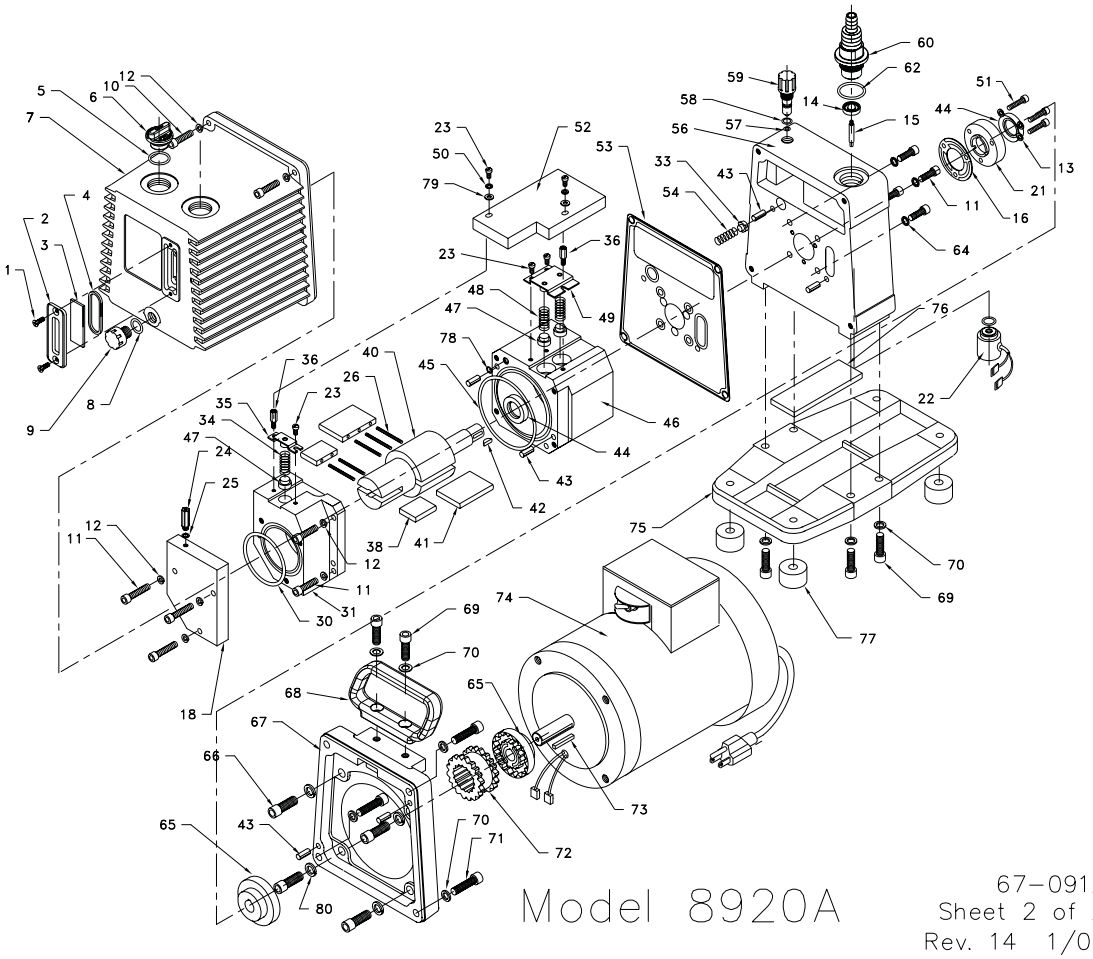
Item #	Qty.	P/N	Description	Item #	Qty.	P/N	Description
1	4	62-0325	Screw, Socket Hd. M6x20 Blk.	21	1	61-6324	Gas Ballast Assembly
2	1	61-6443	Oil Case Assembly	22	3	62-0270	Screw, Socket Hd. M6x20
3	1	61-6354	Pump Module	23	1	66-0200	O-ring, Fluoroelast. #216
4	1	61-6385	Gasket	24	1	61-6323	Intake Fitting Assembly
5	1	66-0194	O-ring, Fluoroelast. #164	25	1	61-6360	Top Cover
6	1	61-6305A	Spring, Gas Ballast	26	2	62-0331	Screw, Socket Hd. M8x20 Blk.
7	1	61-2118A	Valve, Gas Ballast	27	1	61-6038	Coupling, Rubber
8	1	61-9429	Screw w/O-ring	28	1	61-6024	Fan
9	6	62-0265	Screw, Button Hd. M4x8 Blk.	29	1	62-0286	Set Screw #10--32
10	1	61-5353	Left Cover	30	1	61-6081	Key
11	4	66-0211	Rubber Feet	31	4	61-9280A	Dowel Pin, 1/4”
12	4	62-0349	Screw Socket Hd. M8x16	32	4	62-0346	Screw, Socket Hd. M8x35
13	8	2-63-0356	Lock Washer 5/16”	33	1	62-0344	Line Cord
14	1	61-6306	Base	34	1	61-6460	Motor Assembly 1/2 H.P.
15	1	61-6084	Drip Pad	35	1	61-6011	Handle
16	1	61-5352	Right Cover	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
20	1	61-9282A	O-ring, Fluoroelast. #011	76	1	61-6076	Exhaust Plug

10.33 Exploded Views and Parts List for 8917A



Item #	Qty.	P/N	Description	Item #	Qty.	P/N	Description
1	4	62-0325	Screw, Socket Hd. M6x20 Blk.	21	1	61-6324	Gas Ballast Assembly
2	1	61-6443	Oil Case Assembly	22	3	62-0270	Screw, Socket Hd. M6x20
3	1	61-6354	Pump Module	23	1	66-0200	O-ring, Fluoroelast. #216
4	1	61-6385	Gasket	24	1	61-6323	Intake Fitting Assembly
5	1	66-0194	O-ring, Fluoroelast. #164	25	1	61-6360	Top Cover
6	1	61-6305A	Spring, Gas Ballast	26	2	62-0331	Screw, Socket Hd. M8x20 Blk.
7	1	61-2118A	Valve, Gas Ballast	27	1	61-6038	Coupling, Rubber
8	1	61-9429	Screw w/O-ring	28	1	61-6024	Fan
9	6	62-0265	Screw, Button Hd. M4x8 Blk.	29	1	62-0286	Set Screw #10--32
10	1	61-5353	Left Cover	30	1	61-6081	Key
11	4	66-0211	Rubber Feet	31	4	61-9280A	Dowel Pin, 1/4”
12	4	62-0349	Screw Socket Hd. M8x16	32	4	62-0346	Screw, Socket Hd. M8x35
13	8	2-63-0356	Lock Washer 5/16”	33	1	62-0344	Line Cord
14	1	61-6306	Base	34	1	61-6460	Motor Assembly 1/2 H.P.
15	1	61-6084	Drip Pad	35	1	61-6011	Handle
16	1	61-5352	Right Cover	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
20	1	61-9282A	O-ring, Fluoroelast. #011	76	1	61-6076	Exhaust Plug

10.34 Exploded Views and Parts List for 8920A

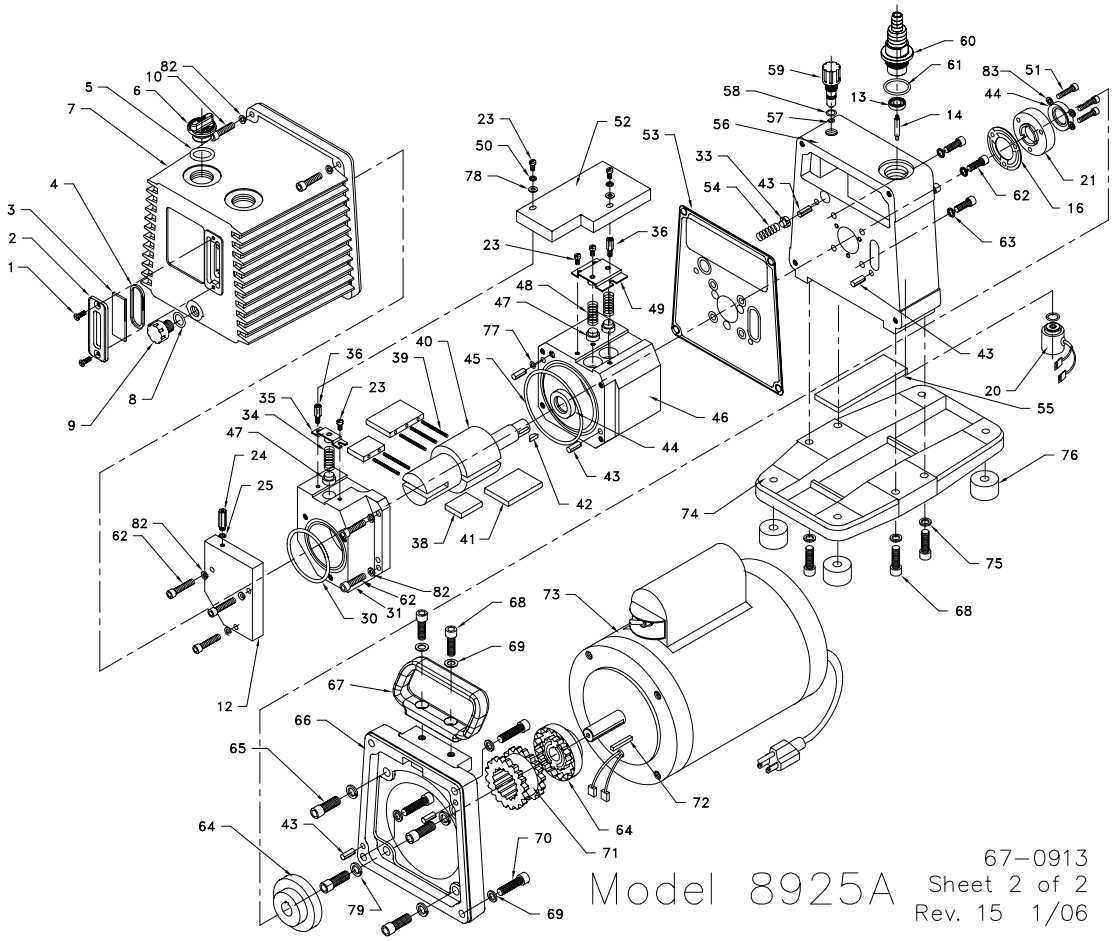


PARTS LIST FOR MODEL 8920A

ITEM	QTY	P/N	A*	B*	DESCRIPTION
1	2	62-1014			SCREW FLAT HD #8-32x3/8
2	1	61-2370			WINDOW HOLDER
3	1	61-2229A			WINDOW GLASS
4	1	66-0304			O-RING, FLUOROELAST. #127
5	1	66-0212			O-RING, FLUOROELAST. #119
6	1	61-6020			OIL FILL PLUG
7	1	61-5358			OIL CASE
8	1	61-2130A			O-RING, FLUOROELAST. #115
9	1	61-2372			DRAIN PLUG
10	4	2-01-6116			SCREW SOCKET HD 1/4-20x1
11	11	2-01-6114			SCREW SOCKET HD 1/4-20x7/8
12	11	2-63-0193			LOCK WASHER 1/4
13	3	2-62-0793			LOCK WASHER #10
14	1	61-9793			ISOLATOR DISK
15	1	61-6279			PLUNGER
16	1	41-0643			GASKET
18	1	61-9539B			END PLATE
21	1	61-8104A			SHAFT SEAL HOUSING
22	1	61-9935			ISO OPERATOR ASSEMBLY
23	5	2-00-2604			SCREW FILLISTER HD #8-32x1/4
24	1	62-0274			ORIFICE .014”
25	1	41-3175			GASKET, NYLON
26	5	41-2996			VANE, SPRING
30	1	61-9527			O-RING, FLUOROELAST. #137
31	1	61-9598D			EXHAUST STAGE
33	1	61-2118A			VALVE, GAS BALLAST
34	1	61-9561A			EXHAUST VALVE SPRING
35	1	61-9580A			EXHAUST VALVE COVER
36	2	61-9478			STAND OFF SPACER
38	2	61-9615A			EXHAUST VANE
40	1	61-9595C			ROTOR
41	2	61-9616B			INTAKE VANE
42	1	41-0624			WOODRUFF KEY
43	6	61-9280A			DOWEL PIN, 1/4”
44	2	41-3390			LIP SEAL 3/4”
45	1	61-9526			O-RING, FLUOROELAST. #151
46	1	61-9597D			INTAKE STAGE
47	3	61-9560A			BYPASS VALVE
48	2	61-9582A			BYPASS VALVE SPRING
49	1	61-9516A			INTAKE VALVE COVER
50	2	2-69-6108			LOCK WASHER #8
51	3	2-00-6814			SCREW SOCKET HD #10-32x7/8
52	1	61-9640A			VALVE COVER ASSEMBLY
53	1	61-9609B			GASKET
54	1	61-6305A			SPRING, GAS BALLAST
56	1	61-5347			MOUNTING PLATE
57	1	61-2157A			O-RING, FLUOROELAST. #007
58	1	61-9282A			O-RING, FLUOROELAST. #011
59	1	61-6324			GAS BALLAST VALVE ASSEMBLY
60	1	61-5348			INTAKE ADAPTER ASSEMBLY
62	1	66-0200			O-RING, FLUOROELAST. #216
64	4	62-1071			LOCK WASHER 1/4 SMALL
65	2	41-3072			FLANGE COUPLING
66	4	2-01-6516			SCREW SOCKET HD 3/8-16x1
67	1	61-5246			MOTOR ADAPTER PLATE
68	1	61-6011			HANDLE
69	6	2-01-6316			SCREW SOCKET HD 5/16-18x1
70	10	41-2363			WASHER
71	4	2-01-6320			SCREW SOCKET HD -18x1-1/4
72	1	41-3073			COUPLING SLEEVE
73	1	41-2637			MOTOR SHAFT KEY (SUPPL. w/MOTOR)
74	1	61-5359			MOTOR ASSEMBLY 3/4 H.P.*
75	1	61-5245			BASE
76	1	61-9742			DRIP PAD
77	4	61-9607A			RUBBER BUMPER
78	1	41-3005			O-RING, FLUOROELAST. #008
79	2	2-68-5632			WASHER #8
80	4	2-63-0593			LOCK WASHER 3/8

A* : MAJOR REPAIR KIT CAT# N/A
B* : MINOR REPAIR KIT CAT# 8915K-05

10.35 Exploded Views and Parts List for 8925A

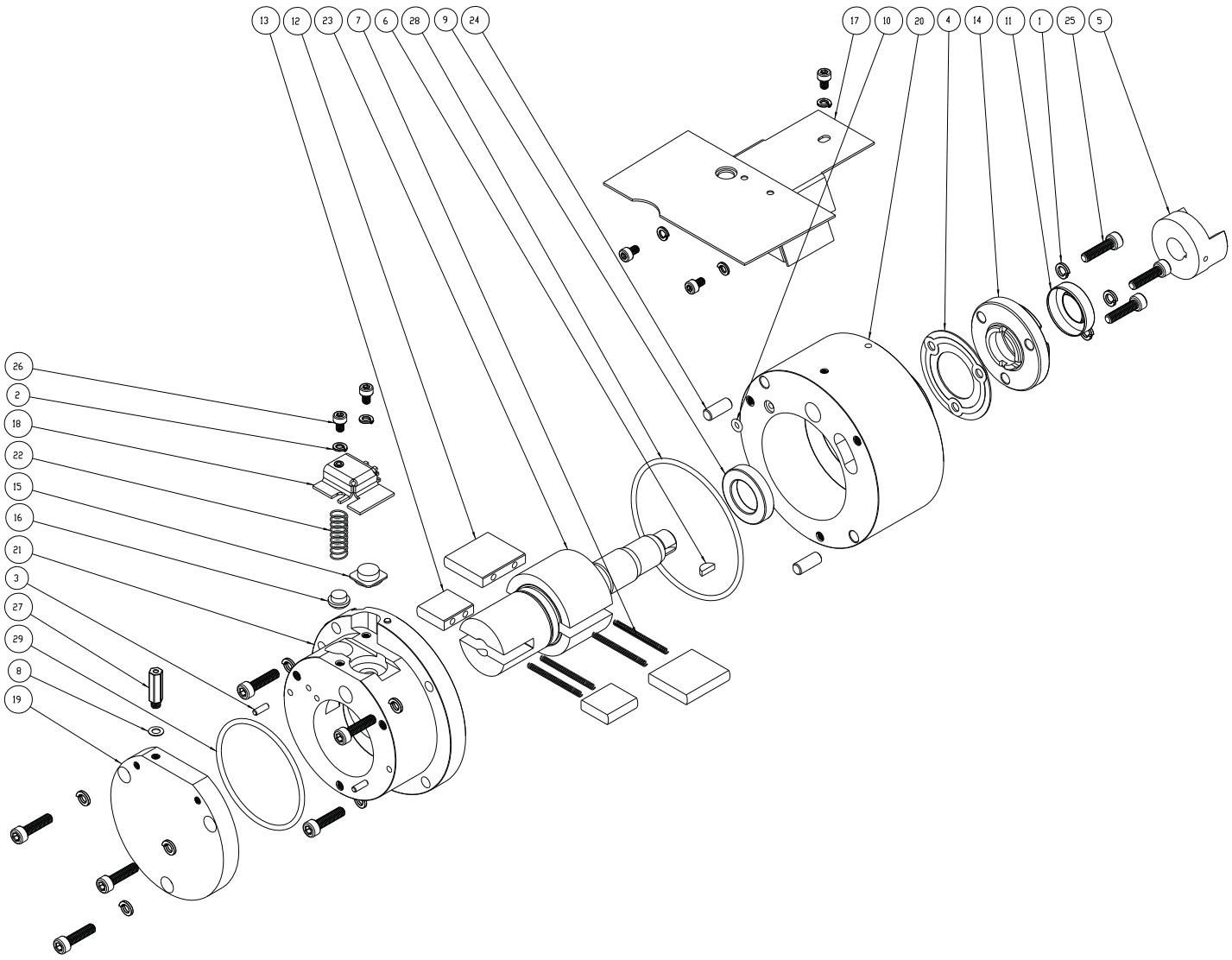


PARTS LIST FOR MODEL 8925A

ITEM	QTY	P/N	A*	B*	DESCRIPTION
1	2	62-1014			SCREW FLAT HD #8-32x3/8
2	1	61-2370			WINDOW HOLDER
3	1	61-2229A			WINDOW GLASS
4	1	66-0304			O-RING, FLUOROELAST. #127
5	1	66-0212			O-RING, FLUOROELAST. #119
6	1	61-6020			OIL FILL PLUG
7	1	61-5358			OIL CASE
8	1	61-2130A			O-RING, FLUOROELAST. #115
9	1	61-2372			DRAIN PLUG
10	4	2-01-6116			SCREW SOCKET HD 1/4-20x1
12	1	61-9539B			COVER PLATE
13	1	61-9793			ISOLATOR DISK
14	1	61-6279			PLUNGER
16	1	41-0643			GASKET
20	1	61-9935			ISOLATOR ASSEMBY
21	1	61-8104A			SHAFT SEAL HOUSING
23	5	2-00-2604			SCREW FILLISTER HD #8-32x1/4
24	1	62-0274			ORIFICE .014”
25	1	41-3175			GASKET, NYLON
30	1	61-9379			O-RING, FLUOROELAST. #139
31	1	61-5307			EXHAUST STAGE
33	1	61-2118A			VALVE, GAS BALLAST
34	1	61-9561A			EXHAUST VALVE SPRING
35	1	61-9685			EXHAUST VALVE COVER
36	2	61-9478			STAND OFF SPACER
38	2	61-9570A			EXHAUST VANE
39	5	41-2996			VANE, SPRING
40	1	61-5304			ROTOR
41	2	61-9571B			INTAKE VANE
42	1	41-0624			WOODRUFF KEY
43	6	61-9280A			DOWEL PIN, 1/4”
44	2	41-3390			LIP SEAL 3/4”
45	1	61-9378			O-RING, FLUOROELAST. #152
46	1	61-5305			INTAKE STAGE
47	3	61-9560A			BYPASS VALVE
48	2	61-9582A			BYPASS VALVE SPRING
49	1	61-9686			INTAKE VALVE COVER
50	2	2-69-6108			LOCK WASHER #8
51	3	2-00-6814			SCREW SOCKET HD #10-32x7/8
52	1	61-9687			VALVE COVER ASSEMBLY
53	1	61-9609B			GASKET
54	1	61-6305A			SPRING, GAS BALLAST
55	1	61-9742			DRIP PAD
56	1	61-5347			MOUNTING PLATE
57	1	61-2157A			O-RING, FLUOROELAST. #007
58	1	61-9282A			O-RING, FLUOROELAST. #011
59	1	61-6324			GAS BALLAST VALVE ASSEMBLY
60	1	61-5348			INTAKE ADAPTER ASSEMBLY
61	1	66-0200			O-RING, FLUOROELAST. #216
62	11	2-01-6114			SCREW SOCKET HD 1/4-20x7/8
63	4	62-1071			LOCK WASHER 1/4 SMALL
64	2	41-3072			FLANGE COUPLING
65	4	2-01-6516			SCREW SOCKET HD 3/8-16x1
66	1	61-5246			MOTOR ADAPTER PLATE
67	1	61-6011			HANDLE
68	6	2-01-6316			SCREW SOCKET HD 5/16-18x1
69	6	41-2363			WASHER
70	4	2-01-6320			SCREW SOCKET HD 5/16-18x1-1/4
71	1	41-3073			COUPLING SLEEVE
72	1	41-2637			MOTOR SHAFT KEY (SUPPL. w/MOTOR)
73	1	61-5359			MOTOR ASSEMBLY 3/4 H.P.
74	1	61-5245			BASE
75	4	2-63-0356			LOCK WASHER 5/16
76	4	61-9607A			RUBBER BUMPER
77	1	41-3005			O-RING, FLUOROELAST. #008
78	2	2-68-5632			WASHER #8
79	4	2-63-0593			LOCK WASHER 3/8
82	11	2-63-0193			LOCK WASHER 1/4
83	3	2-62-0793			LOCK WASHER #10

A* : MAJOR REPAIR KIT CAT# N/A
B* : MINOR REPAIR KIT CAT# 8925K-02

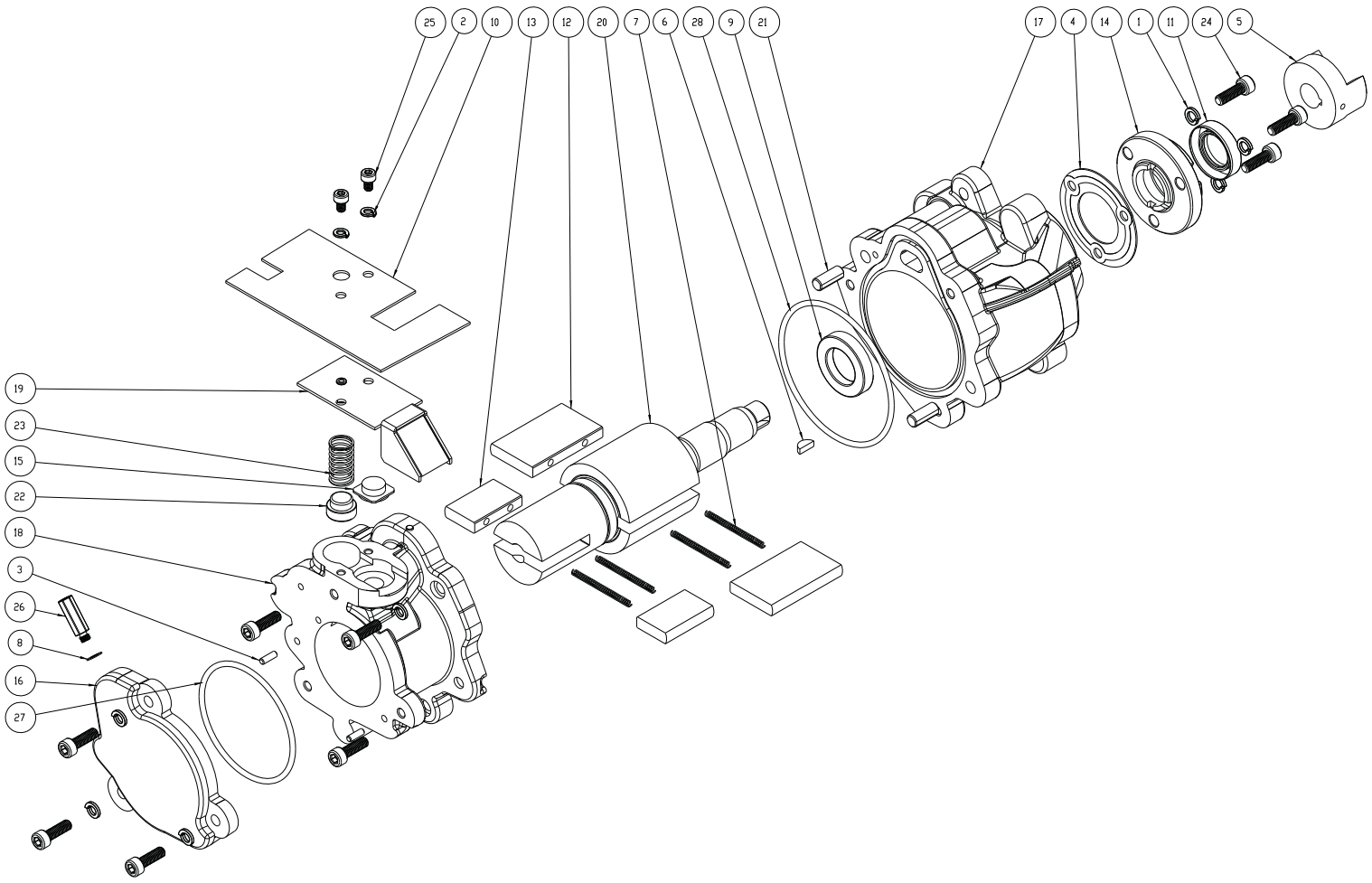
10.40 Exploded Views and Parts List for Pump Module 61-6168



ITEM	PART NO.	QTY	DESCRIPTION
1	2-62-0793	9	WASHER, LOCK SPLIT #10 MED.
2	2-69-6108	5	WASHER, LOCK #8
3	4-21-3006	2	DOWEL PIN 1/8 x 3/8 PLAIN
4	41-0643	1	GASKET, SEAL
5	41-2730	1	COUPLING
6	41-2732	1	KEY #403
7	41-2996	4	VANE SPRING, S.S.
8	41-3175	1	GASKET, NYLON
9	41-3390	1	LIP SEAL, VITON .75/1.25
10	61-2157A	1	O-RING #007, VITON
11	61-6042	1	LIP SEAL 17mm
12	61-6050	2	INTAKE VANE
13	61-6053	2	EXHAUST VANE
14	61-6055	1	LIP SEAL HOUSING
15	61-6057	1	VALVE BY-PASS

ITEM	PART NO.	QTY	DESCRIPTION
16	61-6058	1	VALVE, EXHAUST POPPET
17	61-6123	1	TOP COVER
18	61-6164	1	EXHAUST VALVE HOLDER ASSY
19	61-6165	1	COVER PLATE
20	61-6166	1	INTAKE STAGE
21	61-6167	1	EXHAUST STAGE ASSY
22	61-6305	1	SPRING, EXHAUST VALVE
23	61-6465	1	ROTOR
24	61-9280A	2	DOWEL PIN .25"
25	62-0262	9	SCREW SOCKET HD M5 x 20mm LG.
26	62-0271	5	SCREW SOCKET HD M4 x 6mm LG.
27	62-0274	1	ORIFICE .014" S.S.
28	66-0203	1	O-RING #151, VITON
29	66-0204	1	O-RING #141, VITON

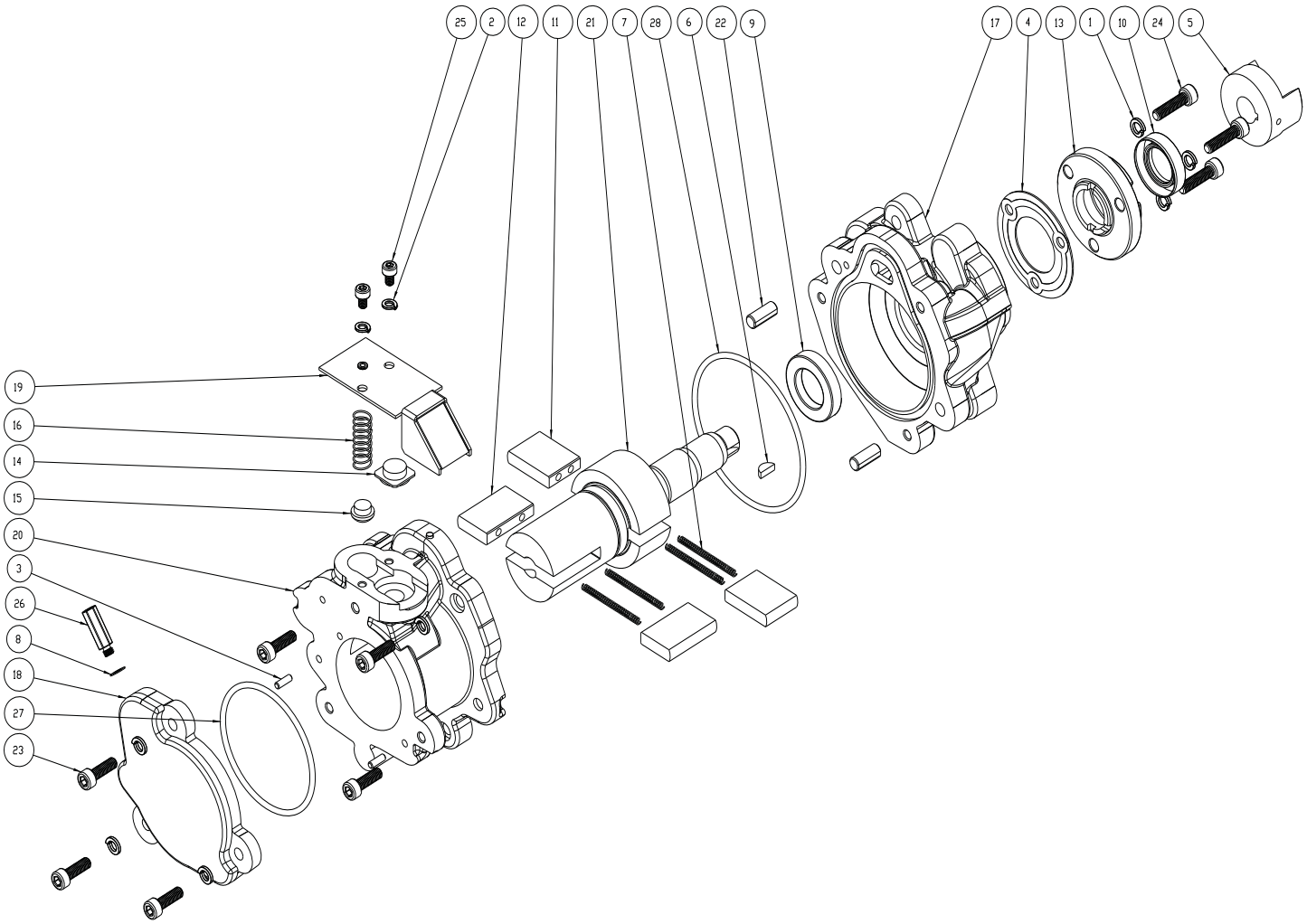
10.41 Exploded Views and Parts List for Pump Module 61-6435



ITEM	PART NO.	QTY	DESCRIPTION
1	2-62-0793	9	WASHER, LOCK SPLIT #10 MED.
2	2-69-6108	2	WASHER, LOCK #8
3	4-21-3006	2	DOWEL PIN 1/8 x 3/8 PLAIN
4	41-0643	1	GASKET, SEAL
5	41-2730	1	COUPLING
6	41-2732	1	KEY #403
7	41-2996	4	VANE SPRING, S.S.
8	41-3175	1	GASKET, NYLON
9	41-3390	1	LIP SEAL, VITON .75/1.25
10	61-5351	1	SPLASH GUARD
11	61-6042	1	LIP SEAL 17mm
12	61-6049	2	INTAKE VANE
13	61-6052	2	EXHAUST VANE
14	61-6055	1	LIP SEAL HOUSING

ITEM	PART NO.	QTY	DESCRIPTION
15	61-6057	1	VALVE BY-PASS
16	61-6318	1	COVER PLATE
17	61-6427	1	INTAKE STAGE
18	61-6429	1	EXHAUST STAGE ASSY
19	61-6432	1	EXHAUST VALVE BRACKET ASSY
20	61-6463	1	ROTOR
21	61-9280A	2	DOWEL PIN .25"
22	61-9560A	1	EXHAUST VALVE
23	61-9561A	1	SPRING, EXHAUST VALVE
24	62-0177	9	SCREW SOCKET HD M5 x 16mm LG.
25	62-0271	2	SCREW SOCKET HD M4 x 6mm LG.
26	62-0274	1	ORIFICE .014" S.S.
27	66-0204	1	O-RING #141, VITON
28	66-0207	1	O-RING #149, VITON

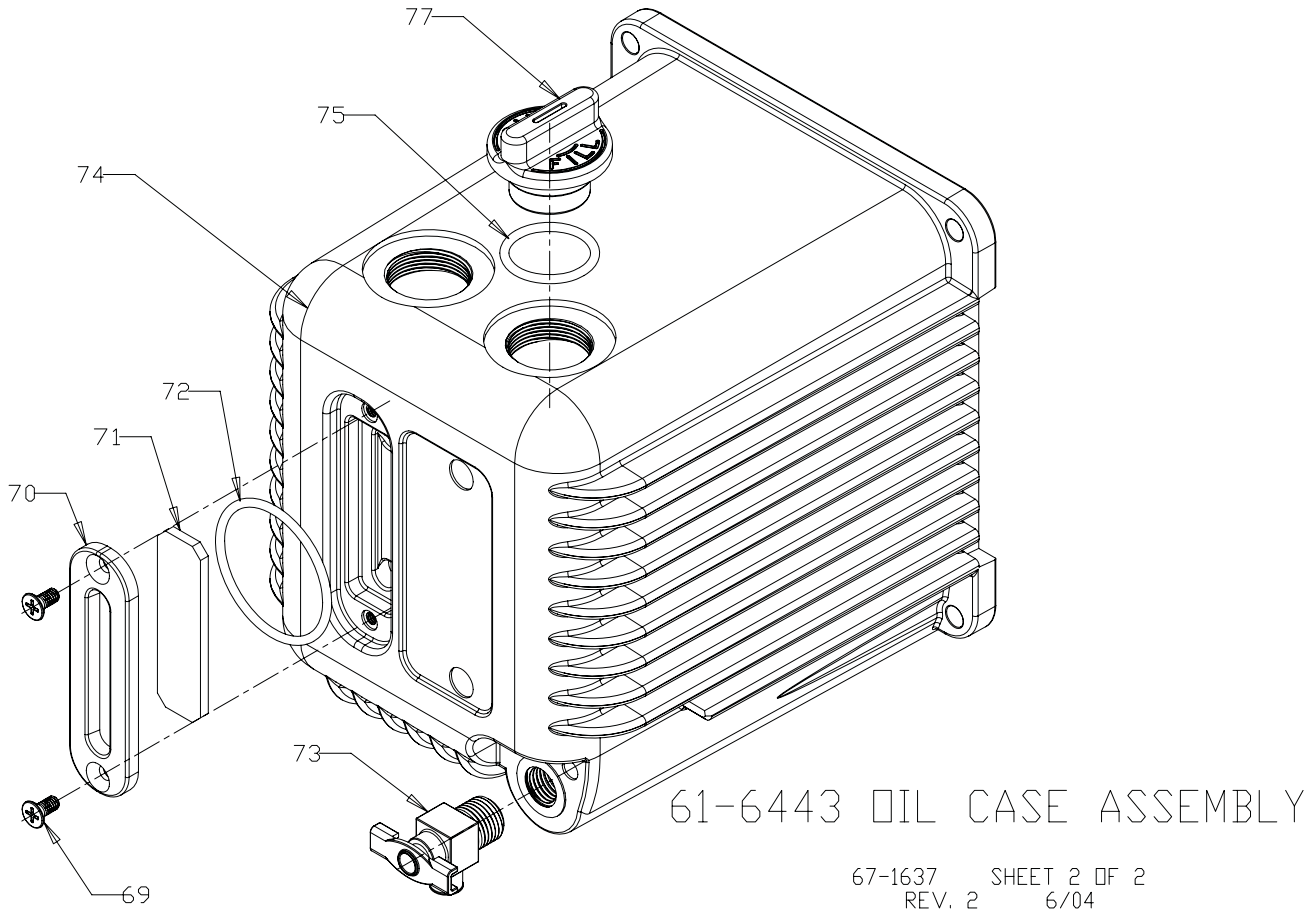
10.42 Exploded Views and Parts List for Pump Module 61-6354



ITEM	PART NO.	QTY	DESCRIPTION
1	2-62-0793	9	WASHER, LOCK SPLIT #10 MED.
2	2-69-6108	2	WASHER, LOCK #8
3	4-21-3006	2	DOWEL PIN 1/8 x 3/8 PLAIN
4	41-0643	1	GASKET, SEAL
5	41-2730	1	COUPLING
6	41-2732	1	KEY #403
7	41-2996	4	VANE SPRING, S.S.
8	41-3175	1	GASKET, NYLON
9	41-3390	1	LIP SEAL, VITON .75/1.25
10	61-6042	1	LIP SEAL 17mm
11	61-6051	2	INTAKE VANE
12	61-6052	2	EXHAUST VANE
13	61-6055	1	LIP SEAL HOUSING
14	61-6057	1	VALVE BY-PASS

ITEM	PART NO.	QTY	DESCRIPTION
15	61-6058	1	VALVE, EXHAUST POPPET
16	61-6305	1	SPRING, EXHAUST VALVE
17	61-6316	1	INTAKE STAGE
18	61-6318	1	COVER PLATE
19	61-6348	1	EXHAUST VALVE BRAKET ASSY
20	61-6350	1	EXHAUST STAGE ASSY
21	61-6464	1	ROTOR
22	61-9280A	2	DOWEL PIN .25"
23	62-0177	6	SCREW SOCKET HD M5 x 16mm LG.
24	62-0262	3	SCREW SOCKET HD M5 x 20mm LG.
25	62-0271	2	SCREW SOCKET HD M4 x 6mm LG.
26	62-0274	1	ORIFICE .014" S.S.
27	66-0204	1	O-RING #141, VITON
28	66-0207	1	O-RING #149, VITON

10.50 Exploded Views and Parts List for Oil Case 61-6443



PARTS LIST FOR OIL CASE 61-6443

ITEM	QTY	P/N	A*	B*	DESCRIPTION
69	2	62-1014			SCREW COUNTER SINK #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

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

Section 11: WARRANTY

UNPACKING

Inspect the pump carefully. If any damage has occurred, file claim with the carrier immediately. Save the shipping container for carrier to inspect.

OPERATING PUMP

Refer to the enclosed Instruction/Operation Manual for all information to properly operate and maintain the pump.

WARRANTY

This Welch Vacuum product is warranted to be free from defects in material and workmanship. The liability of Gardner Denver Welch Vacuum Technology, Inc. under this warranty is limited to servicing, adjusting, repairing or replacing any unit or component part which in the judgment of Gardner Denver Welch Vacuum Technology, Inc. has not been misused, abused or altered in any way causing impaired performance or rendering it inoperative. 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 Rietschle Thomas. Vacuum pumps that have been used 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, or alteration, 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.

To reduce additional charges and delays either within or outside of the warranty period, contact Gardner Denver Welch Vacuum Technology, Inc. @847-676-8800 for a return authorization number. Products without a return authorization number will be refused by our receiving department. Before shipping, properly pack the pump, insure it against loss or damage, and on the outside of the pump packaging and the packing slip write in the return authorization number. Pumps damaged due to improper packaging are the customer's responsibility.

Section 12: MSDS SHEET FOR 8995P

MATERIAL SAFETY DATA SHEET
FOR: 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:	**Gardner Denver Welch Vacuum Technology, Inc.** **5621 W. Howard Street** **Niles, IL 60714**
Date Prepared:	February 10, 2004
Telephone Number for General Information:	(847) 676-8800

SECTION 2 - HAZARDOUS INGREDIENTS/IDENTITY

Exposure Limits in Air

Component	CAS No.	OSHA PEL	ACGIH TVL
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

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 inhalation, 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

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 5 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. mg/m of air for mineral oil mist average over an eight-hour daily exposure (AC IH 4- 5). entilation: Normal.

Protective loves: 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.

SECTION ENVIROMENTAL DATA

Se tion 1 To i C e i as

This product does not contain toxic chemicals of Section of Title III of Supervened Amendments and Reauthorization Act of (SARA) and 4 CFR Part 72.

Se tion 11 Ha a Cata o ies

.	Not Applicable	es
2.	Acute (Immediate Health Hazard)	No
.	Chronic (Delayed Health Hazard)	No
4.	Fire Hazard	No
5.	Sudden Release of Pressure Hazard	No
.	Reactive Hazard	No

Se tion 02(A) E t e Ha a o s S stan es

(R Reportable uantity)
(TP Threshold Planning uantity)
This product does not contain extremely hazardous substances of Section 2(A)

C ean Wate A t

Under Section (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 2 Hazardous Substances 42 U.S.C. 2
Petroleum and petroleum fractions are excluded from the list of CERCLA hazardous substances by Section (4) of CERCLA.

Fe e a Re ations

Reported in TSCA Inventory
Product: es
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 **e e ess is ai a a anties o eve in o nat e, in in a anties o e anta i it an itness o a a ti e ose in es e t to t e se o s ita i it o t e o t.** 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. eep container closed and drum bungs in place.

REGULATION INFORMATION:

D.O.T. SHIPPIN NAME:	N/A
D.O.T. HA ARD CLASS:	N/A
D.O.T. IDENTIFICATION NUM ER:	N/A

NOTES

GARDNER DENVER WELCH CONTACT LIST

USA, Canada, Latin America
Gardner Denver Thomas, Inc.,
Welch Vacuum Technology
5621 W. Howard St.
Niles, IL 60714 USA
Phone: 847-676-8800
Fax: 847-677-8606
Email: welchvacuum@rtpumps.com

Asia
Rietschle Thomas Asia Pacific, Ltd.
Unit 2503, Metropole Square
No. 2 On Yiu St., Siu Lek Yuen
Shatin, New Territories, Hong Kong, P.R.C.
Phone: 852 2690 3502
Fax: 852 2792 4598
Email: tiap@rtpumps.com

Europe
Gardner Denver UK
Waterbrook Estate, Waterbrook Road
Alton Hampshire
GU342UD United Kingdom
Phone: 01 420 544 184
Fax: 01 420 544 183
Email: webinfo@rtpumps.com

Gardner Denver Thomas, Inc.
Welch Vacuum Technology
Vacuum Pump Repair Facility
5621 W. Howard Street
Niles, IL 60714
Phone: (847) 676-8800
Fax: (847) 677-8606 (Technical Support) (847) 588-2366
E-Mail: gdwelchvacuum@gardnerdenver.com
Web-Page: www.welchvacuum.com

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