

LACO TECHNOLOGIES USER MANUAL



ROTARY VANE HIGH VACUUM PUMPS

CONTACT US



PHONE/FAX

Toll Free: 800.465.1004

Phone: 801.486.1004

Fax: 801.486.1007

ADDRESS

LACO Technologies, Inc.

3085 West Directors Row

Salt Lake City, UT 84104

WEB

www.lacotech.com

info@lacotech.com

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1. SCOPE

This manual contains installation, operation, maintenance, and troubleshooting information for the W2V10, W2V20, W2V40 and W2V80 Rotary Vane Vacuum Pumps. Please read the manual in its entirety before operating the pump.

Our rotary vane vacuum pumps are designed to ensure safety when used properly. It is the responsibility of the user to follow safety-related warnings, cautions, notes, and other requirements described in this manual.

Returned equipment will not be accepted without prior authorization. Prior to shipping please call for a returned material authorization (RMA) number.

LACO Technologies reserves the right to cancel the warranty if the pump is disassembled without authorization, if pump fluids are used that are not compatible with the design and materials used in the manufacture of the pump, and if unauthorized spare parts are used.

2. SAFETY

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

WARNING Ground the motor properly during installation. Disconnect the power before beginning installation, maintenance or repair work or before interchanging the input leads when correcting the direction of rotation. Disconnecting the power also avoids an unexpected start-up for pumps with automatically resetting thermal overloads.

WARNING If hazardous gasses or vapors are expelled from the pump, do not operate the pump without an exhaust line and an adequate exhaust system.

WARNING Do not exceed a maximum backpressure of 7 psig. Excessive pressure in the pump could damage the seals, blow out the sight glass, or rupture the pump housing. In addition, excessive backpressure can result in hazardous process gas or contaminated oil leaking out of the pump.

WARNING Don't install an exhaust line with a smaller ID than the exhaust port or allow restrictions or deposit build up in the exhaust line.

WARNING If you are purging the oil casing with inert gas, limit the inert gas flow to avoid exceeding the 7 psig limit. Accidentally connecting the pump's exhaust port to a vacuum line containing a closed valve also causes a dangerous excessive pressure.

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

Proper precautions could include:

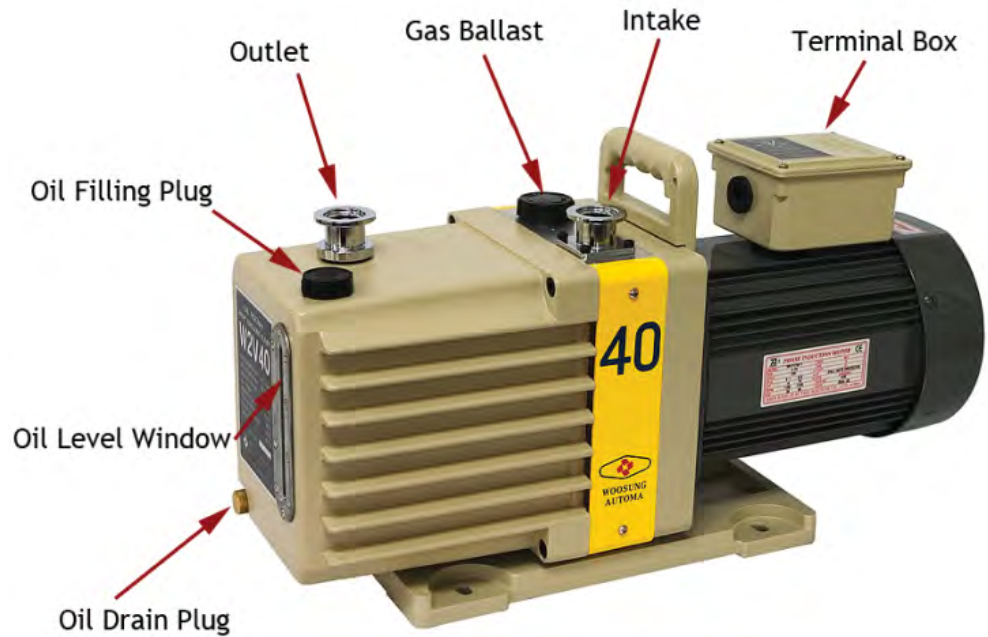
- inert gas purging before and after you drain the oil
- sweeping hazardous gas from the pump or filters
- wearing gloves or protective clothing to avoid skin contact with toxic or highly corrosive substances
- using a ventilated work area
- employing fume hoods
- wearing safety masks
- using a breathing apparatus



CAUTION LACO rotary vane vacuum pumps are two-stage units designed to operate continuously in the low torr & sub-torr (millitorr) pressure range (<10 mmHg). Operation for prolonged periods of time above 10 mm HG (Torr) can result in permanent damage to the pump.

3. SPECIFICATIONS

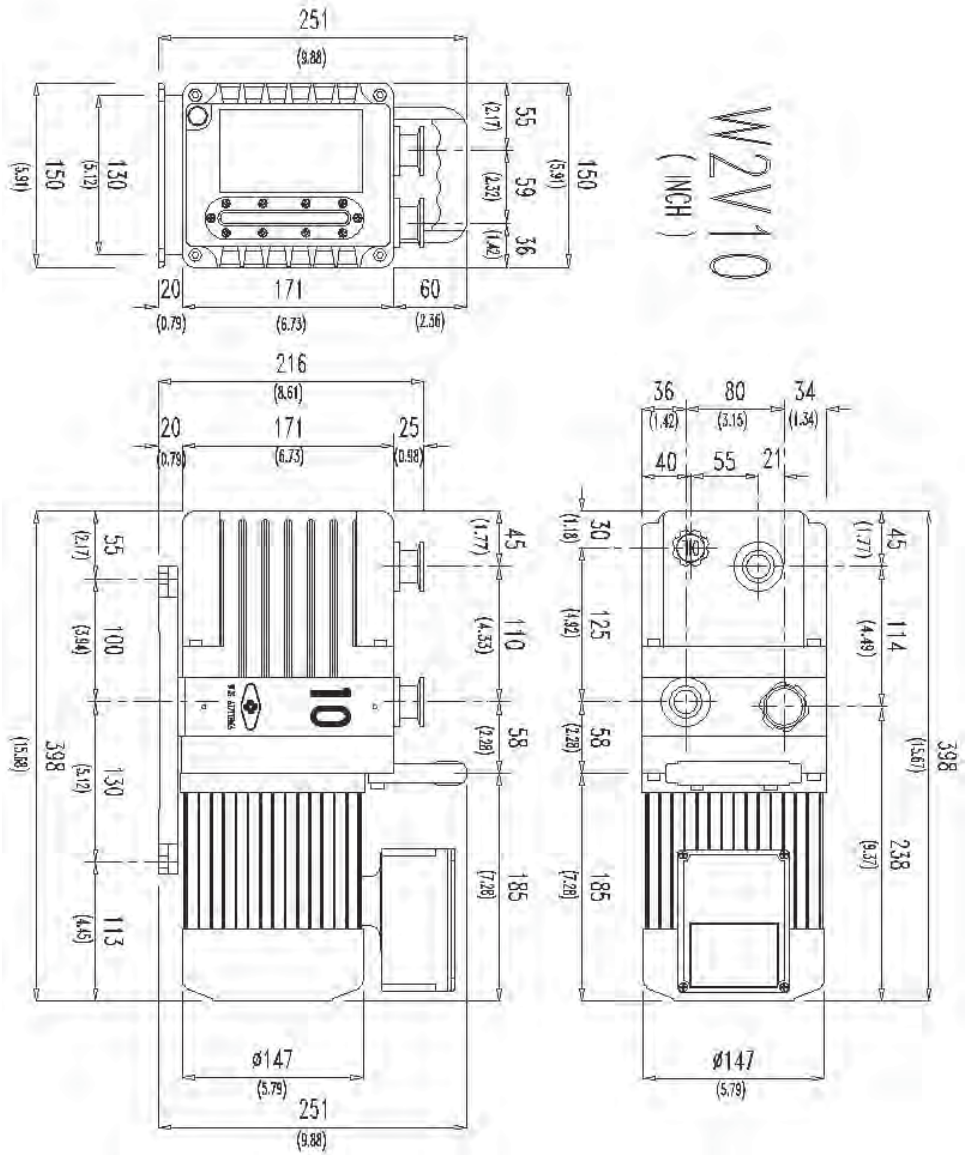
3.1 BASIC PARTS AND SPECIFICATIONS



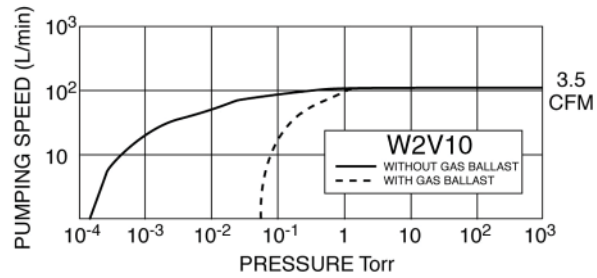
3.2 W2V10 SPECIFICATIONS

COMPONENT	DESCRIPTION
Pumping Speed @ 60 Hz	100 l/m, 3.5 cfm, 6 m ³ /hr
Pumping Speed @ 50 Hz	83 l/m, 3 cfm, 5 m ³ /hr
Ultimate Pressure (Gas Ballast Open)	5 x 10 ⁻² Torr
Ultimate Pressure (Gas Ballast Closed)	5 x 10 ⁻³ Torr
Standard Motor, CE Marked	115V, 1 HP, 60 Hz, On/Off Switch
Power Connection	6 ft (2 m) 3 conductor cord
Motor Speed @ 60 Hz	1700 rpm
Oil Capacity	500 cc (.53 quart)
Weight	Net 50 lbs, shipping 54 lbs
Intake/Exhaust type/diameter	NW 25 (26 mm) O.D. tube
Ambient Operating Temperature	70° to 40° C (45° to 104° F)

3.2.1 W2V10 DIMENSIONS



3.2.2 W2V10 PUMP CURVE

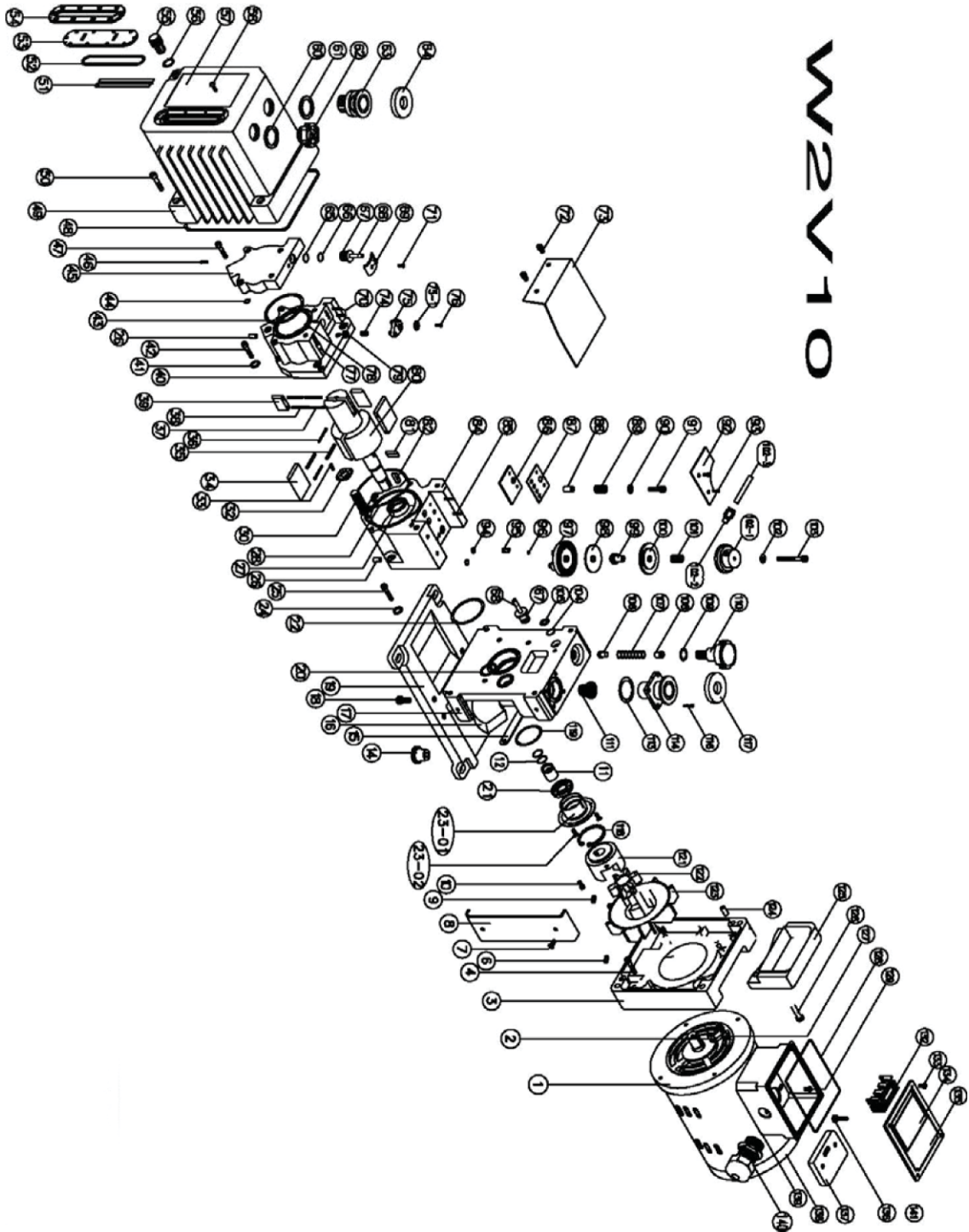


3.2.3 W2V10 SERVICE KIT

CODE #	DESCRIPTION	QTY	REMARKS
W2V0020	O-ring P-20	1	Common*
W2V0021	Oil Seal: dia 22X32X5 (Rubber)	1	Common*
W2V0113	O-ring P30	1	Common*
W2V0086	Valve 36X24X2	1	Common*
W2V0093	O-ring P6	2	Common*
W2V0098	Distributor Valve dia45X2	1	Common*
W2V0027	Oil Seal: dia 35X25X7 (steel)	1	Common*
W2V0028	O-ring S-80	1	Common*
W2V0022	O-ring G45(small)	1	Common*
W2V0079	2nd Stage Valve dia 11.5X7	1	Common*
W2V0043	O-ring G45(small)	1	Common*
W2V0044	O-ring P-6	1	Common*
W2V0048	O-ring AN-166 D-Type	1	Common*
W2V0104	O-ring AN-109	1	Common*
W2V0016	Oil Suction Felt	1	Common*
W2V0052	O-ring S75	1	Common*
Total (minor kit)			
W2V0081	Oil Pump Blade	1	Major Only
W2V0036	1st Stage Spring Guide dia 1.8x26	2	Major Only
W2V0035	1st Stage Blade Spring dia 0.5x2.9x33	2	Major Only
W2V0034	1st Stage Blade 25x32x6	2	Major Only
W2V0037	2nd Stage Blade Spring Guide dia 1.8x26	2	Major Only
W2V0038	2nd Stage Blade Spring dia 0.5x2.9x30	2	Major Only
W2V0039	2nd Stage Blade 22x21.5x6	2	Major Only
W2V0074	2nd Valve Spring dia 0.5x7.2x17	1	Major Only
Total (major kit)			

*Major and Minor

3.2.4 W2V10 EXPLODED VIEWS

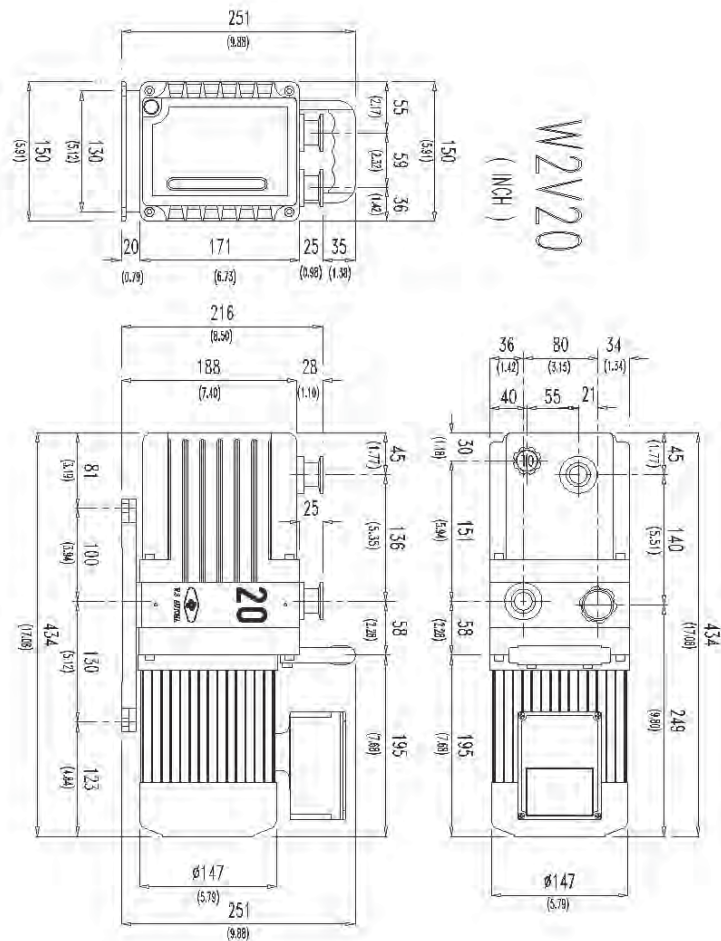


W2V10

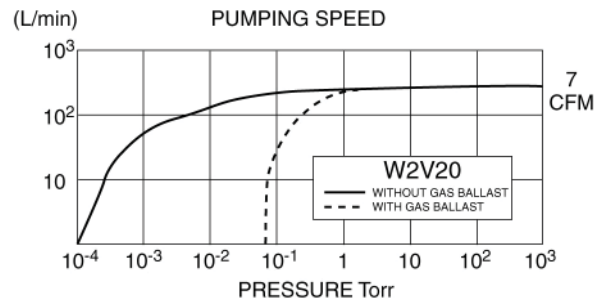
3.3 W2V20 SPECIFICATIONS

COMPONENT	DESCRIPTION
Pumping Speed @ 60 Hz	200 l/m, 7 cfm, 12 m ³ /hr
Pumping Speed @ 50 Hz	166 l/m, 5.8 cfm, 10 m ³ /hr
Ultimate Pressure (Gas Ballast Open)	5 x 10 ⁻² Torr
Ultimate Pressure (Gas Ballast Closed)	5 x 10 ⁻³ Torr
Standard Motor, CE Marked	115V, 1 HP, 60 Hz, On/Off Switch
Power Connection	6 ft (2 m) 3 conductor cord
Motor Speed @ 60 Hz	1700 rpm
Oil Capacity	500 cc (.53 quart)
Weight	Net 50 lbs, shipping 54 lbs
Intake/Exhaust type/diameter	NW 25 (26 mm) O.D. tube
Ambient Operating Temperature	70° to 40° C (45° to 104° F)

3.3.1 W2V20 DIMENSIONS



3.3.2 W2V20 PUMP CURVE

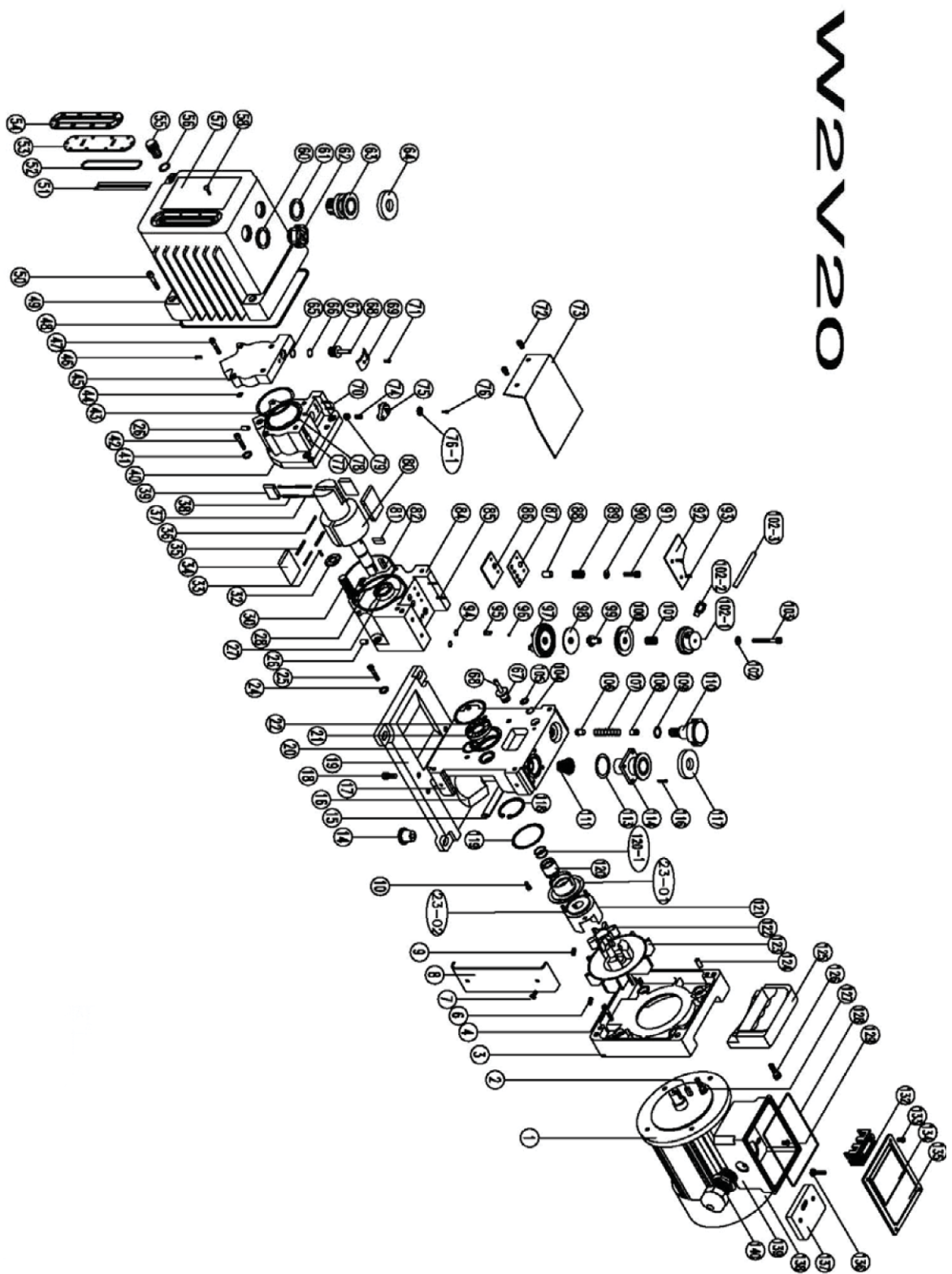


3.3.3 W2V20 SERVICE KIT

CODE #	DESCRIPTION	QTY	REMARKS
W2V0020	O-ring P-20	1	Common*
W2V0021	Oil Seal: dia 22X32X5 (Rubber)	1	Common*
W2V0113	O-ring P30 1	1	Common*
W2V0086	Valve 36X24X2	1	Common*
W2V0093	O-ring P6	2	Common*
W2V0098	Distributor Valve dia45X2	1	Common*
W2V0027	Oil Seal: dia 35X25X7 (steel)	1	Common*
W2V0028	O-ring S-80	1	Common*
W2V0022	O-ring G45(small)	1	Common*
W2V0079	2nd Stage Valve dia 11.5X7	1	Common*
W2V0043	O-ring G45(small)	1	Common*
W2V0044	O-ring P-6	1	Common*
W2V0048	O-ring AN-109	1	Common*
W2V0104	O-ring AN-109	1	Common*
W2V0016	Oil Suction Felt	1	Common*
W2V0052	O-ring S75	1	Common*
Total (minor kit)			
W2V0036	1st Stage Spring Guide dia 1.8x26	2	Major Only
W2V0035	1st Stage Blade Spring dia 0.5x2.9x33	2	Major Only
W2V0034	1st Stage Blade 25x32x6	2	Major Only
W2V0037	2nd Stage Blade Spring Guide dia 1.8x26	2	Major Only
W2V0038	2nd Stage Blade Spring dia 0.5x2.9x30	2	Major Only
W2V0039	2nd Stage Blade 22x21.5x6	2	Major Only
W2V0074	2nd Valve Spring dia 0.5x7.2x17	2	Major Only
Total (major kit)			

*Major and Minor

3.3.4 W2V20 EXPLODED VIEWS

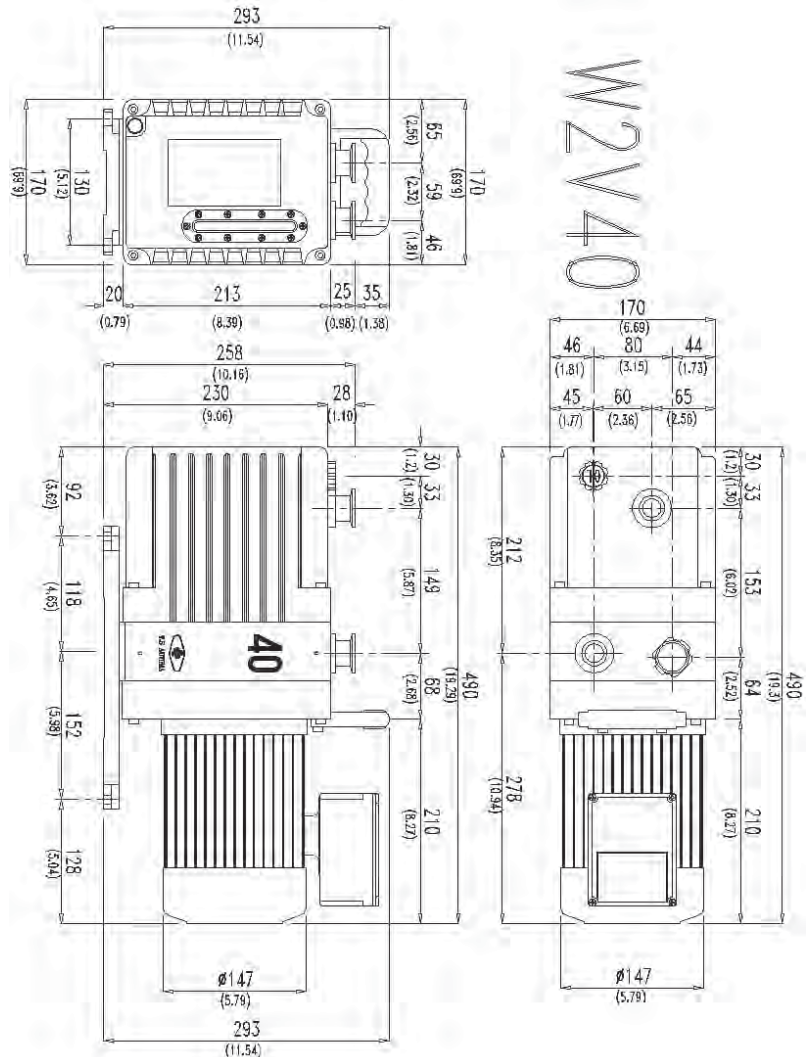


W2V20

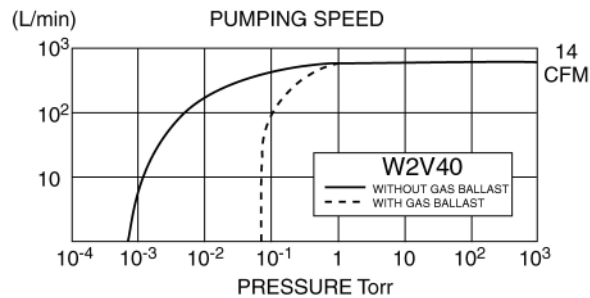
3.4 W2V40 SPECIFICATIONS

COMPONENT	DESCRIPTION
Pumping Speed @ 60 Hz	400 l/m, 14 cfm, 24 m ³ /hr
Pumping Speed @ 50 Hz	333 l/m, 11.6 cfm, 20 m ³ /hr
Ultimate Pressure (Gas Ballast Open)	5 x 10 ⁻² Torr
Ultimate Pressure (Gas Ballast Closed)	5 x 10 ⁻³ Torr
Standard Motor, CE Marked	115V, 1 HP, 60 Hz, On/Off Switch
Power Connection	Junction Box
Motor Speed @ 60 Hz	1700 rpm
Oil Capacity	1500 cc (1.5 quart)
Weight	Net 70 lbs, shipping 75 lbs
Intake/Exhaust type/diameter	NW 25 (26 mm) O.D. tube
Ambient Operating Temperature	70° to 40° C (45° to 104° F)

3.4.1 W2V40 DIMENSIONS



3.4.2 W2V40 PUMP CURVE

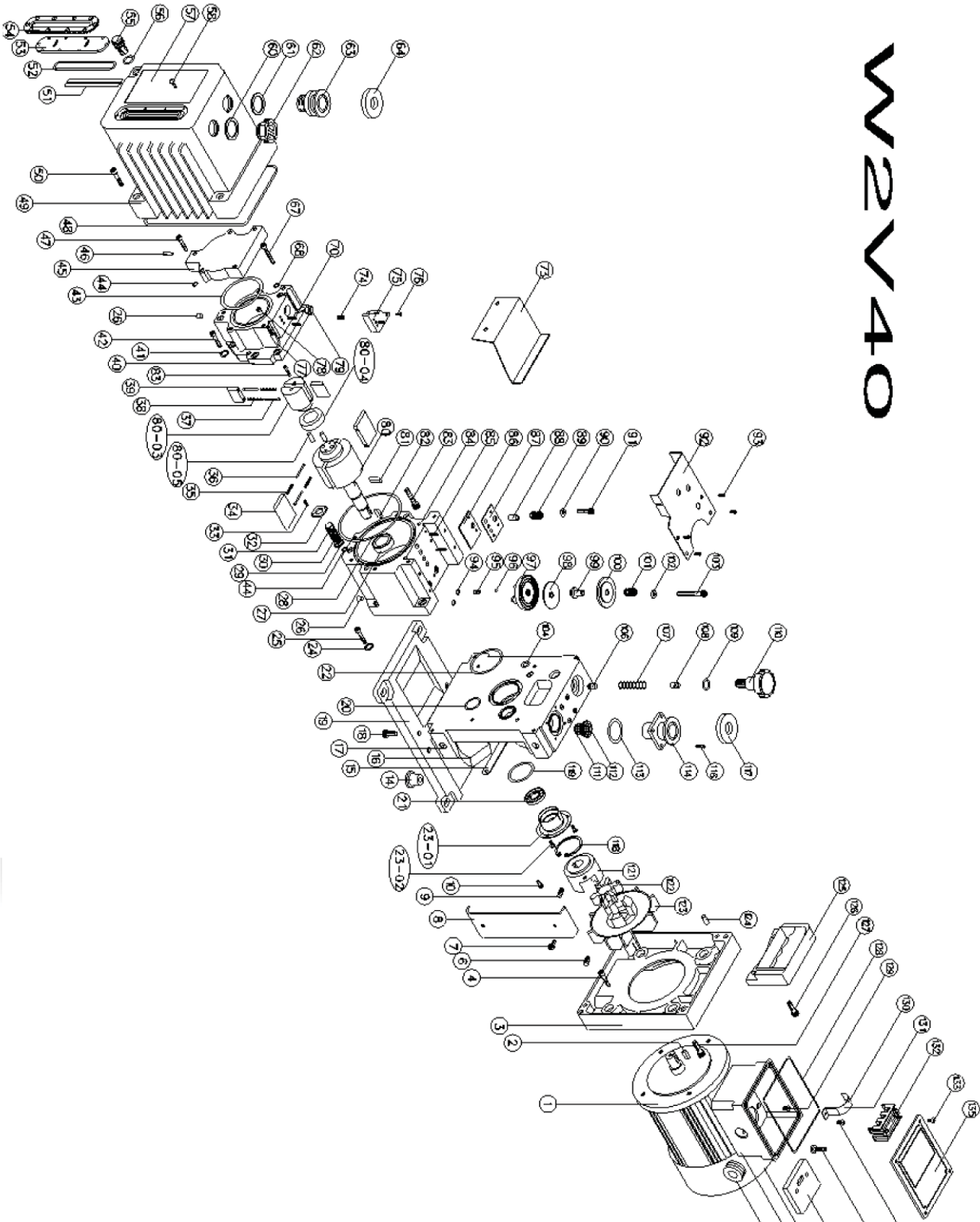


3.4.3 W2V40 SERVICE KIT

CODE #	DESCRIPTION	QTY	REMARKS
W2V0020	O-ring G-45	1	Common*
W4V0022	Oil Seal (Viton)	1	Common*
W2V0021	Oil Seal (Iron)	1	Common*
W4V0027	O-ring S-95	1	Common*
W4V0028	O-ring G-70	1	Common*
W4V0043	O-ring P-6	1	Common*
W4V0044	O-ring AN-170	1	Common*
W4V0048	O-ring P-5	1	Common*
W4V0068	1st Stage Valve	1	Common*
W4V0086	2nd Stage Valve 14.5X7	1	Common*
W4V0079	Distributor Valve dia 45X2	1	Common*
W4V0098	O-ring P-6	1	Common*
W4V0094	O-ring P-6	2	Common*
W4V0104	Oil Suction Felt	1	Common*
W4V0016	O-ring S-75	1	Common*
W4V0052	O-ring G-45	1	Common*
Total (minor kit)			
W4V0034	1st Stage Blade 55X38X6t	2	Major Only
W4V0035	1st Stage Blade Spring 0.5X2.5X3.5X45	2	Major Only
W4V0036	1st Stage Spring Guide 2.2X3.5X32	2	Major Only
W4V0037	2nd Blade Spring Guide 2.2X3.5X32	2	Major Only
W4V0038	2nd Stage Blade Spring 0.5X2.5X3.5X45	2	Major Only
W4V0039	2nd Stage Blade 40X30.5X6t	2	Major Only
W4V0074	2nd Valve Spring 0.6X7.2X17	1	Major Only
W4V0081	Oil Pump Blade 6X6X21	1	Major Only
Total (major kit)			

*Major and Minor

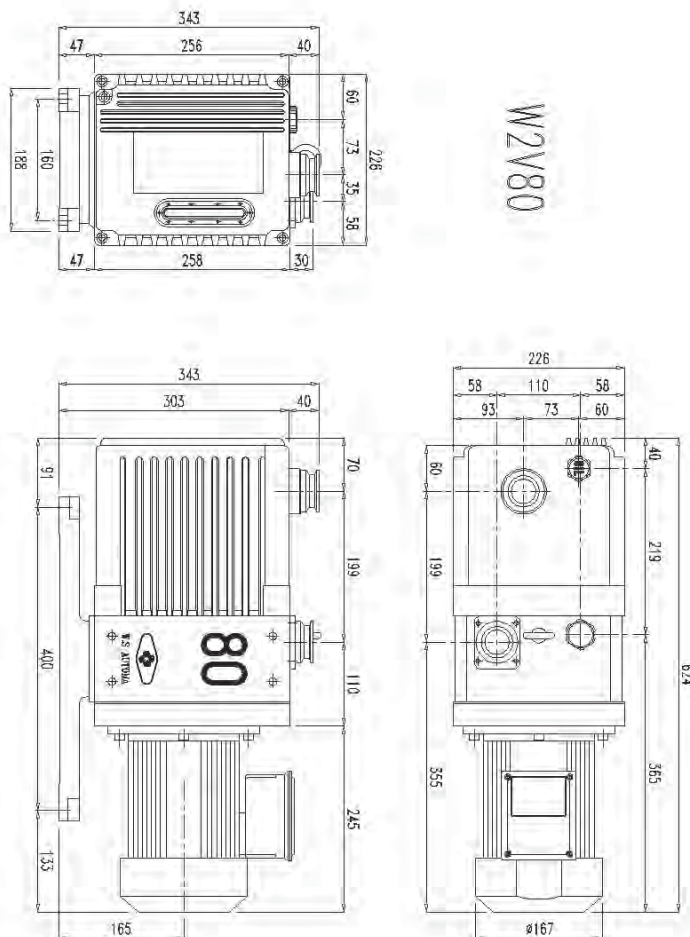
3.4.4 W2V40 EXPLODED VIEWS



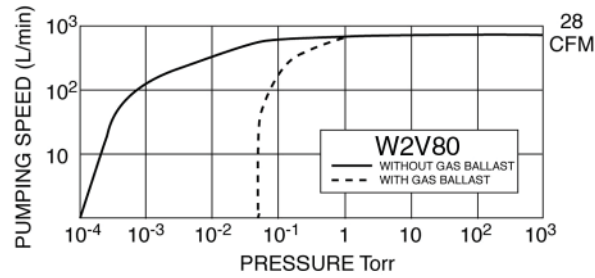
3.5 W2V80 SPECIFICATIONS

COMPONENT	DESCRIPTION
Pumping Speed @ 60 Hz	800 l/m, 28 cfm, 48 m ³ /hr
Pumping Speed @ 50 Hz	666 l/m, 23 cfm, 40 m ³ /hr
Ultimate Pressure (Gas Ballast Open)	5 x 10 ⁻² Torr
Ultimate Pressure (Gas Ballast Closed)	5 x 10 ⁻³ Torr
Standard Motor, CE Marked	Three phase, 230/460V, 2 HP, 50/60 Hz
Power Connection	Junction Box
Motor Speed @ 60 Hz	1700 rpm
Oil Capacity	2300 cc (2.4 quart)
Weight	Net 117 lbs, shipping 133 lbs
Intake/Exhaust type/diameter	NW 40 O.D. tube
Ambient Operating Temperature	70° to 40° C (45° to 104° F)

3.5.1 W2V80 DIMENSIONS



3.5.2 W2V80 PUMP CURVE

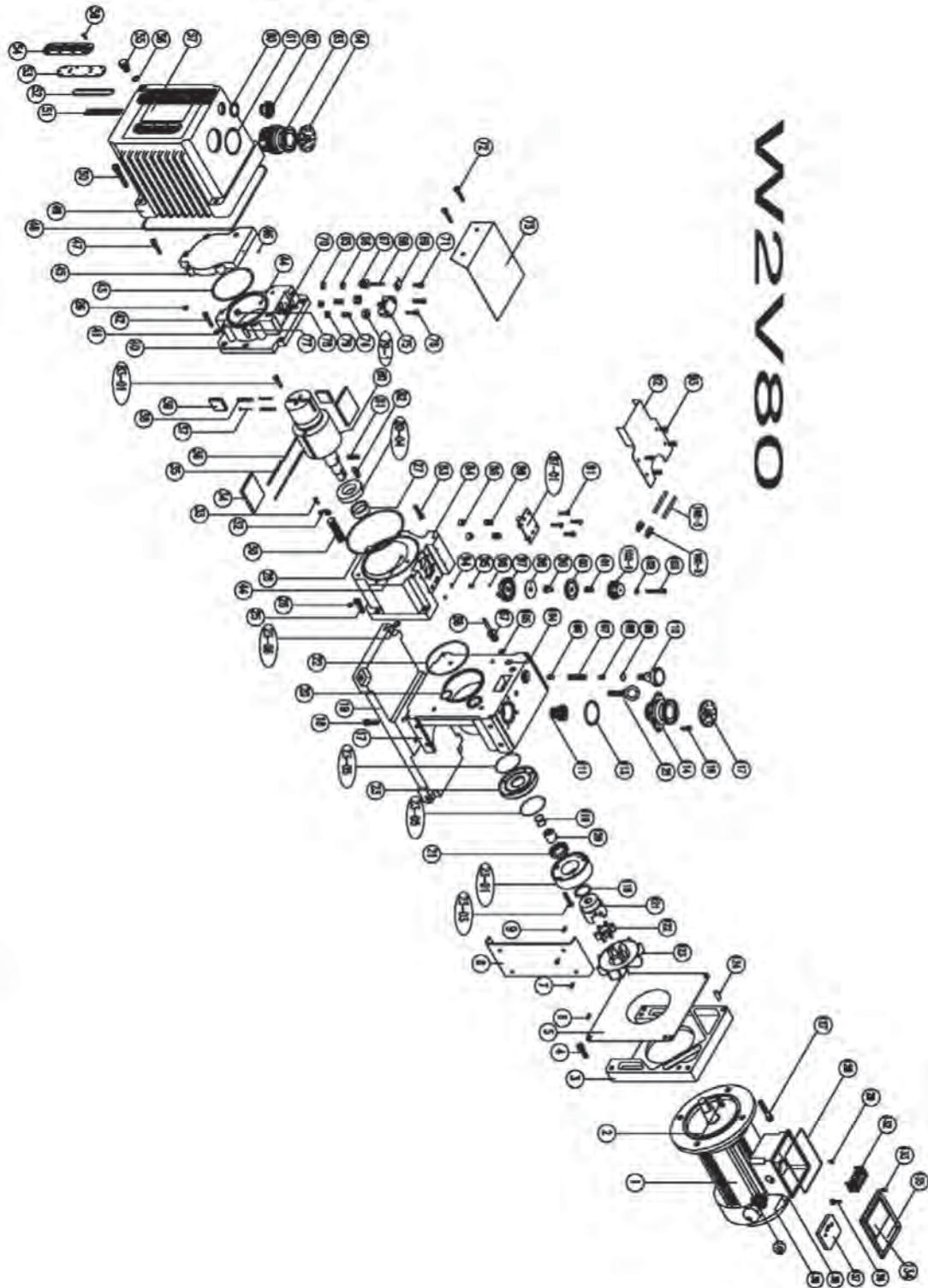


3.5.3 W2V80 SERVICE KIT

CODE #	DESCRIPTION	QTY	REMARKS
W2V0020	O-ring P-20	1	Common*
W2V0021	Oil Seal: dia 22X32X5 (rubber)	1	Common*
W2V0113	O-ring P30	1	Common*
W2V0086	Valve 36X24X2	1	Common*
W2V0093	O-ring P6	2	Common*
W2V0098	Distributor Valve dia45X2	1	Common*
W2V0027	Oil Seal: dia 35X25X7 (steel)	1	Common*
W2V0028	O-ring S-80	1	Common*
W2V0022	O-ring G45(small)	1	Common*
W2V0079	2nd Stage Valve dia 11.5X7	1	Common*
W2V0043	O-ring G45(small)	1	Common*
W2V0044	O-ring P-6	1	Common*
W2V0048	O-ring AN-166 D-Type	1	Common*
W2V0104	O-ring AN-109	1	Common*
W2V0016	Oil Suction Felt	1	Common*
W2V0052	O-ring S75	1	Common*
Total (minor kit)			
W2V0081	Oil Pump Blade	1	Major Only
W2V0036	1st Stage Spring Guide dia 1.8X26	2	Major Only
W2V0035	1st Stage Blade Spring dia 0.5X2.9X33	2	Major Only
W2V0034	1st Stage Blade 25X32X6	2	Major Only
W2V0037	2nd Stage Blade Spring Guide dia 1.8X26	2	Major Only
W2V0038	2nd Stage Blade Spring dia 0.5X2.9X30	2	Major Only
W2V0039	2nd Stage Blade 22X21.5X6	2	Major Only
W2V0074	2nd Valve Spring dia 0.5X7.2X17	1	Major Only
Total (major kit)			

*Major and Minor

3.5.4 W2V80 EXPLODED VIEWS



4. PREPARATION & INSTALLATION

4.1 RECEIVING

Each rotary vane vacuum pump is inspected and carefully packed prior to shipment. Inspect it after carefully unpacking it. In case of external damage, retain the shipping container and notify the shipping carrier and LACO immediately. The packing materials are designed specifically for the pump, they should always be used when transporting the pump.

Unpack the pump and check for shipping damage as follows:

1. Inspect the outside of the shipping container for shipping damage. If you will be making a damage claim, save the shipping container and packing materials.
2. Unpack the pump.
3. Carefully inspect the pump for damage.
4. If you find any damage, proceed as follows:
 - a. Save the shipping container, packing material, and parts for inspection.
 - b. Notify the carrier that made the delivery within 7 days of delivery.
 - c. File a claim with the carrier.
 - d. Contact LACO Technologies to make arrangements for replacing the damaged part(s).

4.2 REPORTING SHIPPING SHORTAGE

If you did not receive all the goods that you ordered, do the following:

1. Check the number of items listed on the packing slip. If the number of pieces listed is greater than the number of shipping containers received, contact the carrier concerning the missing piece.
2. Check the packing list to see if the missing item(s) are on back order.
3. Carefully check the packing material and container to ensure the missing item(s) were not overlooked.
4. If you cannot find the item(s), please notify LACO Technologies immediately

4.3 REPORTING INCORRECT SHIPMENT

If the item received is not the item ordered, contact LACO Technologies immediately.

4.4 INITIAL FILLING WITH VACUUM PUMP FLUID

All our rotary vane vacuum pumps are shipped with a full change of vacuum pump fluid. Always be sure that the oil level is approximately in the middle of the low and high level marks in the sight glass and please note that upon start up of the pump, the oil level in the sight glass will drop slightly.

4.5 CONNECTING THE PUMP TO THE SYSTEM

Clamps and centering rings are supplied for the intake and exhaust ports of the pump.



CAUTION Do not connect power to your pump until the blank-off plate is removed from the exhaust port. Operating the pump with the blank-off in place will damage the pump and can injure the operator.

All connections must be vacuum tight for your pump to achieve its ultimate pressure. The O-ring on the centering ring must be clean to avoid leaks. Be sure that all quick release clamps are in place and properly tightened.

Connect The Pump To The System As Follows:

1. Set the pump on an even horizontal surface. It need not be permanently mounted on the surface.



CAUTION Failure to remove the exhaust port cover before starting the pump could result in damage to the pump.

WARNING Ensure that your vacuum line is connected to the pump's intake port and not to the exhaust port. If your vacuum line has a closed valve, accidentally connecting it to the pumps exhaust port causes a dangerous overpressure.

NOTE Ideally, the inside diameter of the vacuum line should be the same size or larger than the (ID) of the intake port. If the vacuum line is too narrow, it will reduce the pumping speed.

WARNING Do not install an exhaust line with a smaller ID than the exhaust port. Restrictions reduce the pumping speed and could damage the oil seals or cause dangerous overpressure in the pump.

2. If possible, install the exhaust line at a slightly descending angle to prevent condensate from flowing back into the pump and contaminating the pump's vacuum fluid.
3. If the exhaust line must be installed in the ascending position and the process gas contains high levels of condensable vapors, connect a condensate trap to the exhaust port. Condensate traps serve to collect the condensates from saturated vapors. Contact LACO Technologies for more information on the correct trap for your pump.
4. If no exhaust line is connected and your pump will be running above 1 Torr inlet pressure, connect an exhaust mist eliminator to the exhaust port to remove pump fluid vapors and smoke. Contact LACO Technologies for more information on exhaust mist eliminators.
5. If the exhaust line is attached to a negative pressure exhaust system, adjust the negative pressure so that the vacuum pump fluid will not be drawn from the pump.

5. BASIC OPERATION



5.1 START UP

Before starting the pump, please complete the following checklist:

CAUTION Do not connect power to your pump until the blank off plate is removed from the exhaust port. Operating the pump with the exhaust port blanked off will damage the pump and can injure the operator.

1. Be sure that the pump is filled with the appropriate amount of vacuum fluid.
2. Be sure that all electrical connections have been properly wired and that there are no bare wires that could cause an electrical shock or fire.
3. Be sure that the rotation of the pump is correct. You will find a rotational arrow on the front of the motor.
4. Be sure that all system connections have been secured with the appropriate seal rings and clamps.

WARNING If your pump has been prepared for oxygen service, check if an explosion-proof motor is required.

5.2 OPERATION

1. These vacuum pumps are not designed for use in corrosive service. When pumping hazardous or corrosive passes, we recommend the use of an inlet vacuum trap. In addition a pump specially prepared for perfluoropolyether vacuum fluid is required when pumping highly reactive or extremely corrosive gas. Contact us for recommendations.
2. Periodically check the vacuum fluid level in the sight glass to be sure it is between the low and high levels. If you are operating the pump with the gas ballast open, it will be necessary to check the oil level more frequently.
3. If the vacuum fluid within the pump becomes discolored or contaminated, change the fluid as soon as possible. Operating the pump with contaminated or dirty oil will greatly reduce the life expectancy of the pump and may lead to the cancellation of the warranty.

5.3 ANTISUCKBACK

If the pump stops with the inlet under vacuum the antisuckback system will stop air or oil leakage inside the module or into the vacuum chamber. The vacuum integrity is guaranteed by:

- Quality of machining from surfaces between the functional elements (stator, plates, housing, etc.).
- The exhaust valves on the exhaust orifice.
- A spring valve automatically closes the oil injection canal in the pump. When the pump stops, the oil pump exhaust pressure is decreased and a spring activated valve closes the oil injection canal.

5.4 GAS BALLAST

When condensable vapors (such as water vapor) are being pumped the gas is compressed beyond its saturated pressure and can condense, impairing pump performance. The vapor pressure of water at typical pump temperatures is over 100 Torr. Even small amounts of water in the pump fluid will have a big effect on pump performance. The gas ballast control button allows a quantity of air to be injected into the second stage of the pump during "compression" to reduce the partial pressure of the pumped gas below its saturated vapor pressure and thus prevent condensation. At the end of "compression" the pressure in the discharge chamber is greater than atmospheric. The saturated vapor pressure of pump fluid and the condensed vapors such as water is higher when it is hot than when it is cold; therefore it is necessary to wait until the pump reaches its operating temperature before pumping condensable vapor. Using the gas ballast increases the ultimate pressure the pump can achieve.

6. MAINTENANCE

6.1 PREVENTATIVE MAINTENANCE

6.1.1 PUMP FLUID

Every vacuum pump is designed to work best with a specific pump fluid and the fluid is an active part of the pumping mechanism. For best performance, care must be used to select fluid with the physical and chemical properties engineered for the pump. For LACO pumps the ideal fluid for general purpose pumping is LACO's LVO19 vacuum fluid. This is a moderately priced fluid that is engineered to give the best vacuum and longest life in LACO pumps. Other fluids may give good performance but our specifications are based on regular use of LVO19 vacuum fluid.

WARNING If the pump has been used on corrosive, toxic or volatile chemicals, observe proper safety precautions before removing the drain plug.



CAUTION Hydrocarbon pump fluid should be changed at the following times:

1. After a 100 hour break-in period of pump operation.
2. When the pump fluid becomes contaminated or is discolored.
3. When condensation in the pump fluid is present.
4. Before and after the pump has been stored for a long period of time.
5. Perfluoropolyether fluid should be reconditioned when it becomes contaminated.

NOTE Always change the pump fluid while the pump is warm to prevent condensable vapors, such as water, from remaining in the pump.

6.1.2 CHANGING THE PUMP FLUID

1. Turn the pump off and drain the fluid from the pump. Use your fingers to remove the oil fill cap and the oil drain plug from the pump; allow the fluid to drain into a suitable container. If the fluid fill cap or fluid drain cap cannot be loosened with your fingers, cover them with a cloth and use pliers.
2. After the oil flow diminishes, switch ON the pump, and allow it to run for about 10 seconds and then switch it OFF.
3. If the fluid drained from the pump is discolored, contains particulate, has a foul odor or is very dirty, flush out the pump using the procedure below until the drained fluid is clean. If your pump requires more than 2 flushes, a foreline trap or oil filtration unit should be installed on the

pump. Contact our company for more information on foreline traps and oil filtration units.

- a. Reinstall the fluid-drain plug with flat gasket into the fluid-drain port.
 - b. Refill the pump with LVOFF vacuum pump fluid until the fluid level is visible in the lower rim of the fluid sight glass.
 - c. Blank off/on valve off the inlet port.
 - d. Turn **ON** the pump and allow it to run for about 10 minutes.
 - e. Turn the pump **OFF** and refer to step 1 to drain the vacuum fluid.
4. Charge the pump with fluid as follows:
- a. Reinstall the fluid-drain plug with flat gasket into the fluid port.
 - b. Remove the fluid-fill cap and fill the pump to capacity with LVO10 vacuum pump fluid. Using other than LVO19 vacuum pump fluid may result in damage to the pump or compromise the pump performance and lifetime.
 - c. Reinstall the fluid-fill cap with flat gasket.

6.2 LONG TERM STORAGE (2 WEEKS OR LONGER)

Before placing a pump in long term storage, follow the procedure below:

1. Drain all fluids from the pump as described in the previous section.
2. Refill the pump with clean LVO19 or LVOFF vacuum fluid as described in the section for changing the pump fluid.
3. Always cover both the intake and exhaust ports with caps to keep any dust or foreign materials from entering the pump. Place pump in original container if available.
4. Be sure that the pump is stored in a horizontal position with the intake and exhaust ports facing up.
5. When putting a pump into storage, put a pin hole in both the intake and exhaust port caps.

6.3 AVOIDING OIL LEAKS DURING SHIPPING AND STORAGE

Always drain your vacuum pump of all fluids before shipping. Failure to do so can result in damaged shipping containers and delays by freight carriers due to possibility of the presence of hazardous materials in the event of a spill.

7. TROUBLE-SHOOTING

SYMPTOM	CHECK	SOLUTION
Noisy motor, will not turn	Power line voltage and connections	Correct voltage or connections
	Any foreign materials inside the pump	Remove the foreign materials. If problem is with oil, change oil.
	Motor (open internal circuit)	Replace open windings.
Noisy and hot pump	Any foreign materials inside the exhaust valve.	Remove foreign materials.
	Power line voltage and connections	Fix the leakage
	If leakage, valve is open.	.Close the valve.
	All the valves in the vacuum line.	Close if found open
Vacuum level declines	Oil level	Add oil.
	Leakage on the device connected.	Close the intake and recheck.
	Moisture content of oil.	Change oil.
	Oil regulator.	Replace.
	If gas ballast is open.	C lose the gas ballast.
Motor runs, but not pump.	Worn out coupling mechanism.	Replace coupling.
	Worn out key between motor and pump.	Replace the key and the set screws.