

# SERVICE AND OPERATING MANUAL



## Model W09

2" Non-Clog Wastewater

Air-Operated Double Diaphragm Pump



Flap Valve Type 1

### PLEASE NOTE!

The photos shown in this manual are for general instruction only. Your specific model may not be shown. Always refer to the parts list and exploded view drawing for your specific model when installing, disassembling or servicing your pump.

### PRINCIPLE OF PUMP OPERATION

This flap swing check valve pump is powered by compressed air and is a 1:1 pressure ratio design. It alternately pressurizes the inner side of one diaphragm chamber, while simultaneously exhausting the other inner chamber. This causes the diaphragms, which are connected by a common rod, to move endwise. Air pressure is applied over the entire surface of the diaphragm, while liquid is discharged from the opposite side. The diaphragm operates under a balanced condition during the discharge stroke, which allows the unit to be operated at discharge heads over 200 feet (61 meters) of water head.

Since the diaphragms are connected by a common rod, secured by plates to the center of the diaphragms, one diaphragm performs the discharge stroke, while the other is pulled to perform the suction stroke in the opposite chamber.

For maximum diaphragm life, keep the pump as close to the liquid being pumped as possible. Positive suction head in excess of 10 feet of liquid (3.048 meters) may require a back pressure regulating device. This will maximize diaphragm life.

Alternate pressuring and exhausting of the diaphragm chamber is performed by means of an externally mounted, pilot operated, four-way spool type air distribution valve. When the spool shifts to one end of the valve body, inlet air pressure is applied to one diaphragm chamber and the other diaphragm chamber exhausts. When the spool shifts to the opposite end of the valve body, the porting of chambers is reversed. The air distribution valve spool is moved by an internal pilot valve which alternately pressurizes one side of the air distribution valve spool, while exhausting the other side. The pilot valve is shifted at each end of the diaphragm stroke by the diaphragm plate coming in contact with the end of the pilot valve spool. This pushes it into position for shifting of the air distribution valve.

The chambers are manifolded together with a suction and discharge flap-type check valve for each chamber, maintaining flow in one direction through the pump.

### INSTALLATION & START-UP

Locate the pump as close to the product being pumped as possible, keeping suction line length and number of fittings to a minimum. Do not reduce line size.

For installations of rigid piping, short flexible sections of hose should be installed between pump and piping. This reduces vibration and strain to the piping system. A surge suppressor is recommended to further reduce pulsation in flow.

This pump was tested at the factory prior to shipment and is ready for operation. It is completely self-priming from a dry start for suction lifts of 20 feet (6.096 meters) or less. For suction lifts exceeding 20 feet of liquid, fill the chambers with liquid prior to priming.

### AIR SUPPLY

Air supply pressures cannot exceed 125 psi (8.61 bar). Connect the pump air inlet to an air supply of sufficient capacity and pressure required for desired performance. When the air line is solid piping, use a short length of flexible hose (not less than 3/4" (19mm) in diameter) between pump and piping to eliminate strain to pipes.



#### IMPORTANT

*Read these safety warnings and instructions in this manual completely, before installation and start-up of the pump. It is the responsibility of the purchaser to retain this manual for reference. Failure to comply with the recommendations stated in this manual will damage the pump, and void factory warranty.*



#### WARNING

*Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded.*



#### CAUTION

*Before pump operation, inspect all gasketed fasteners for looseness caused by gasket creep. Re-torque loose fasteners to prevent leakage. Follow recommended torques stated in this manual.*



#### WARNING

*Before doing any maintenance on the pump, be certain all pressure is completely vented from the pump, suction, discharge, piping, and all other openings and connections. Be certain the air supply is locked out or made non-operational, so that it cannot be started while work is being done on the pump. Be certain that approved eye protection and protective clothing are worn all times in the vicinity of the pump. Failure to follow these recommendations may result in serious injury or death.*



#### WARNING

*In the event of diaphragm rupture, pumped material may enter the air end of the pump, and be discharged into the atmosphere. If pumping a product which is hazardous or toxic, the air exhaust must be piped to an appropriate area for safe disposition.*



#### WARNING

*Before maintenance or repair, shut off the compressed air line, bleed the pressure, and disconnect the air line from the pump. The discharge line may be pressurized and must be bled of its pressure.*

## AIR INLET & PRIMING

For start-up, open an air valve approximately  $\frac{1}{2}$ " to  $\frac{3}{4}$ " turn. After the unit primes, an air valve can be opened to increase flow as desired. If opening the valve increases cycling rate, but does not increase flow rate, cavitation has occurred, and the valve should be closed slightly.

For the most efficient use of compressed air and the longest diaphragm life, throttle the air inlet to the lowest cycling rate that does not reduce flow.

## AIR VALVE LUBRICATION

The air end pilot and distribution valves of this pump are designed to operate without lubrication. However, if poor quality compressed air is interfering with valve shifting, lubrication may enhance operation. A small amount of non-detergent lightweight oil (SAE 10 wt. maximum) added at the air inlet port, or the addition of an FRL unit (filter/regulator/lubricator) will help the pump operate. If the air supply is contaminated, dirty, or excessively wet, an air dryer will remove most water and impurities.

## AIR EXHAUST

If a diaphragm fails, the pumped liquid or fumes can enter the air end of the pump, and be exhausted into the atmosphere. When pumping hazardous or toxic materials, pipe the exhaust to an appropriate area for safe disposition.

This pump can be submerged if materials of construction are compatible with the liquid. The air exhaust must be piped above the liquid level. Piping used for the air exhaust must not be smaller than 1" (2.54 cm). Reducing the pipe size will restrict air flow and reduce pump performance. When the product source is at a higher level than the pump (flooded suction), pipe the exhaust higher than the product source to prevent siphoning spills.

Freezing or icing-up of the air exhaust can occur under certain temperature and humidity conditions. Use of an air dryer should eliminate most icing problems.

## BETWEEN USES

When used for materials that tend to settle out or transform to solid form, the pump should be completely flushed after each use, to prevent damage. Product remaining in the pump between uses could dry out or settle out. This could cause problems with valves and diaphragms at re-start. In freezing temperatures, the pump must be drained between uses in all cases.

## CHECK VALVE INSPECTION & CLEAN-OUT

This pump has replaceable flap-type check valves on suction and discharge of both outer chambers. A special wrench (See Figure 1.) is provided with each pump. With it, all fasteners (locking knobs) securing the chambers and valves can be removed. This allows quick and easy access to all four check valves. A standard  $\frac{3}{4}$ " socket wrench can also be used to loosen locking knobs.

This wastewater pump is designed to handle small and large solids, up to nearly inlet size; dry sludge; and stringy materials. Solids may occasionally become lodged between the flap valve and seat. By loosening one locking knob holding the cover plate yoke, the flap valve is accessible to dislodge debris. (See Figure 2.) This also allows the insertion of a water hose to flush the outer chambers. Flush the pump by opening all valve covers (note Caution on Page 1) and allowing water to flow in the top and out the bottom port on each side of the pump.

## CHECK VALVE REPLACEMENT

To replace the check valves, remove the four (4)  $\frac{3}{8}$ " hex nuts. When removed, the flange on the suction side carries the valve and seat as an assembly. On the discharge side, the valve and seat will remain with the diaphragm housing. If parts are being replaced, remove the self-locking nuts to gain access. The large rivet head on the valve faces toward the seat. Replace the hinge pad and retainer if wear is evident. Valves must sit flat against the seat. Adjust the fit by tightening the  $\frac{3}{8}$ " hex nuts.

Use caution when reassembling check valves. The flap valves are designed for some preload over the retainer hinge pad. This is to insure proper face contact with the seat. After all parts are in place, tighten the lock nuts on the assembly. Visual inspection should show the seat and valve face fitting together without a gap. This fit is important for dry priming. Once primed, the valves will function normally under differential pressure.



Figure 1: Loosening locking knobs

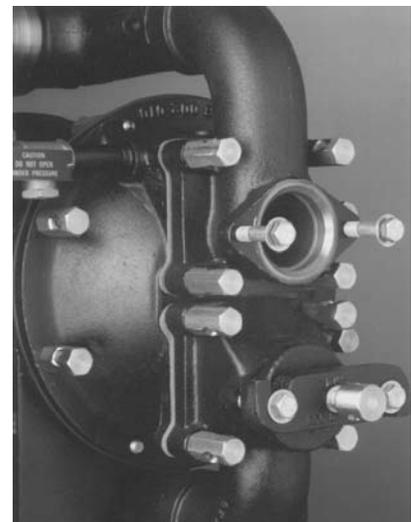


Figure 2: Check valve clean out

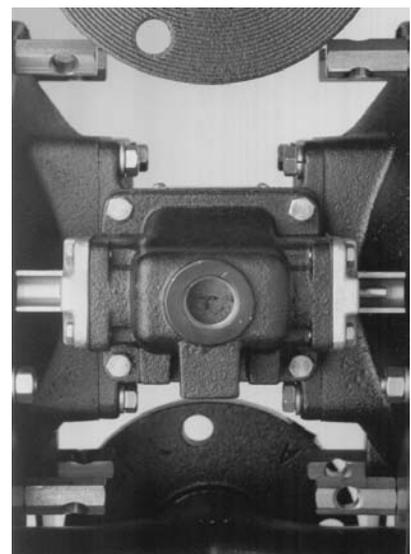


Figure 3: Air distribution valve

## EXTERNALLY SERVICEABLE MAIN AIR DISTRIBUTION VALVE

The sleeve and spool set is located in the valve body, which is held onto the intermediate bracket by four (4) capscrews. Loosening the four (4) hex head capscrews allows the valve body to drop out of place (See Figure 3).

Once the valve body is off the pump, remove the four capscrews on the endcap to inspect the spool and sleeve set. The spool of the air distribution valve is closely sized to the sleeve. The spool must slide freely in the sleeve. Accumulation of dirt and contaminants may prevent the spool from moving freely. It may stick in a position that prevents the pump from cycling.

The plungers (visual stroke indicator) are locked in place on each end of the brass spool. Before removal, mark the spool and the sleeve, so the spool can be reassembled in the same end from which it was removed. A spring will be on one side only, within the spool cavity. The plungers in the spool slide through a brass bushing and o-ring in the cap.

Clean all parts before reassembly. Use a safety solvent and air oil to keep the parts from oxidizing. Any nicks on the spool should be removed with a fine stone or crocus cloth.

When removing the stainless steel sleeve, carefully press it out of the body, preferably using an arbor press. Reinstall it into the body until it bottoms out against the opposite endcap and bumper. Use new o-rings when reinstalling and apply a light coating of grease or O-ring lube before placing in the valve body.

Reinstall the bumper(s), spring, and new gaskets. Tighten the four capscrews to eliminate air leakage. Reinstall the body on the intermediate bracket with new gaskets.

## PILOT VALVE

The pilot valve assembly is accessed by removing the main air distribution valve body from the pump and lifting the pilot valve body out of the intermediate housing.

Most problems with the pilot valve can be corrected by replacing the O-rings. Always grease the spool prior to inserting it into the sleeve. If the sleeve is removed from the body, reinsertion must be at the chamfered side. Grease the o-rings to slide the sleeve into the valve body. Securely insert the retaining ring around the sleeve. When reinserting the pilot valve, push both plungers (located inside the intermediate bracket) out of the path of the pilot valve spool ends to avoid damage.

## PILOT VALVE ACTUATOR

Bushings for the pilot valve actuators are threaded into the intermediate bracket from the outside. The plunger may be removed for inspection or replacement. First remove the air distribution valve body and the pilot valve body from the pump. The plungers can be located by looking into the intermediate. It may be necessary to use a fine piece of wire to pull them out. The bushing can be turned out through the inner chamber by removing the outer chamber assembly. Replace the bushings if pins have bent.

## MANUAL VALVE OVERRIDE

As the pump shifts, the rods from the main air valve move through the endcap. A rod on the manual override (see Figure 4) can be locked to one side. A pin is provided to do so. If the rod is on the left, the left side of the pump is on a discharge stroke. When the pump is cycling, keep fingers away from the override rod and pump casting. A shield is installed in this area for protection.

By locking the air valve to one side, air cannot flow through the pump, and the pump will not shift. Use extreme caution when opening clean-out ports. Vent both air and fluid pressure in the pump and system, prior to opening.

The manual override can also be used to move air through the pump, at low pressures, to clear blockages. Typically, about 15 psi (1 bar) of air is all that can be applied to the pump by manually moving the override rods. The valve override can also be helpful when checking through the troubleshooting points mentioned elsewhere in this manual.



Figure 4: Locking pin

**CAUTION**  
Locking pin must be removed before operation.

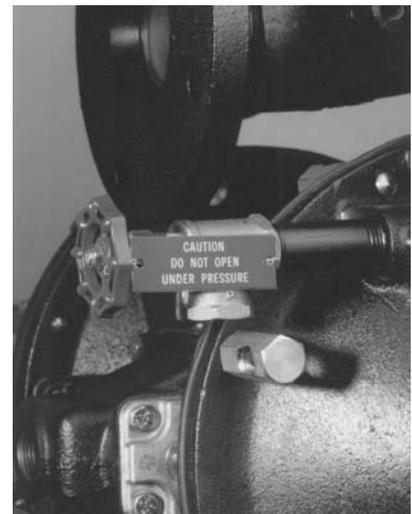


Figure 5: Chamber vent

## TAPPED CHAMBER VENTS

The chamber vent at the top of each outer chamber (see Figure 5) is used to purge any entrapped air that might accumulate in the chamber. Entrapped air could cause unbalanced cycling or loss of prime. The gate valve with 1/2" NPT (12.7mm) threads accommodates a hose or pipe, to vent accumulated air and fluid back to the liquid source. Ends of the hose or pipe must be submerged in the liquid being pumped. Tying the pump sides together into a common hose only moves the air from side to side.

When air is purged, pumped product will discharge from the hose. When this occurs, close the gate valve and continue normal operation. The valves may be left partially open, but pump performance will decrease. The tapped chamber vents can also be used to flush the chambers between uses.

## DIAPHRAGM REPLACEMENT

Diaphragms are in-line accessible for service, without disturbing the suction and discharge flanges. To access the diaphragm, remove the eight (8) locking knobs around the diaphragm chamber. Remove the locking knobs at the manifold elbow connections. The housing assembly will pull off. Diaphragms can now be inspected or replaced. Clear all foreign matter from behind the diaphragm before reassembling.

## REASSEMBLY AFTER SERVICE

To reassemble the pump, begin with the diaphragm assembly. Stack the wear pad onto the stud of the outer plate. Next, put the diaphragm on to the stud, with the natural bulge toward the outer plate. Place the inner plate onto the stud.

Align the five (5) hexhead capscrews and washers through the inner plate, diaphragm and wear pad, into the outer plate (See Figure 6). Tighten the capscrews alternately, side to side and corner to corner, use 242 Loctite and torque to 190 in/lbs. Place the bumper onto the diaphragm rod.

Once the diaphragm assembly is made, thread the stud (from the outer plate side) into the diaphragm rod. Use Neverseize® or equivalent anti-galling thread lubricant on threads. Turn the assembly onto the rod until it bottoms out, and the eight (8) holes around the outside of the diaphragm line up with those on the outer chamber rim (See Figure 7). Back-off tightening as required for alignment. Reassemble the other side of the pump in the same way. Tighten all locking knobs to secure the outer chamber to the inner chamber. Tighten all knobs alternately, side to side and corner to corner.

## WARRANTY

This pump is warranted for a period of five years against defective material and workmanship. Failure to comply with the recommendations stated in this manual voids all factory warranty.



Figure 6: Align hexhead capscrews and tighten



Figure 7: Align diaphragm holes with chamber holes

	<p><b>⚠ WARNING</b></p> <p><i>This pump is pressurized internally with air pressure during operation. Always make certain that all bolting is in good condition and that all of the correct bolting is reinstalled during assembly.</i></p>
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# SERVICE AND OPERATING MANUAL



# Model W09

2" Non-Clog Wastewater  
Air-Operated Double Diaphragm Pump

CE

Flap Valve Type 1

ITEM NO.	PART NUMBER	DESCRIPTION	TOTAL RQD.
1	070-006-170	Bearing, Sleeve	2
2	114-018-010	Bracket, Intermediate	1
3	<b>720-004-360</b>	<b>Seal, U-Cup</b>	<b>2</b>
4	<b>135-016-162</b>	<b>Bushing, Threaded</b>	<b>2</b>
5	<b>620-011-114</b>	<b>Plunger, Actuator</b>	<b>2</b>
6	<b>095-073-000</b>	<b>Pilot Valve Body Assembly<sup>1</sup></b>	<b>1</b>
6-A	<b>095-070-551</b>	<b>Pilot Valve Body</b>	<b>1</b>
6-B	<b>755-025-000</b>	<b>Sleeve (With O-Ring)</b>	<b>1</b>
6-C	<b>560-033-360</b>	<b>O-Ring (Sleeve)</b>	<b>4</b>
6-D	<b>775-026-000</b>	<b>Spool (With O-Ring)</b>	<b>1</b>
6-E	<b>560-023-360</b>	<b>O-Ring (Spool)</b>	<b>2</b>
6-F	<b>675-037-080</b>	<b>Retaining Ring</b>	<b>1</b>
7	<b>360-041-379</b>	<b>Gasket, Valve Body</b>	<b>1</b>
8	<b>560-001-360</b>	<b>O-Ring (Actuator Plunger)</b>	<b>2</b>
9	095-076-010	Body, Valve	1
10	<b>132-014-358</b>	<b>Bumper, Valve Spool</b>	<b>2</b>
11	165-066-010W	Cap, End (Includes Item 55)	2
12	<b>360-048-425</b>	<b>Gasket, Valve Body<sup>2</sup></b>	<b>1</b>
13	<b>360-010-425</b>	<b>Gasket, End Cap</b>	<b>2</b>
14	<b>560-020-360</b>	<b>O-Ring (Sleeve O.D.)</b>	<b>6</b>
15	<b>031-066-000</b>	<b>Sleeve &amp; Spool Set</b>	<b>1</b>
16	170-032-115	Capscrew, Hex Head	8
17	170-045-115	Capscrew, Hex Head	4
18	115-121-080	Mounting Foot, Left Hand	2
19	<b>132-025-000</b>	<b>Bumper, Diaphragm</b>	<b>2</b>
20	196-132-010	Chamber, Inner	2
21	196-131-010	Chamber, Outer	2
22	<b>286-060-365</b>	<b>Diaphragm</b>	<b>2</b>
	<b>286-060-360</b>	<b>Diaphragm</b>	<b>2</b>
	<b>286-060-354</b>	<b>Diaphragm</b>	<b>2</b>
23	<b>560-022-360</b>	<b>O-Ring (Intermediate)</b>	<b>2</b>
24	612-138-010	Plate, Diaphragm (Outer)	2
25	685-007-120	Rod, Diaphragm	1
27	170-024-115	Capscrew, Hex Head (Intermediate)	8
28	807-080-330	Stud (Outer Plate)	2
29	115-122-080	Mounting Foot, Right Hand	2
30	<b>170-053-115</b>	<b>Hex Head Capscrew (Diaphr. Plate)</b>	<b>10</b>
31	115-124-080	Mounting Foot	2
32	807-079-115	Stud, Inner (Chamber)	4
33	900-001-115	Washer, Lock (Inner/Outer Plate)	10
34	612-136-010	Plate, Diaphragm (Inner)	2
35	312-089-010	Elbow, Suction	2
36	312-091-010	Elbow, Discharge	2
37	<b>338-010-357</b>	<b>Flap Valve</b>	<b>4</b>
	338-005-365	Flap Valve	4

Repair Parts shown in **bold face (darker)** type are more likely to need replacement after extended periods of normal use. They are readily available from most SANDPIPER distributors. The pump owner may prefer to maintain a limited inventory of these parts in his own stock to reduce repair downtime to a minimum.

**IMPORTANT:** When ordering repair parts always furnish pump model number, serial number and type number.

### MATERIAL CODES

#### The Last 3 Digits of Part Number

000...	Assembly sub assembly; and some purchased items
010...	Cast Iron
015...	Ductile Iron
080...	Carbon Steel AISI B-1112
100...	Alloy 20
110...	Alloy Type 316 Stainless Steel
112...	Alloy C
114...	303 Stainless Steel
115...	301/302/304 Stainless Steel
120...	416 Stainless Steel (Wrought Martensitic)
148...	Hardcoat Anodized Aluminum
150...	6061-T6 Aluminum
151...	6063-T6 Aluminum
154...	Almag 35 Aluminum
155 or 156...	356-T6 Aluminum
157...	Die Cast Aluminum Alloy #380
159...	Anodized Aluminum
162...	Brass Yellow Screw Machine Stock
170...	Bronze Bearing Type Oil Impregnated
180...	Copper Alloy
330...	Plated Steel
331...	Chrome Plated Steel
332...	Electroless Nickel Plated
335...	Galvanized Steel
356...	Hytrel
357...	Urethane
360...	Nitrile Rubber Color coded: RED
363...	FKM (Fluorocarbon) Color coded: YELLOW
364...	E.P.D.M Rubber Color coded: BLUE
365...	Neoprene Rubber Color coded: GREEN
366...	Food Grade Nitrile Color coded: WHITE
375...	Fluorinated Nitrile
379...	Conductive Nitrile
405...	Cellulose Fibre
408...	Cork and Neoprene
425...	Compressed Fibre
440...	Vegetable Fibre
500...	Delrin 500
501...	Delrin 570
520...	Injection Molded PVDF Natural Color
541...	Nylon, glass filled
542...	Nylon, unfilled
550...	Polypropylene
551...	Polypropylene, glass filled
552...	Polypropylene, unfilled
555...	PVC (Polyvinyl Chloride)
580...	Ryton
600...	PTFE (virgin material) Tetrafluoroethylene (TFE)
603...	Blue Gylon
604...	PTFE - Diaphragm
606...	PTFE
610...	PTFE Encapsulated Silicon
611...	PTFE Encapsulated Viton

*continued next page*

<sup>1</sup>Pilot Valve Body Assembly available in kit form. Order 031-064-000 which includes items 5,7,8 & 12.

<sup>2</sup>Use gasket adhesive during assembly.

ITEM NO.	PART NUMBER	DESCRIPTION	TOTAL RQD.
	338-005-360	Flap Valve	4
	338-010-354	Flap Valve	4
40	518-113-010	Manifold, Discharge & Suction	2
41	980-004-115	Yoke, Handle	4
<b>42</b>	<b>570-001-365</b>	<b>Pad, Hinge - Flap Valve</b>	<b>4</b>
		<b>(Not used with Santoprene)</b>	
	<b>570-001-364</b>	<b>Pad, Hinge - Flap Valve</b>	<b>4</b>
		<b>(Not used with Santoprene)</b>	
	<b>570-001-360</b>	<b>Pad, Hinge - Flap Valve</b>	<b>4</b>
		<b>(Not used with Santoprene)</b>	
<b>43</b>	<b>670-044-110</b>	<b>Retainer, Flap Valve</b>	<b>4</b>
<b>44</b>	<b>675-013-365</b>	<b>Ring, Sealing</b>	<b>4</b>
	<b>675-013-364</b>	<b>Ring, Sealing</b>	<b>4</b>
	675-013-360	Ring, Sealing	4
<b>45</b>	<b>722-071-360</b>	<b>Seat, Flap Valve</b>	<b>4</b>
	722-071-363	Seat, Flap Valve	4
	722-071-364	Seat, Flap Valve	4
46	807-016-115	Stud, Outer (Chamber)	20
47	807-018-110	Stud (Flap Retaining)	8
48	538-080-115	Pipe Nipple (Shut-Off Valve)	2
49	893-013-162	Shut-Off Valve	2
49A	405-008-000	Valve Handle	2
50	545-007-115	Nut, Hex (Chamber at Feet)	8
51	900-006-115	Washer, Lock	20
<b>52</b>	<b>547-002-110</b>	<b>Nut, Stop</b>	<b>8</b>
53	542-015-115	Stud Nut Assembly	4
54	530-008-000	Muffler, Exhaust	1
<b>55</b>	<b>560-023-360</b>	<b>O-Ring (Spool Pin)</b>	<b>2</b>
56	538-082-335	Pipe Nipple	2
57A	334-095-010	Flange (W09-2 Only)	2
57B	334-094-010	Flange (W09-3 Only)	2
58	570-014-371	Wear pad	2
59	170-058-115	Capscrew, Hex Head (Mounting Feet)	4
60	210-008-330	Safety Clip	1
61	170-031-115	Hex Head Capscrew (Elbows)	8
62	901-035-115	Washer, Flat	4
		(in place of hinge pad - for use w/Santoprene only)	
64	478-007-115	Locking Knob	24
65	560-012-360	O-Ring (Clean-Out)	4
66	165-063-010	Clean-Out Cap	4
67	200-054-015	Clean-Out Clamp Assembly	4
68	542-014-115	Stud Nut Assembly	8
Not Shown:			
	535-069-000	Name Plate	1
	705-001-330	Drive Screw	2
	535-037-000	Caution Plate	4
	930-009-115	Handle Wrench	1
	031-067-010	Main Air Valve Assembly	1
		(Includes Items 9,10,11,13,14,15, 16,60)	
	705-001-330	Drive Screw (Cleanout Clamp)	2

Repair Parts shown in **bold face (darker)** type are more likely to need replacement after extended periods of normal use. They are readily available from most Pulsafeeder distributors. The pump owner may prefer to maintain a limited inventory of these parts in his own stock to reduce repair downtime to a minimum.

**IMPORTANT:** When ordering repair parts always furnish pump model number, serial number and type number.

Delrin, Viton and Hytel are registered tradenames of E.I. DuPont.

Gylon is a registered tradename of Garlock, Inc.

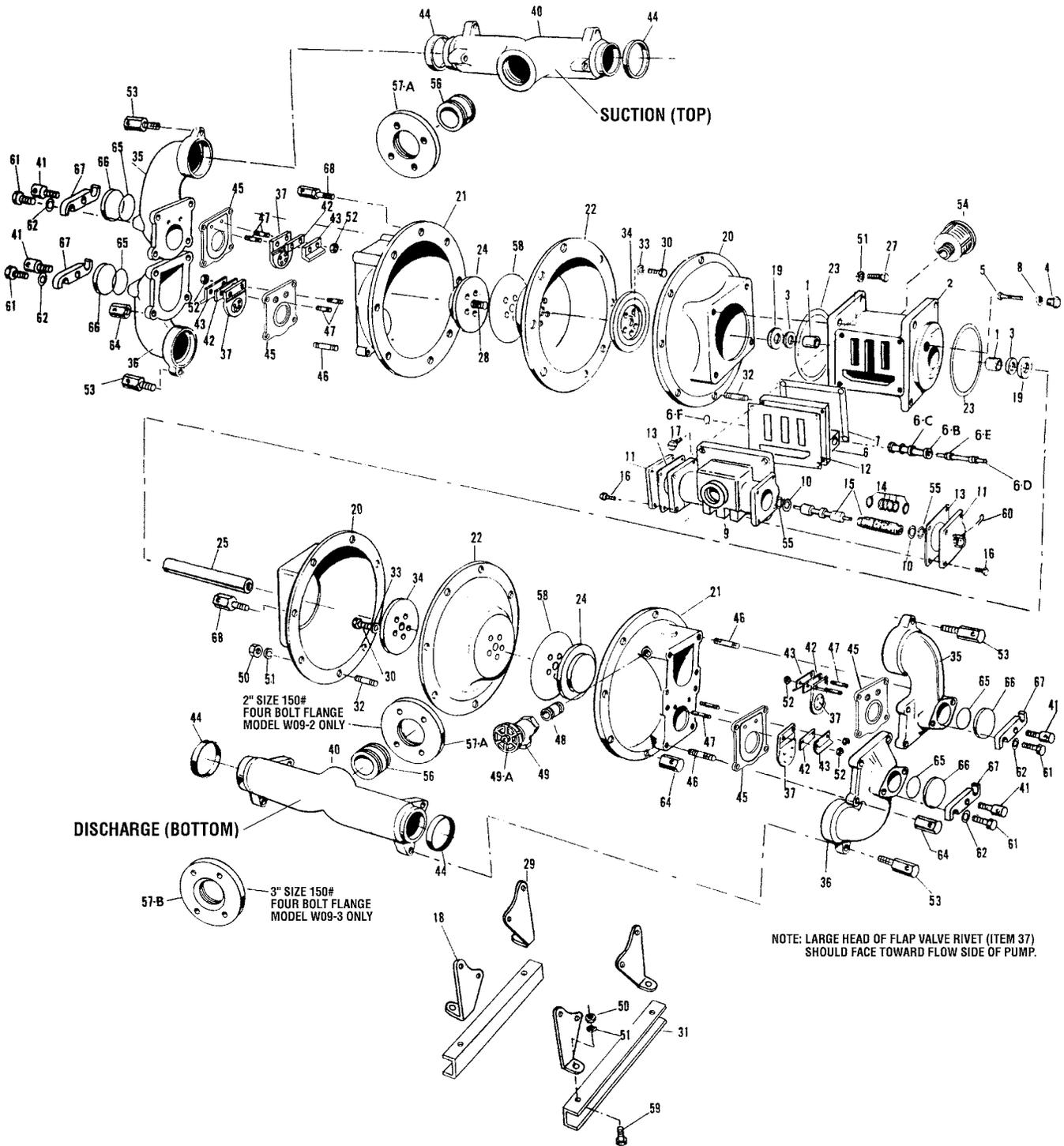
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Kynar® is a registered tradename of ATOFINA Chemicals, Inc.



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Specifications are subject to improvement without notice

2" Non-Clog Wastewater Model W09

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# **WARREN RUPP, INC.®**

## **Declaration of Conformity**

**Manufacturer:**

**Warren Rupp, Inc.®, 800 N. Main Street, P.O. Box 1568,  
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certifies that Air-Operated Double Diaphragm Pump Series: HDB, HDF, M Non-Metallic, S Non-Metallic, M Metallic, S Metallic, T Series, G Series, RS Series U Series, EH and SH High Pressure, W Series, SMA and SPA Submersibles, and Tranquilizer Surge Suppressors comply with the European Community Directive 2006/42/EC on Machinery, according to Annex VIII. This product has used Harmonized Standard EN 809, Pumps and Pump Units for Liquids - Common Safety Requirements, to verify conformance.

David Roseberry  
Signature of authorized person

October 20, 2005  
Date of issue

David Roseberry  
Printed name of authorized person

Engineering Manager  
Title

Revision Level: E

MAY 27, 2010  
Date of revision

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