

**WARREN
RUPP®**

IDEX
FLUID & METERING

SANDPIPER®
A WARREN RUPP PUMP BRAND



CE
I M2 c T5
II 2GD T5

SERVICE AND OPERATING MANUAL

Model HDB1½-A Type 6
Model HDB40-A Type 6

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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 ball type 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. Do not install on suction head in excess of 10 feet of liquid (3.048 meters). Consult factory if conditions exceed this recommendation.

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 spool. This pushes it into position for shifting of the air distribution valve.

The chambers are manifolded together with a suction and discharge 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 Warren Rupp Tranquilizer® surge suppressor is recommended to further reduce pulsation in flow. Tighten all gaskets prior to start-up.

This pump was tested at the factory prior to shipment and is ready for operation.

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 ¾" (19mm) in diameter] between pump and piping to eliminate strain to pipes.

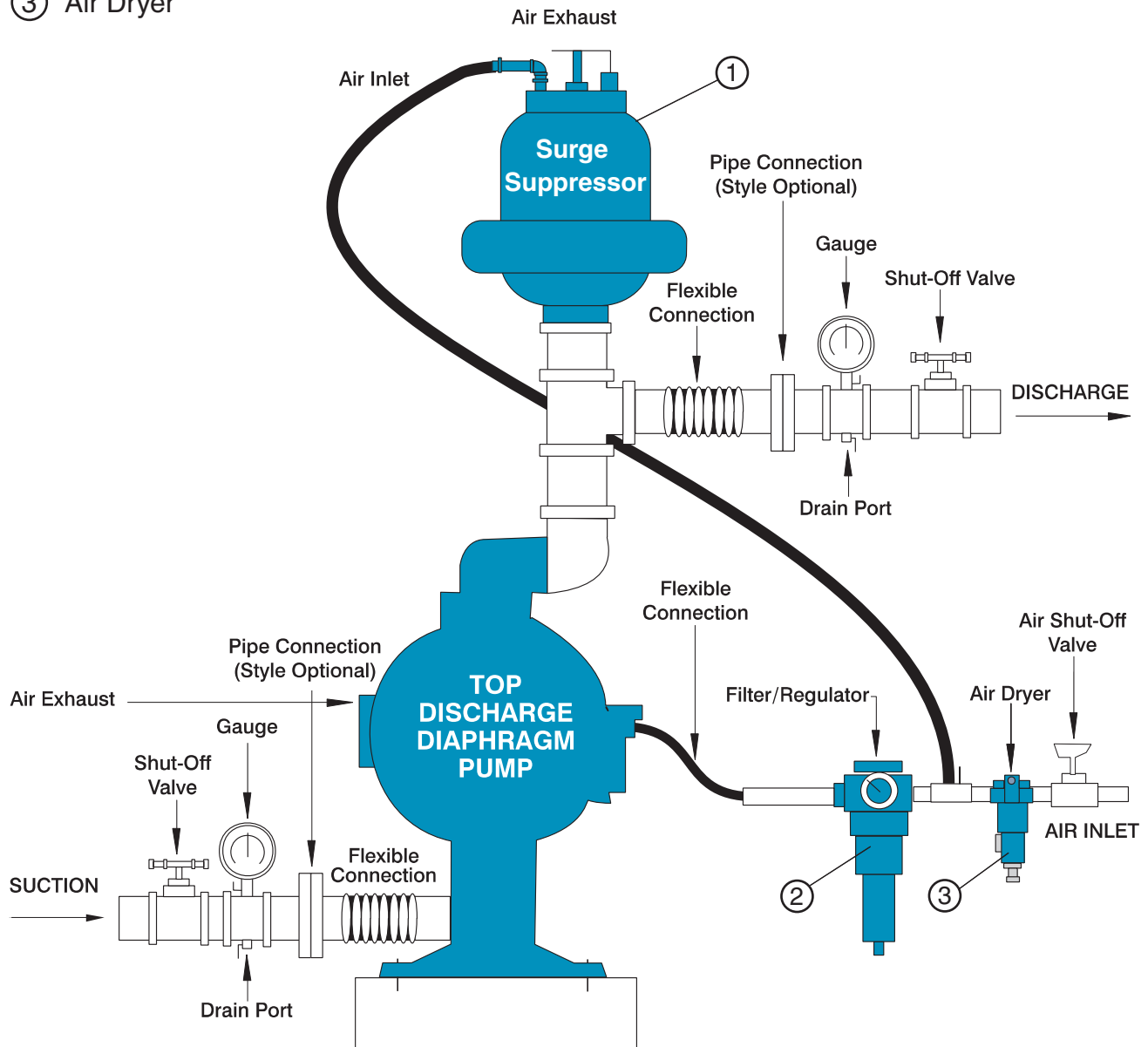
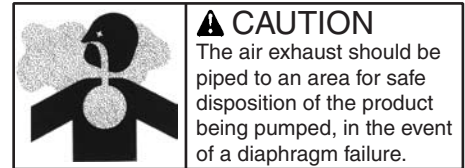
⚠ WARNING ⚠

HAZARD WARNING -POSSIBLE EXPLOSION HAZARD can result if 1,1,1-Trichloroethane, Methylene Chloride or other Halogenated Hydrocarbon solvents are used in pressurized fluid systems having Aluminum or Galvanized wetted parts. Death, serious bodily injury and/or property damage could result. Consult with the factory if you have questions concerning Halogenated Hydrocarbon solvents.

INSTALLATION GUIDE Top Discharge Ball or Flap Valve Unit

Available from
Warren Rupp

- ① Tranquilizer®/Surge Suppressor
- ② Filter/Regulator
- ③ Air Dryer



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 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 unit 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 SERVICING

For best priming and most efficient pumping performance, it is important to maintain check valves and valve seats in good condition for proper sealing. Need for inspection or service of ball valves is usually indicated by poor priming, unstable cycling, reduced performance, or pump cycles but will not pump.

Inspection and service of check valves requires the removal of six bolts which provide access to all four ball valves and both, suction and discharge, valve seats. New ball check valves are $2\frac{1}{4}$ " (5.715 cm) diameter and will require replacement when worn to approximately 2" (5.08 cm) diameter.

DIAPHRAGM SERVICING

Need for inspection, or service, of diaphragm is usually indicated when unit pumps from one chamber only and air is discharged out pump discharge port or when liquid being pumped is discharged through air exhaust port. To service diaphragms, remove V-Band clamp (no. 15) and two hex nuts (no. 29) which secure chamber port to manifold. To remove diaphragms, loosen diaphragm assembly (outer plate no. 20, diaphragm no. 21, inner plate no. 19) by turning out of the shaft using a wrench. A 1" (2.54 cm) square lug is provided on the outer plate (no. 20) for this purpose. Removal of opposite outer chamber will permit removal of second diaphragm assembly and shaft as a unit. To disassemble the diaphragm assemblies, clamp the inner diaphragm plate (no. 19) around the outer diameter between jaws of a vise to hold it while you turn the outer diaphragm plate (no. 20) loose using a wrench. Interior components consisting of shaft seals and sleeve bearings are now accessible for service if required.

REASSEMBLY

All procedures for reassembling the diaphragms are just in reverse of previous instructions for disassembly. The diaphragms are to be installed with their natural bulge outward or toward the outer diaphragm plate (no. 20). Make sure the inner plate is installed with the flat face against the diaphragm.

After all components are in position in vise and hand tight, tighten with wrench to approximately 40 ft. lbs. (54.23 Newton meters) torque. After each diaphragm assembly has been made, thread one assembly into shaft (no. 16) (hold shaft near middle in vise having soft jaws to protect finish). Install this sub assembly into pump and secure by placing the outer chamber (no. 22) on the end with the diaphragm. This will hold the

assembly in place while the opposite side is installed. Make sure the last diaphragm assembly is torqued to 30 ft. lbs. (40.67 Newton meters). This final torquing will lock the diaphragm assemblies together. Place remaining outer chamber on open end and secure. Snug flange bolts of chamber to port manifold to square the flanges before the final tightening of the V-Band clamps. Tighten flange bolts securely after tightening V-Band clamp. **IMPORTANT: Do not tighten the V-Band clamp without loosening manifold flange bolts at outer chamber ports. The chamber flange may be broken this way.**

⚠ IMPORTANT ⚠
Do not tighten the V-Band clamp without loosening manifold flange bolts at outer chamber ports. The chamber flange may be broken this way.

A Note about Air Valve Lubrication

The SANDPIPER pump's pilot valve and main air valve assemblies are designed to operate WITHOUT lubrication. This is the preferred mode of operation. There may be instances of personal preference, or poor quality air supplies when lubrication of the compressed air supply is required. The pump air system will operate with properly lubricated compressed air supplies. Proper lubrication of the compressed air supply would entail the use of an air line lubricator (available from Warren Rupp) set to deliver one drop of 10 wt., non-detergent oil for every 20 SCFM of air the pump consumed at its point of operation. Consult the pump's published Performance Curve to determine this.

It is important to remember to inspect the sleeve and spool set routinely. It should move back and forth freely. This is most important when the air supply is lubricated. If a lubricator is used, oil accumulation will, over time, collect any debris from the compressed air. This can prevent the pump from operating properly.

Water in the compressed air supply can create problems such as icing or freezing of the exhaust air causing the pump to cycle erratically, or stop operating. This can be addressed by using a point of use air dryer to supplement a plant's air drying equipment. This device will remove excess water from the compressed air supply and alleviate the icing or freezing problem.

ESADS: Externally Serviceable Air Distribution System

Please refer to the exploded view drawing and parts list in the Service Manual supplied with your pump. If you need replacement or additional copies, contact your local Warren Rupp Distributor, or the Warren Rupp factory Literature Department at the number shown below. To receive the correct manual, you must specify the MODEL and TYPE information found on the name plate of the pump.

Models with 1" suction/discharge or larger, and METAL center sections:

The main air valve sleeve and spool set is located in the valve body mounted on the pump with four hex head capscrews. The valve body assembly is removed from the pump by removing these four hex head capscrews.

With the valve body assembly off the pump, access to the sleeve and spool set is made by removing four hex head capscrews (each end) on the end caps of the valve body assembly. With the end caps removed, slide the spool back and forth in the sleeve. The spool is closely sized to the sleeve and must move freely to allow for proper pump operation. An accumulation of oil, dirt or other contaminants from the pump's air supply, or from a failed diaphragm, may prevent the spool from moving freely. This can cause the spool to stick in a position that prevents the pump from operating. If this is the case, the sleeve and spool set should be removed from the valve body for cleaning and further inspection.

Remove the spool from the sleeve. Using an arbor press or bench vise (with an improvised mandrel), press the sleeve from the valve body. Take care not to damage the sleeve. At this point, inspect the o-rings on the sleeve for nicks, tears or abrasions. Damage of this sort could happen during assembly or servicing. A sheared or cut o-ring can allow the pump's compressed air supply to leak or bypass within the air valve assembly, causing the pump to leak compressed air from the pump air exhaust or not cycle properly. This is most noticeable at pump dead head or high discharge pressure conditions. Replace any of these o-rings as required or set up a routine, preventive maintenance schedule to do so on a regular basis. This practice should include cleaning the spool and sleeve components with a safety solvent or equivalent, inspecting for signs of wear or damage, and replacing worn components.

To re-install the sleeve and spool set, lightly lubricate the o-rings on the sleeve with an o-ring assembly lubricant or lightweight oil (such as 10 wt. air line lubricant). Re-install one end cap, gasket and bumper on the valve body. Using the arbor press or bench vise that was used in disassembly, carefully press the sleeve back into the valve body, without shearing the o-rings. You may have to clean the surfaces of the valve body where the end caps mount. Material may remain from the old gasket. Old material not cleaned from this area may cause air leakage after reassembly. Take care that the bumper stays in place allowing the sleeve to press in all the way. Re-install the spool, the opposite end cap, gasket and bumper on the valve body. After inspecting and cleaning the gasket surfaces on the valve body and intermediate, re-install the valve body on the pump using new gaskets. Tighten the four hex head capscrews evenly and in an alternating cross pattern.

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 (see #40 on drawing), located inside the intermediate bracket, out of the path of the pilot valve spool ends to avoid damage.

PILOT VALVE ACTUATOR

The bushings (no. 37) for the pilot valve actuators threaded into the intermediate bracket (no. 17) from the outside. The plunger (no. 40) may be removed for inspection or replacement from the inside by removing the air distribution valve body (no. 5) and the pilot valve body (no. 34) from the pump. The plungers (no. 40) should be visible as you look down into the intermediate from the top. Depending on their position, you may find it necessary to use a fine piece of wire to pull them out.

Under rare circumstances, it may become necessary to replace the o-ring seal (no. 41). If it cannot be removed in much the same manner as the plunger (no. 40), the bushing (no. 37) can be turned out through the inner chamber (no. 12) by removing the manifold assembly (no. 31) and the outer chamber (no. 22) to reach the bushing (no. 37).

TROUBLESHOOTING

PROBLEM: Pump cycles but will not pump. (Note: higher suction lifts require faster cycling speed for priming.)

POSSIBLE CAUSES:

- A. Air leak in suction line.
- B. Excessive suction lift.
- C. Check valve not seating properly.
- D. Leakage at joint of suction manifold or elbow flange.
- E. Suction line or strainer plugged.
- F. Diaphragm ruptured.

PROBLEM: Pump will not cycle. (Note: Always disconnect air supply to relieve air pressure before disassembling any portion of pump.)

POSSIBLE CAUSES:

- A. Discharge hose or line plugged, or discharge head requirement greater than air supply pressure. (Disconnect discharge line to check.)
- B. Spool in air distribution valve not shifting. (Remove end cap and check spool — must slide freely.)
- C. Diaphragm ruptured. (Air will escape out discharge line in this case.)
- D. Blockage in diaphragm chamber preventing movement. (Shut off air supply and reopen after pressure is relieved.)
- E. Muffler clogged.

PROBLEM: Uneven discharge flow. (Indicates one chamber not operating properly.)

POSSIBLE CAUSES:

- A. Check valve not sealing properly in one chamber.
- B. Diaphragm failure in one chamber.
- C. Air leak at suction manifold joint or elbow flange one side.
- D. Muffler clogged.

For additional information, see the Warren Rupp Troubleshooting Guide.

WARRANTY:

This unit is guaranteed for a period of five years against defective material and workmanship.

RECOMMENDED WARREN RUPP ACCESSORIES TO MAXIMIZE PUMP PERFORMANCE:

- **Tranquilizer® Surge Suppressor:** For nearly pulse-free flow.
- **Warren Rupp Filter/Regulator:** For modular installation and service convenience.
- **Warren Rupp Speed Control:** For manual or programmable process control. Manual adjustment or 4-20mA reception.

*For more detailed information on these accessories,
contact your local Warren Rupp Factory-Authorized Distributor,
or Warren Rupp corporate headquarters.*

IMPORTANT SAFETY INFORMATION



! 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.



! CAUTION

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




! 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.




! 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

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. (See page 32)




! WARNING

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.



! WARNING

When used for toxic or aggressive fluids, the pump should always be flushed clean prior to disassembly.



! 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

Airborne particles and loud noise hazards. Wear ear and eye protection.

RECYCLING

Many components of SANDPIPER® AODD pumps are made of recyclable materials (see chart on page 9 for material specifications). We encourage pump users to recycle worn out parts and pumps whenever possible, after any hazardous pumped fluids are thoroughly flushed.

Pump complies with EN809 Pumping Directive, Directive 98/37/EC Safety of Machinery, and Directive 94/9/EC, EN13463-1 Equipment for use in Potentially Explosive Environments. For reference to the directive certificates visit: www.warrenrupp.com. The Technical File No. AX1 is stored at KEMA, Notified Body 0344, under Document #203040000.



Grounding The Pump

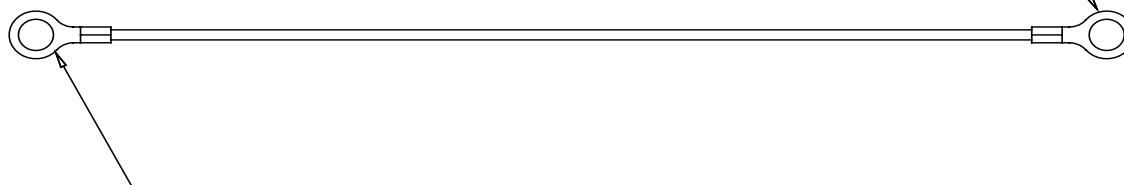


WARNING

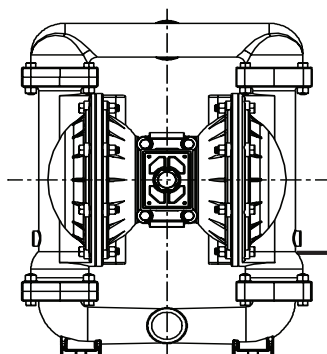


Take action to prevent static sparking. Fire or explosion can result, especially when handling flammable liquids. The pump, piping, valves, containers or other miscellaneous equipment must be grounded.

The clamp end is installed to a true earth ground.



The eyelet end is fastened to the pump hardware.



This 8 foot long (244 centimeters) Ground Strap, part number 920-025-000 can be ordered as a service item.

To reduce the risk of static electrical sparking, this pump must be grounded. Check the local electrical code for detailed grounding instruction and the type of equipment required, or in the absence of local codes, an industry or nationally recognized code having jurisdiction over specific installations.

MATERIAL CODES THE LAST 3 DIGITS OF PART NUMBER

000	Assembly, sub-assembly; and some purchased items	342	Filled Nylon	580	Ryton
010	Cast Iron	351	Food Grade Santoprene	590	Valox
012	Powered Metal	353	Geolast; Color: Black	591	Nylatron G-S
015	Ductile Iron	354	Injection Molded #203-40 Santoprene- Duro 40D +/-5; Color: RED	592	Nylatron NSB
020	Ferritic Malleable Iron			600	PTFE (virgin material) Tetrafluorocarbon (TFE)
025	Music Wire	355	Thermal Plastic	601	PTFE (Bronze and moly filled)
080	Carbon Steel, AISI B-1112	356	Hytrell	602	Filled PTFE
100	Alloy 20	357	Injection Molded Polyurethane	603	Blue Gylon
110	Alloy Type 316 Stainless Steel	358	Urethane Rubber (Some Applications) (Compression Mold)	604	PTFE
111	Alloy Type 316 Stainless Steel (Electro Polished)			606	PTFE
112	Alloy C	359	Urethane Rubber	607	Envelon
113	Alloy Type 316 Stainless Steel (Hand Polished)	360	Nitrile Rubber Color coded: RED	608	Conductive PTFE
114	303 Stainless Steel	361	Nitrile	610	PTFE Encapsulated Silicon
115	302/304 Stainless Steel	363	FKM (Fluorocarbon). Color coded: YELLOW	611	PTFE Encapsulated FKM
117	440-C Stainless Steel (Martensitic)	364	E.P.D.M. Rubber. Color coded: BLUE	632	Neoprene/Hytrel
120	416 Stainless Steel (Wrought Martensitic)	365	Neoprene Rubber. Color coded: GREEN	633	FKM/PTFE
123	410 Stainless Steel (Wrought Martensitic)	366	Food Grade Nitrile	634	EPDM/PTFE
148	Hardcoat Anodized Aluminum	368	Food Grade EPDM	635	Neoprene/PTFE
149	2024-T4 Aluminum	370	Butyl Rubber Color coded: BROWN	637	PTFE , FKM/PTFE
150	6061-T6 Aluminum			638	PTFE , Hytrel/PTFE
151	6063-T6 Aluminum	371	Philthane (Tuftane)	639	Nitrile/TFE
152	2024-T4 Aluminum (2023-T351)	374	Carboxylated Nitrile	643	Santoprene®/EPDM
154	Almag 35 Aluminum	375	Fluorinated Nitrile	644	Santoprene®/PTFE
155	356-T6 Aluminum	378	High Density Polypropylene	656	Santoprene Diaphragm and Check Balls/EPDM Seats
156	356-T6 Aluminum	379	Conductive Nitrile	661	EPDM/Santoprene
157	Die Cast Aluminum Alloy #380	405	Cellulose Fibre	666	FDA Nitrile Diaphragm, PTFE Overlay, Balls, and Seals
158	Aluminum Alloy SR-319	408	Cork and Neoprene	668	PTFE, FDA Santoprene/PTFE
159	Anodized Aluminum	425	Compressed Fibre		
162	Brass, Yellow, Screw Machine Stock	426	Blue Gard		
165	Cast Bronze, 85-5-5-5	440	Vegetable Fibre		
166	Bronze, SAE 660	465	Fibre		
170	Bronze, Bearing Type, Oil Impregnated	500	Delrin 500		
175	Die Cast Zinc	501	Delrin 570		
180	Copper Alloy	502	Conductive Acetal, ESD-800		
305	Carbon Steel, Black Epoxy Coated	503	Conductive Acetal, Glass-Filled		
306	Carbon Steel, Black PTFE Coated	505	Acrylic Resin Plastic		
307	Aluminum, Black Epoxy Coated	506	Delrin 150		
308	Stainless Steel, Black PTFE Coated	520	Injection Molded PVDF Natural color		
309	Aluminum, Black PTFE Coated	540	Nylon		
310	PVDF Coated	541	Nylon		
313	Aluminum, White Epoxy Coated	542	Nylon		
330	Zinc Plated Steel	544	Nylon Injection Molded		
331	Chrome Plated Steel	550	Polyethylene		
332	Aluminum, Electroless Nickel Plated	551	Glass Filled Polypropylene		
333	Carbon Steel, Electroless Nickel Plated	552	Unfilled Polypropylene		
335	Galvanized Steel	553	Unfilled Polypropylene		
336	Zinc Plated Yellow Brass	555	Polyvinyl Chloride		
337	Silver Plated Steel	556	Black Vinyl		
340	Nickel Plated	558	Conductive HDPE		
		570	Rulon II		

Delrin and Hytrel are registered
tradenames of E.I. DuPont.

Gylon is a registered tradename
of Garlock, Inc.

Nylatron is a registered tradename
of Polymer Corp.

Santoprene is a registered tradename
of Monsanto Corp.

Rulon II is a registered tradename
of Dixon Industries Corp.

Ryton is a registered tradename
of Phillips Chemical Co.

Valox is a registered tradename
of General Electric Co.

PortaPump, Tranquilizer and SludgeMaster
are registered tradenames
of Warren Rupp, Inc.

**WARREN
RUPP®**

IDEX
FLUID & METERING

Declaration of Conformity

Warren Rupp, Inc., 800 North Main Street, Mansfield, Ohio, certifies that Air-Operated Double Diaphragm Metallic Pumps Series: HDB, HDF, M Non-Metallic, S Non-Metallic, M Metallic, S Metallic, Containment Duty, Gas, UL, High Pressure, W, Submersible and Tranquilizers comply with the European Community Directive 98/37/EC, Safety of Machinery. This product has used EN 809, Pumps and Pump Units for Liquids - Common Safety Requirements harmonized standard 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

CE

ITEM NO.	PART NUMBER	DESCRIPTION	TOTAL RQD.
2	165.011.157.	Cap, End	2
	165.011.010.	Cap, End	2
3	170.032.330.	Capscrew, Hex Head	8
4	132.014.358.	Bumper, Valve	2
5	095.043.156.	Body, Valve	1
	095.043.010.	Body, Valve	1
6	360.010.425.	Gasket, End Cap²	2
7	530.036.000.	Muffler, Exhaust	1
8	560.020.360.	O-Ring²	6
9	031.012.000.	Sleeve & Spool Set²	1
10	360.048.425.	Gasket, Valve Body²	1
11	360.041.379.	Gasket, Valve Body²	1
12	196.025.157.	Chamber, Inner	2
	196.025.010.	Chamber, Inner	2
13	070.006.170.	Bearing, Sleeve	2
14	720.004.360.	Seal, U-Cup²	2
15	200.009.330.	Clamp, V-Band	2
15-1	475.028.000.	Service Kit	2
16	685.007.120.	Rod, Diaphragm	1
17	114.002.156.	Bracket, Intermediate	1
	114.002.010.	Bracket, Intermediate	1
18	132.002.360.	Bumper	2
19	612.052.157.	Plate, Inner	2
	612.052.010.	Plate, Inner	2
20	612.039.157.	Plate, Assembly, Outer	2
	612.039.010.	Plate, Assembly, Outer	2
	612.097.110.	Plate, Assembly, Outer	2
	612.097.112.	Plate, Assembly, Outer	2
21	286.005.365.	Diaphragm	2
	286.005.354.	Diaphragm	2
	286.005.364.	Diaphragm	2
	286.005.363.	Diaphragm	2
	286.005.360.	Diaphragm	2
22	196.007.156.	Chamber, Outer	2
	196.007.010.	Chamber, Outer	2
	196.007.110.	Chamber, Outer	2
	196.007.112.	Chamber, Outer	2
23	560.022.360.	O-Ring	2
26	115.046.080.	Bracket, Foot (Side Ported Only)	2
	115.057.080.	Bracket, Foot (Bottom Ported Only)	1
29	545.007.330.	Nut, Hex	4
30	807.017.330.	Stud (Side Ported Only)	4
	807.017.330.	Stude (Bottom Ported Only)	8
31	518.005.000.	Manifold Assembly	1
	(Const. Of:)	(Not Sold As Assembly)	
31-1	050.005.365W.	Ball, Weighted	4
	050.005.364.	Ball, Check Valve	4
	050.005.354.	Ball, Check Valve	4
	050.005.360W.	Ball, Weighted	4
	050.005.363.	Ball, Check Valve	4
	050.010.600.	Ball, Check Valve	4
31-2	334.008.156.	Flange, Threaded	2
	334.008.010.	Flange, Threaded	2
	334.008.110.	Flange, Threaded	2
	334.008.112.	Flange, Threaded	2
	334.008.156E.	Flange, Threaded (SB40 Only) BSP	2
	334.008.110E.	Flange, Threaded (SB40 Only) BSP	2

ITEM NO.	PART NUMBER	DESCRIPTION	TOTAL RQD.
	334.008.010E.	Flange, Threaded (SB40 Only) BSP	2
	334.008.112E.	Flange, Threaded (SB40 Only) BSP	2
31-3	334.006.156.	Flange, Discharge	1
	334.006.010.	Flange, Discharge	1
	334.006.110.	Flange, Discharge	1
	334.006.112.	Flange, Discharge	1
31-4	722.010.110.	Seat Assembly	2
	722.010.112.	Seat Assembly	2
	722.031.110.	Seat Assembly (Discharge)	
		(Use w/Teflon and Santoprene Balls Only)	1
	722.031.112.	Seat Assembly (Discharge)	
		(Use w/Teflon Balls Only)	1
31-5	360.017.379.	Gasket, Manifold/Seat	4
	360.017.384.	Gasket, Manifold/Seat	4
	360.017.608.	Gasket, Manifold/Seat	4
31-6	518.003.156.	Manifold, Suction/Discharge	1
	518.003.010.	Manifold, Suction/Discharge	1
	518.003.110.	Manifold, Suction/Discharge	1
	518.003.112.	Manifold, Suction/Discharge	1
31-7	545.005.330.	Nut, Hex	6
31-8	334.007.156.	Flange, Suction	1
	334.007.010.	Flange, Suction	1
	334.007.110.	Flange, Suction	1
	334.007.112.	Flange, Suction	1
31-9	170.035.330.	Capscrew (SS Pumps Only)	4
	170.023.330.	Capscrew	4
31-10	560.028.360.	O-Ring	2
	560.028.610.	O-Ring	2
		(Use w/FKM & overlay units only)	
31-11	900.005.330.	Washer, Lock	6
31-12	900.006.330.	Washer, Lock	4
31-13	170.040.330.	Capscrew, Hex Head	6
33	170.045.330.	Capscrew, Hex Head	4
34	095.073.000.	Pilot Valve Body Assembly^{1,2}	1
	095.115.000.	Pilot Valve Body Assembly (CI Only)	1
34-A	095.070.551.	Pilot Valve Body	1
34-B	755.025.000.	Sleeve (w/O-Ring)	1
34-C	560.033.360.	O-Ring (Sleeve)	4
34-D	775.026.000.	Spool (w/O-Ring)	1
34-E	560.023.360.	O-Ring (Spool)	2
34-F	675.037.080.	Retaining Ring	1
35	170.024.330.	Capscrew, Hex Head	4
36	900.006.330.	Washer, Lock (Side Ported)	12
37	135.016.162.	Bushing, Threaded²	2
38	905.001.330.	Washer, Taper	4
39	170.058.330.	Capscrew, Hex Head	4
40	620.011.114.	Plunger, Actuator²	2
41	560.001.360.	O-Ring (Sold with Item 37)	2
42	360.022.425.	Gasket, Manifold (Side Ported Only)	2
	360.022.425.	Gasket, Manifold (Bottom Ported Only)	4
	360.022.600.	Gasket, Manifold (Side Ported Only)	2
	360.022.600.	Gasket, Manifold (Bottom Ported Only)	4
		(Use w/FKM & overlay units only)	
43	618.003.330.	Plug, Pipe	2
44	618.003.330.	Plug, Pipe (Alum. & CI Only)	4
	031.019.156.	Valve Body Assembly	1
	031.019.010.	Valve Body Assembly	1
		(Includes Items 2, 3, 4, 5, 6, 8, 9)	
46	286.026.604.	Overlay Diaphragm	2
48	685.032.080.	Rod, Connecting (Bottom Ported Only)	1

¹ Available in kit form. Order P/N 031.055.000., which also includes items 10, 11, 34, 40 and 47.

² Available as Air End Kit 476.100.000.

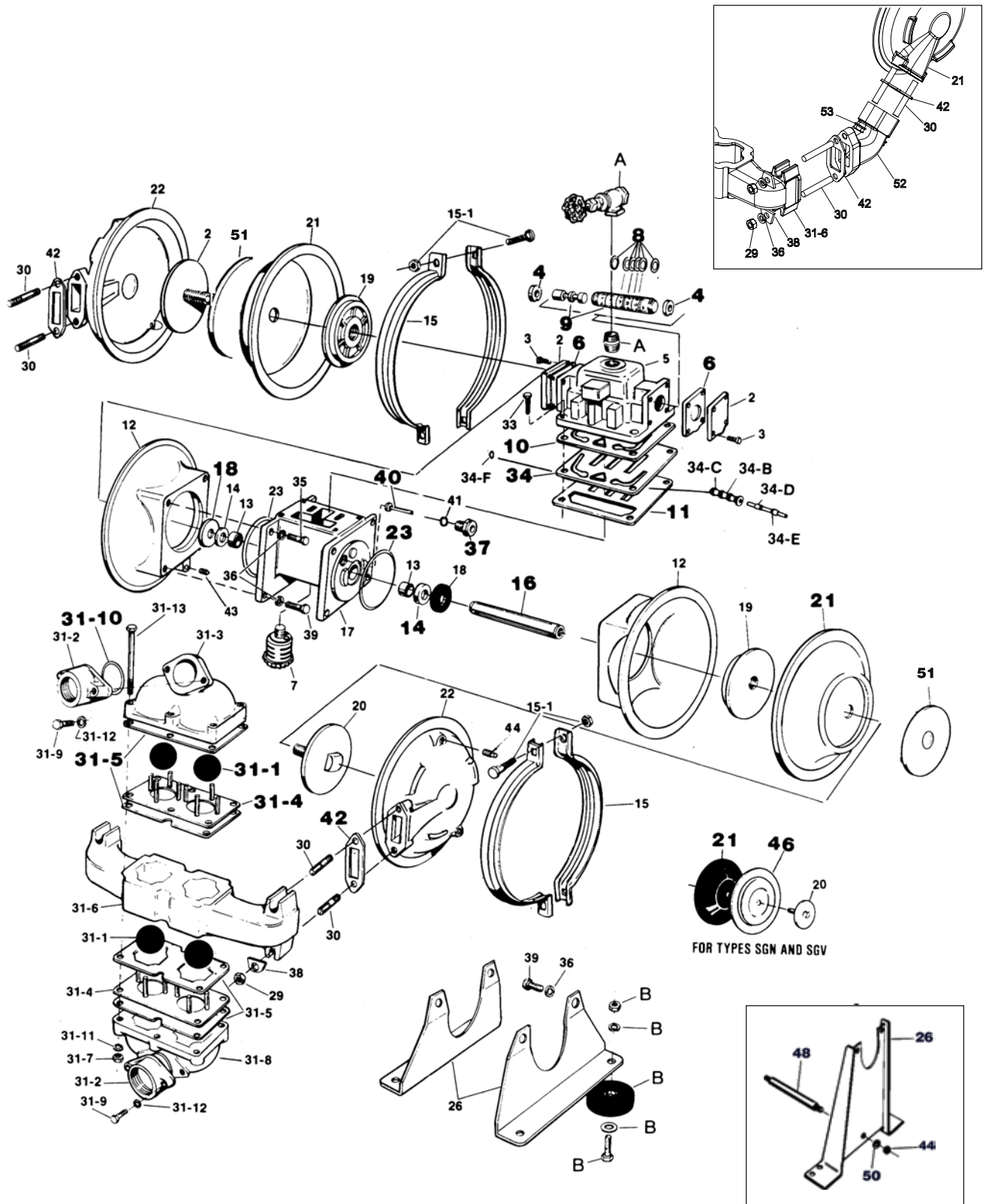
ITEM NO.	PART NUMBER	DESCRIPTION	TOTAL RQD.
49	545.004.330.	Nut, Hex (Bottom Ported Only)	2
50	900.004.330.	Washer, Lock (Bottom Ported Only)	2
51	570.009.360.	Wear Pad	2
	570.009.363.	Wear Pad	2
	570.009.364.	Wear Pad	2
	570.009.365.	Wear Pad	2
		(Use w/Santoprene Fitted Pumps)	
52	312.020.156.	Elbow (Bottom Ported Only)	1
	312.020.110.	Elbow (Bottom Ported Only)	1
53	544.001.330.	Nut, Flange (Bottom Ported Only)	4

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