SERVICE AND OPERATING MANUAL

SANDPIPER®
A WARREN RUPP PUMP BRAND

I M2 c T5
II 2GD T5

Models HDB3-A/HDB4-A
Type 3

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, disasembling or servicing your pump.

PRINCIPLE OF PUMP OPERATION

This ball 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 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.

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.

⚠ 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 maintenance or repair, shut off the com-pressed 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. 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.

AIR INLET & PRIMING

For start-up, open an air valve approximately 1/2" to 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 five hex nuts and one capscrew for each set of check valves (i.e., suction & discharge), providing access to the two ball valves and their valve seats. New ball valves are $3^{5}/_{8}$" (9.21 cm) in diameter and will require replacement when worn to approximately $3^{3}/_{8}$" (8.57 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 two capscrews which secure the chamber to the manifold assembly, and twelve hex nuts that secure the chamber to the main pump assembly. To remove diaphragms, loosen diaphragm assembly by turning it out of the diaphragm rod using a $1^{1}/_{8}$" (2.857 cm) socket or wrench. Removal of opposite outer chamber will permit removal of second diaphragm assembly and diaphragm rod as a unit.

To remove the diaphragm from the diaphragm assembly, hold the diaphragm rod in a clamping device, making sure to protect the rod surface of shaft so as not to scratch or mar it in any way. With a wrench turn the diaphragm assembly out of the diaphragm rod. To disassemble the components, turn a 5/16-18 UNC capscrew by hand into the tapped hole in the inner diaphragm plate. This will keep the plate from turning while the capscrew is removed. To remove the capscrew, place the assembly in a vise so the two protruding ends of screws are loose in the vise jaws (approximately 7/8" apart). Turn the center screw loose from the back plate and the assembly will come apart.

⚠ WARNING

Do not smoke near the pump or use the pump near an open flame. Fire or explosion could result.

⚠ WARNING

This pump must not be used for fluid transfer into aircraft.

⚠ 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 main-tenance 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.

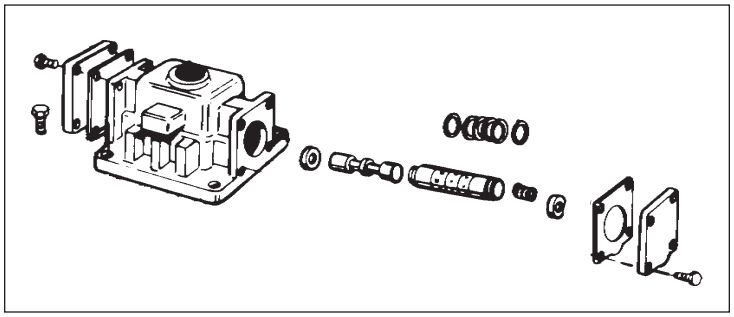
REASSEMBLY

All procedures for reassembling the pump are the reverse of the disassembly instructions with further instructions as shown:

The diaphragm assemblies are to be installed with the natural bulge outward or toward the head of the center screw. Make sure both plates are installed with outer radii against the diaphragm. After all components are in position in a vise and hand tight, set a torque wrench for 40 ft. pounds (54.23 Newton meters) using a $1^{1}/_{8}$" (2.857 cm) socket. After each diaphragm sub assembly has been completed, thread one assembly into the diaphragm rod. Make sure the 5/16-18 UNC capscrew has been removed from the inner plate and the diaphragm rod bumper is in place on the diaphragm rod.

Install this sub assembly into the pump and secure by installing the outer chamber in place and tightening the capscrews. This will hold the assembly in place while the opposite side is installed. Install the second diaphragm assembly into the diaphragm rod checking to see that the diaphragm rod bumper is in place. Tighten to 30 ft. lbs. (40.67 Newton meters) torque before installing the outer chamber in place. If the holes in the diaphragm flange do not align with the holes in the inner chamber flange, turn the diaphragm assembly in the direction of tightening to align the holes so that the capscrews can be inserted. This final torquing of the last diaphragm assembly will lock the two diaphragm assemblies together. Secure the last outer chamber by tightening down the securing nuts gradually and evenly. This tightening procedure should be done on both sides.

When reinstalling check valves, take care that the seat gaskets are aligned properly before securing porting flange in place.



Air valve body.

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 (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 th eair 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.

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 closing.
D. Leakage at joint of suction manifold or elbow flange.
E. Suction line 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. Plugged or dirty exhaust muffler.

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. Plugged or dirty muffler.

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.**

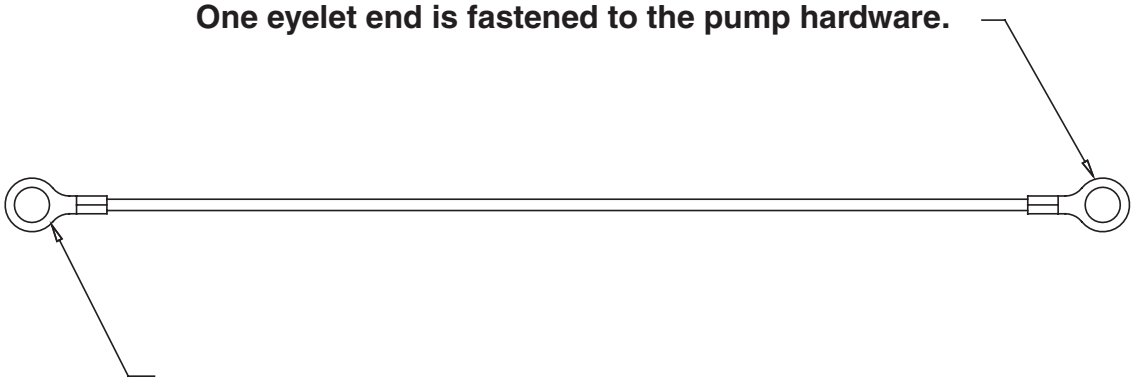
For more detailed information on these accessories, contact your local Warren Rupp Factory-Authorized Distributor, or Warren Rupp corporate headquarters.

Grounding The Pump

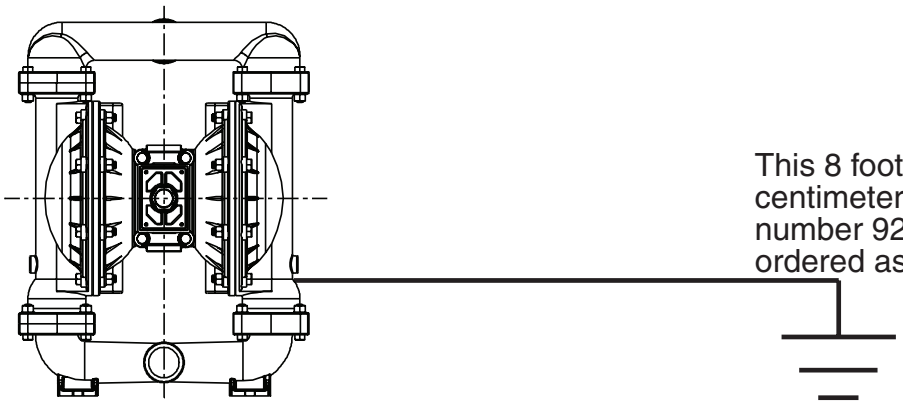
WARNING

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.

One eyelet end is fastened to the pump hardware.



One eyelet end is installed to a true earth ground.



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 juristiction over specific installations.

ITEM NO.	PART NUMBER	DESCRIPTION	TOTAL RQD.
1	**095.073.000**	**Pilot Valve Assembly**	**1**
1-A	**095-070-551**	**Pilot Valve Body**	**1**
1-B	**755-025-000**	**Sleeve, with O-Ring**	**1**
1-C	**560-033-360**	**O-Ring (Sleeve)**	**4**
1-D	**775-026-000**	**Spool, with O-Ring**	**1**
1-E	**560-023-360**	**O-Ring (Spool)**	**2**
1-F	**675-037-080**	**Retaining Ring**	**1**
2	**070.017.170.**	**Bearing, Sleeve**	**2**
3	**114.003.010.**	**Bracket, Intermediate**	**1**
4	**135.016.162.**	**Bushing, Threaded, with O-Ring**	**2**
5	**360.041.379.**	**Gasket, Valve Body**	**1**
6	560.001.360.	O-Ring	2
7	**620.011.114.**	**Plunger, Actuator**	**2**
8	**720.014.360.**	**Seal, HUVA Cup**	**2**
9	**031.018.000.**	**Sleeve & Spool Set**	**1**
10	095.043.010.	Body, Valve	1
11	**132.014.358.**	**Bumper, Valve Spool**	**2**
12	165.011.010.	Cap, End	2
13	**360.048.425.**	**Gasket, Valve Body**	**1**
14	360.010.425.	Gasket, End Cap	2
15	**560.020.360.**	**O-Ring**	**6**
16	170.032.330.	Capscrew, Hex Head	8
17	**132.012.360.**	**Bumper, Diaphragm**	**2**
18	196.032.010.	Chamber, Diaphragm	2
19	**560.045.360.**	**O-Ring**	**2**
20	612.085.330.	Plate, Diaphragm	2
20-A	612.113.156.	Plate, Inner Diaphragm (Overlay Pumps Only)	2
21	685.030.120.	Rod, Diaphragm	1
22	060.012.000.	Base, Pump — Low (Top Ported)	1
22	060.013.000.	Base, Pump — High (Bottom Ported)	1
23	**170.065.110.**	**Capscrew, Hex Head**	**2**
23	170.065.330.	Capscrew, Hex Head	2
24	196.031.010.	Chamber, Diaphragm — Outer	2
24	196.031.110.	Chamber, Diaphragm — Outer	2
25	286.014.360.	Diaphragm	2
	286.014.363.	Diaphragm	2
	286.014.364.	Diaphragm	2
	286.014.365.	**Diaphragm**	**2**
	286.014.366.	Diaphragm	2
25-A	286.047.604.	Diaphragm (Overlay)	2
25-B	286.048.365.	Diaphragm (Use with Overlay)	2
26	312.031.010.	Elbow, Manifold	2
	312.031.110.	Elbow, Manifold	2
27	**360.046.425.**	**Gasket, Flange**	**2**
	360.046.603.	Gasket, Flange (Use with Viton and Teflon Diaphragms)	2
28	510.002.330.	Lug, Clamp	4
29	050.014.360W.	Ball, Check Valve	4
	050.014.364.	Ball, Check Valve	4
	050.015.600.	Ball, Check Valve	4
	050.014.365W.	**Ball, Check Valve**	**4**
30	170.064.330.	Capscrew, Hex Head	2
31	334.023.010.	Flange, Suction & Discharge	2
	334.023.110.	Flange, Suction & Discharge	2
32	360.045.608.	Gasket, Manifold (Use with Viton & Teflon Diaphragms)	4
	360.045.379.	**Gasket, Manifold**	**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 Warren Rupp 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
025... Music Wire
080... Carbon Steel, AISI B-1112
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
354...Injection Molded #203-40 Santoprene — Duro 40D + /-5. Color coded: RED
356... Hytrel
357... Rupplon (Urethane Rubber)
360... Buna-N Rubber. Color coded: RED
363... Viton (Fluorel). 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
384... Conductive Neoprene
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, Food Grade/USDA Acceptable
540... Nylon
550... Polyethylene
551... Polypropylene
555... PVC (Polyvinyl Chloride)
580... Ryton
600... PTFE (virgin material) Tetrafluoroethylene (TFE)
603... Blue Gylon
604... PTFE— Diaphragm
608... Conductive PTFE
610... Encapsulated Silicon
611... PTFE Encapsulated Viton

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

Gylon is a registered tradename of Garlock, Inc.

Rupplon and SANDPIPER are registered tradenames of Warren Rupp, Inc.

Ryton is a registered tradename of Phillips Chemical Company.

Loctite is a registered tradename of Loctite Corporation.

	360.045.384.	**Gasket, Manifold**	**4**
33	518.023.010.	Manifold	1
	518.023.110.	Manifold	1
34	545.009.330.	Nut, Hex	10
35	722.028.010.	Seat, Ball Check Valve	4
	722.028.110.	**Seat, Ball Check Valve**	**4**
37	900.007.330.	Washer, Lock	16
38	612.063.110.	Plate, Diaphragm — Outer	2
	612.063.330.	Plate, Diaphragm — Outer	2
39	618.003.110.	Plug, Pipe	2
	618.003.330.	Plug, Pipe	2
40	675.021.360.	Ring, Sealing	2
	675.021.363.	Ring, Sealing	2
	675.021.364.	Ring, Sealing	2
	675.021.365.	**Ring, Sealing**	**2**
	675.021.366.	Ring, Sealing	2
	675.021.600.	Ring, Sealing	2
41	901.006.330.	Washer, Flat	4
42	170.015.330.	Capscrew, Hex Head	4
43	170.034.330.	Capscrew, Hex Head	18
44	170.045.330.	Capscrew, Hex Head	4
45	170.066.330.	Capscrew, Hex Head	24
46	544.003.330.	Nut, Flange	4
47	545.008.330.	Nut, Hex	24
49	900.003.330.	Washer, Lock	14
52	530.033.000.	Muffler, Exhaust	1
	031.021.010.	Valve Body Assembly (Inc. Items 9, 10, 11, 12, 14, 15, 16)	1
53	807.085.330.	Stud	14
54	570.010.360.	Pad, Wear	2
	570.010.363.	Pad, Wear	2
	570.010.364.	Pad, Wear	2
	570.010.365.	Pad, Wear (Not used on PTFE overlay units)	2
HDB4-A:			
55	334.037.010.	Flange, Adapter	2
56	360.036.425.	Gasket, Flange	2
57	900.007.330.	Washer, Lock	8
58	545.009.330.	Nut, Hex	8
59	807.005.330.	Stud	8

[1]Available in kit form. Order P/N 031.055.000., which also includes items 5, 13, 7, and 54.

AVAILABLE SERVICE AND CONVERSION KITS:

476.101.000. **AIR END KIT**
Seals, O-Rings, Gaskets, Air Valve Sleeve and Spool, Pilot Valve Assembly

476.046.360. **WETTED END KIT**
Buna Check Balls, Diaphragms, Sealing Rings, Gaskets

476.046.364. **WETTED END KIT**
EPDM Check Balls, Diaphragms, Sealing Rings, Gaskets

476.046.365. **WETTED END KIT**
Neoprene Check Balls, Diaphragms, Sealing Rings, Gaskets

476.046.633. **WETTED END KIT**
Viton Diaphragms, Sealing Rings, PTFE Check Balls, Gaskets

476.046.635. **WETTED END KIT**
Teflon Check Balls, Overlay Diaphragms and Sealing Rings, Neoprene Backup Diaphragms, Gaskets

476.046.636. **WETTED END KIT**
Food Grade Nitrile Diaphragms and Sealing Rings, PTFE Check Balls, Gaskets

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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
025... Music Wire
080... Carbon Steel, AISI B-1112
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
354...Injection Molded #203-40 Santoprene — Duro 40D + /-5. Color coded: RED
356... Hytrel
357... Rupplon (Urethane Rubber)
360... Buna-N Rubber. Color coded: RED
363... Viton (Fluorel). 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
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, Food Grade/USDA Acceptable
540... Nylon
550... Polyethylene
551... Polypropylene
555... PVC (Polyvinyl Chloride)
580... Ryton
600... PTFE (virgin material) Tetrafluoroethylene (TFE)
603... Blue Gylon
604... PTFE — Diaphragm
610... Encapsulated Silicon
611... PTFE Encapsulated Viton

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

Gylon is a registered tradename of Garlock, Inc.

Rupplon and SANDPIPER are registered tradenames of Warren Rupp, Inc.

Ryton is a registered tradename of Phillips Chemical Company.

Loctite is a registered tradename of Loctite Corporation.

BOTTOM PORTING is recommended for pumping material containing solids which could settle out in the pumping chambers.

TOP PORTING is recommended if there is a possibility of entrapped air vapors inhibiting the pumping action.

Convert from one configuration to the other by rotating the outer chambers as indicated and substituting the proper pump base (low base for top porting, high base for bottom porting).