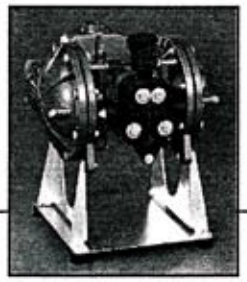
WARREN RUPP

# Model SB1-A Type 3

# SandPIPER®

## Operating Instructions, Service Manual and Repair Parts List



**⚠ 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.**

### PRINCIPLE OF OPERATION:

The SandPIPER pump is designed to be powered only by compressed air which alternately pressurizes the inner sides of the two diaphragm chambers while simultaneously exhausting the opposite inner chambers causing the diaphragms, which are connected by a shaft, to move endwise. Since air pressure is applied over the entire surface of the diaphragm which is forcing liquid to be discharged by its other side, the diaphragm is operating under a balanced condition during the discharge stroke. This allows the unit to be operated at discharge heads over 200 feet (61 meters) of water head.

Alternate pressurizing and exhausting of the diaphragm chamber is performed by an externally mounted, pilot operated, four way, spool type air distribution valve. When the spool is at one end of the valve body, inlet air pressure is connected to one diaphragm chamber and the other diaphragm chamber is connected to the exhaust. When the spool is removed to the opposite end of the valve body, the porting of chambers is reversed. The air distribution valve spool is moved from one end position to the other in the valve body by means of an internal pilot valve which alternately pressurizes the ends of the air distribution valve spool while simultaneously exhausting the other ends. The pilot valve is positively shifted at each end of the diaphragm stroke by the diaphragm plate's coming in contact with the end of the pilot valve spool and pushing 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 to maintain flow in one direction through the pump.

### INSTALLATION PROCEDURES:

Position the pump as close as possible to the source of the liquid to be pumped. Avoid long or undersize suction lines and use the minimum number of fittings.

For permanent installations involving rigid piping, install short flexible sections of hose between the pump and piping. This reduces strains and permits easier removal of the pump for service when required. **At time of installation, inspect all external gasketed fasteners for looseness caused by gasket creep. Tighten loose fittings securely to prevent leakage.**

### AIR SUPPLY:

Do not connect the unit to air supply in excess of 125 PSI (8.61 bars). Install a shutoff valve in the air supply line to permit removal of the unit for servicing. When connecting an air supply of rigid piping, mount a section of flexible line to the pump to eliminate piping strain. In permanent installations, an air line filter is recommended. **The weight of the air supply line and of the filter must be supported by some means other than the air valve cap. Failure to provide support may result in damage to the pump.**

### LUBRICATION:

A small amount of lightweight oil (max. SAE 10 wt.) poured into the air inlet daily is recommended to lubricate the air distribution valve. An air line filter and lubricator is recommended on permanent installations. The lubricator should be set at a rate of one drop of oil for every 20 SCFM (Standard Cubic Feet per Minute) (9.44 lit./sec.) of air being used. When using EPDM elastomers, use no oil in the system or chemical attack may occur.

### OPERATION:

Your SandPIPER pump has been tested prior to shipment and is ready for use as received. It is completely self-priming and no initial filling with fluid is required.

If the unit is to be totally submerged, the air exhaust must be piped above liquid level to prevent the liquid and foreign material from entering the air distribution valve mechanism.

Open the inlet air valve at least one turn to allow sufficient cycling rate for the pump to prime (30 to 60 cycles per minute). After pumping starts, adjust the inlet air valve for the desired pumping capacity. When further opening of the inlet air valve increases cycling rate without increasing the flow rate, the pump is being starved of liquid due to suction limitations. Further opening of the air inlet valve will waste compressed air. Set the inlet air valve for lowest cycling rate that does not decrease flow rate for most efficient operation.

### FREEZING OR ICING OF EXHAUST:

Icing of air exhaust can occur under certain conditions of temperature and humidity on compressed air power equipment. Icing is more likely to occur at high discharge pressures. Use of a Warren Rupp Extractor/Dryer should eliminate the problem.

### AIR EXHAUST:

SandPIPER pumps can be submerged if the materials of construction are compatible with the liquid and the exhaust is piped above the liquid level. (See **OPERATION**, above.) Piping used for the exhaust should not be smaller than the 1" pipe size. Reduced pipe size can restrict the exhausted air and cause reduce pump performance.

**⚠ CAUTION: If a diaphragm fails, the pumped product or fumes can enter the air side of the pump. This side is exhausted through the exhaust port (muffler).**

**When the product is a hazardous or toxic material, the exhaust should be piped to an appropriate area for safe disposition.**

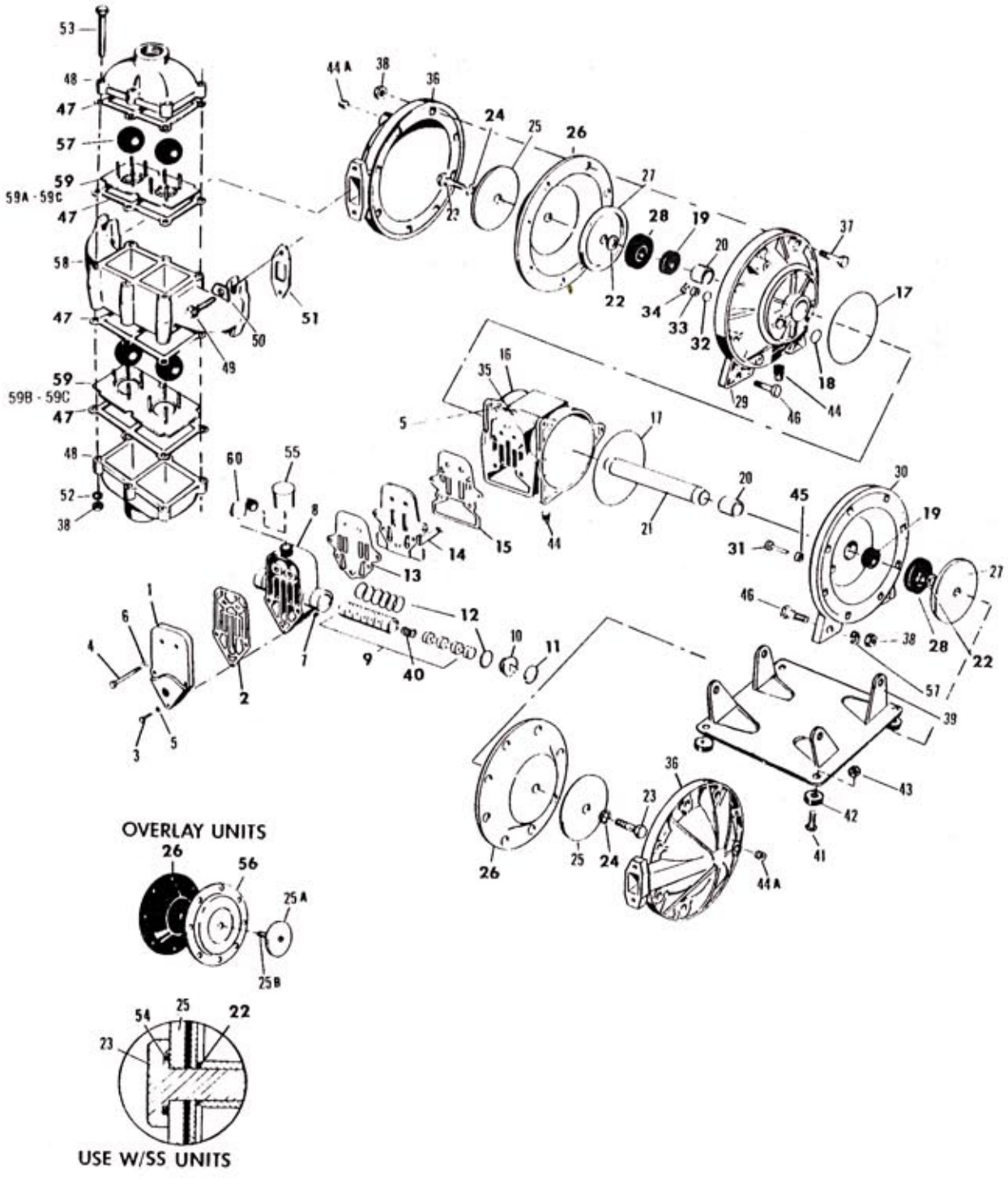
**When the product source is at a higher level than the pump (flooded suction), the exhaust should be piped to a higher level than the product to prevent spills caused by siphoning.**

### MAINTENANCE AFTER USE:

**⚠ CAUTION: 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. When the pump is used for toxic or aggressive fluids, it should be flushed clean prior to disassembly.**

When the pump is used for materials that tend to settle out or transform from liquid to solid form, care must be taken after

# Model SB1-A Type 3 SandPIPER




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.

# SB1-A Type 3 Repair Parts List

| ITEM NO. | PART NO. | DESCRIPTION | RQD. |
|---|---|---|---|
| 1 | 165-042-157 | Cap, Valve Body (AL Center) | 1 |
| | 165-042-551 | Cap, Valve Body (CI Center) | 1 |
| **2** | **360-058-360** | **Gasket, Valve Cap** | **1** |
| 3 | 170-063-330 | Capscrew, Hex Head | 1 |
| 4 | 170-033-330 | Capscrew, Hex Head | 4 |
| 5 | 901-035-330 | Washer, Flat (AL Center) | 7 |
| | 901-035-330 | Washer, Flat (CI Center) | 1 |
| | 900-005-330 | Washer, Lock (CI Center) | 6 |
| 6 | 901-005-330 | Washer, Flat | 4 |
| 7 | 542-001-330 | Nut, Square | 1 |
| 8 | 095-051-551 | Body, Spool Valve | 1 |
| **9** | **031-039-000** | **Sleeve & Spool Set** | **1** |
| 10 | 165-038-356 | Cap, End | 2 |
| **11** | **675-043-115** | **Ring, Retainer** | **2** |
| **12** | **560-058-360** | **O-Ring** | **8** |
| **13** | **360-057-360** | **Gasket** | **1** |
| **14** | **095-066-000** | **Pilot Valve Assembly[1] (AL Center)** | **1** |
| | **095-067-000** | **Pilot Valve Assembly[2] (CI Center)** | **1** |
| **15** | **360-056-360** | **Gasket** | **1** |
| 16 | 114-007-157 | Bracket, Intermediate | 1 |
| | 114-012-010 | Bracket, Intermediate | 1 |
| **17** | **560-040-360** | **O-Ring** | **2** |
| **18** | **675-040-360** | **Ring, Sealing (AL Center)** | **2** |
| **19** | **720-010-375** | **Seal, U-Cup** | **2** |
| 20 | 070-012-170 | Bearing, Sleeve | 2 |
| 21 | 685-039-120 | Rod, Diaphragm | 1 |
| **22** | **901-012-180** | **Washer, Sealing** | **2** |
| 23 | 170-034-330 | Capscrew, Hex Head | 2 |
| | 170-059-110 | Capscrew, Hex Head (S.S. Non-Overlay) | 2 |
| **24** | **900-003-330** | **Washer, Lock (not used with 612-023-330)** | **2** |
| 25 | 612-023-330 | Plate, Outer | 2 |
| | 612-023-110 | Plate, Outer | 2 |
| 25A | 612-067-110 | Plate, Outer (Overlay & Viton w/Teflon Balls) | 2 |
| 25A | 612-101-112 | Plate, Outer | 2 |
| 25B | 171-011-110 | Capscrew, Flat Head (Use with 612-067-110) | 2 |
| 25B | 807-048-330 | Stud (Use with 612-101-112) | 2 |
| **26** | **286-008-356** | **Diaphragm** | **2** |
| | 286-008-360 | Diaphragm | 2 |
| | 286-008-363 | Diaphragm | 2 |
| | 286-008-364 | Diaphragm | 2 |
| | 286-008-365 | Diaphragm | 2 |
| | 286-008-366 | Diaphragm | 2 |
| 27 | 612-022-330 | Plate, Inner Diaphragm | 2 |
| **28** | **132-019-360** | **Bumper** | **2** |
| 29 | 196-043-157 | Chamber, Inner (left side) | 1 |
| | 196-084-010 | Chamber, Inner (left side) | 1 |
| 30 | 196-042-157 | Chamber, Inner (right side) | 1 |
| | 196-090-010 | Chamber, Inner (right side) | 1 |
| **31** | **620-015-114** | **Plunger, Actuator** | **2** |
| **32** | **560-001-360** | **O-Ring** | **2** |
| **33** | **135-013-162** | **Bushing** | **2** |
| **34** | **675-042-115** | **Ring, Retainer** | **2** |
| 35 | 170-043-330 | Capscrew, Hex Head (AL Center) | 6 |
| | 170-006-330 | Capscrew, Hex Head (CI Center) | 6 |
| 36 | 196-012-157 | Chamber, Outer | 2 |
| | 196-012-110 | Chamber, Outer | 2 |
| | 196-012-112 | Chamber, Outer | 2 |
| 37 | 170-029-330 | Capscrew, Hex Head | 16 |
| 38 | 545-004-330 | Nut, Hex | 26 |
| 39 | 115-071-330 | Foot Bracket | 1 |
| 39 | 115-070-330 | Foot Bracket (Dual Ported Only) | 1 |
| **40** | **780-027-025** | **Spring** | **1** |
| 41 | 706-013-330 | Screw, Machine | 4 |
| 42 | 350-002-360 | Foot, Rubber | 4 |
| 43 | 547-002-330 | Nut, Stop | 4 |
| 44 | 618-003-330 | Plug, Pipe | 3 |
| 44A | 618-003-330 | Plug, Pipe | 2 |
| | 618-003-110 | Plug, Pipe | 2 |
| | 618-003-112 | Plug, Pipe | 2 |
| **45** | **132-022-360** | **Bumper, Actuator** | **2** |
| 46 | 170-045-330 | Capscrew, Hex Head | 4 |
| **47** | **360-031-360** | **Gasket** | **4** |
| | 360-031-363 | Gasket | 4 |
| | 360-031-364 | Gasket | 4 |
| | 360-031-365 | Gasket | 4 |
| | 360-031-600 | Gasket | 4 |
| 48 | 334-013-157 | Flange, Porting | 2 |
| | 334-013-110 | Flange, Porting | 2 |
| | 334-013-112 | Flange, Porting | 2 |
| | 334-036-156 | Flange, Porting (Dual Porting) | 2 |
| 49 | 171-010-330 | Capscrew, Flanged | 4 |
| 50 | 905-001-330 | Washer, Taper | 4 |
| **51** | **360-030-425** | **Gasket Manifold** | **2** |
| | 360-030-600 | Gasket, Manifold | 2 |
| 52 | 900-004-330 | Washer, Lock | 10 |
| 53 | 170-075-330 | Capscrew, Hex Head | 6 |
| 53A | 170-075-330 | Capscrew, Hex Head (Dual Ported) | 3 |
| | 170-084-330 | Capscrew, Hex Head (Dual Ported) | 3 |
| **54** | **560-030-360** | **O-Ring (use with 612-023-110)** | **2** |
| | **560-030-363** | **O-Ring (use with 612-023-110)** | **2** |
| 55 | 530-018-000 | Muffler | 1 |
| 56 | 286-015-604 | Diaphragm, Overlay | 2 |
| **57** | **050-008-356** | **Check Ball** | **4** |
| | 050-008-360 | Check Ball | 4 |
| | 050-008-363 | Check Ball | 4 |
| | 050-008-365 | Check Ball | 4 |
| | 050-011-600 | Check Ball | 4 |
| 58 | 518-006-156 | Manifold | 1 |
| | 518-006-110 | Manifold | 1 |
| | 518-006-112 | Manifold | 1 |
| **59** | **722-026-580** | **Seat, Check Ball (use w ith Elast. Balls)** | **2** |
| **59A** | **722-024-110** | **Seat, Discharge (use with Teflon Balls)** | **1** |
| **59B** | **722-025-110** | **Seat, Suction (use with Teflon Balls)** | **1** |
| **59C** | **722-047-112** | **Seat, Check Ball** | **2** |
| 60 | 312-022-360 | Elbow (Top Ported) | 2 |
| Items Not Shown: | | | |
| | 031-030-000 | Valve Body Assembly (Includes Items: 8, 9, 10, 11, 12 & 40) | 1 |
| | 485-004-000 | Label "IN" | 1 |
| | 485-005-000 | Label "OUT" | 1 |
| | 535-015-000 | Name Plate | 1 |
| | 535-022-115 | Name Plate (AL Outer Chamber Only) | 2 |
| | 545-005-330 | Nut, Hex (SS Only) | 4 |
| | 705-002-000 | Drive Screw (AL Center) | 4 |
| | 705-003-330 | Drive Screw (CI Center) | 4 |
| | 705-001-330 | Drive Screw (AL Outer Chamber only) | 4 |
| Optional Item: | | | |
| | 808-008-000 | Strainer (AL Only) | 1 |

[1] Available only in kit form. Order P/N 031-052-000 which also includes items no. 2, 13, 15, 31, & 71.

[2] Available only in kit form. Order P/N 031-051-000 which also includes items no. 2, 13, 15, 31, & 71.

## MATERIAL CODES

**The Material Code Is The Last 3 Digits Of The Part Number**

000...Assembly, sub-assembly; and some purchased items
010...Cast Iron
012...Powered Metal
015...Ductile Iron
020...Ferritic Malleable Iron
025...Music Wire
080...CarbonSteel AISI B-1112
100...Alloy 20
110...Alloy Type 316 Stainless Steel
111...Alloy Type 316 Stainless Steel (Electro Polished)
112...Alloy "C"
113...Alloy Type 316 Stainless Steel (Hand Polished)
114...303 Stainless Steel
115...302/304 Stainless Steel
117...440-C Stainless Steel (Martensitic)
120...416 Stainless Steel (Wrought Martensitic)
148...Hardcoat Anodized Aluminum
149...2024-T4 Aluminum
150...6061-T6 Aluminum
151...6063-T6 Aluminum
152...2024-T4 Aluminum (2023-T351)
154...Almag 35 Aluminum
155 or 156...356-T6 Aluminum
157...Die Cast Aluminum Alloy #380
158...Aluminum Alloy SR-319
159...Anodized Aluminum
162...Brass, Yellow, Screw Machine Stock
165...Cast Bronze, 85-5-5-5
166...Bronze SAE 660
170...Bronze, Bearing Type, Oil Impregnated
180...Copper Alloy
310...Kynar Coated
330...Zinc Plated Steel
331...Chrome Plated Steel
332...Electroless Nickel Plated
335...Galvanized Steel
336...Zinc Plated Yellow Brass
337...Silver Plated Steel
340...Nickel Plated
342...Filled Nylon
356...Hytrel
357...Rupplon (Urethane Rubber) Color coded:PURPLE
358...Rupplon (Urethane Rubber) Color coded:PURPLE (Some Applications) (Compression Mold)
359...Urethane Rubber
360...Buna-N Rubber Color coded: RED
361...Buna-N
363...Viton (Fluorel) Color coded: YELLOW
364...E.P.D.M. Rubber Color coded: BLUE
365...Neoprene Rubber Color coded: GREEN
370...Butyl Rubber Color coded: BROWN
371...Philthane (Tuftane)
375...Fluorinated Nitrile
378...High density Polypropylene
405...Cellulose Fibre
408...Cork and Neoprene
425...Compressed Fibre
426...Blue Gard
440...Vegetable Fibre
465...Fibre
500...Delrin 500
501...Delrin 570
505...Acrylic Resin Plastic
520...Injection Molded PVDF Natural Color
540...Nylon
541...Nylon
542...Nylon
544...Nylon Injection Molded
550...Polyethylene
551...Polypropylene
552...Unfilled Polypropylene
553...Unfilled Polypropylene
555...Polyvinyl Chloride
570...Rulon II
580...Ryton
590...Valox
591...Nylatron G-S
592...Nylatron NSB
600...Teflon (virgin material) Tetrafluoroethylene (TFE)
601...Teflon (Bronze and moly filled)
602...Filled Teflon
603...Blue Gylon
604...Teflon
606...Teflon
610...Teflon Encapsulated Silicon
611...Teflon Encapsulated Viton

each use or during idle time to remove them and flush the pump as required to prevent damage.

In freezing temperatures the pump must be completely drained when idle.

## SERVICE INSTRUCTIONS: TROUBLE SHOOTING

1. Pump will not cycle

A. Check to make sure the unit has enough pressure to operate and that the air inlet valve is open.

B. Check the discharge line to insure that the discharge line is neither closed nor blocked.

C. It the spool in the air distribution valve is not shifting, check the main spool. It must slide freely.

D. Excessive air leakage in the pump can prevent cycling. This condition will be evident. Air leakage into the discharge line indicates a ruptured diaphragm. Air leakage from the exhaust port indicates leakage in the air distribution valve. See further service instructions.

E. Blockage in the liquid chamber can impede movement of diaphragm.

**2. Pump cycles but will not pump**

A. Suction side of pump pulling in air. Check the suction line for air leaks and be sure that the end of the suction line is submerged. Check flange bolting. Check valve flanges and manifold to chamber flange joints.

B. Make certain the suction line or strainer is not plugged. Restriction at the suction is indicated by a high vacuum reading when a vacuum gauge is installed in the suction line.

C. Check valves may not be seating properly. To check, remove the suction line and cover the suction port with your hand. If the unit does not pull a good suction (vacuum), the check valves should be inspected for proper seating.

D. Static suction lift may be too high. Priming can be improved by elevating the suction and discharge lines higher than the check valves and pouring liquid into the unit through the suction inlet. When priming at high suction lifts or with long suction lines operate the pump at maximum cycle rate.

**3. Low performance**

A. Capacity is reduced as the discharge pressure increases, as indicated on the performance curve. Performance capability varies with available inlet air supply. Check air pressure at the pump inlet when the pump is operating to make certain that adequate air supply is maintained.

B. Check vacuum at the pump suction. Capacity is reduced as vacuum increases. Reduced flow rate due to starved suction will be evident when cycle rate can be varied without change in capacity. This condition will be more prevalent when pumping viscous liquids. When pumping thick, heavy materials the suction line must be kept as large in diameter and as short as possible, to keep suction loss minimal.

C. Low flow rate and slow cycling rate indicate restricted flow through the discharge line. Low flow rate and fast cycling rate indicate restriction in the suction line or air leakage into suction.

D. Unstable cycling indicates improper check valve seating on one chamber. This condition is confirmed when unstable cycling repeats consistently on alternate exhausts. Cycling that is not consistently unstable may indicate partial exhaust restriction due to freezing and thawing of exhaust air. Use of the Warren Rupp Extractor/Dryer should solve this problem.

## CHECK VALVE SERVICING:

Need for inspection or service is usually indicated by poor priming, unstable cycling, reduced performance or the pump's cycling but not pumping.

Remove the six flange bolts securing the inlet and outlet flanges to the manifold. Inspect the surfaces of both check valve and seat for wear or damage that could prevent proper sealing. If pump is to prime properly, valves must seat air tight.

## DIAPHRAGM SERVICING:

Remove the four bolts securing the manifold flange to the chamber. Remove the eight nuts securing the outer diaphragm chamber flange and remove the chamber. Loosen the capscrew securing the diaphragm and plate to the rod by leaving the diaphragm engaged with the capscrews around the outer flange, preventing rotation of the rod. DO NOT USE A WRENCH ON THE DIAPHRAGM ROD. FLAWS ON THE SURFACE MAY DAMAGE BEARINGS AND SEAL.

During reassembly make certain that the rubber bumper is on the rod on each side. Install the diaphragm with the natural bulge outward as indicated on the diaphragm. Install the heavier plate on the outside of the diaphragm and make certain that the large radius side of both plates are toward the diaphragm. Place the sealing washer between the inner diaphragm plate and the end of the rod. Tighten the capscrew to approximately 25 ft. lbs. (33.9 Newton meters). Torque while allowing diaphragm to turn freely with plates. Use a wrench on the capscrew of the opposite side to keep the rod from rotating. If the opposite chamber is assembled, the rod need not be held.

When reassembling the outer chambers and the manifold, the bolts securing the manifold flange to the chamber should be snugged prior to tightening the chamber bolts, to insure that the chamber port flange is square with the manifold flange. Finish tightening the manifold flange bolts after chamber bolting IS secured.

## AIR DISTRIBUTION VALVE SERVICING:

The spool and sleeve are rust and corrosion resistant brass and hardened stainless steel. The spool is closely sized to the sleeve and should slide freely. Accumulation of dirt and oils may prevent the pump from cycling. Remove the valve body from the center pump housing, remove the end caps, and push the spool out of the sleeve. Wash the parts in cleaning solvent or kerosene, and check the spool and sleeve for possible roughness, nicks or scratches. Use a fine stone or crocus cloth to carefully remove any irregular marks on the surfaces. When the spool slides freely on the sleeve, coat the parts with light oil and reassemble. The four capscrews inserted through the valve body cap to hold the air valve to the intermediate section should be torqued to 150 in./lbs. (16.9 Newton meters).

## PILOT VALVE SERVICING:

This assembly is reached by removing the air distribution valve body from the pump and lifting the pilot valve body out of the intermediate housing.

When reinserting an externally serviceable pilot valve, push both plungers out of the path of the pilot valve so that they and the pilot valve are not damaged.

## PILOT VALVE ACTUATOR SERVICING:

The bushings for the pilot valve actuators are pressed into the intermediate bracket from the outside. The plunger may be removed for inspection or replacement from the inside by removing the air distribution valve body and the pilot valve body from the pump. The plungers should be visible as you look 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. The bushing can be pushed through the inner chamber removing the outer chamber assembly to reach the bushing.

## WARRANTY:

This unit is guaranteed for a period of one year against defective material and workmanship.

**BEFORE PUMP OPERATION** all external gasketed fasteners must be inspected for looseness caused by gasket creep after leaving the factory. Retorque loose fasteners to insure against leakage. Follow recommended torques where called out. (A card is attached to each new pump stating this fact.)

## 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.**

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