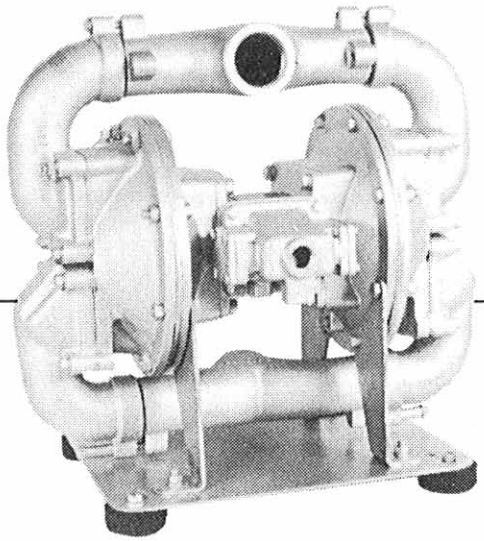
WARREN RUPP

Model SA2-A Type 3 2-INCH SandPIPER®

Operating Instructions, Service Manual and Repair Parts List



Operating and Service Instructions

⚠ **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:

This pump is powered by compressed air which alternately pressurizes the inner side of one diaphragm chamber while simultaneously exhausting the other inner chamber 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 from opposite side, the diaphragm is operating under a balanced condition during the discharge stroke and allows the unit to be operated at discharge heads over 200 feet (61 meters) of water head.

Since the diaphragms are connected by a shaft secured by plates to the center of the diaphragms, one diaphragm is being pressurized to perform the discharge stroke while the other diaphragm is being pulled to perform th· suction stroke in the opposite chamber. The suction stroke becomes the only unbalanced load applied to diaphragms during operation, providing much longer life than mechanical operated diaphragms under similar conditions. Since the suction lift portion of the operation is essentially the only load applied to diaphragms, the longest possible diaphragm life will be attained by the least amount of suction lift. ALWAYS KEEP THE UNIT AS CLOSE TO THE LIQUID BEING PUMPED AS POSSIBLE. POSITIVE SUCTION HEAD IN EXCESS OF 10 FEET (3.048 METERS) OF LIQUID SHOULD ALSO BE AVOIDED FOR GOOD DIAPHRAGM SERVICE LIFE.

Alternate pressurizing 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 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 one end of the air distribution valve spool while simultaneously exhausting the other. The pilot valve is positively shifted at each end of the diaphragm stroke by the diaphragm plate 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:

Locate the pump as close to product to be pumped as is practical, to keep length of suction line and number of fittings to a minimum. DO NOT REDUCE LINE SIZE except for very low flow rates or where higher velocities are required to keep pumped material in suspension in the carrying liquid. For installations involving the use of rigid piping, short flexible sections of hose are recommended between pump and piping. This reduces piping strains and vibrations.

OPERATION:

This pump has been tested at factory prior to shipment and is ready for operation as received. Rubber pads for mounting feet are shipped loose and must be installed if unit is for portable use.

The pump is completely self-priming from a dry start up to suction lifts of 20 feet (6.096 meters). For priming at suction lifts in excess of 20 feet (6.096 meters), fill the chambers with liquid prior to operation.

AIR SUPPLY:

Do not connect the unit to air supply in excess of 125 PSI (8.61 bars). Connect the pump air inlet to air supply of sufficient capacity and pressure as required for desired performance. When air supply line is solid piping, use a short length of flexible hose between pump and piping to eliminate piping strains.

LUBRICATION:

A small amount of lightweight oil (SAE 10 wt. max.) poured into air inlet daily is desirable to provide lubrication for air distribution valve. An air line filter and lubricator is recommended on permanent installations. Set at a rate of 1 drop of oil for every 20 SCF (Standard Cubic Feet) (9.4386 lit/sec.) of air being used. When using EPDM RUBBER (diaphragms and ball valves) eliminate the use of all oil in the system; chemical attack may otherwise result.

INLET AIR VALVE SETTING:

Make certain that the capacity at which the pump is operating is not limited by the suction conditions involved. Keep in mind that the diaphragms will move at a rate proportional to inlet air flow. If the cycling rate is allowed to exceed the rate that liquid can enter the chamber that is on the suction stroke, the liquid is simply pulled apart (cavitation) and displacement is reduced. For the most efficient use of compressed air and longest diaphragm life, always throttle the air inlet to lowest cycling rate that does not decrease flow rate.

Start the unit by opening air valve approximately ½ to ¾ turn. After the unit starts pumping, the air valve can be opened to increase pumping capacity as desired. When further opening of the valve increases cycling rate without increase in capacity, cavitation exists; and valve should be closed slightly.

FREEZING OR ICING OF EXHAUST

Icing of air exhaust can be experienced under certain temperature and humidity conditions on all compressed air powered equipment. Use of the Warren Rupp Extractor/Dryer should eliminate the problem.

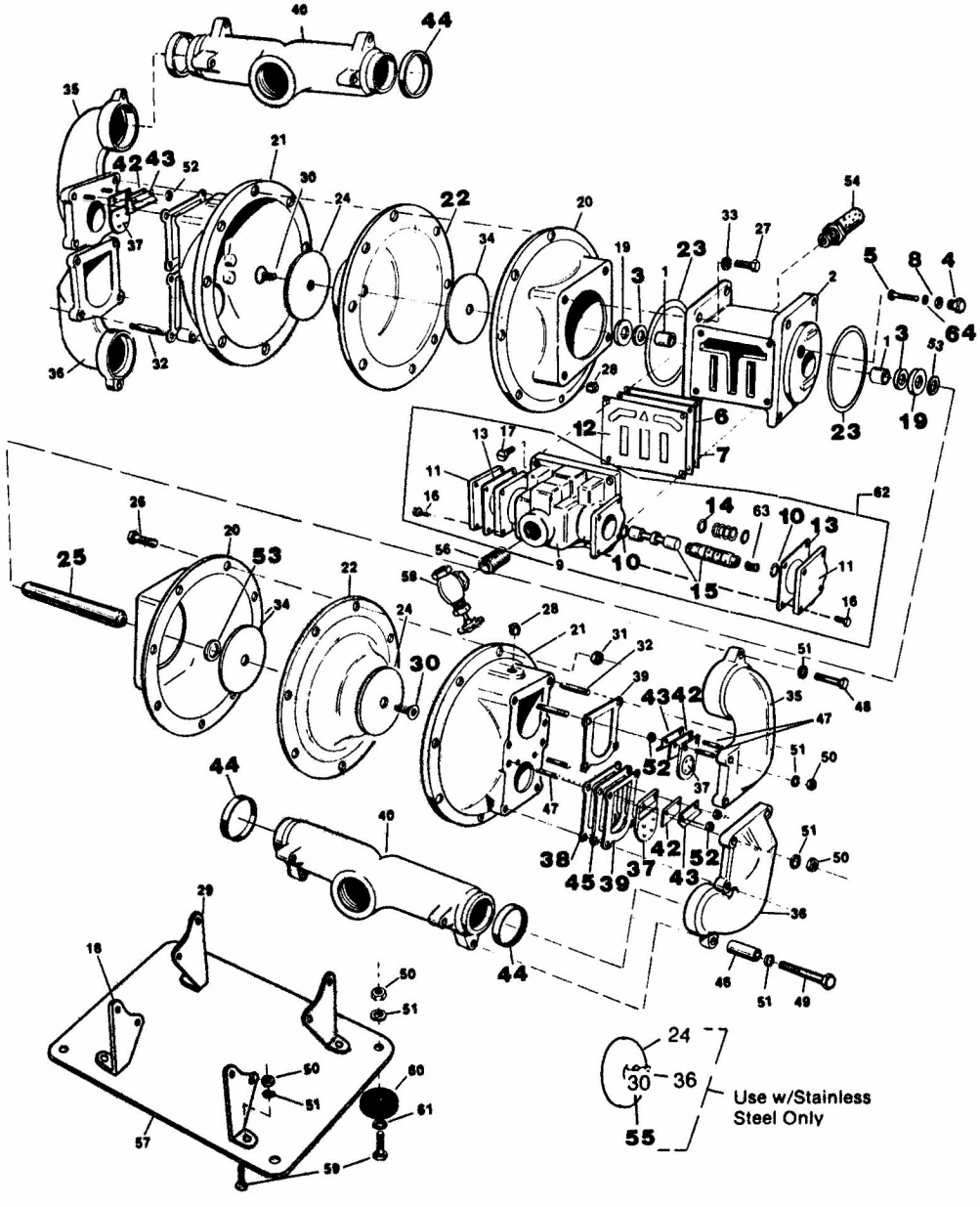
AIR EXHAUST:

This pump can be submerged if the materials of construction are compatible with the liquid and the exhaust is piped above the liquid level. Piping used for the exhaust should not be smaller than 1" (2.54 cm) pipe size. Reduced pipe size can restrict the exhausted air and cause reduced 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.



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Gylon is a registered tradename of Garlock, Inc.
Hastelloy-C is a registered tradename of Cabot Corporation.
Rupplon and SandPIPER are registered tradenames of Warren Rupp, Inc.
Ryton is a registered tradename of Phillips Chemical Company.

This unit is equipped with a spring assisted sleeve and spool set (Items 15 and 63) to help eliminate pump shifting problems created by vapor locks and automatic on-off systems. A slightly varied shifting pattern may occur. The set may not help if the problem is caused by other outside factors.

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

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
015...Ductile Iron
080...Carbon Steel, AISI B-1112
100...Alloy 20
110...316 Stainless Steel (Austenitic)
112...Hastelloy-C
114...303 Stainless Steel
115...302/304 Stainless Steel
117...440-C Stainless Steel (Martensitic)
120...416 Stainless Steel (Wrought Martensitic)
123...410 Stainless Steel (Wrought Martensitic)
148...Hardcoat Anodized Aluminum
149...2024-T4 Aluminum
150...6061-T6 Aluminum
151...6063-T6 Aluminum
152...2024-T6 Aluminum (2023-T351)
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
165...Cast Bronze, 85-5-5-5
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...Rupplon (Urethane Rubber) (Injection Mold) Color coded: PURPLE (Injection Mold)
358...Rupplon (Urethane Rubber) (Compression Mold)
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
370...Butyl Rubber. Color coded: BROWN
375...Fluorinated Nitrile
405...Cellulose Fibre
408...Cork and Neoprene
425...Compressed Fibre
440...Vegetable Fibre
465...Fibre
500...Delrin 500
505...Acrylic Resin Plastic
520...Injection Molded PVDF, Natural Color, Food Grade/USDA Acceptable
540...Nylon
550...Polyethylene
580...Ryton
600...Teflon (virgin material) Tetrafluoracarbon (TFE)
601...Teflon (Bronze and moly filled)
602...Filled Teflon
603...Blue Gylon
604...Teflon, Diaphragm
610...Teflon Encapsulated Silicone

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 limit inventory of these parts in his own stock to reduce repair downtime to a minimum.

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 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. This model must be tilted to allow the liquid from the chambers to run out of the discharge port.

TROUBLE SHOOTING:

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 require-

SA2-A TYPE 3 REPAIR PARTS LIST

ITEM NO.	PART NO.	DESCRIPTION	TOTAL RQD.
1	070-006-170	Bearing, Sleeve	2
2	114-002-156	Bracket, Intermediate	1
2	114-002-010	Bracket, Intermediate	1
3	**720-004-360**	**Seal, U-Cup**	**2**
4	**135-008-000**	**Bushing, Threaded, W/O-Ring**	**2**
5	**620-004-114**	**Plunger, Actuator**	**2**
6	**095-038-000**	**Body Assembly, Pilot Valve**	**1**
6	095-037-000	Body Assembly, Pilot Valve (All Iron)	1
7	**360-041-425**	**Gasket, Valve Body**	**1**
8	**560-001-360**	**O-Ring**	**2**
9	095-043-156	Body, Valve	1
9	095-043-010	Body, Valve	1
10	**132-014-358**	**Bumper, Valve Spool**	**2**
11	165-011-157	Cap, End	2
11	165-011-010	Cap, End	2
12	**360-048-425**	**Gasket, Valve Body**	**1**
13	**360-010-425**	**Gasket, End Cap**	**2**
14	**560-020-360**	**O-Ring**	**6**
15	**031-012-000**	**Sleeve & Spool Set**	**1**
16	170-032-330	Capscrew, Hex Head	8
17	170-045-330	Capscrew, Hex Head	4
18	115-062-080	Mounting Foot, Left Hand	2
19	**132-002-360**	**Bumper, Diaphragm**	**2**
20	196-001-157	Chamber, Inner	2
20	196-001-010	Chamber, Inner	2
21	196-002-155	Chamber, Outer	2
21	196-002-110	Chamber, Outer	2
21	196-002-010	Chamber, Outer	2
22	**286-007-365**	**Diaphragm**	**2**
22	286-007-356	Diaphragm	2
22	286-007-363	Diaphragm	2
22	286-007-360	Diaphragm	2
22	286-007-366	Diaphragm	2
22	286-007-364	Diaphragm	2
23	**560-022-360**	**O-Ring**	**2**
24	612-008-330	Plate, Diaphragm (Outer)	2
24	612-096-110	Plate, Diaphragm (Outer) (SS Units Only)	2
25	**685-007-120**	**Rod, Diaphragm**	**1**
26	170-023-330	Capscrew, Hex Head	16
27	170-024-330	Capscrew, Hex Head	8
28	618-003-330	Plug, Pipe	4
28	618-003-110	Plug, Pipe (SS Pump Only)	2
29	115-063-080	Mounting Foot, Right Hand	2
30	**171-002-330**	**Capscrew, Socket Head**	**2**
30	171-002-110	Capscrew, Socket Head	2
31	545-007-330	Nut, Hex	16
32	807-008-330	Stud	16
33	900-006-330	Washer, Lock	12
34	612-047-330	Plate, Diaphragm	2
35	312-012-156	Elbow, Suction	2
35	312-012-110	Elbow, Suction	2
35	312-012-010	Elbow, Suction	2
36	312-013-156	Elbow, Discharge	2
36	312-013-110	Elbow, Discharge	2
36	312-013-010	Elbow, Suction	2
37	**338-010-357**	**Flap Valve**	**4**
37	338-005-365	Flap Valve	4
37	338-005-360	Flap Valve	4
37	338-005-366	Flap Valve	4
37	338-005-363	Flap Valve	4
37	338-005-364	Flap Valve	4
37	338-010-356	Flap Valve	4
38	**360-011-425**	**Gasket, Seat**	**4**
38	360-011-366	Gasket, Seat	4
39	**360-012-425**	**Gasket, Flange**	**4**
39	360-012-366	Gasket, Flange	4
40	518-001-155	Manifold, Discharge, Suction	2
40	518-001-010	Manifold, Discharge, Suction	2
40	518-001-110	Manifold, Discharge, Suction	2
42	**570-001-365**	**Pad, Hinge—Flap Valve**	**4**
42	570-001-366	Pad, Hinge—Flap Valve	4
42	570-001-360	Pad, Hinge—Flap Valve	4
42	570-001-363	Pad, Hinge—Flap Valve	4
42	570-001-364	Pad, Hinge—Flap Valve	4
43	**670-005-115**	**Retainer, Flap Valve**	**4**
44	**675-013-365**	**Ring, Sealing**	**4**
44	675-013-360	Ring, Sealing	4
44	675-013-363	Ring, Sealing	4
44	675-013-366	Ring, Sealing	4
44	675-013-364	Ring, Sealing	4
45	**722-004-110**	**Seat, Flap Valve**	**4**
46	770-005-330	Spacer	2
47	807-018-110	Stud	8
48	170-052-330	Capscrew, Hex Head	2
49	170-026-330	Capscrew, Hex Head	2
50	545-005-330	Nut, Hex	24
51	900-005-330	Washer, Lock	28
52	**547-002-115**	**Nut, Stop**	**8**
53	**902-003-000**	**Stat-O-Seal**	**2**
54	530-008-000	Muffler, Exhaust—Iron Only	1
54	530-002-000	Muffler, Exhaust	1
55	**560-046-360**	**O-Ring**	**2**
55	**560-070-610**	**O-Ring**	**2**
56	538-025-335	Nipple	1
57	612-007-150	Plate, Base	1
57	612-007-080	Plate, Base	1
58	893-048-162	Valve, Angle	1
59	170-018-330	Capscrew, Hex Head	8
60	350-001-360	Foot, Rubber	4
61	901-005-330	Washer, Flat	4
62	031-019-156	Main Air Valve Assembly	1
62	031-019-010	(Inc. Items 9, 10, 11, 13, 14, 15, 16, 63)	
63	780-026-025	Spring	1
64	132-022-360	Bumper	2
	Not Shown:		
	535-015-000	Name Plate	1
	705-002-000	Drive Screw	4
	705-003-330	Drive Screw	4
FOR DUAL-PORTED SA2-A			
Parts not used			
35	312-012-XXX	Elbow, Suction	2
36	312-013-XXX	Elbow, Discharge	2
40	518-001-XXX	Manifold	2
44	675-013-XXX	Sealing Ring	4
New parts required			
	334-014-XXX	Flange, Suction	2
	334-015-XXX	Flange, Discharge	2

ment 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.)

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.

REPAIR INSTRUCTIONS:
This pump is built for long maintenance-free operation; however each installation is different, and ideal conditions cannot always be maintained. There are five areas for which it is felt necessary to detail the disassembly and reassembly procedure.

DISASSEMBLY:
1. Check Valve:
   Valve inspection requires removal of (4) ⅜" hex nuts. On the suction side the flange, when removed, carries the valve and seat as an assembly. On the discharge side, the valve and seat will stay with the diaphragm housing. Visual inspection and cleaning is possible. If parts are to be replaced, remove the self locking nuts and all parts are accessible.
2. Diaphragm Assembly:
   Diaphragms can be inspected or the diaphragm assembly removed without removing the suction and discharge flanges. Remove (8) nuts around the chamber flange, and the housing assembly will pull off. Check valves can be inspected for proper seating at this point as well as the diaphragm. Use care to keep foreign matter from behind the diaphragm. The opposite diaphragm may be inspected by the same procedure.
   If either diaphragm has to be replaced, follow closely these steps:
   Pull the outer diameter of one diaphragm off the (8) capscrews. NOTE: One side only! On the free diaphragm assembly, use a ⅜" allen wrench to turn the assembly (diaphragm, plates and screw) loose from the shaft. Once the assembly has turned, it will turn out by hand by use of the diaphragm. Now the opposite diaphragm assembly and the drive shaft will pull free from the capscrews and pump intermediate assembly. The interior components consisting of sleeve bearings, rod seals, and pilot valve actuator bushings are now accessible for service if required. Hold the shaft in a clamping device making sure to protect surface of shaft so as not to scratch or mar it in any way. The diaphragm assembly will turn loose. To disassemble the components, turn a ¼-20 capscrew by hand into the tapped hole in the inner plate. This keeps the plate from turning while the socket head capscrew is removed. To do this, place assembly in a vise so the two protruding ends of screws are loose in the vise jaws (say ¾" apart). Turn the center screw loose from the back plate and the assembly will come apart.
3. Air Distribution Valve:
   The spool and sleeve are rust and corrosion resistant brass and hardened stainless steel. The spool is closely sized to the sleeve, but should slide freely. Accumulation of dirt and oils may cause the spool not to move freely or possibly stick in a position that will prevent the pump from cycling. Remove the valve body from the center pump housing, remove end caps, and push the spool out of the sleeve. Wash parts in cleaning solvent or kerosene, and check the spool and sleeve for possible roughness due to nicks or scratches. Use a fine stone to carefully remove any irregular marks on surfaces. When the spool slides freely on the sleeve, coat the parts with light oil and reassemble.

PILOT VALVE:
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:
The bushings for the pilot valve actuators are threaded 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 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. The bushing can be turned out through the inner chamber by removing the outer chamber assembly to reach the bushing.

ASSEMBLING:
All procedures for reassembling the pump are the reverse of the instructions above with further instructions as shown·

1. 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 480 inch pounds (40 ft. pounds) (5.530 kilograms/meter) using a (⅜") allen head socket. After each diaphragm sub assembly has been completed, thread one assembly into the shaft (held near the middle in a vise having soft jaws to protect the finish) making sure the stainless steel washer is in place on the capscrew.
   Make sure ¼-20 mounting screw has been removed and that the bumper (Item #19 on drawing) is in place in the shaft.
   Install this sub assembly into the pump and secure by placing the outer chamber housing and capscrews 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. (4.15 kilograms/meter) before placing the outer diaphragm over the capscrews. If the holes in the diaphragm flange do not line up with the holes in the 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. Place remaining outer chamber on the open end and tighten down the securing nuts gradually and evenly on both sides.
2. Caution should be used while reassembling check valves. The valves are designed for some preload over the retainer hinge pad. This is done to insure proper face contact with the seat. After all parts are in place, tighten the lock nuts down on the assembly to the point where visual inspection shows that seat and valve face mate without gap. This is important for dry prime. However, after priming action has started, valves will function due to differential pressure without concern or trouble.

IMPORTANT:
This pump is pressurized internally with air pressure during operation. Always make certain all bolting is in good condition and that ALL of correct bolting is reinstalled during assembly.

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

BEFORE PUMP OPERATION all external gasket 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.