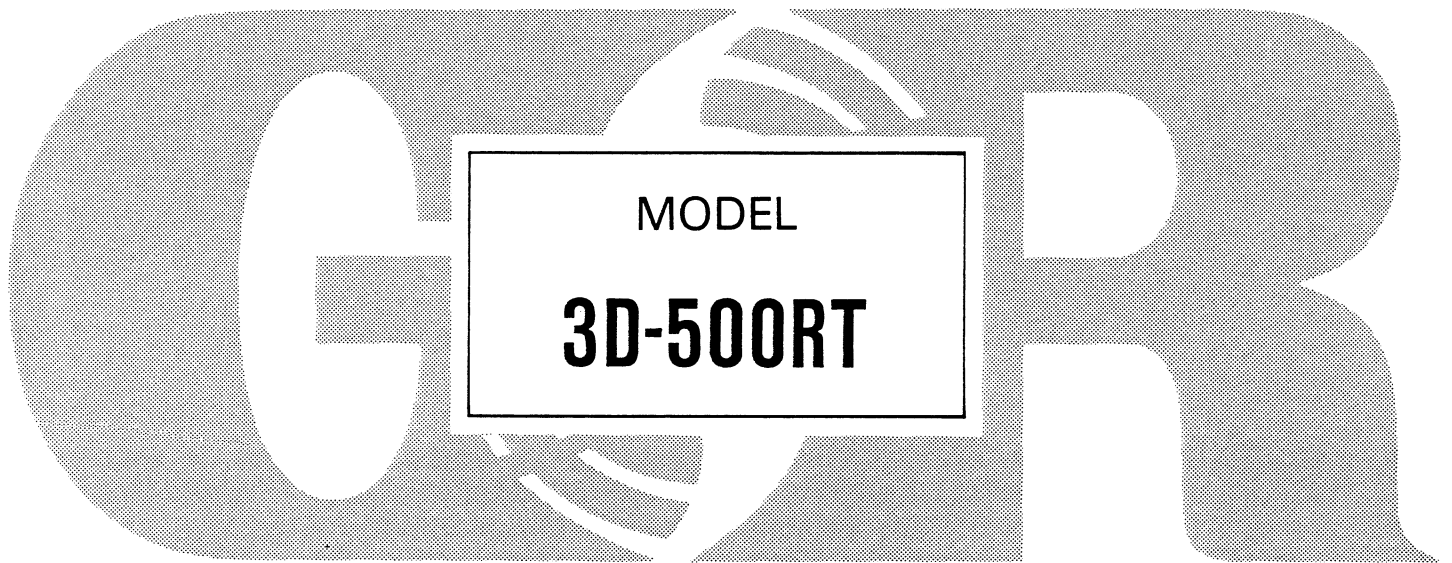

DSERIES

INSTALLATION, OPERATION, PARTS LIST, AND MAINTENANCE MANUAL



THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA

Printed in U.S.A.

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INTRODUCTION

This Installation, Operation, and Maintenance Manual is designed to help you achieve the best performance and longest life from your Gorman-Rupp pump.

This is a D Series, engine driven, positive displacement pump utilizing a single-action diaphragm to produce a straight-through flow of liquid. The pump is flex-coupled to a 4.5 HP Lombardini diesel engine, model 6LD260RT5. It is ideally suited to industrial and contractor's applications since it will handle liquids ranging from clear water to construction-site muck. The basic material of construction for wetted parts is aluminum, with neoprene flap valves and a DURABLU 1000™ diaphragm.

If there are any questions regarding the pump or its application which are not covered in this manual or in other literature accompanying this unit, please contact your Gorman-Rupp distributor, or write:

The Gorman-Rupp Company	or	Gorman-Rupp of Canada Limited
P.O. Box 1217		70 Burwell Road
Mansfield, Ohio 44901-1217		St. Thomas, Ontario N5P 3R7

For information or technical assistance on the engine, contact the engine manufacturer's local dealer or representative.

The following are used to alert maintenance personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:

NOTE

Instructions to aid in installation, operation, and maintenance or which clarify a procedure.

CAUTION

Instructions which must be followed to avoid causing damage to the product or other equipment incidental to the installation. These instructions describe the requirements and the possible damage which could result from failure to follow the procedures.

WARNING

```

////////////////////////////////////
//
// These instructions must be followed to avoid causing in-
// jury or death to personnel, and describe the procedure
// required and the injury which could result from failure
// to follow the procedure.
//
////////////////////////////////////

```


WARNINGS

WARNINGS - SECTION A

THESE WARNINGS APPLY TO D-SERIES ENGINE DRIVEN DIAPHRAGM PUMPS. REFER TO THE MANUAL ACCOMPANYING THE ENGINE BEFORE ATTEMPTING TO BEGIN OPERATION.

WARNING

Before attempting to open or service the pump:
1. Familiarize yourself with this manual.
2. Shut down the engine and take precautions to ensure that the pump will remain inoperative.
3. Drain the pump.

WARNING

This pump is designed to handle non-volatile, non-flammable liquids containing specified entrained solids. Do not attempt to pump volatile, corrosive, or flammable liquids which may damage the pump or endanger personnel as a result of pump failure.

WARNING

After the pump has been installed, block the wheels and secure the pump to prevent creeping. Make certain that the pump and all piping are tight, properly supported and secure before operation.

WARNING

Do not operate the pump without the eccentric and coupling guards in place. Exposed rotating parts can catch clothing, fingers, or tools, causing severe injury to personnel.

WARNINGS

WARNING

```

////////////////////////////////////
//
// The gearbox provided on this pump is designed for opera- //
// tion at 2600 RPM MAXIMUM input speed. If operated at a //
// higher RPM, pump components may be destroyed. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Never tamper with the governor to gain more power. The //
// governor establishes safe operating limits that should //
// not be exceeded. The maximum continuous operating speed //
// is 2600 RPM. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Do not operate an internal combustion engine in an ex- //
// plosive atmosphere. When operating internal combustion //
// engines in an enclosed area, make certain that exhaust //
// fumes are piped to the outside. These fumes contain //
// carbon monoxide, a deadly gas that is colorless, //
// tasteless, and odorless. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Fuel used by internal combustion engines presents an ex- //
// treme explosion and fire hazard. Make certain that all //
// fuel lines are securely connected and free of leaks. //
// Never refuel a hot or running engine. Avoid overfilling //
// the fuel tank. Always use the correct type of fuel. //
// //
////////////////////////////////////

```

CAUTION

Never install a positive shut-off valve in the discharge line; discharge restrictions will cause excessive friction loss resulting in overloading and destruction of pump and drive components. It is strongly recommended that unless absolutely necessary, no positive shut-off valve be installed in the suction line; excessive restriction will cause incomplete filling of the diaphragm chamber and result in short diaphragm life.

INSTALLATION - SECTION B

Since pump installations are seldom identical, this section offers only general recommendations and practices required to inspect, position, and arrange the pump and piping.

For further assistance, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

Pump Dimensions

See Figure 1 for the approximate physical dimensions of this pump and engine.

OUTLINE DRAWING

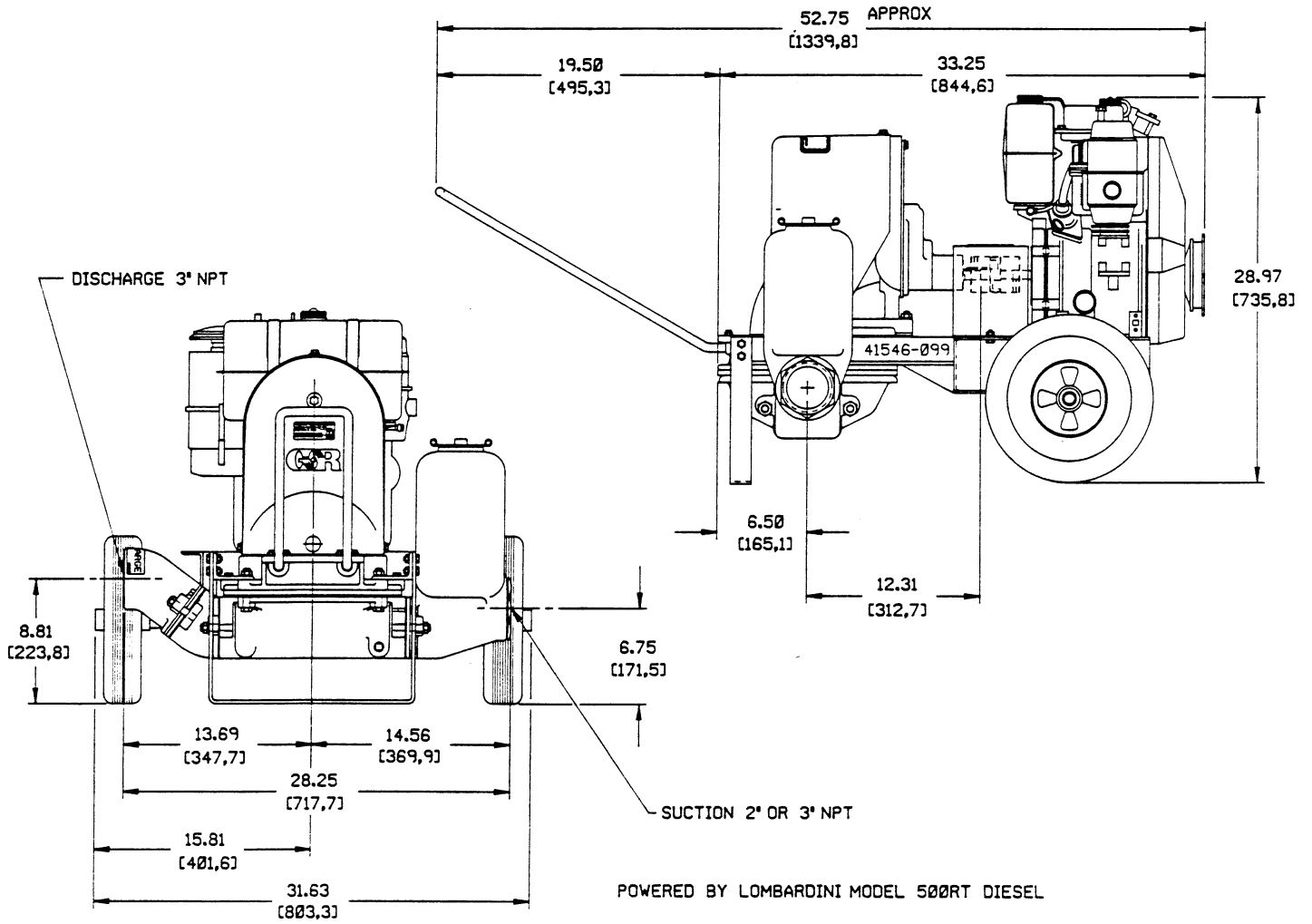


Figure 1. Pump Model 3D-500RT

PREINSTALLATION INSPECTION

The pump assembly was inspected and tested before shipment from the factory. Before installation, inspect the pump for damage which may have occurred during shipment. Check as follows:

- a. Inspect the pump and engine for cracks, dents, damaged threads, and other obvious damage.
- b. Check for and tighten loose bolts, nuts, capscrews, and other attaching hardware. Since gaskets tend to shrink after drying, check for and tighten loose nuts and capscrews securing mating surfaces.
- c. Carefully read all tags, decals, and markings on the pump assembly, and follow the instructions indicated.
- d. Check all lubricant levels and lubricate as necessary. Refer to LUBRICATION in the MAINTENANCE AND REPAIR section of this manual and perform duties as instructed.
- e. If the pump and engine have been stored for more than 12 months, some of the components or lubricants may have exceeded their maximum shelf life. These **must be inspected or replaced** to ensure maximum pump service.

If the maximum shelf life has been exceeded, or if anything appears to be abnormal, contact your Gorman-Rupp distributor or the factory to determine the repair or updating policy. **Do not** put the pump into service until appropriate action has been taken.

POSITIONING PUMP

Lifting

This pump is designed to be easily positioned for operation using the drawbar and wheels. The total pump weight is approximately 275 pounds, not including accessories or options. Customer installed equipment such as suction and discharge hoses **must** be removed before attempting to lift.

CAUTION

The pump assembly can be seriously damaged if the cables or chains used to lift and move the unit are improperly wrapped around the pump.

Mounting

Locate the pump in an accessible place as close as practical to the liquid being pumped. Level mounting is essential for proper operation. The pump may have to

be supported or shimmed to provide for level operation or to eliminate vibration.

After the pump has been positioned, block the wheels and secure the pump to prevent creeping.

SUCTION AND DISCHARGE PIPING

Materials

Either pipe or hose may be used for suction and discharge lines; however, the materials must be compatible with the liquid being pumped. If hose is used in suction lines, it must be the rigid-wall, reinforced type to prevent collapse under suction. The use of pipe couplings in suction lines is not recommended.

Line Configuration

Keep suction and discharge lines as short and straight as possible. Make minimum use of elbows and fittings, which substantially increase friction loss.

Never pull a line into place by tightening connections at the pump. Lines near the pump must be independently supported to avoid strain on the pump which could cause excessive vibration and increased diaphragm and gear train wear. If hose-type lines are used, they should have adequate support to secure them when filled with liquid and under pressure.

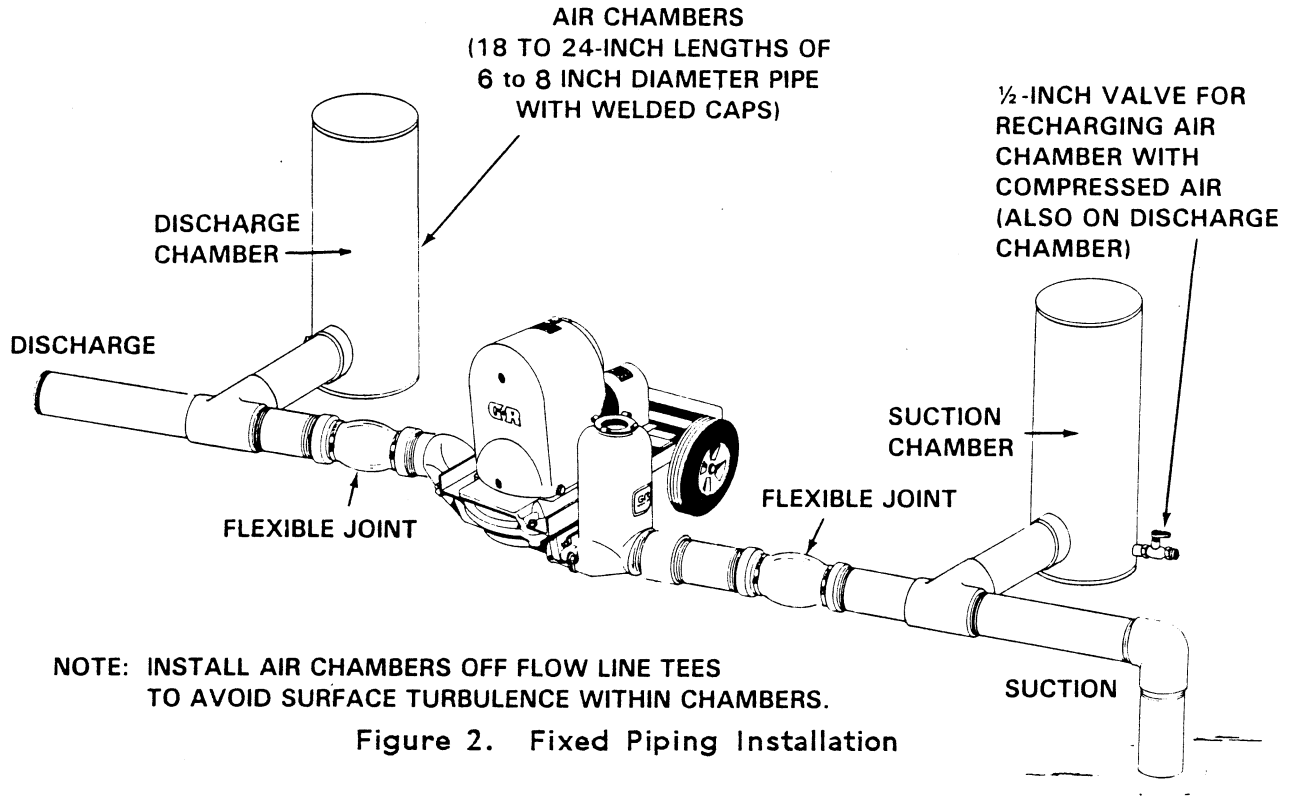
Fixed, Rigid Piping

This pump is equipped with an integral suction accumulator chamber which promotes an efficient flow of liquid and acts as an air cushion against shock. Since the air in this chamber will leak away during pump operation, the air must be replenished periodically. To introduce air into the chamber, stop the pump and remove the suction accumulator plug and integral gasket; this will break prime and allow the liquid in the chamber to drain away through the suction line.

If the pump is mounted in a system with fixed, rigid piping, it is recommended that a flexible connection be installed at or near the suction and discharge ports to absorb shock which would otherwise be transmitted through the drive train and greatly accelerate pump wear.

In a fixed piping installation, properly sized surge suppressors **must** be installed in both suction and discharge lines. If commercial surge suppressors are not readily available, air chambers may be fabricated from pipe as shown in Figure 2.

INSTALLATION



Note that the air chambers have not been installed directly in the flow line, but have been installed off tees to avoid turbulence within the chambers. The air chambers are fitted with valves to permit introduction of small amounts of compressed air to further dampen shock; this compressed air will leak away during operation, and should be replaced from time to time. If the suction chamber floods, open the suction chamber valve to break prime and allow the liquid in the chamber to drain through the suction line.

Gauges

If discharge pressure and vacuum suction gauges are desired, drill and tap the suction and discharge lines not less than 18 inches from the suction and discharge ports and install the gauges. Installation closer to the pump may result in erratic readings.

SUCTION LINES

To avoid air pockets which could affect pump priming, the suction line must be as short and direct as possible. When operation involves a suction lift, the line must always slope upward to the pump from the source of the liquid being pumped; if the line slopes down to the pump at any point along the suction run, air pockets will be created.

NOTE

Maximum pump performance is realized at suction lifts of 5 feet or less. Use the shortest possible length of suction hose or piping; lengths of 25 feet or longer will reduce the capacity of the pump.

It is strongly recommended that no positive shut-off valve be installed in the suction line; excessive restrictions will cause incomplete filling of the diaphragm chamber and result in short diaphragm life.

Fittings

If a reducer is used in the suction line, it should be the eccentric type, and should be installed with the flat part of the reducer uppermost to avoid creating air pockets. The suction line should not be restricted more than 1 inch below the nominal suction size.

The use of pipe couplings in the suction line is not recommended.

Strainers

If a strainer is furnished with the pump, be certain to use it; any spherical solids which pass through a strainer furnished with the pump will also pass through the pump itself.

If a strainer is not furnished with the pump, but is installed by the pump user, make certain that the total area of the openings in the strainer is at least three or four times the cross section of the suction line, and that the openings will not permit passage of solids larger than the solids handling capability of the pump.

This pump is designed to handle up to 2 1/4 inch diameter spherical solids.

Sealing

Since even a slight leak will affect priming, head, and capacity, especially when operating with a high suction lift, all connections in the suction line should be sealed with pipe dope to ensure an airtight seal. Follow the sealant manufacturer's recommendations when selecting and applying the pipe dope. The pipe dope should be compatible with the liquid being pumped.

DISCHARGE LINES

CAUTION

The discharge line must be the same size as, or larger than, the suction line. Never install or operate the pump with a discharge line smaller than the suction; a restricted discharge line will cause excessive friction loss resulting in overloading and destruction of pump and drive components.

Siphoning

Do not terminate the discharge line at a level lower than that of the liquid being pumped unless a siphon breaker is used in the line. Otherwise, a siphoning action causing damage to the pump could result.

Valves

The pump is provided with integral suction and discharge check valves.

CAUTION

Never install a positive shut-off valve in the discharge line; discharge restrictions will cause excessive friction loss resulting in overloading and destruction of pump and drive components. It is strongly recommended that unless absolutely necessary, no positive shut-off valve be installed in the suction line; excessive restriction will cause incomplete filling of the diaphragm chamber and result in short diaphragm life.

ALIGNMENT

WARNING

```

////////////////////////////////////
//
// Before attempting to open or service the pump:
//
// 1. Familiarize yourself with this manual.
// 2. Shut down the engine and take precautions to en-
//     sure that the pump will remain inoperative.
// 3. Drain the pump.
//
////////////////////////////////////

```

CAUTION

<p>It is imperative that alignment be checked before the pump is operated.</p>
--

The pump end, gearbox and engine were aligned and secured at the factory, but fastening hardware may have loosened during shipment. It is imperative that this hardware and the alignment be checked after the pump is installed and **before** operation. Adjustments may be made by loosening the securing hardware and shifting or shimming components as required.

This pump is designed to be driven by a flex-coupled engine.

To check coupling alignment, use a feeler gauge or taper gauge between the coupling halves every 90°. The coupling is in alignment when the hubs are the same distance apart at all points.

To check parallel adjustment, lay a straightedge across both coupling halves at the top, bottom and sides. The horizontal parallel adjustment is correct when the straightedge rests evenly on both halves of the coupling at all points. Use a feeler gauge between the coupling to measure any misalignment.

WARNING

```

////////////////////////////////////
//
// Do not operate the pump without the eccentric and coupl-
// ing guards in place. Exposed rotating parts can catch
// clothing, fingers, or tools, causing severe injury to
// personnel.
//
////////////////////////////////////

```


OPERATION - SECTION C

WARNING

```

////////////////////////////////////
//
// This pump is designed to handle non-volatile, //
// non-flammable liquids containing specified entrained //
// solids. Do not attempt to pump volatile, corrosive, or //
// flammable liquids which may damage the pump or endanger //
// personnel as a result of pump failure. //
//
//
////////////////////////////////////

```

Pump application will affect its performance, especially discharge velocities. Consult the Gorman-Rupp factory for actual performance levels for the pump.

Install the pump and piping as described in INSTALLATION. Make sure that the piping connections are tight, and that the pump is securely mounted.

CAUTION

<p>Make certain that any positive shut-off valve installed in the suction line is open before operating the pump; excessive restriction will cause incomplete filling of the diaphragm chamber and result in short diaphragm life. No positive shut-off valve should be installed in the discharge line.</p>
--

STARTING

Consult the operations manual furnished with the engine before starting the pump. Open any valves installed in the suction line and start the pump.

OPERATION

CAUTION

<p>The pump end is designed to operate at 60 cycles per minute through a gearbox with a 43.36:1 ratio at a maximum input speed of 2600 RPM. Make certain that input speed does not exceed this RPM. Operation at higher RPM can cause pump components to be damaged or destroyed.</p>

Priming

The pump may not prime immediately because the suction line must first fill with liquid. If the pump fails to prime within five minutes, stop the engine and check the suction line for leaks.

OPERATION CHECKS

gearbox Check

Check that the gearbox is properly lubricated (see LUBRICATION in MAINTENANCE AND REPAIR).

Leakage Check

No leakage should be visible at pump mating surfaces, connections, or fittings. Keep all line connections and fittings tight to maintain maximum pump efficiency.

Strainer Check

If a suction strainer has been installed, check and clean it as necessary. It should be cleaned if pump flow begins to drop. If a vacuum suction gauge has been installed, monitor and record the readings regularly to detect strainer blockage.

Accumulator Chamber Check

Check periodically to ensure that there is sufficient air in the integral suction accumulator chamber. Replenish as required (see Section B, INSTALLATION - Fixed/Rigid Piping for details).

STOPPING

After stopping the pump, shut down the engine and take precautions to ensure that the pump will remain inoperative.

If the pump will be idle for more than a few hours, or if it has been pumping liquid containing a large amount of solids, flush it with clean water.

Cold Weather Preservation

CAUTION

The primary construction materials of this pump are aluminum, with neoprene flap valves and a DURABLU[®] 1000™ diaphragm. Do not attempt to clean or flush this pump with any liquid which would attack pump fittings or components. Avoid cleaning with cleaning solvent.

In below-freezing conditions, drain the water from the pump and the lines when the pump is not in operation. Also, clean out any solids by flushing with a hose.

BEARING TEMPERATURE CHECK

Bearings normally run at higher than ambient temperatures because of heat generated by friction. Temperatures up to 160°F are considered normal for bearings, and they can operate safely to at least 180°F.

Checking bearing temperatures by hand is inaccurate. Bearing temperatures can be measured accurately by placing a contact-type thermometer against the housing. Record this temperature for future reference.

A sudden increase in bearing temperatures is a warning that the bearings are at the point of failing to operate properly. Make certain that the bearing lubricant is of the proper viscosity and at the correct level (see LUBRICATION in MAINTENANCE AND REPAIR). Bearing overheating can also be caused by shaft misalignment and/or excessive vibration.

When pumps are first started, the bearings may seem to run at temperatures above normal. Continued operation should bring the temperatures down to normal levels.

PUMP TROUBLESHOOTING - SECTION D

WARNING

```

////////////////////////////////////
//
// Before attempting to open or service the pump:
//
// 1. Familiarize yourself with this manual.
// 2. Shut down the engine and take precautions to en-
//     sure that the pump will remain inoperative.
// 3. Drain the pump.
//
////////////////////////////////////
    
```

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
<p>PUMP FAILS TO PRIME</p>	<p>Air leak in suction line.</p> <p>Lining of suction hose collapsed.</p> <p>Integral suction or discharge check valve clogged, binding, or not seating properly.</p> <p>Cracked or broken diaphragm.</p> <p>Diaphragm not securely in place.</p> <p>Strainer clogged.</p>	<p>Correct leak.</p> <p>Replace suction hose.</p> <p>Clean valves, check that flange nuts are tight.</p> <p>Replace diaphragm.</p> <p>Secure diaphragm.</p> <p>Check strainer and clean if necessary.</p>
<p>PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE</p>	<p>Air leak in suction line.</p> <p>Suction intake not properly submerged.</p> <p>Lining of suction hose collapsed.</p> <p>Cracked or broken diaphragm.</p>	<p>Correct leak.</p> <p>Check installation.</p> <p>Replace suction hose.</p> <p>Replace diaphragm.</p>

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (cont.)	Diaphragm not securely in place. Strainer clogged. Integral suction or discharge check valve clogged, binding, or not seating properly.	Secure diaphragm. Check strainer and clean if necessary. Clean valves, check that flange nuts are tight.
PUMP REQUIRES TOO MUCH POWER	Liquid solution too thick. Pump speed too high. Integral discharge check valve clogged or binding. Bearings in engine or gear box worn or binding.	Dilute if possible. Check engine output. Clean valve. Check bearings.
PUMP CLOGS FREQUENTLY	Integral suction or discharge check valve clogged, binding, or not seating properly. Liquid solution too thick.	Clean valves, check that flange nuts are tight. Dilute if possible.
EXCESSIVE NOISE	Pump, gearbox, or engine not securely mounted. Gearbox or engine not properly lubricated.	Check and tighten mounting bolts. See LUBRICATION in MAINTENANCE AND REPAIR.
BEARINGS RUN TOO HOT	Bearing temperature is high, but within limits. Low or incorrect lubricant. Drive misaligned.	Check bearing temperature regularly to monitor any increase. Check for proper type and level of lubricant. Align drive properly.

PUMP MAINTENANCE AND REPAIR - SECTION E

MAINTENANCE AND REPAIR OF THE WEARING PARTS OF THE PUMP WILL MAINTAIN PEAK OPERATING PERFORMANCE.

STATIC LIFT IN FEET	STATIC DISCHARGE HEAD IN FEET			
	5	10	15	20
5	78	67	66	68
10	73	64	66	62
15	68	60	64	59
20	64	59	65	59
25	56	56	60	56

In Gallons Per Minute, 60 Strokes Per Minute

STATIC LIFT IN METERS	STATIC DISCHARGE HEAD IN METERS			
	1,5	3,0	4,6	6,1
1,5	295,2	253,6	249,8	257,4
3,0	276,3	242,2	249,8	234,7
4,6	257,4	227,1	242,2	223,2
6,1	242,2	223,3	246,0	223,3
7,6	212,0	212,0	227,1	212,0

In Liters Per Minute, 60 Strokes Per Minute

***STANDARD PERFORMANCE TEST DATA FOR PUMP MODEL 3D-500RT**

*Based on 70°F clear water at sea level with minimum suction lift, using 2 inch (5,08 cm.) suction hose and 3 inch (7,62 cm.) non-collapsible hose. Since pump installations are seldom identical, your performance may be different due to such factors as viscosity, specific gravity, elevation and temperature.

If your pump serial number is followed by an "N", your pump is **NOT** a standard production model. Contact the Gorman-Rupp Company to verify performance or part numbers.

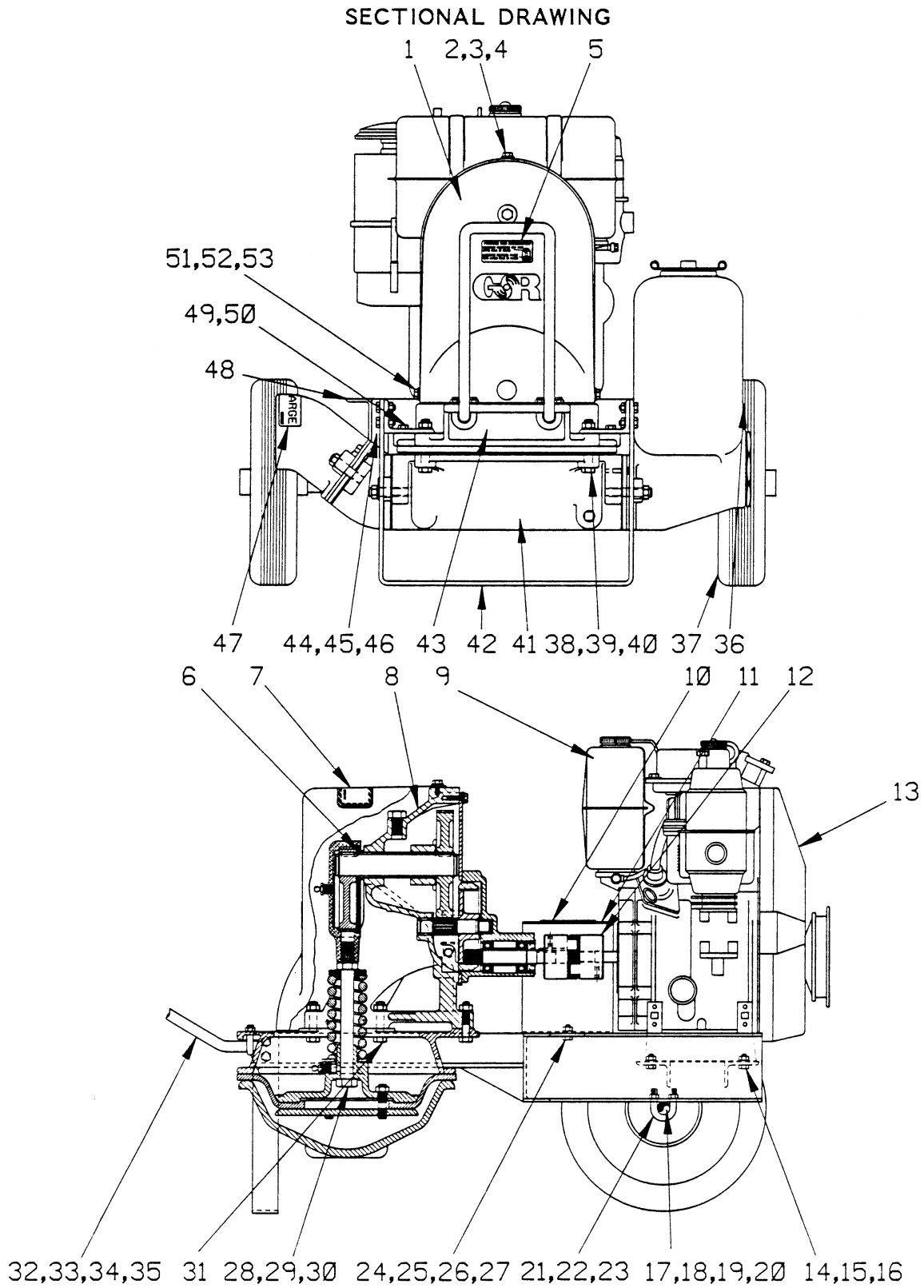


Figure 1. Pump Model 3D-500RT

PARTS LIST
Pump Model 3D-500RT
 (From S/N 883291 up)

If your pump serial number is followed by an "N", your pump is **NOT** a standard production model. Contact the Gorman-Rupp Company to verify part numbers.

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	ECC GUARD	38861-501	23200	1	30	HEX NUT	D06	15991	5
2	HEX HD CAPSCREW	BT0403	15991	1	31	PLUNGER ROD ASSY	5685	-----	1
3	RUBBER WASHER	S157	15991	1	32	DRAW BAR	5438	15990	1
4	FLAT WASHER	K04	15991	1	33	U-BOLT	5495	15990	2
5	LUBRICATION DECAL	38817-066	-----	1	34	LOCKWASHER	J06	15991	4
6	SNAP RING	5385	-----	1	35	HEX NUT	D06	15991	4
7	WARNING DECAL	38816-063	-----	1	36	SUCTION STICKER	6588-AG	-----	1
8	GEARBOX ASSY	8981	-----	1	37	*TIRE	S263	-----	2
9	WARNING DECAL	2613-FE	-----	1	38	HEX HD CAPSCREW	B0811	15991	4
10	GRD WARNING STKR	38816-063	-----	1	39	FLAT WASHER	K08	15991	4
11	COUPLING GUARD	34613-005	15020	1	40	HEX NUT	D08	15991	4
12	*COUPLING	48113-004	-----	1	41	DIAPH POT ASSY	46475-701	-----	1
13	LOMBARDINI ENGINE	29226-002	-----	1	42	FRONT STAND	13759-L	15990	1
14	HEX HD CAPSCREW	B0606	15991	4	43	DIAPHRAGM RING	5379	13010	1
15	LOCKWASHER	J06	15991	4	44	HEX HD CAPSCREW	B0605	15991	4
16	HEX NUT	D06	15991	4	45	LOCKWASHER	J06	15991	4
17	AXLE	4607-Q	15990	1	46	HEX NUT	D06	15991	4
18	CLAMP	S967	-----	2	47	DISCHARGE STICKER	6588-BJ	-----	1
19	FLAT WASHER	S1532	-----	4	48	BASE ASSY	41546-099	24150	1
20	COTTER PIN	M0306	15990	2	49	HEX HD CAPSCREW	B0604	15991	2
21	U-BOLT	4610	15990	2	50	LOCKWASHER	J06	15991	2
22	LOCKWASHER	J06	15991	4	51	HEX HD CAPSCREW	B0402 1/2	15991	4
23	HEX NUT	D06	15991	4	52	LOCKWASHER	AK04	15991	4
24	HEX HD CAPSCREW	B0404	15991	2	53	FLAT WASHER	K04	15991	4
25	FLAT WASHER	K04	15991	2		NOT SHOWN:			
26	LOCKWASHER	J04	15991	2		DRIVE SCREW	BM#04-03	15990	4
27	HEX NUT	D04	15991	2		NAME PLATE	2613-BP	13990	1
28	HEX HD CAPSCREW	B0608	15991	5		STRAINER	9026-D	24001	1
29	LOCKWASHER	J06	15991	5					

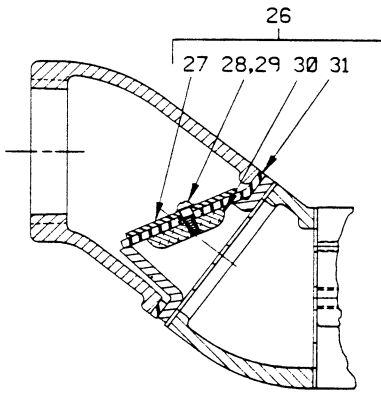
*INDICATES PARTS RECOMMENDED FOR STOCK

Above Serial Numbers Do Not Apply To Pumps Made In Canada.

CANADIAN SERIAL NO AND UP

SECTIONAL DRAWING

DISCHARGE FLAP VALVE
DETAIL



SUCTION FLAP VALVE
DETAIL

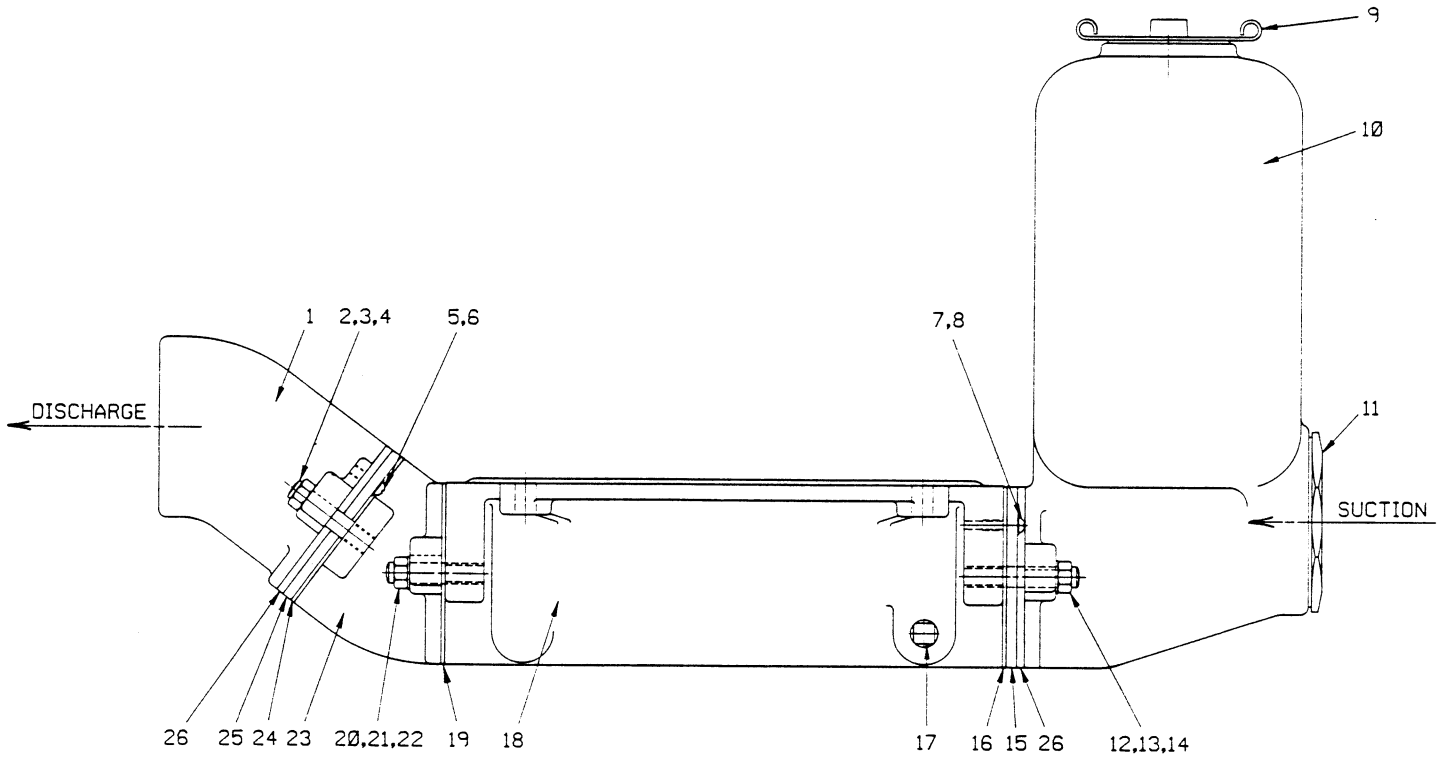
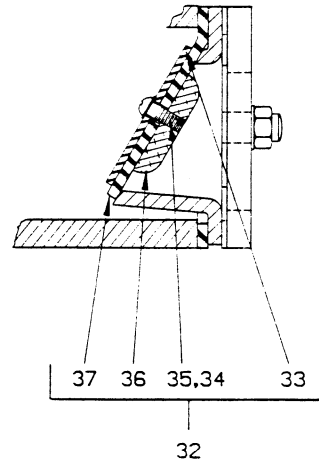


Figure 2. 46475-701 Diaphragm Pot Assembly

PARTS LIST
46475-701 Diaphragm Pot Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	DISCHARGE ELBOW	5658	13040	1
2	STUD	C0810	15991	2
3	HEX NUT	D08	15991	2
4	WASHER	11273	15990	2
5	RD HD MACHINE SCREW	X0404	15991	2
6	LOCKWASHER	J04	15991	2
7	RD HD MACHINE SCREW	X0404	15991	2
8	LOCKWASHER	J04	15991	2
9	SUCTION ACCUMULATOR PLUG AND GSKT	S591	-----	1
10	SUCTION ACCUMULATOR	5376	13010	1
11	REDUCING PIPE BUSHING	AP4832	11990	1
12	STUD	C0810	15991	2
13	FLAT WASHER	K07	15991	2
14	HEX NUT	D08	15991	2
15	SUCTION FLAP VALVE SEAT	5374	10010	1
16	* SUCTION ACCUMULATOR GSKT	5374-G	19100	1
17	DIAPHRAGM POT DRAIN PLUG	P06	11990	1
18	DIAPHRAGM POT	5375	13010	1
19	* DISCHARGE FLANGE GSKT	5374-G	19100	1
20	STUD	C00809	15991	2
21	FLAT WASHER	K07	15991	2
22	HEX NUT	D08	15991	2
23	DISCHARGE FLANGE	5377	13040	1
24	* DISCHARGE FLANGE GSKT	5374-G	19100	1
25	DISCHARGE FLAP VALVE SEAT	5734	10010	1
26	DISCHARGE FLAP VALVE ASSY	46413-013	-----	1
27	-FLAP VALVE WEIGHT	5428	15990	1
28	-ROUND HD MACHINE SCREW	X0403	17090	2
29	-LOCKWASHER	J04	17000	2
30	-FLAP VALVE WEIGHT	5426	13010	1
31	* -FLAP VALVE	5427	19100	1
32	SUCTION FLAP VALVE ASSY	46413-013	-----	1
33	-FLAP VALVE WEIGHT	5428	15990	1
34	-ROUND HD MACHINE SCREW	X0403	17090	2
35	-LOCKWASHER	J04	17000	2
36	-FLAP VALVE WEIGHT	5426	13010	1
37	* -FLAP VALVE	5427	19100	1

OPTIONAL:

FOR OIL-BASE SERVICE (BUNA-N):				
	-FLANGE GSKTS	5474-GA	19140	3
	-FLAP VALVE ASSY	46413-027	-----	2

*INDICATES PARTS RECOMMENDED FOR STOCK

SECTIONAL DRAWING

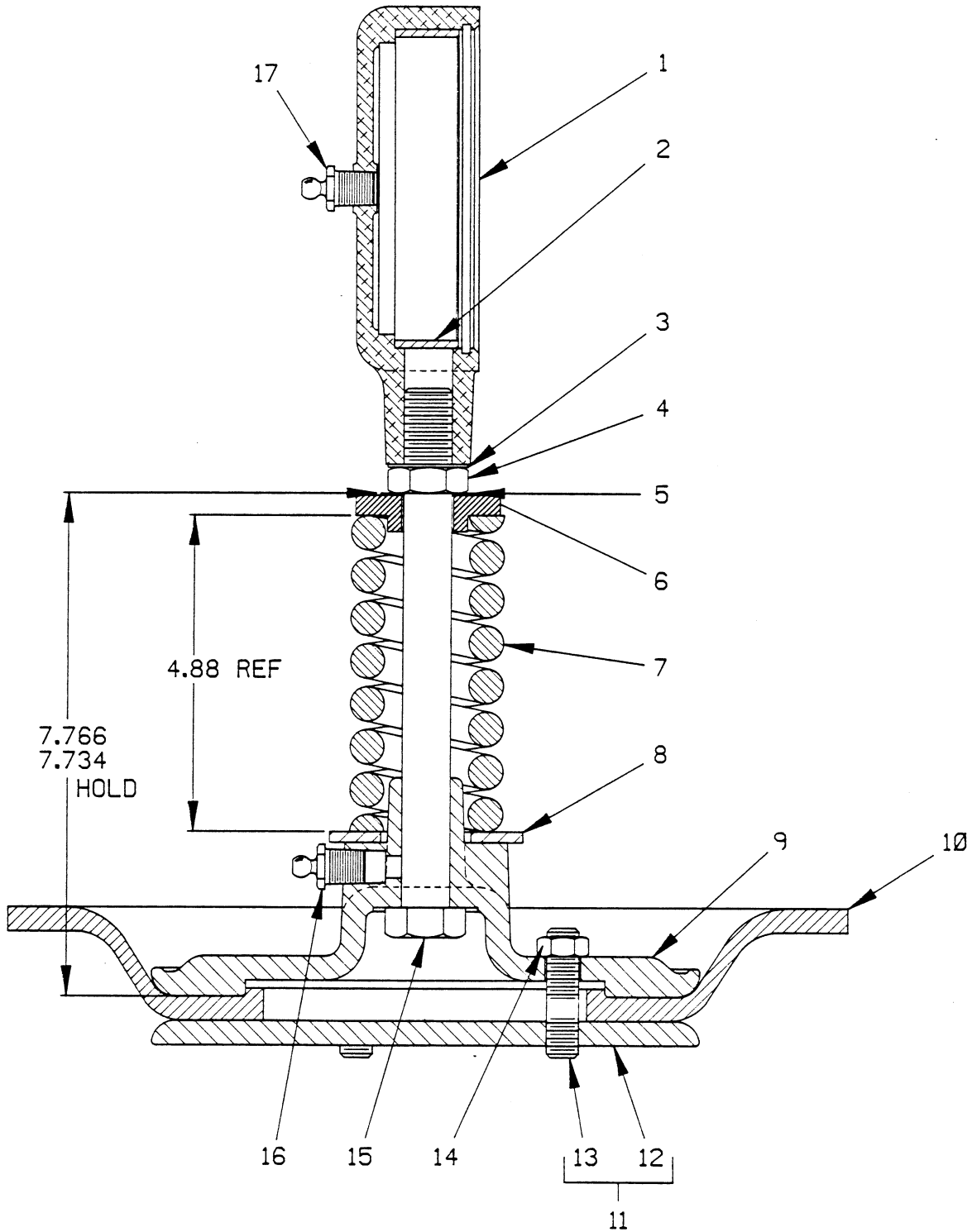


Figure 3. 5685 Plunger Rod Assembly

PARTS LIST
5685 Plunger Rod Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	ECCENTRIC CAP	5373	13010	1
2	* ECCENTRIC BEARING	5610	14000	1
3	T-TYPE LOCKWASHER	AK12	15991	1
4	JAM NUT	AT12	15990	1
5	* ADJUSTING SHIM	11840-B	15990	4
6	SPRING WASHER	5384	15990	1
7	* PLUNGER SPRING	5398	16080	1
8	FLAT WASHER	K20	15991	1
9	UPPER DIAPHRAGM PLATE	5381	10010	1
10	* DIAPHRAGM (DURABLU 1000™)	26844-041	-----	1
11	LOWER DIAPHRAGM PLATE ASSY	5394	-----	1
12	-LOWER DIAPHRAGM PLATE	5394-A	10030	1
13	-STUD	C0808	15991	3
14	HEX NUT	D08	15991	3
15	* PLUNGER ROD	21612-577	-----	1
16	LUBRICATION FITTING	S191	-----	1
17	LUBRICATION FITTING	S191	-----	1
OPTIONAL:				
	FOR OIL-BASE SERVICE (BUNA-N):			
	-DIAPHRAGM	S1042	-----	1
	NEOPRENE DIAPHRAGM:			
	-DIAPHRAGM	S701	-----	1

*INDICATES PARTS RECOMMENDED FOR STOCK

SECTIONAL DRAWING

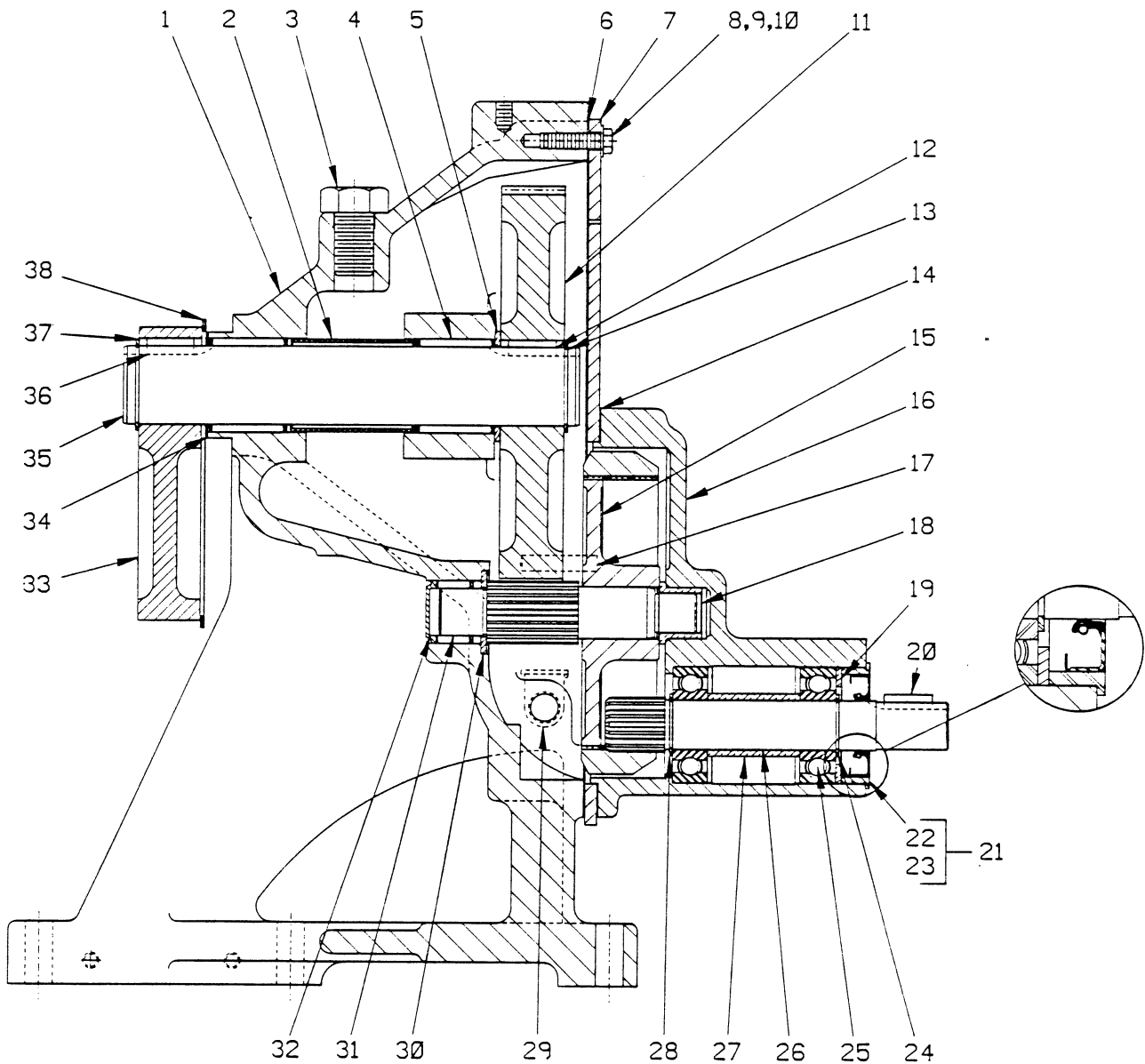


Figure 4. 44161-008 Gearbox Assembly

PARTS LIST
44161-008 Gearbox Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	GEAR HOUSING	5367	13010	1
2	SPACER SLEEVE	S952	-----	1
3	HEX HD CAPSCREW	B1004	15991	1
4	* DRIVE SHAFT BEARING	S702	-----	2
5	SPACER WASHER	5395	15990	1
6	* HOUSING GASKET	5367-G	20050	1
7	COVER PLATE	5396	15990	1
8	HEX HD CAPSCREW	B0403	15991	7
9	LOCKWASHER	J04	15991	9
10	HEX HD CAPSCREW	B0407	15991	2
11	DRIVE GEAR	5334	16060	1
12	KEY	31811-040	15990	1
13	SNAP RING	S700	-----	1
14	* BEARING HOUSING GASKET	S825	-----	1
15	PINION GEAR	S823	-----	1
16	BEARING HOUSING	5918-A	13010	1
17	LOCATING PIN	AA0405	15990	2
18	* PINION SHAFT BUSHING	S824	-----	1
19	WASHER	2M	15990	3
20	* DRIVE KEY	N0304	15990	1
21	OIL SEAL ASSY	14408	-----	1
22	-OIL SEAL ADAPTOR	14407	15000	1
23	* -OIL SEAL	25227-355	-----	1
24	SNAP RING	S269	-----	1
25	* PINION DRIVE SHAFT, BEARING	S1044	-----	2
26	PINION DRIVE SHAFT	8211	16070	1
27	SLEEVE	5922	15070	1
28	SNAP RING	S269	-----	1
29	OIL CUP	S617	-----	1
30	SPACER WASHER	5382	15990	1
31	PINION SHAFT	5333	16020	1
32	* PINION SHAFT BEARING	S703	-----	1
33	ECCENTRIC CAM	5378-A	10080	1
34	ADJ SHIM SET	13103-A	15990	1
35	DRIVE SHAFT	5397	15020	1
36	* KEY	31811-040	15990	1
37	SNAP RING	S700	-----	1
38	WASHER	6531	18040	1

*INDICATES PARTS RECOMMENDED FOR STOCK

PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

This pump requires little service due to its rugged, minimum-maintenance design. However, if it becomes necessary to inspect or replace the wearing parts, follow these instructions which are keyed to the sectional view(s) (see Figures 1, 2, 3 and 4) and the accompanying parts list(s).

Most service functions may be performed without separating the pump and gearbox from the engine. If major repair is required, the pump, gearbox and engine must be disconnected.

Before attempting to service the pump, shut down the engine and take precautions to ensure that the engine will remain inoperative and close any valves in the suction line.

For engine disassembly and repair, consult the literature supplied with the engine, or contact your local Lombardini engine representative.

WARNING

```

////////////////////////////////////
//
// Before attempting to open or service the pump:
//
// 1. Familiarize yourself with this manual.
// 2. Shut down the engine and take precautions to en-
//     sure that the pump will remain inoperative.
// 3. Drain the pump.
//
////////////////////////////////////

```

Before attempting to service the pump, drain the pump by removing the drain plug (17, Figure 2). Clean and reinstall the drain plug.

Suction And Discharge Flap Valve Removal

(Figure 2)

Before attempting to service the suction and discharge flap valves, remove the suction and discharge piping.

To service the suction flap valve assembly (32), remove the suction accumulator (10) by disconnecting the hardware (13 and 14) securing it to the diaphragm pot (18).

Remove the hardware (7 and 8) securing the valve seat (15) and flap valve assembly to the diaphragm pot.

To service the discharge flap valve assembly (26), remove the hardware (3 and 4) and remove the discharge elbow (1). Remove the hardware (5 and 6) securing the valve seat (25) and discharge flap valve to the outboard discharge flange.

To remove the inboard discharge flange (23), remove the hardware (21 and 22) securing the flange to the diaphragm pot.

The suction and discharge flap valve assemblies are identical parts, and operate in the same direction. For removal and/or replacement, remove the machine screws and lockwashers (28, 29, 34 and 35), and separate the parts.

If no further disassembly is required, see **Suction And Discharge Flap Valve Installation**.

Diaphragm Removal

(Figure 1)

To remove the diaphragm, disengage the hardware (38, 39 and 40) and remove the diaphragm pot assembly (41).

(Figure 3)

Remove the nuts (14), lower diaphragm plate assembly (11) and the diaphragm (10). Inspect the diaphragm ring (43, Figure 1) for wear or damage. If replacement is necessary, the gearbox assembly (8, Figure 1) must be removed.

If no further disassembly is required, see **Diaphragm Installation**.

Plunger Rod Removal And Disassembly

(Figure 1)

With the diaphragm pot assembly and diaphragm removed, disengage the hardware (2, 3, 4, 51, 52 and 53), and remove the eccentric guard (1).

Remove the retaining ring (6) and slide the plunger rod assembly (31) off the eccentric cam (15, Figure 4).

(Figure 3)

Use a socket wrench to hold the plunger rod (15), and unscrew the eccentric cap (1). Remove the T-type lockwasher (3), jam nut (4), adjusting shims (5), spring washer (6) and spring (7). Remove the flat washer (8) and slide the plunger rod out of the upper diaphragm plate (9).

Inspect the eccentric bearing (2) for excessive wear. If replacement is necessary, cut the bearing with a chisel. **Be careful** not to damage the eccentric cap.

Gearbox Removal And Disassembly

(Figure 1)

When properly operated and maintained, the gearbox should not require disassembly. Disassemble the gearbox **only** when there is evidence of wear or damage.

CAUTION

Shaft and bearing disassembly in the field is not recommended. These operations should be performed only in a properly-equipped shop by qualified personnel.

Support the diaphragm ring (43) with wood blocks. Remove the hardware (28, 29 and 30) securing the gearbox to the diaphragm ring.

Disengage the hardware (24, 25, 26 and 27) and remove the coupling guard (11). Loosen the hardware securing the coupling (12) and separate the halves. Remove the gearbox assembly, and slide the coupling half off the pinion drive shaft (26, Figure 4).

Inspect the diaphragm ring for wear or damage and replace as necessary.

(Figure 4)

Before attempting to disassemble the gearbox assembly, drain the lubricant by removing the oil cup (29) and turning the gearbox on its side. Reinstall the oil cup.

Remove the two lower capscrews and lockwashers (9 and 10) and the five upper capscrews and lockwashers (8 and 9) securing the cover plate (7) to the gear housing (1). Pull the bearing housing (16) and cover plate from the pinion shaft (31) and gear (15). Remove the gasket (6) and clean the mating surfaces.

Remove the two remaining capscrews and lockwashers (8 and 9) and separate the cover plate from the gear housing. Remove the gasket (14) and clean the mating surfaces.

To disassemble the drive shaft components, remove the key (20), and pry the oil seal assembly (21) from the bearing housing. Press the oil seal (23) from the adaptor (22).

Remove the washer (19). Slide the assembled pinion drive shaft (26) and bearings (25) from the bearing housing.

Remove the snap ring (24) and use a bearing puller to remove the outer bearing (25) from the shaft.

Remove the sleeve (27), and pull the inner bearing (25) from the shaft.

NOTE

It is not necessary to remove the inboard snap ring (28) unless replacement is required. Use snap ring pliers to remove the ring.

Inspect the pinion bushing (18) for excessive wear. If replacement is required, use a bearing puller (or similar device) to remove the bushing from the bearing housing.

Slide the pinion shaft and gear (15 and 31) out of the pinion bearing (32). Remove the spacer washer (30).

Inspect the pinion shaft and gear for wear or broken teeth. If replacement of either part is necessary, use a bearing puller to remove the gear.

Use an arbor (or hydraulic) press to remove the pinion bearing from the gear housing (1).

NOTE

It is not necessary to remove the drive shaft (35), gear (11), bearings (4) or eccentric cam (33) unless wear or damage is obvious. Inspect the parts, and if replacement is necessary, proceed as follows.

Remove the snap ring (37) from the drive shaft. Use a bearing puller to remove the eccentric cam (33) and key (36) from the drive shaft. Remove the eccentric cam shim set (34) and washer (38). Tie and tag the shims or measure and record their thickness for ease of reassembly.

Slide the drive shaft and gear out of the housing. Slide the spacer washer (5) off the drive shaft.

Remove the snap ring (13). Install two 1/2 - 13 UNC capscrews in the gear, and use a gear puller to remove the gear and key (12) from the shaft.

To remove the drive shaft bearings (4), the spacer sleeve (2) must be coiled into a smaller diameter to allow passage through the I.D. of the bearings.

NOTE

After the spacer sleeve is compressed, it will be permanently damaged and require replacement.

To remove the spacer sleeve, remove the capscrew (3) and use a pointed tool to rotate the perforated steel sleeve until the seam is visible through the tapped hole. Apply pressure on one side of the seam until one edge overlaps the other. Reach through the I.D. of the bearings and continue to coil the spacer sleeve until it can be removed. Reinstall the capscrew (3).

Use an arbor (or hydraulic) press to remove the bearings from the gear housing.

It is not necessary to remove the locating pins (17) from the gear housing unless they are bent or damaged. If replacement is required, press the pins from the housing.

Gearbox Reassembly And Installation

(Figure 4)

Clean the bearing bores and all component parts (except bearings) with a soft cloth soaked in cleaning solvent. Inspect the parts for wear and replace as necessary.

MAINTENANCE AND REPAIR

WARNING

```

////////////////////////////////////
//
// Most cleaning solvents are toxic and flammable. Use //
// them only in a well-ventilated area free from excessive //
// heat, sparks, and flame. Read and follow all prec- //
// autions printed on solvent containers. //
// //
////////////////////////////////////

```

Clean all bearings thoroughly in **fresh** cleaning solvent, agitating to remove the old lubricant. Dry the bearings with filtered compressed air and coat with light oil.

Rotate the bearings by hand to check for roughness or binding, and inspect the bearing needles or balls. If rotation is rough or the needles or balls are discolored, replace the bearings.

CAUTION

<p>Bearings must be kept free of all dirt and foreign material. Failure to do so will greatly shorten bearing life. DO NOT spin dry bearings. This may scratch the balls or races and cause premature bearing failure.</p>
--

Use a press to install one of the bearings (4) in the gear housing until it is flush with the outer machined face of the housing. Install a new spacer sleeve through the open bearing bore and press the other bearing into the bore until it is flush with the inner machined face on the housing.

CAUTION

<p>When installing the bearings into the bearing bore, push against the outer race. NEVER hit the needles or cage.</p>
--

Install the gear key (12) and press the drive gear (11) onto the drive shaft. Secure the gear with the snap ring (13).

Install the spacer washer (5) and slide the drive shaft through the bearings. Install the washer (38) and the same thickness of shims (34) as previously removed. Press the eccentric cam (33) and key (36) onto the shaft and secure with the snap ring (37).

Press the pinion bearing (32) into the gear housing until the closed end is flush with the outer face of the bore.

Press the pinion gear (15) onto the pinion shaft until it seats squarely against the shaft shoulder. Position the spacer washer (30) in the housing and slide the shaft through the washer into the pinion bearing.

Press the pinion bushing (18) into the bearing housing until fully seated.

If removed, install the snap ring (28) in the groove on the shaft (26). Press the lubricated inboard bearing onto the shaft until fully seated against the snap ring. Install the sleeve (27), and press the outboard bearing onto the shaft until squarely seated against the sleeve. Secure the bearings with the snap ring (24).

Slide the assembled shaft and bearings into the housing until the inboard bearing is fully seated against the bore shoulder.

Press the oil seal (23) into the adaptor (22) with the lip positioned as shown in Figure 4. The outer face of the oil seal should be just flush with the face of the adaptor. Install the washer (19), and press the oil seal assembly (21) into the bearing housing until fully seated. **Be careful** not to damage the oil seal lip on the shaft keyway.

Install the gasket (14), and secure the cover plate to the bearing housing (16) with two of the capscrews and lockwashers (8 and 9).

If removed, press the locating pins (17) into the housing. Install the gasket (6), and position the bearing housing and cover plate against the gear housing so the locating pins align with the holes in the cover plate. Be sure the teeth on the shaft (26) mesh with those on the gear (15), and tap against the bearing housing with a soft-faced mallet or wood block until the bushing (18) fully engages the pinion shaft (31).

Secure the cover plate to the gear housing with the two lower capscrews and lockwashers (9 and 10) and the five upper capscrews and lockwashers (8 and 9).

(Figure 1)

Install the shaft key (20, Figure 4), and coupling half on the pinion drive shaft (26, Figure 4).

Secure the gearbox to the diaphragm ring (43) with the hardware (28, 29 and 30). Connect the coupling halves and check the alignment as described in Section B.

Secure the coupling guard (11) to the base with the hardware and (24, 25, 26 and 27).

Lubricate the gearbox as described in LUBRICATION.

Plunger Rod Reassembly And Installation

(Figure 3)

If the eccentric bearing (2) was removed, clean the eccentric cap bore with a cloth soaked in cleaning solvent.

WARNING

```

////////////////////////////////////
//
// Most cleaning solvents are toxic and flammable. Use //
// them only in a well-ventilated area free from excessive //
// heat, sparks, and flame. Read and follow all prec- //
// autions printed on solvent containers. //
// //
////////////////////////////////////

```

Press the eccentric bearing into the cap with an arbor (or hydraulic) press.

Slide the plunger rod (15) through the upper diaphragm plate. Install the flat washer (8), spring (7), spring washer (6), adjusting shims (5) and jam nut (4). Compress the spring to the dimension shown in Figure 3.

Install the T-type lockwasher (3). Apply "Loctite Threadlocker No. 242" on the plunger rod threads, and screw the eccentric cap (1) on until tight.

NOTE

The lubrication fitting in the eccentric cap must face the same direction as the fitting in the diaphragm plate. Use the jam nut (4) to secure the eccentric cap in this position.

(Figure 1)

Lubricate the eccentric bearing with a thin coating of No. 2 lithium base grease. Install the plunger rod assembly onto the eccentric cam (33, Figure 4), and secure with the snap ring (6).

Install the eccentric guard (1), and secure it with the hardware (2, 3, 4, 51, 52 and 53).

Lubricate the plunger rod assembly as described in LUBRICATION, Section E.

Diaphragm Installation

(Figure 3)

Position the diaphragm on the upper diaphragm plate, making sure the lip is properly seated. Slide the studs in the lower diaphragm plate through the holes in the upper plate and secure with the nuts (14).

Secure the diaphragm pot assembly (41, Figure 1) to the diaphragm ring with the hardware (38, 39 and 40, Figure 1).

Suction And Discharge Flap Valve Installation

(Figure 2)

If either flap valve assembly was disassembled, use the round head machine screws and lockwashers to secure the weights to the flap valves.

If the inboard discharge flange (23) was removed, clean the mating surfaces, install the gasket (19) and secure the flange to the diaphragm pot with the hardware (21 and 22).

Subassemble the valve seat (25) and discharge flap valve assembly (26) to the discharge elbow (1) with the weights positioned as shown in Figure 2. Secure with the hardware (5 and 6).

Clean the mating surfaces of the valve seat and inboard discharge flange. Install the gasket (24) and secure the discharge elbow to the inboard discharge flange.

Subassemble the suction flap valve (32) and valve seat (15) to the diaphragm pot with the weights positioned as shown in Figure 2, and secure with the hardware (7 and 8).

Clean the mating surfaces, install the gasket (16) and secure the suction accumulator to the diaphragm pot with the hardware (13 and 14).

Connect the suction and discharge piping as described in **INSTALLATION**, Section B.

Refer to **OPERATION**, Section C before starting the pump.

LUBRICATION

Plunger Rod Assembly

(Figure 3)

CAUTION

The eccentric bearing should be lubricated thoroughly after each 8 hours of operation. Failure to do so may cause the bearing to overheat and fail.

Before attempting to lubricate the plunger rod assembly, set the engine control on the stop position, and use the engine pull rope to rotate the eccentric cam until the grease fittings (16 and 17) can be accessed through the holes in the eccentric guard (1, Figure 1).

Apply No. 2 lithium base grease to the upper lubrication fitting until grease escapes from the eccentric cap. Lubricate the lower fitting until grease escapes from the top of the upper diaphragm plate inside the spring.

Gearbox

(Figure 4)

The gearbox was fully lubricated when shipped from the factory. Check the oil level regularly at the oil cup (29), keeping the oil cup full. When lubrication is required, lubricate with SAE No. 30 non-detergent oil. **Do not** over-lubricate. Over-lubrication can cause the bearings to overheat, resulting in premature bearing failure.

Under normal conditions, drain the gearbox once each year. Change the oil more frequently if the pump is operated continuously or installed in an environment with rapid temperature change.

CAUTION

Monitor the condition of the bearing lubricant regularly for evidence of rust or moisture condensation. This is especially important in areas where variable hot and cold temperatures are common.

When lubricating a dry (or over-hauled) gearbox, add one ounce of "Molykote M Gear Guard", and "top off" with clean oil.

For cold weather operation, consult the factory or a lubricant supplier for the recommended grade of oil.

Engine

Refer to the engine manufacturer's recommendations, or contact your local Lombardini engine representative.

**For U.S. and International Warranty Information,
Please Visit www.grpumps.com/warranty
or call:
U.S.: 419-755-1280
International: +1-419-755-1352**

**For Canadian Warranty Information,
Please Visit www.grcanada.com/warranty
or call:
519-631-2870**