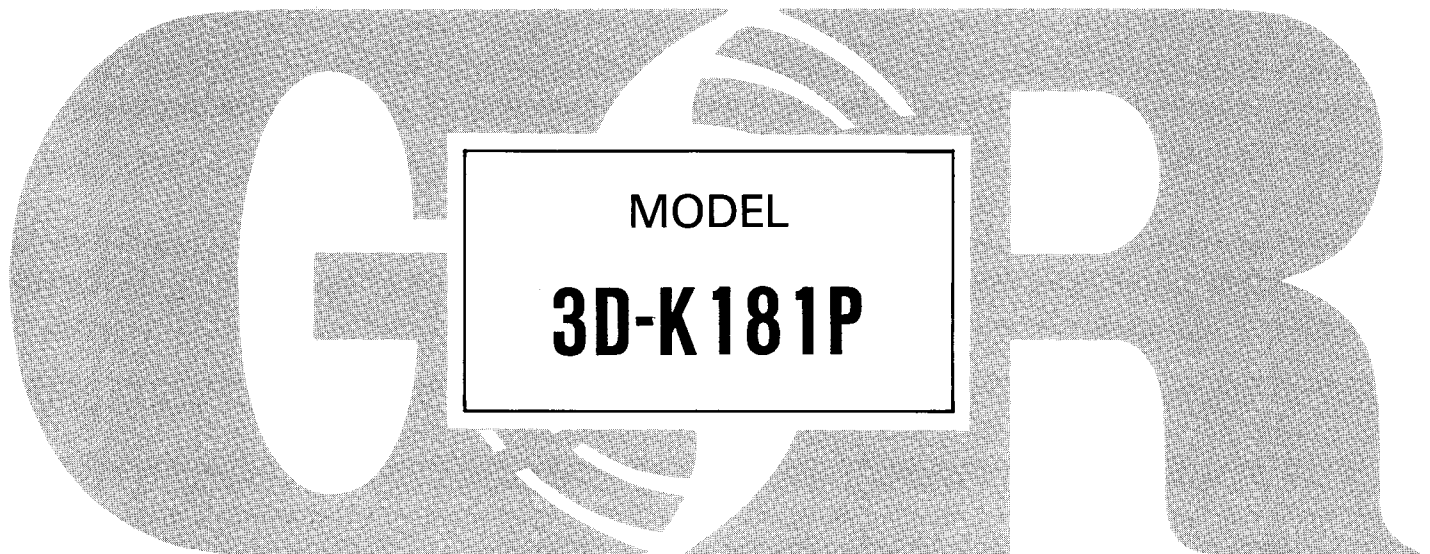

DSERIES

INSTALLATION, OPERATION, PARTS LIST, AND MAINTENANCE MANUAL



THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO
GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA

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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 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 diaphragm and flap valves.

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		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

<p>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.</p>

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. Remove or ground the spark plug to ensure that
//    the pump will remain inoperative.
// 3. Drain the pump.
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// This pump is designed to pump only 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 secure before operation.
//
////////////////////////////////////

```

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.
//
////////////////////////////////////

```

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

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

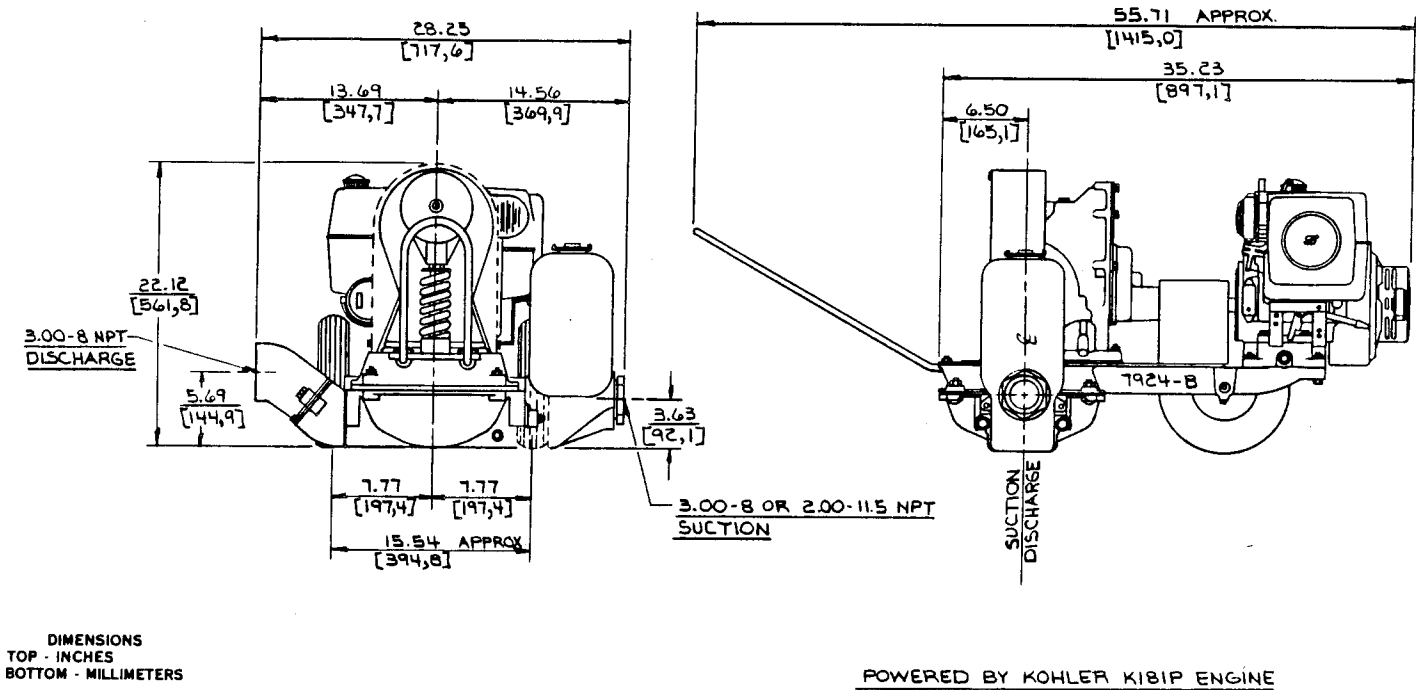


Figure 1. Pump Model 3D-K181P

INSTALLATION

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

Use lifting equipment with a capacity of at least **1500 pounds**. This pump weighs approximately **285 pounds**, not including the weight of accessories and customer installed equipment. Customer installed equipment such as 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

INSTALLATION

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

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.

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.

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.

INSTALLATION

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.

INSTALLATION

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.

INSTALLATION

ALIGNMENT

WARNING

```

////////////////////////////////////
//
// Before attempting to open or service the pump:
//
// 1. Familiarize yourself with this manual.
// 2. Remove or ground the spark plug to ensure 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 an engine flex-coupled to the gearbox.

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

OPERATION - SECTION C

WARNING

```

////////////////////////////////////
//
// This pump is designed to pump only 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

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.

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

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.

OPERATION

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, remove or ground the spark plug 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.

OPERATION

Cold Weather Preservation

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. Remove or ground the spark plug to ensure that
//    the pump will remain inoperative.
// 3. Drain the pump.
//
////////////////////////////////////
    
```

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

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE(cont.)	Diaphragm not securely in place. Suction lift or discharge head too high. Integral suction or discharge check valve clogged, binding, or not seating properly.	Secure diaphragm. Check piping installation and install bypass line if needed. See INSTALLATION. 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. Discharge head too high. Bearings in engine or gear box worn or binding.	Dilute if possible. Check engine output. Clean valve. Install bypass line. 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	223,3
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-K181P**

*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.

SECTIONAL DRAWING

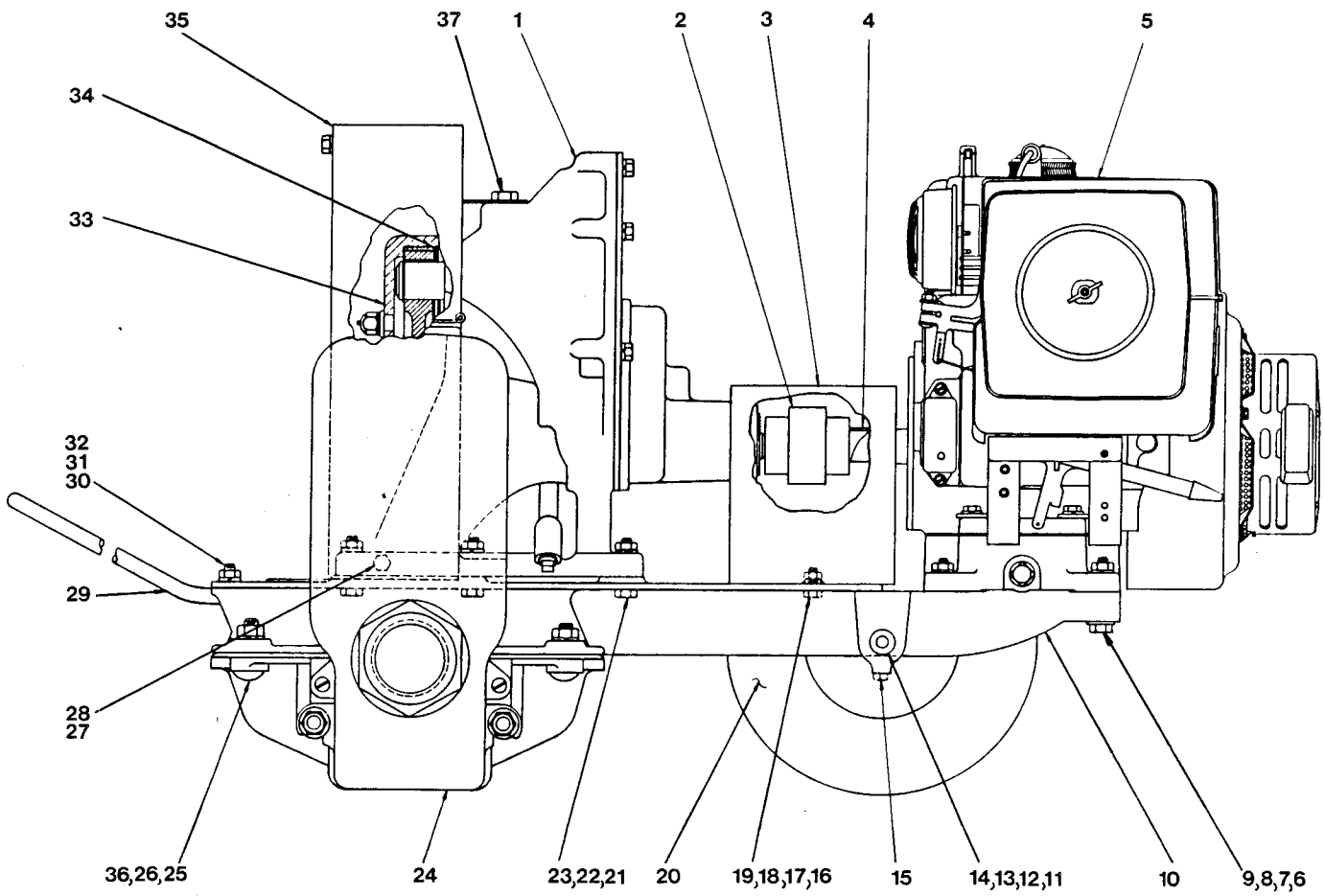


Figure 1. Pump Model 3D-K181P

PARTS LIST
Pump Model 3D-K181P
 (From S/N 813566 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	GEARBOX ASSY (See Figure 4)	44161-008	-----	1	24	DIAPH POT ASSY (See Figure 2)	46475-701	-----	1
2	*COUPLING	11730	00000	1	25	HEX NUT	D00008	15991	4
3	COUPLING GUARD	34613-005	15020	1	26	FLAT WASHER	K00007	15991	4
4	SLEEVE	2-R	16000	1	27	HEX HD CAPSCREW	B00402	15991	2
5	KOHLER K181P ENGINE	29127-084	-----	1	28	LOCKWASHER	J00004	15991	2
6	HEX HD CAPSCREW	B00607	15991	4	29	DRAW BAR	5438	15990	1
7	LOCKWASHER	J00006	15991	4	30	U-BOLT	5495	15990	2
8	FLAT WASHER	K00006	15991	2	31	LOCKWASHER	J00006	15991	4
9	HEX NUT	D00006	15991	4	32	HEX NUT	D00006	15991	4
10	DIAPHRAGM FRAME	7924-B	13010	1	33	PLUNGER ROD ASSY	5685 (See Fig. 3)	-----	1
11	SPACER WASHER	5382	15990	6	34	SNAP RING	5385	00000	1
12	PIPE	5657	15070	2	35	ECC GUARD ASSY	42381-030	-----	1
13	AXLE	5645-A	15990	1	36	RIB MACHINE BOLT	BJ00811	15990	REF
14	COTTER PIN	M00306	15990	2	37	HEX HD CAPSCREW	B01004	15991	REF
15	SQUARE HD SETSCREW	G00604	15990	2	NOT SHOWN:				
16	HEX HD CAPSCREW	B00404	15991	2		NAME PLATE	2613-BP	13990	1
17	LOCKWASHER	J00004	15991	2		DRIVE SCREW	BM#04-03	15990	4
18	FLAT WASHER	K00004	15991	2		WARNING DECAL	2613-FE	-----	1
19	HEX NUT	D00004	15991	2		SUCTION STICKER	6588-AG	00000	1
20	*PNEUMATIC TIRE	S00752	-----	2		DISCH STICKER	6588-BJ	00000	1
21	HEX HD CAPSCREW	B00608	15991	5		LUBRICATION DECAL	38816-085	-----	1
22	LOCKWASHER	J00006	15991	5		STRAINER	9026	24000	1
23	HEX NUT	D00006	15991	5		GRD WARNING STKR	38816-063	-----	1

*INDICATES PARTS RECOMMENDED FOR STOCK

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

CANADIAN SERIAL NO AND UP

SECTIONAL DRAWING

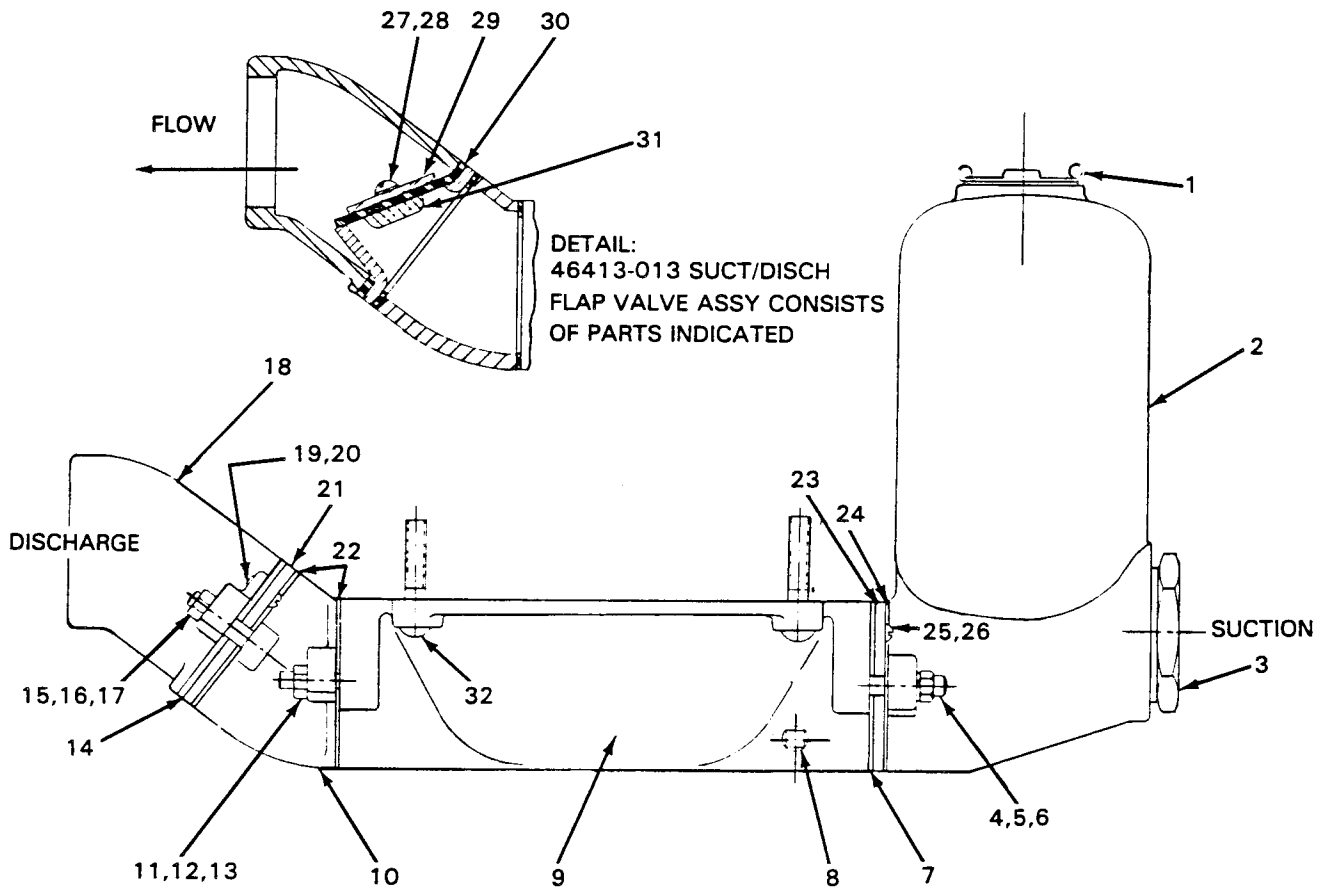


Figure 2. 46475-701 Diaphragm Pot Assembly

 MAINTENANCE AND REPAIR

 PARTS LIST
 46475-701 Diaphragm Pot Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	SUCTION ACCUMULATOR PLUG AND GSKT	S00591	-----	1
2	SUCTION ACCUMULATOR	5376	13010	1
3	REDUCING PIPE BUSHING	AP04832	11990	1
4	STUD	C00810	15991	2
5	HEX NUT	D00008	15991	2
6	FLAT WASHER	K00007	15991	2
7	* SUCTION FLAP VALVE ASSY	46413-013	-----	1
8	DIAPHRAGM POT DRAIN PLUG	P00006	11990	1
9	DIAPHRAGM POT	5375	13010	1
10	INBOARD DISCHARGE FLANGE	5377	13040	1
11	STUD	C00809	15991	2
12	HEX NUT	D00008	15991	2
13	FLAT WASHER	K00007	15991	2
14	* DISCHARGE FLAP VALVE ASSY	46413-013	-----	1
15	STUD	C00810	15991	2
16	HEX NUT	D00008	15991	2
17	WASHER	11273	15990	2
18	OUTBOARD DISCHARGE FLANGE	5658	13040	1
19	ROUND HD MACHINE SCREW	X00404	15991	2
20	LOCKWASHER	J00004	15991	2
21	DISCHARGE FLAP VALVE SEAT	5374	10010	1
22	* GASKET	5374-G	19100	2
23	SUCTION FLAP VALVE SEAT	5374	10010	1
24	* GASKET	5374-G	19100	1
25	ROUND HD MACHINE SCREW	X00404	15991	2
26	LOCKWASHER	J00004	15991	2
27	** ROUND HD MACHINE SCREW	X00403	15991	4
28	** LOCKWASHER	J00004	15991	4
29	** FLAP VALVE WEIGHT	5428	15990	2
30	** FLAP VALVE	5427	19100	2
31	** FLAP VALVE WEIGHT	5426	13010	2
32	RIB MACHINE BOLT	BJ00811	15990	4

** PARTS ARE INCLUDED IN 46413-013 SUCT/DISCH FLAP VALVE ASSY

*INDICATES PARTS RECOMMENDED FOR STOCK

SECTIONAL DRAWING

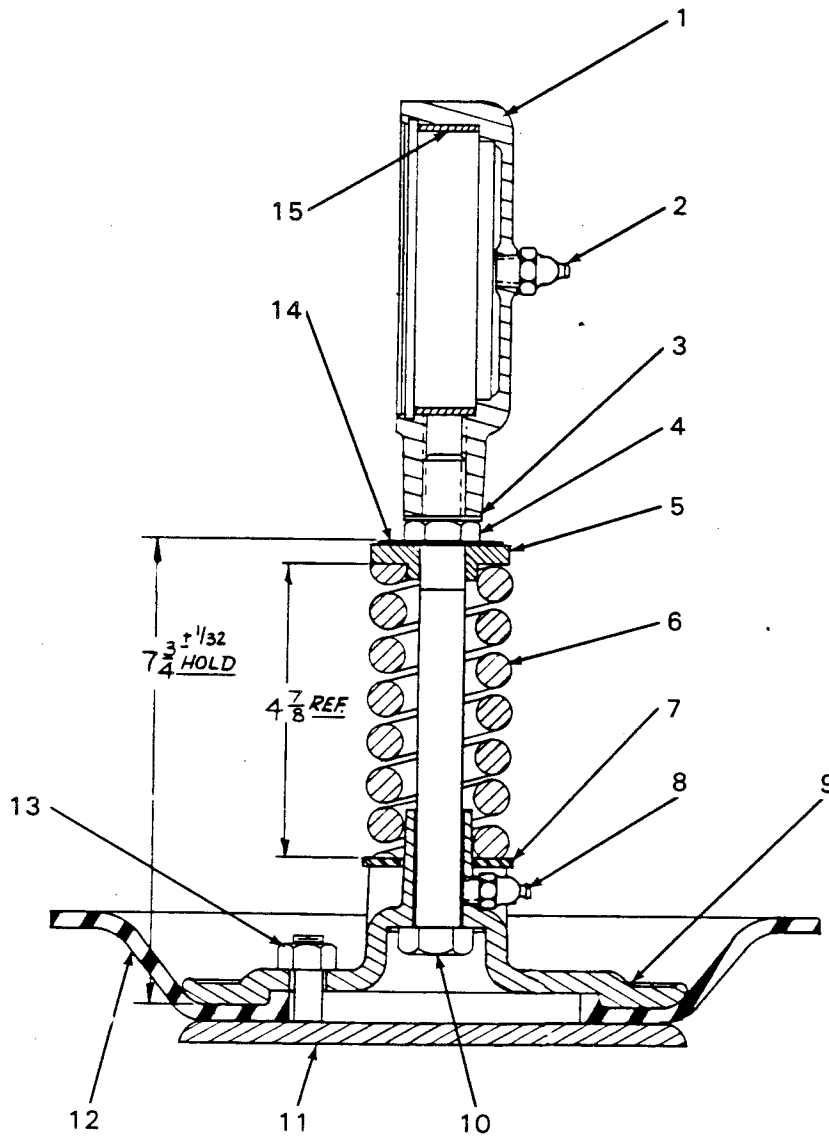


Figure 3. 5685 Plunger Rod Assembly

PARTS LIST
5685 Plunger Rod Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	ECCENTRIC CAP	5373	13010	1
2	LUBE FITTING	S00191	-----	1
3	T-LOCKWASHER	AK00012	15991	1
4	JAM NUT	AT00012	15990	1
5	SPRING WASHER	5384	15990	1
6	* SPRING	5398	16080	1
7	FLAT WASHER	K00020	15991	1
8	LUBE FITTING	S00191	-----	1
9	UPPER DIAPHRAGM PLATE	5381	10010	1
10	* PLUNGER ROD	5383	15990	1
11	LOWER DIAPHRAGM PLATE ASSY	5394	-----	1
12	* DIAPHRAGM	S00701	-----	1
13	HEX NUT	D00008	15991	3
14	* ADJUSTING SHIM	11840-B	15990	4
15	* ECCENTRIC BEARING	5610	14000	1

*INDICATES PARTS RECOMMENDED FOR STOCK

SECTIONAL DRAWING

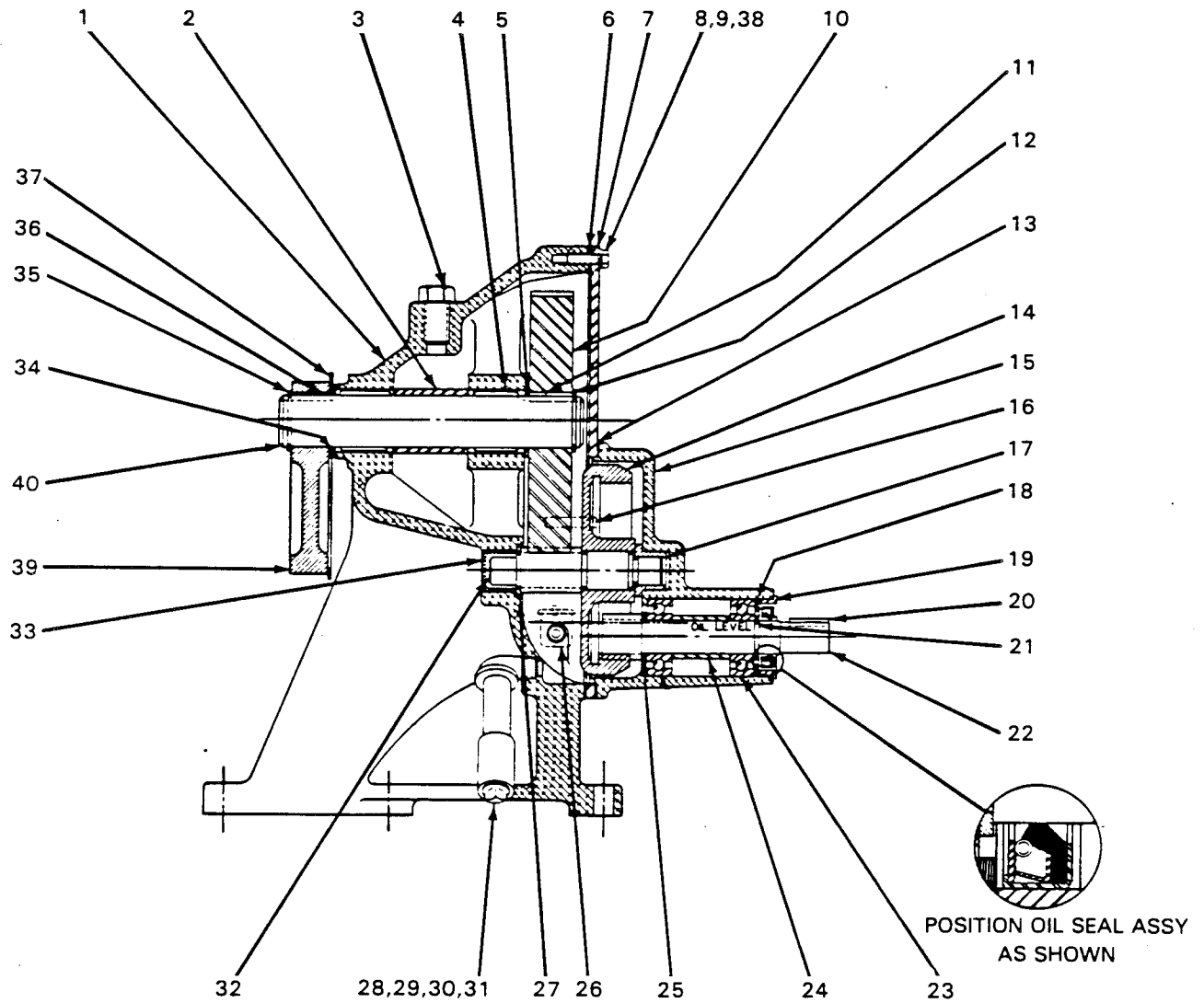


Figure 4. 44161-008 Gearbox Assembly

PARTS LIST
44161-008 Gearbox Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	GEAR HOUSING	5367	13010	1
2	SPACER SLEEVE	S00952	-----	1
3	HEX HD CAPSCREW	B01004	15991	1
4	* CAM SHAFT BEARING	S00702	-----	2
5	SPACER WASHER	5395	15990	1
6	* COVER PLATE GSKT	5367-G	20050	1
7	COVER PLATE	5396	15990	1
8	HEX HD CAPSCREW	B00403	15991	7
9	LOCKWASHER	J00004	15991	9
10	* CAM SHAFT GEAR	5334	16060	1
11	* CAM SHAFT GEAR KEY	31811-040	15990	1
12	* SNAP RING	S00700	-----	1
13	* BEARING HOUSING GSKT	S00825	-----	1
14	* PINION GEAR	S00823	-----	1
15	BEARING HOUSING	5918-A	13010	1
16	DOWEL PIN	AA00405	15990	2
17	* PINION SHAFT BUSHING	S00824	-----	1
18	DRIVE SHAFT WASHER	2-M	15990	3
19	OIL SEAL ASSY	14408	-----	1
19A	* -OIL SEAL	25227-355	-----	1
19B	-OIL SEAL ADAPTOR	NOT AVAILABLE	-----	1
20	* DRIVE SHAFT KEY	N00304	15990	1
21	SNAP RING	S00269	-----	1
22	* DRIVE SHAFT	8211	16070	1
23	* DRIVE SHAFT BEARING	S01044	-----	2
24	SPACER SLEEVE	5922	15070	1
25	SNAP RING	S00269	-----	1
26	OIL CUP	S00617	-----	1
27	SPACER WASHER	5382	15990	1
28	STREET ELBOW	RS00004	11990	1
29	PIPE NIPPLE	T00408	15070	1
30	PIPE COUPLING	AE00004	11990	1
31	GEARBOX DRAIN PLUG	P00004	11990	1
32	* PINION SHAFT	5333	16020	1
33	* PINION SHAFT BEARING	S00703	-----	1
34	* ECCENTRIC CAM SHIM SET	13103-A	15990	1
35	SNAP RING	S00700	-----	1
36	* ECCENTRIC CAM KEY	31811-040	-----	1
37	WASHER	6531	18040	1
38	HEX HD CAPSCREW	B00407	15991	2
39	* ECCENTRIC CAM	5378-A	10080	1
40	* ECCENTRIC CAM SHAFT	5397	15020	1

*INDICATES PARTS RECOMMENDED FOR STOCK

MAINTENANCE AND REPAIR

PUMP 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 views (see Figures 1, 2, 3 and 4) and the accompanying parts lists.

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, take precautions to ensure that the engine will remain inoperative. Close any connecting valves in the suction line and drain the pump by removing the drain plug (8, Figure 2). Clean and reinstall the drain plug.

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

WARNING

```

////////////////////////////////////
//
// Before attempting to open or service the pump:
//
// 1. Familiarize yourself with this manual.
// 2. Remove or ground the spark plug to ensure that
// the pump will remain inoperative.
// 3. Drain the pump.
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Use lifting and moving equipment in good repair and with
// adequate capacity to prevent injuries to personnel or
// damage to equipment.
//
////////////////////////////////////

```

Suction And Discharge Flap Valve Removal

(Figure 2)

To service the suction and discharge flap valves, the suction and discharge piping must be removed.

To service the suction flap valve (7), remove the suction accumulator (2) by disengaging the hardware (5 and 6) securing it to the diaphragm pot (9).

Remove the machine screws and lockwashers (25 and 26) securing the valve seat (23) and flap valve assembly to the diaphragm pot.

To service the discharge flap valve (14), remove hardware (16 and 17) and the outboard discharge flange (18). Remove the machine screws and lockwashers (19

MAINTENANCE AND REPAIR

and 20) securing the valve seat (21) and discharge flap valve to the outboard discharge flange.

To remove the inboard discharge flange (10), remove the hardware (12 and 13) 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 of flap valve components, remove the machine screws and lockwashers (27 and 28).

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

Diaphragm Removal

(Figure 3)

To remove the diaphragm, disengage the hardware (25, 26, and 36, Figure 1) and remove the diaphragm pot (24, Figure 1).

Remove the nuts (13), lower diaphragm plate (11) and the diaphragm (12).

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

Plunger Rod Assembly Removal

(Figure 1)

With the diaphragm pot assembly and diaphragm removed, disengage the hardware (27, 28, and 37) and remove the eccentric guard assembly (35). Remove the snap ring (34) and separate the plunger rod assembly (33) from the eccentric cam shaft on the gearbox (1).

Plunger Rod Assembly Disassembly

(Figure 3)

Use a socket wrench to hold the plunger rod (10) and unscrew the eccentric cap (1), T-lockwasher (3), and jam nut (4). Remove the adjusting shim (14), spring washer (5), spring (6) and flat washer (7). Remove the plunger rod from the upper diaphragm plate (9).

Inspect the eccentric bearing (15) for excessive wear. If replacement is necessary, cut the bearing with a chisel. **Be careful** not to damage the eccentric cap.

Gearbox Assembly Removal And Disassembly

(Figure 4)

When the pump is properly operated and maintained, the gearbox assembly 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.

Drain the gearbox by removing the gearbox drain plug (31). Clean and reinstall the plug.

To remove the gearbox assembly, disengage the hardware (21, 22, and 23, Figure 1) and separate the gearbox assembly from the coupling (2, Figure 1). Be careful not to lose the drive shaft key (20).

Remove the two lower capscrews and lockwashers (38 and 9) and the five upper capscrews and lockwashers (8 and 9) securing the cover plate (7) to the gear housing (1).

Pull the bearing housing (15) and cover plate from the pinion shaft (32) and pinion gear (14).

Remove the two capscrews and lockwashers (8 and 9) securing the cover plate to the bearing housing.

To disassemble the drive shaft components, pry the oil seal adaptor (included in 19) out of the bearing housing and remove the oil seal and the washer (18). Press the drive shaft (22) and assembled bearings out of the bearing housing. Remove the outboard snap ring (21), and use a bearing puller (or similar device) to remove the outboard bearing (23). Remove the spacer sleeve (24). Remove the inboard snap ring (25), and the inboard bearing.

Inspect the pinion shaft bushing (17) for wear. If replacement is necessary, use a bearing puller (or similar device) to remove the bushing from the bearing housing.

Disengage the assembled pinion shaft (32) and pinion gear (14) from the cam shaft gear (10) and pinion shaft bearing (33).

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

Use an arbor (or hydraulic) press to remove the pinion shaft bearing (33).

NOTE

It is not necessary to remove the eccentric cam shaft (40), gear (10) and needle bearings (4) unless there is evidence of wear or damage. Inspect the gear, shaft and bearings for problems such as broken teeth, binding or loose bearings. If replacement is necessary, proceed as follows.

Remove the snap ring (35) from the eccentric cam shaft (40). Use a bearing puller (or similar device) to remove eccentric cam (39) from the shaft. Be careful not to lose the eccentric cam key (36). Remove the eccentric cam shim set (34) and the washer (37). Tag and tie the shims or measure and record their thickness for ease of reassembly.

Slide the assembled eccentric cam shaft and gear out of the housing. Install two 1/2 - 13 NC capscrews in the gear and use a gear puller (or similar device) to remove the gear from the shaft.

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

NOTE

After the spacer sleeve (2) is compressed, it will be permanently damaged and require replacement.

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

Gearbox Reassembly And Installation

(Figure 4)

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

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. //
// //
////////////////////////////////////
    
```

Bearing tolerances provide a snug fit into the gear housing and a light press fit on the cam shaft. Dip bearings in clean oil to ease installation.

CAUTION

Bearings must be kept free of all dirt and foreign material. Failure to do so will greatly shorten bearing life.

Use an arbor (or hydraulic) press to install one of the bearings (4) until it is flush with the machined face of the housing. Install a new spacer sleeve through the open bearing bore and press the other bearing flush with the housing.

Install the cam shaft gear key (11) and press the cam shaft gear (10) onto the cam shaft. Install the snap ring (12).

Slide the cam shaft through the bearings. Install the washer (37) and the same thickness of shims (34) as previously removed.

Press the eccentric cam onto the shaft and install the snap ring (35).

Press the pinion shaft bearings (33) into the gear housing until the open end is flush with the counter bore.

Press the pinion gear (14) onto the pinion shaft (32) until seated squarely against the shaft shoulder.

Position the washer (27) on the shaft and slide the shaft into the pinion shaft bearing.

Press the pinion shaft bushing (17) into the bearing housing. Clean the drive shaft bearings thoroughly in **fresh** cleaning solvent. Dry the bearings with filtered air and coat with light oil.

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

CAUTION

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.

The bearing tolerances provide a light press fit onto the drive shaft, and a snug fit into the bearing housing. If the bearing slips on and off easily, the shaft is worn and must be replaced. The bearing housing must be replaced if the bearings do not fit snugly.

Install the snap ring (25) onto the shaft. Dip the bearings in clean oil. Use an arbor (or hydraulic) press to press the inboard bearing on until seated squarely against the snap ring.

CAUTION

When installing the bearings onto the shaft, NEVER press or hit against the outer race, balls, or ball cage. Press ONLY on the inner race.

Install the spacer sleeve (24) and press the outboard bearing on until fully seated.

Slide the shaft and assembled bearings into the bearing housing until the in-board bearing seats squarely against the bearing bore shoulder.

Install the drive shaft washer (18). Press the oil seal (19) into the oil seal adaptor so that the lip will be positioned as shown in Figure 4.

Apply "Permatex Aviation #3 Form-A-Gasket" to the O.D. of the oil seal adaptor. Slide the oil seal assembly over the shaft and press it into the bearing housing.

Subassemble the bearing housing to the cover plate (7) using the two long capscrews (38) and lockwashers in the uppermost holes of the housing.

Position the subassembly on the dowel pins (16) in the gear housing. Make sure the teeth on the drive shaft mesh properly with the pinion gear before securing the subassembly to the gear housing with the remaining short hardware (8 and 9).

Install the shaft key (20) and drive coupling.

Check the coupling alignment as described in **ALIGNMENT**, Section B and secure the gearbox assembly to the frame.

Lubricate the gearbox as described in **LUBRICATION**, Section E.

Plunger Rod Reassembly

(Figure 3)

If the eccentric bearing (15) 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 new bearing into the eccentric cap with an arbor (or hydraulic) press.

Slide the plunger rod through the upper diaphragm plate. Install the flat washer (7), spring (6), spring washer (5), adjusting shim (14) and jam nut (4). Compress the spring to the dimension shown in Figure 3. Install the eccentric cap (1).

Plunger Rod Assembly Installation

(Figure 1)

Install the plunger rod assembly onto the eccentric cam shaft of the gearbox and secure with the snap ring.

Reinstall the eccentric guard assembly and secure it with the hardware previously removed. 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 nuts (13).

Secure the diaphragm pot (24, Figure 1) to the frame using the hardware (25, 26, and 36, Figure 1).

Suction And Discharge Flap Valve Installation

(Figure 2)

If the inboard discharge flange (10) was removed, clean the mating surfaces, install the gasket (22) and secure the flange to the diaphragm pot using hardware (11 and 12).

Subassemble the valve seat (21) and discharge flap valve (14) with the outboard discharge flange (18) and secure using hardware (19 and 20).

Clean the mating surfaces of the valve seat and inboard discharge flange. Install the gasket (22) and secure the outboard discharge flange to the inboard discharge flange.

Subassemble the suction flap valve (7) and valve seat (23) to the diaphragm pot and secure using hardware (25 and 26).

Clean the mating surfaces, install the gasket (24) and secure the suction accumulator to the diaphragm pot.

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 (15, Figure 3) should be lubricated thoroughly after each 8 hours of operation. Failure to do so may cause the bearing to overheat and fail.

Lubricate the plunger rod assembly with Citgo #2 or equivalent automotive grease through the lubrication fittings (2 and 8), which are accessible through openings in the eccentric guard.

Apply grease to the upper lubrication fitting until grease escapes from the eccentric cap (1). Grease the lower fitting until grease escapes from the top of the upper diaphragm plate (9).

Gearbox

(Figure 4)

Under normal conditions, change the oil each 5000 hours of operation, or at 12 month intervals, whichever ever occurs first. In dirty or humid conditions change more frequently.

Add one ounce of "Molykote M Gear Guard" (or equivalent) to the gearbox through the oil cup (42) and then fill the gearbox with a good grade of SAE 30 non-detergent motor oil to the midpoint of the oil cup sight gauge. The oil level must be maintained at this point.

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

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International: +1-419-755-1352**

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