ACDH

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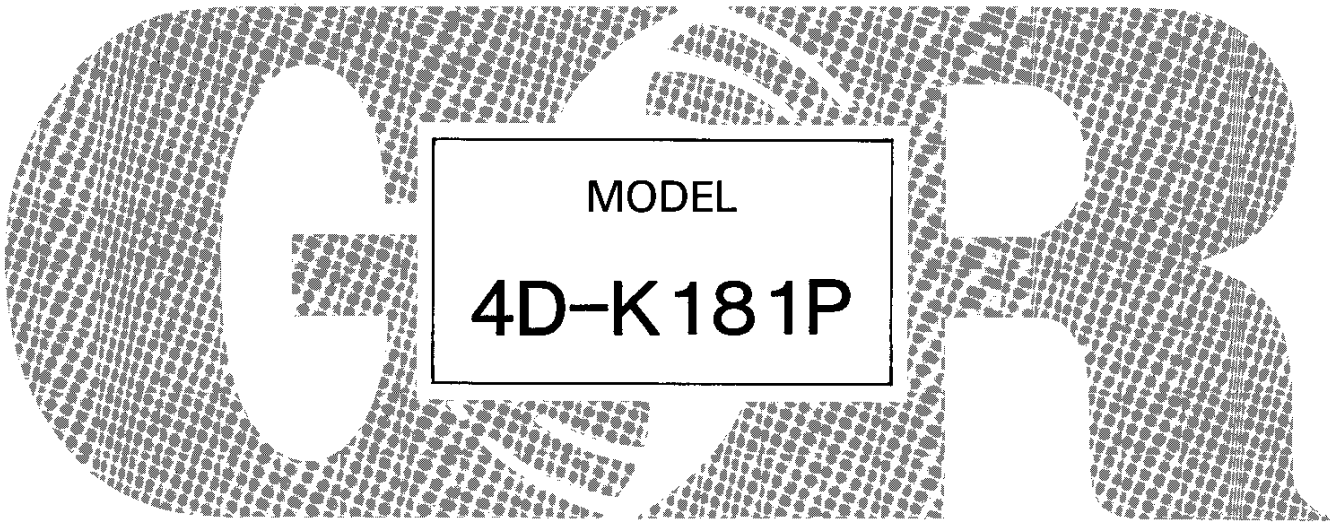
September 25, 1984

D SERIES

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
P.O. Box 1217
Mansfield, Ohio 44901

or

Gorman-Rupp of Canada Limited
70 Burwell Road
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 injury or death to personnel, and describe the procedure required and the injury which could result from failure to follow the procedure.

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 coupling guard in place. Exposed rotating parts can catch clothing, fingers, or tools, causing severe injury to personnel.

WARNING

The gearbox provided on this pump is designed for operation at 2385 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 2385 RPM.

WARNING

Do not operate an internal combustion engine in an explosive 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 extreme 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

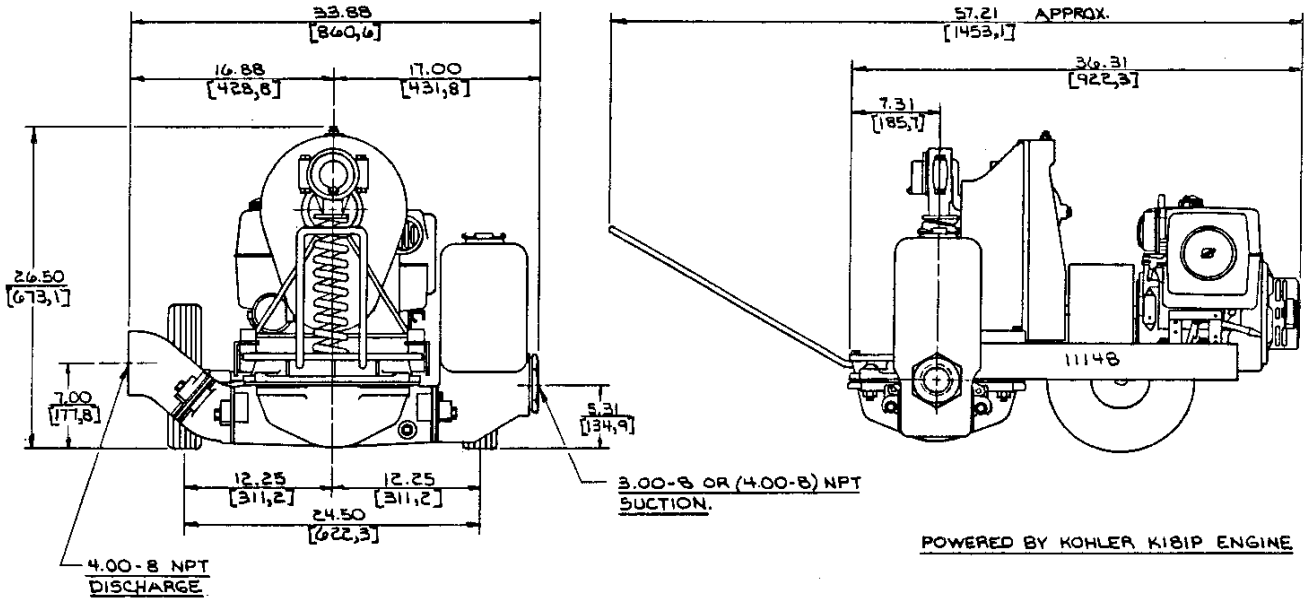

Figure 1. Pump Model 4D-K181P

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 a least **1750 pounds**. This pump weighs approximately **345 pounds**, not including the weight of accessories and customer installed equipment. 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

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 amd 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.

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

CAUTION

It is imperative that alignment be checked before the pump is operated.

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 coupling guard 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 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 52 cycles per minute through a Gearbox with a 45.85:1 ratio at a maximum input speed of 2385 RPM. Make certain that input speed does not exceed this RPM. Operation at higher RPM can cause pump components to be damaged or destroyed.

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.

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

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE(cont.)	Diaphragm not securely in place.	Secure diaphragm.
	Strainer clogged.	Check strainer and clean if necessary.
	Integral suction or discharge check valve clogged, binding, or not seating properly.	Clean valves, check that flange nuts are tight.
PUMP REQUIRES TOO MUCH POWER	Liquid solution too thick.	Dilute if possible.
	Pump speed too high.	Check engine output.
	Integral discharge check valve clogged or binding.	Clean valve.
	Bearings in engine or gear box worn or binding.	Check bearings.
PUMP CLOGS FREQUENTLY	Integral suction or discharge check valve clogged, binding, or not seating properly.	Clean valves, check that flange nuts are tight.
	Liquid solution too thick.	Dilute if possible.
EXCESSIVE NOISE	Pump, gearbox, or engine not securely mounted.	Check and tighten mounting bolts.
	Gearbox or engine not properly lubricated.	See LUBRICATION in MAINTENANCE AND REPAIR.
BEARINGS RUN TOO HOT	Bearing temperature is high, but within limits.	Check bearing temperature regularly to monitor any increase.
	Low or incorrect lubricant.	Check for proper type and level of lubricant.
	Drive misaligned.	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	STATIC DISCHARGE HEAD IN FEET					
IN FEET	0	5	10	15	20	25
5	150	125	119	113	112	104
10	126	118	108	105	105	100
15	98	97	75	74	73	70
20	94	82	74	73	66	63
25	74	82	70	66	60	52

In Gallons Per Minute, 52 Strokes Per Minute

STATIC LIFT	STATIC DISCHARGE HEAD IN METERS					
IN METERS	0	1,5	3,0	4,6	6,1	7,6
1,5	567,8	473,1	450,4	427,7	423,9	393,6
3,0	476,9	446,6	408,8	397,4	397,4	378,5
4,6	370,9	367,1	283,8	280,1	276,3	264,9
6,1	355,8	310,3	280,1	276,3	249,8	238,4
7,6	280,1	310,3	264,9	249,8	227,1	196,8

In Liters Per Minute, 52 Strokes Per Minute

***STANDARD PERFORMANCE TEST DATA FOR PUMP MODEL 4D-K181P**

*Based on 70°F clear water at sea level with minimum suction lift, using 3 inch (7,62 cm.) suction hose and 4 inch (10,16 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

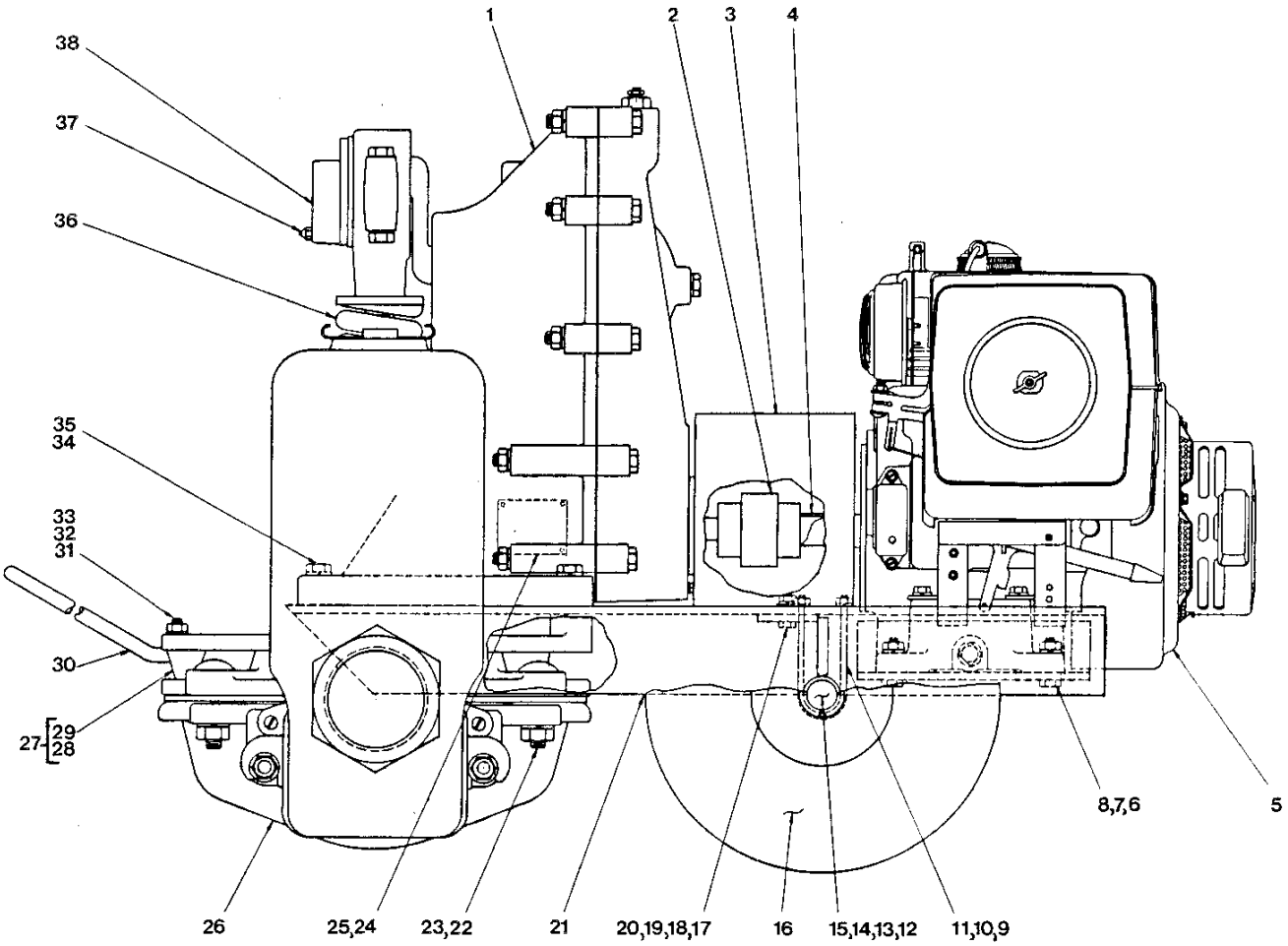

Figure 1. Pump Model 4D-K181P

PARTS LIST
Pump Model 4D-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
1	GEAR BOX ASSY (SEE FIGURE 4)	44161-010	-----	1
2	*COUPLING	11730	00000	1
3	COUPLING GUARD	34613-005	15020	1
4	SLEEVE	2-R	16000	1
5	KOHLER K181P ENGINE	29127-084	-----	1
6	HEX HD CAPSCREW	B00605	15991	4
7	LOCKWASHER	J00006	15991	4
8	HEX NUT	D00006	15991	4
9	U-BOLT	6945	15000	2
10	LOCKWASHER	J00006	15991	4
11	HEX NUT	D00006	15991	4
12	AXLE	6619	15990	1
13	SPACER	6619-A	15070	2
14	FLAT WASHER	S01532	-----	4
15	COTTER PIN	M00306	15990	2
16	PNEU WHEEL	S00263	-----	2
17	HEX HD CAPSCREW	B00404	15991	2
18	FLAT WASHER	K00004	15991	2
19	LOCKWASHER	J00004	15991	2
20	HEX NUT	D00004	15991	2
21	BASE	11148	24000	1
22	LOCKWASHER	J00012	15991	4
23	HEX NUT	D00012	15991	4
24	NAME PLATE	2613-BP	13990	1
25	DRIVE SCREW	BM#04-03	15990	4
26	DIAPH POT ASSY (SEE FIGURE 2)	46475-702	-----	1
27	DIAPH RING ASSY	41881-061	-----	1
28	-RING	6621	13010	4
29	-RIB MACH BOLT	BJ01211	15991	4
30	DRAW BAR	5438	15990	1
31	U-BOLT	5495	15990	2
32	LOCKWASHER	J00006	15991	4
33	HEX NUT	D00006	15991	4
34	HEX HD CAPSCREW	B01010	15991	4
35	LOCKWASHER	J00010	15991	4
36	PLUNGER ROD ASSY (SEE FIGURE 3)	6595	-----	1
37	LUB FITTING	S00191	-----	1
38	END CAP	6643	10010	1
NOT SHOWN:				
	STRAINER	4917	24000	1
	WARNING DECAL	2613-FE	-----	1
	SUCTION STICKER	6588-AG	00000	1
	DISCH STICKER	6588-BJ	00000	1
	GUARD WARNING STK	38816-063	-----	1
OPTIONAL:				
	STATIONARY BASE	8283	-----	1

*INDICATES PARTS RECOMMENDED FOR STOCK

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

CANADIAN SERIAL NO ..... AND UP

SECTIONAL DRAWING

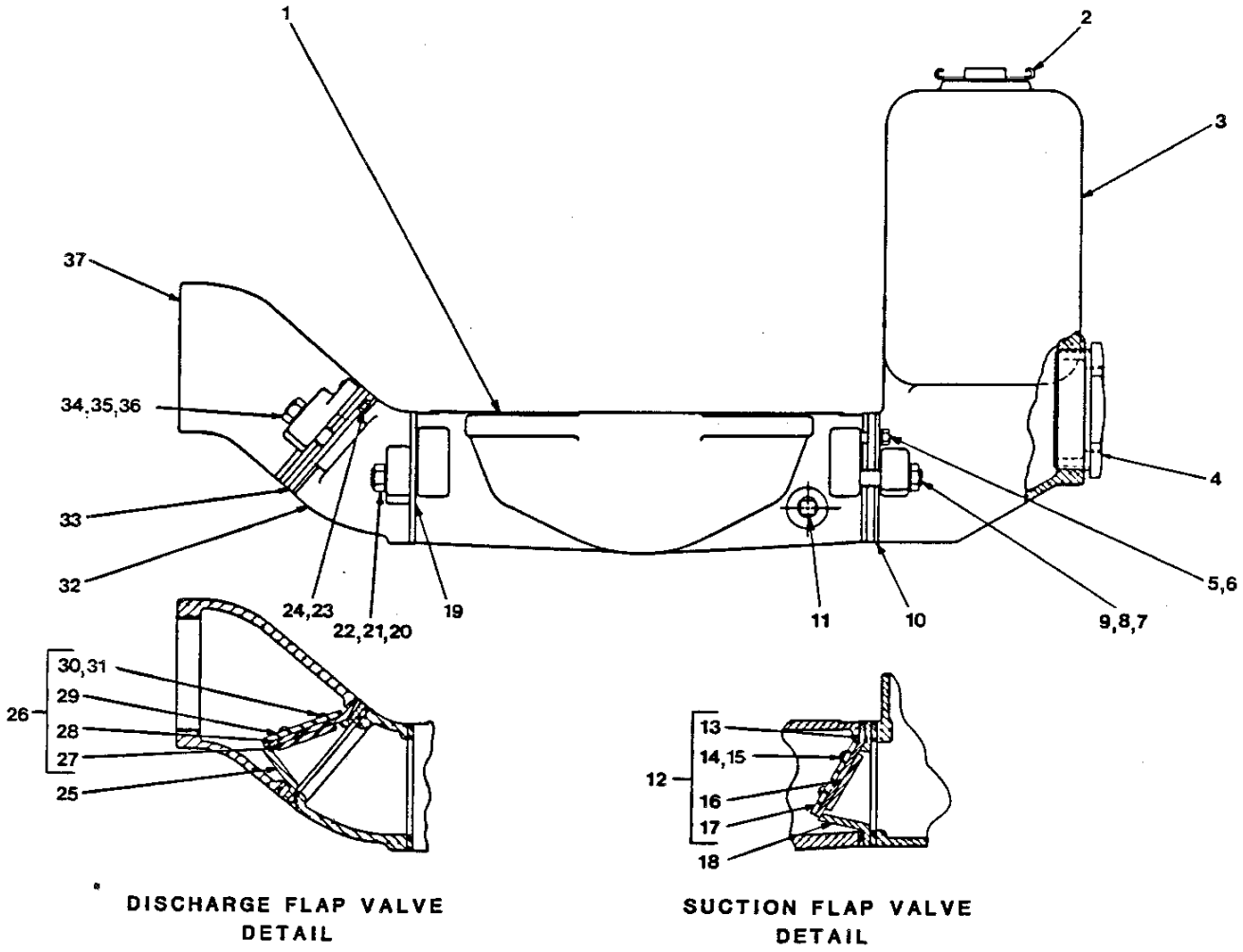

Figure 2. 46475-702 Diaphragm Pot Assembly

PARTS LIST
46475-702 Diaphragm Pot Assembly

ITEM NO.		PART NAME	PART NUMBER	MATL CODE	QTY
1		DIAPHRAGM POT	6622	13010	1
2		SUCTION ACCUMULATOR PLUG AND GSKT	S00591	-----	1
3		SUCTION ACCUMULATOR	6625	13010	1
4		REDUCING PIPE BUSHING	AP06448	11990	1
5		HEX HEAD CAPSCREW	B00504	15991	2
6		LOCKWASHER	J00005	15991	2
7		STUD	C01013	15991	2
8		FLAT WASHER	KE00010	15991	2
9		HEX NUT	D00010	15991	2
10	*	SUCTION ACCUMULATOR GSKT	6625-G	19100	1
11		DIAPHRAGM POT DRAIN PLUG	P00006	11990	1
12		SUCTION FLAP VALVE ASSY	46413-007	-----	1
13	*	-FLAP VALVE	6925	19100	1
14		-ROUND HD MACHINE SCREW	X00402 1/2	17090	4
15		-LOCKWASHER	J00004	17090	4
16	*	-FLAP VALVE WEIGHT	6801	15990	1
17	*	-FLAP VALVE WEIGHT	6642	15990	1
18		SUCTION FLAP VALVE SEAT	6635	10010	1
19	*	DISCHARGE FLANGE GSKT	6625-G	19100	1
20		STUD	C01010	15991	2
21		FLAT WASHER	KE00010	15991	2
22		HEX NUT	D00010	15991	2
23		HEX HD CAPSCREW	B00504	15991	2
24		LOCKWASHER	J00005	15991	2
25		DISCHARGE FLAP VALVE SEAT	6635	10010	1
26	*	DISCHARGE FLAP VALVE ASSY	46413-007	-----	1
27	*	-FLAP VALVE WEIGHT	6801	15990	1
28	*	-FLAP VALVE	6925	19100	1
29	*	-FLAP VALVE WEIGHT	6642	15990	1
30		-ROUND HD MACHINE SCREW	X00402 1/2	17090	4
31		-LOCKWASHER	J00004	17090	4
32		DISCHARGE FLANGE	6627	13040	1
33	*	DISCHARGE ELBOW GSKT	6625-G	19100	1
34		STUD	C01013	15991	2
35		FLAT WASHER	KE00010	15991	2
36		HEX NUT	D00010	15991	2
37		DISCHARGE ELBOW	6626	13040	1

*INDICATES PARTS RECOMMENDED FOR STOCK

SECTIONAL DRAWING

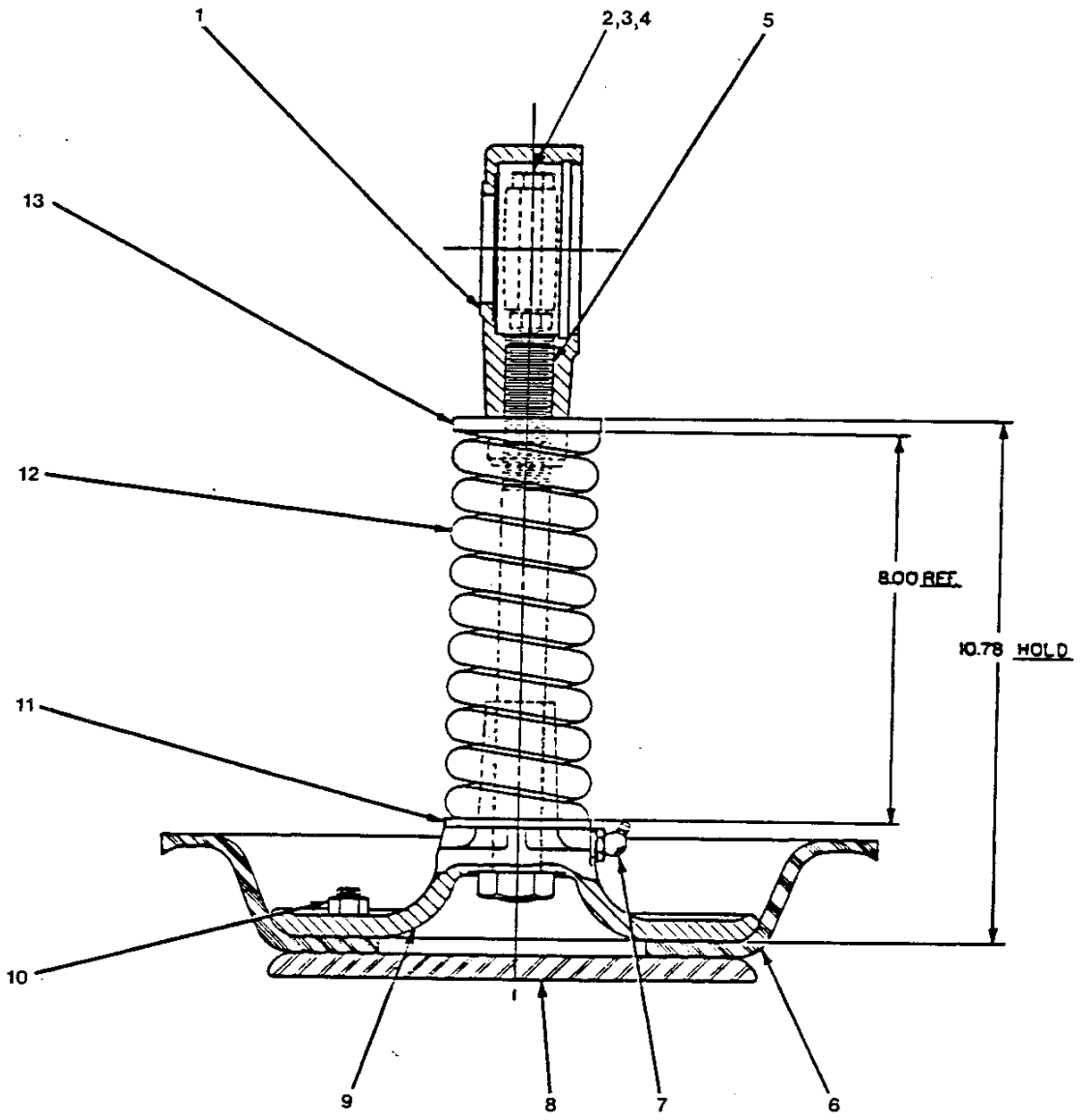

Figure 3. 6959 Plunger Rod Assembly

PARTS LIST
6959 Plunger Rod Assembly

ITEM NO.		PART NAME	PART NUMBER	MATL CODE	QTY
1		BEARING CAP	6560	10010	1
2		-HEX HD CAPSCREW	B00813-S	15991	2
3		-HEX NUT	D00008-S	15991	2
4		-LOCKWASHER	J00008	15991	2
5	*	PLUNGER ROD	6633	15990	1
6	*	DIAPHRAGM	S01017	-----	1
7		LUBE FITTING	S00194	-----	1
8		LOWER DIAPHRAGM PLATE ASSY	6629	-----	1
9		UPPER DIAPHRAGM PLATE	6628	10010	1
10		HEX NUT	D00008	15991	4
11		SPRING WASHER	6639	15000	1
12	*	PLUNGER SPRING	6547	16080	1
13		SPRING RETURN NUT	6638	11000	1

*INDICATES PARTS RECOMMENDED FOR STOCK

SECTIONAL DRAWING

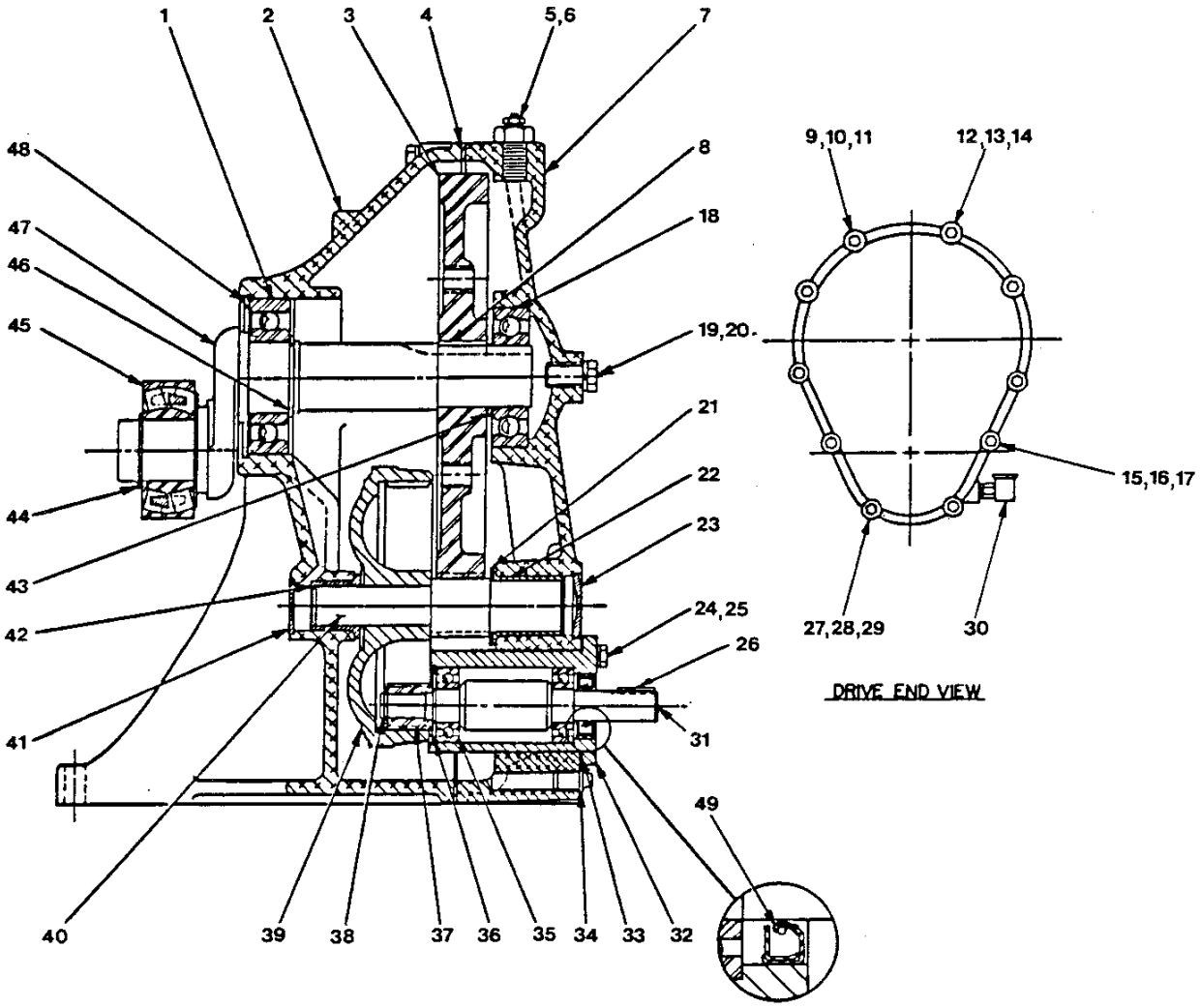

Figure 4. 44161-010 Gearbox Assembly

PARTS LIST
44161-010 Gearbox Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	*CRANKSHAFT INBOARD BEARING	S00374	-----	1
2	GEAR HOUSING	6624	13040	1
3	*CRANKSHAFT GEAR	6641	15060	1
4	*GEAR HOUSING GSKT	6624-G	18000	1
5	VENT BOLT	31871-038	-----	1
6	*PRES RELIEF FITTING	S01523	-----	1
7	GEAR COVER	6623	13010	1
8	*CRANKSHAFT GEAR KEY	N00605	15990	1
9	HEX HD CAPSCREW	B00511	15991	5
10	HEX NUT	D00005	15991	5
11	LOCKWASHER	J00005	15991	5
12	SHOULDER BOLT	S01018	-----	1
13	HEX NUT	D00005	15991	1
14	LOCKWASHER	J00005	15991	1
15	HEX HD CAPSCREW	B00518	15991	3
16	HEX NUT	D00005	15991	3
17	LOCKWASHER	J00005	15991	3
18	*CRANKSHAFT OUTBOARD BEARING	S01080	-----	1
19	HEX HD CAPSCREW	B01004	15991	1
20	FLAT WASHER	KE00010	15991	1
21	WASHER	6637	15000	1
22	*PINION SHAFT OUTBOARD BUSHING	S01016	-----	1
23	GEAR COVER PLUG	S01053	-----	1
24	HEX HD CAPSCREW	B00504	15991	4
25	LOCKWASHER	J00005	15991	4
26	*DRIVE SHAFT KEY	N00304	15990	1
27	SHOULDER BOLT	S01019	-----	1
28	HEX NUT	D00005	15991	1
29	LOCKWASHER	J00005	15991	1
30	OIL CUP	S00617	15991	1
31	*DRIVE SHAFT	6631	15010	1
32	ECCENTRIC HOUSING	6632	10010	1
33	*ECC HOUSING GSKT	6632-G	18000	1
34	DRAIN PLUG	P00004	11990	1
35	*DRIVE SHAFT BRG	S01044	-----	2
36	*RETAINING RING	S00204	-----	1
37	*DRIVE GEAR	6488-A	16040	1
38	*SNAP RING	S01004	-----	1
39	*PINION GEAR	S01014	-----	1
40	*PINION SHAFT	6634	16070	1
41	GEAR HOUSING PLUG	S01054	-----	1
42	*PINION SHAFT INBOARD BUSHING	S01015	-----	1
43	WASHER	6636	15990	1
44	*SNAP RING	S00244	-----	1
45	*CRANKSHAFT ROLLER BEARING	S01011	-----	1
46	*RETAINING RING	S00442	-----	1
47	*CRANKSHAFT	6550	11000	1
48	*SNAP RING	S01010	-----	1
49	*OIL SEAL	S01012	-----	1

*INDICATES PARTS RECOMMENDED FOR STOCK

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 (11, 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 (12), remove the suction accumulator (3) by disengaging the hardware (8 and 9) securing it to the diaphragm pot (1).

Remove the hardware (5 and 6) securing the valve seat (18) and flap valve assembly to the diaphragm pot.

To service the discharge flap valve (26), remove hardware (35 and 36) and the discharge elbow (37). Remove the hardware (23 and 24) securing the valve seat (25) and discharge flap valve to the outboard discharge flange.

To remove the inboard discharge flange (32), 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 of flap valve components, remove the machine screws and lockwashers (14, 15, 30 and 31).

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

Diaphragm Removal

(Figure 3)

To remove the diaphragm, disengage the hardware (22 and 23, Figure 1) and remove the diaphragm pot (26, Figure 1).

Remove the nuts (10), lower diaphragm plate (8) and the diaphragm (6). Inspect the diaphragm ring (27, Figure 1) for wear or damage. If replacement is necessary, the gearbox assembly (1, Figure 1) must be removed.

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

Plunger Rod Assembly Removal

(Figure 3)

With the diaphragm pot assembly and diaphragm removed, loosen the hardware (2, 3, and 4) and separate the plunger rod assembly (36, Figure 1) from the crankshaft roller bearing (45, Figure 4).

Plunger Rod Assembly Disassembly

(Figure 3)

Use a socket wrench to hold the plunger rod (5) and unscrew the bearing cap (1). Remove the spring return nut (13), spring (12) and spring washer (11). Remove the plunger rod from the upper diaphragm plate (9).

Gearbox Assembly Removal

(Figure 1)

Support the base (21) with blocks of wood.

Remove the hardware (34 and 35) from the diaphragm ring assembly and allow it to drop away from the base.

Separate the gearbox assembly (1) from the coupling (2) by pulling straight away.

Gearbox Assembly Disassembly

(Figure 4)

When 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.

Remove the drive shaft key (26) and tag it for reference during reassembly.

Drain the gear box lubricant by removing the drain plug (34). Clean and reinstall the drain plug.

Remove the hardware (24 and 25) securing the eccentric housing (32) and gasket (33) to the gear cover (7), and pull the complete drive shaft sub-assembly from the gear cover.

To disassemble the drive shaft sub-assembly, remove the snap ring (38) and slide the drive gear (37) off the drive shaft (31). Remove the inboard bearing retaining ring (36), and press the drive shaft and assembled bearings (35) out of the eccentric housing. Press the oil seal (49) from the housing bore. Use a bearing puller to remove the drive shaft bearings.

For access to the remaining gearbox drive components, the gear cover and gasket (4) must be separated from the gear housing (2). The cover is secured to the housing by two close-tolerance shoulder bolts (12 and 27) - which act as pilots to ensure accurate concentric positioning of the cover - and by nuts and lockwashers (13, 14, 28, and 29), and capscrews, nuts and lockwashers (9, 10, 11, 15, 16 and 17).

NOTE

The shoulder bolts and capscrews securing the gearbox cover to the gearbox housing are of different lengths. Be certain to record the positions of the shoulder bolts and capscrews at the time of removal.

Remove the hardware securing the gear cover to the housing, and remove the cover.

NOTE

If the gear cover does not readily separate from the housing, remove the capscrew and lockwasher (19 and 20), install a 5/8-11 UNC by 4-inch capscrew and jack the cover from the housing. Remove the jackscrew and replace the capscrew and lockwasher.

After the gear cover has been removed, remove the cover plug (23) and press the outboard pinion shaft bushing (22) from the cover bore.

Slide the pinion shaft washer (21) off the shaft and tag it for reference during reassembly.

Install two 5/8-11 UNC capscrews in the tapped holes in the crankshaft gear (3) and use a gear puller to slide the gear, outboard bearing (18), and washer (43) from the crankshaft (47). Tag the washer and the crankshaft gear key (8) for reference during reassembly. Remove the capscrews from the gear.

Remove the bearing snap ring (48) and tap the crankshaft and assembled inboard bearing (1) out of the gearbox housing.

To remove the crankshaft inboard bearing, remove the bearing retaining ring (46). To remove the crankshaft roller bearing (45), remove the bearing snap ring (44). Use a bearing puller to remove the bearings.

To disassemble the pinion shaft (40) and components, slide the shaft and assembled pinion gear (39) out of the inboard shaft bushing (42). The pinion gear is retained on the shaft by a tight friction fit and does not normally require removal. If removal is required, press the pinion gear from the shaft. Remove the gear housing plug (41) and press the shaft bushing out of the gear housing bore.

Gearbox Assembly Reassembly

(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.

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 precautions printed on solvent containers.

Clean all bearings thoroughly in **fresh** cleaning solvent, agitating to remove the old lubricant. 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.

If removed at disassembly, press the pinion gear on the pinion shaft until it seats squarely against the shaft shoulder. Install the pinion shaft inboard bushing in the gear housing bore and install the pinion shaft and assembled gear in the bushing. Install the gear housing plug.

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

Dip the crankshaft bearings in clean oil. Use an arbor (or hydraulic) press to press the inboard bearing on the crankshaft until it seats squarely against the shaft shoulder and install the bearing retaining 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.

Press the assembled crankshaft and bearings into the bearing housing and install the snap ring.

CAUTION

When installing the shaft and bearings into the bearing bore, push against the outer race. NEVER hit the balls or ball cage.

Install the crankshaft gear key in the shaft keyway. Press the gear on the crankshaft, making certain that it engages the pinion shaft and seats squarely against the crankshaft shoulder. Install the crankshaft washer and press the outboard bearing on the shaft until it seats squarely against the washer. Tap the crankshaft into place with a soft-faced mallet to ensure that all components are seated squarely.

Dip the crankshaft roller bearing in clean oil and press it on the shaft. Install the bearing snap ring.

Slide the pinion shaft washer onto the pinion shaft.

Inspect the pressure relief fitting (6) and replace if necessary.

Press the pinion shaft outboard bushing (22) into the gear cover. Position the gear cover so that the respective bores slip over the crankshaft outboard bearing and pinion shaft, and tap the cover into place with a soft-faced mallet.

Install the shoulder bolts, capscrews, lockwashers and nuts securing the gear cover to the gear housing and tighten them evenly.

CAUTION

Make certain to install the shoulder bolts and capscrews in the same holes from which they were removed. The shoulder bolts and capscrews are of different lengths and, if incorrectly installed, could crack or otherwise damage the gear cover and/or housing.

Install the gear cover plug.

Dip the drive shaft bearings in clean oil and press them on the shaft until they seat against the shaft shoulders. Press the shaft and assembled bearings into the eccentric housing and install the inboard bearing retaining ring.

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

Install the helical drive gear on the shaft and install the gear snap ring.

Replace the eccentric housing gasket and install the housing and assembled drive shaft sub-assembly in the gear cover, making certain to engage the pinion gear. Secure the eccentric housing to the gear cover.

NOTE

The bore of the eccentric housing is not concentric to the eccentric housing flange. Install the eccentric housing with the bore in the lower position.

Inspect the oil seal and replace if necessary. Install the oil seal with the lip positioned as shown in Figure 4.

Install the shaft key and drive coupling (2, Figure 1).

Lubricate the gearbox as described in **LUBRICATION.**

Gearbox Assembly Installation

(Figure 1)

Position the gearbox assembly on the frame and reconnect the drive coupling. Check the coupling alignment as described in **ALIGNMENT**, Section B.

Inspect the diaphragm ring assembly (27) for wear or damage and replace as necessary. Position the diaphragm ring assembly and secure with the hardware (34 and 35).

Plunger Rod Reassembly

(Figure 3)

Clean the bearing cap bore with a cloth soaked in cleaning solvent. Inspect the bearing cap for wear or damage and replace if 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 precautions printed on solvent containers.

Slide the plunger rod through the upper diaphragm plate. Install the spring washer (11), spring (12), and spring return nut (13). Compress the spring to the dimension shown in Figure 3. Install the bearing cap (1).

Plunger Rod Assembly Installation

(Figure 1)

Install the plunger rod assembly onto the crankshaft roller bearing and secure with the hardware (2, 3 and 4, Figure 3).

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 (10).

Secure the diaphragm pot (26, Figure 1) to the diaphragm ring assembly using the hardware (22 and 23, Figure 1).

Suction And Discharge Flap Valve Installation

(Figure 2)

If the inboard discharge flange (32) was removed, clean the mating surfaces, install the gasket (19) and secure the flange to the diaphragm pot using hardware (21 and 22).

Subassemble the valve seat (25) and discharge flap valve (26) with the discharge elbow (37) and secure using hardware (23 and 24).

Clean the mating surfaces of the valve seat and inboard discharge flange. Install the gasket (33) and secure the discharge elbow to the inboard discharge flange.

Subassemble the suction flap valve (12) and valve seat (18) to the diaphragm pot and secure using the hardware (5 and 6).

Clean the mating surfaces, install the gasket (10) 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

CAUTION

> The crankshaft roller bearing (45, Figure 4) 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 upper lubrication fitting (37, Figure 1) and lower lubrication fitting (7, Figure 3).

Apply grease to the upper lubrication fitting until grease escapes from the eccentric cap. Grease the lower fitting until grease escapes from the top of the upper diaphragm plate (9, Figure 3).

Gearbox

(Figure 4)

Fill the gearbox through the oil cup (30) with a good grade of SAE 20-30 non-detergent motor oil to the midpoint of the oil cup sight gauge. The oil level must be maintained at this point.

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

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

Engine

Refer to the engine manufacturer's recommendations for engine lubrication.

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

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