
**INSTALLATION, OPERATION,
AND MAINTENANCE MANUAL**
WITH PARTS LIST



10 SERIES PUMPS

MODEL
16A2-F4L /S1

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA Printed in U.S.A.

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The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

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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 pump is a 10 Series, semi-open impeller, self-priming centrifugal model with a suction check valve. The pump is powered by a Deutz Diesel engine, model F3L-912. It is designed for handling dirty water containing specified entrained solids. The basic material of construction for wetted parts is gray iron, with ductile iron impeller and steel wearing parts.

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

<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 10 SERIES ENGINE DRIVEN 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. Switch off the engine ignition and remove the key
//    to ensure that the pump will remain inoperative.
// 3. Allow the pump to cool if overheated.
// 4. Vent the pump slowly and cautiously.
// 5. Close the suction and discharge valves.
// 6. Check the temperature before opening any covers,
//    plates, or plugs.
// 7. Drain the pump.
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// This pump is designed to handle dirty water containing
// specified entrained solids. Do not attempt to pump vol-
// atile, flammable, or corrosive liquids which may damage
// the pump or endanger personnel as a result of pump fail-
// ure.
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Use lifting and moving equipment in good repair and with
// adequate capacity to prevent injuries to personnel or
// damage to equipment. The bail is intended for use in
// lifting the pump assembly only. Suction and discharge
// hoses and piping MUST be removed from the pump when
// lifting the pump by the bail.
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// After the pump has been positioned, make certain that
// the pump and all piping or hose connections are tight,
// properly supported and secure before operation.
//
////////////////////////////////////

```

WARNINGS

WARNING

```

////////////////////////////////////
//
// Do not operate the pump against a closed discharge valve //
// for long periods of time. This could bring the liquid //
// to a boil, build pressure, and cause the pump to rupture //
// or explode. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Do not remove plates, covers, gauges, pipe plugs, or //
// fittings from an overheated pump. Vapor pressure within //
// the pump can cause parts being disengaged to be ejected //
// with great force. Allow the pump to cool before servic- //
// ing. //
// //
////////////////////////////////////

```

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

```

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 1800 RPM. //
// //
////////////////////////////////////

```


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.

Most of the information pertains to a standard static lift application where the pump is positioned above the free level of liquid to be pumped.

If installed in a flooded suction application where the liquid is supplied to the pump under pressure, some of the information such as mounting, line configuration, and priming must be tailored to the specific application. Since the pressure supplied to the pump is critical to performance and safety, be sure to limit the incoming pressure to 50% of the maximum permissible operating pressure as shown on the pump performance curve. (See Section E, Page 1). If the pump is fitted with a Gorman-Rupp double grease lubricated seal, the maximum incoming pressure must be reduced to 10 p.s.i..

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

Pump Dimensions

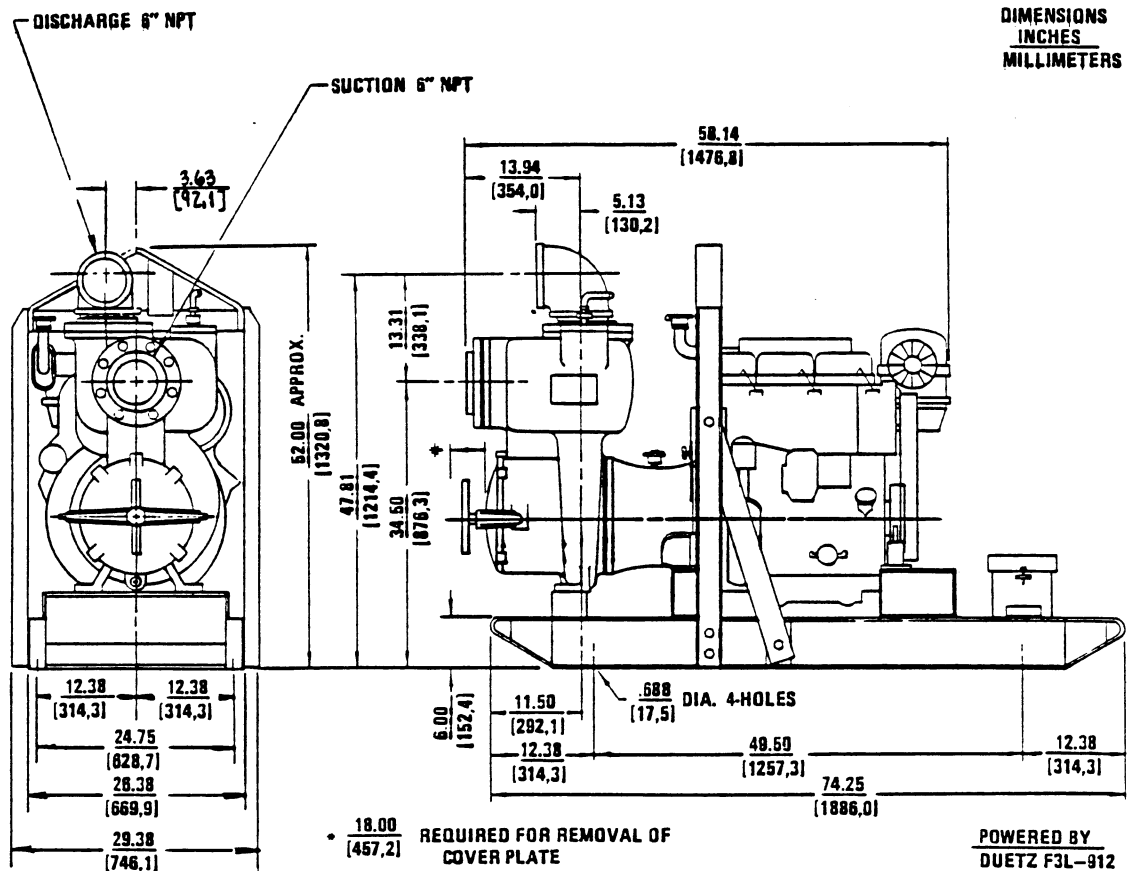


Figure 1. Pump Model 16A2-F4L/S1

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 attaching hardware. Since gaskets tend to shrink after drying, check for loose hardware at 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

WARNING

```

////////////////////////////////////
//
// Use lifting and moving equipment in good repair and with //
// adequate capacity to prevent injuries to personnel or //
// damage to equipment. The bail is intended for use in //
// lifting the pump assembly only. Suction and discharge //
// hoses and piping MUST be removed from the pump when //
// lifting the pump by the bail. //
// //
////////////////////////////////////

```

Lifting

Use lifting equipment with a capacity of at least 9,500 pounds. This pump weighs approximately 1,880 pounds, not including the weight of accessories and wheel kit. 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.

If the pump has been mounted on a moveable base, make certain the base is stationary by setting the brake and blocking the wheels before attempting to operate the pump.

To ensure sufficient lubrication and fuel supply to the engine, **do not** position the pump and engine more than 15° off horizontal for continuous operation. The pump and engine may be positioned up to 30° off horizontal for **intermittent operation only**; however, the engine manufacturer should be consulted for continuous operation at angles greater than 15°.

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. Using piping couplings in suction lines is not recommended.

Line Configuration

Keep suction and discharge lines as straight as possible to minimize friction losses. Make minimum use of elbows and fittings, which substantially increase friction loss. If elbows are necessary, use the long-radius type to minimize friction loss.

Connections to Pump

Before tightening a connecting flange, align it exactly with the pump port. Never pull a pipe line into place by tightening the flange bolts and/or couplings.

Lines near the pump must be independently supported to avoid strain on the pump which could cause excessive vibration, decreased bearing life, and increased shaft and seal wear. If hose-type lines are used, they should have adequate support to secure them when filled with liquid and under pressure.

Gauges

Most pumps are drilled and tapped for installing discharge pressure and vacuum suction gauges. If these gauges are desired for pumps that are not tapped, drill and tap the suction and discharge lines not less than 18 inches from the suction and discharge ports and install the lines. 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.

Fittings

Suction lines should be the same size as the pump inlet. If reducers are used in suction lines, they should be the eccentric type, and should be installed with the flat part of the reducers uppermost to avoid creating air pockets. Valves are not normally used in suction lines, but if a valve is used, install it with the stem horizontal to avoid air pockets.

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 2-1/2 inch diameter spherical solids.

INSTALLATION

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.

Suction Lines In Sumps

If a single suction line is installed in a sump, it should be positioned away from the wall of the sump at a distance equal to one and one-half times the diameter of the suction line.

If there is a liquid flow from an open pipe into the sump, the flow should be kept away from the suction inlet because the inflow will carry air down into the sump, and air entering the suction line will reduce pump efficiency.

If it is necessary to position inflow close to the suction inlet, install a baffle between the inflow and the suction inlet at a distance one and one-half times the diameter of the suction pipe. The baffle will allow entrained air to escape from the liquid before it is drawn into the suction inlet.

If two suction lines are installed in a single sump, the flow paths may interact, reducing the efficiency of one or both pumps. To avoid this, position the suction inlets so that they are separated by a distance equal to at least three times the diameter of the suction pipe.

Suction Line Positioning

The depth of submergence of the suction line is critical to efficient pump operation. Figure 2 shows recommended minimum submergence vs. velocity.

NOTE

The pipe submergence required may be reduced by installing a standard pipe increaser fitting at the end of the suction line. The larger opening size will reduce the inlet velocity. Calculate the required submergence using the following formula based on the increased opening size (area or diameter).

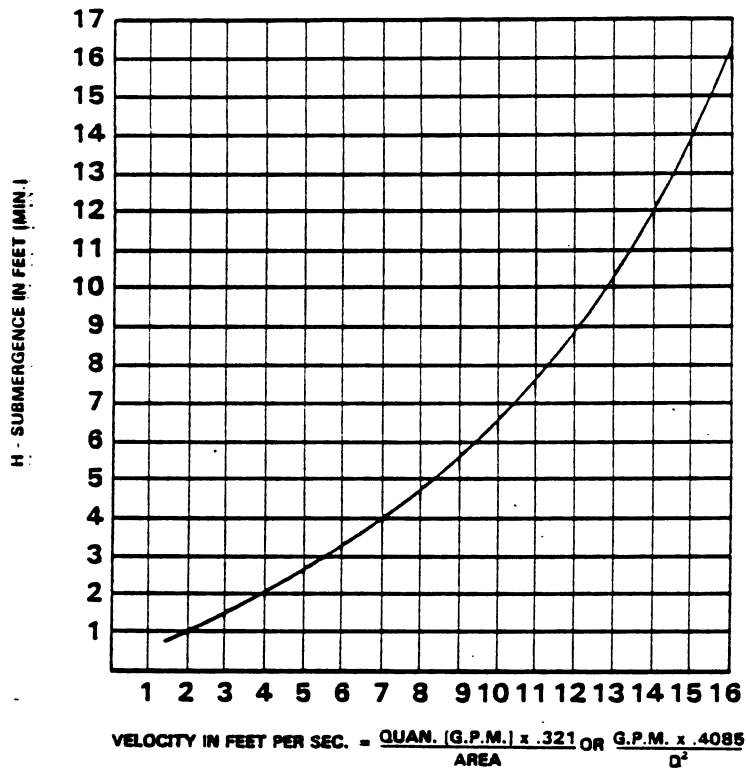


Figure 2. Recommended Minimum Suction Line Submergence Vs. Velocity

DISCHARGE LINES

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

A check valve in the discharge line is normally recommended, but it is not necessary in low discharge head applications.

If a throttling valve is desired in the discharge line, use a valve as large as the largest pipe to minimize friction losses. Never install a throttling valve in a suction line.

With high discharge heads, it is recommended that a throttling valve and a system check valve be installed in the discharge line to protect the pump from excessive shock pressure and reverse rotation when it is stopped.

INSTALLATION

Bypass Lines

If it is necessary to permit the escape of air to atmosphere during initial priming or in the repriming cycle, install a bypass line between the pump and the discharge check valve. The bypass line should be sized so that it does not affect pump discharge capacity.

Either a Gorman-Rupp automatic air release valve - which will automatically open to allow the pump to prime, and automatically close when priming is accomplished - or a hand-operated shutoff valve should be installed in the bypass line.

NOTE

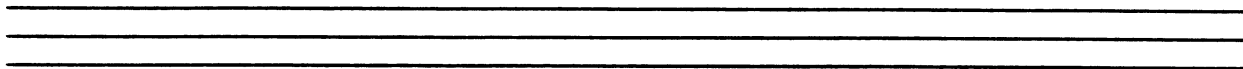
The bypass line may clog frequently, particularly if the valve remains closed. If this condition occurs, either use a larger bypass line or leave the shutoff valve open during the pumping operation.

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 could result, causing damage to the pump.

ALIGNMENT

The alignment of the pump and the engine is critical for trouble free mechanical operation. See Section E, **Securing Intermediate And Drive Assembly To Engine** for detailed information.

OPERATION



OPERATION - SECTION C

WARNING

```

////////////////////////////////////
//
// This pump is designed to handle dirty water containing //
// specified entrained solids. Do not attempt to pump vol- //
// atile, flammable, or corrosive liquids which may damage //
// the pump or endanger personnel as a result of pump fail- //
// ure. //
// //
////////////////////////////////////

```

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 1800 RPM. //
// //
////////////////////////////////////

```

PRIMING

Install the pump and piping as described in INSTALLATION. Make sure that the piping connections are tight, and that the pump is securely mounted. Check that the pump is properly lubricated (see LUBRICATION in MAINTENANCE AND REPAIR).

This pump is self-priming, but the pump should never be operated unless there is liquid in the casing.

CAUTION

Never operate a self-priming pump unless there is liquid in the casing. The pump will not prime when dry. Extended operation of a dry pump will destroy the seal assembly.

Add liquid to the pump casing when:

1. The pump is being put into service for the first time.
2. The pump has not been used for a considerable length of time.
3. The liquid in the pump casing has evaporated.

Once the pump casing has been filled, the pump will prime as necessary.

OPERATION

WARNING

```

////////////////////////////////////
//
// After filling the pump casing, reinstall and tighten the //
// fill plug. Do not attempt to operate the pump unless //
// all connecting piping is securely installed. Otherwise, //
// liquid in the pump forced out under pressure could cause //
// injury to personnel. //
// //
////////////////////////////////////

```

To fill the pump, remove the pump casing fill cover or fill plug at the top of the casing and add clean liquid until the pump is filled. Replace the fill cover or fill plug before operating the pump.

STARTING

Consult the operations manual furnished with the engine.

OPERATION

Lines With a Bypass

Either a Gorman-Rupp automatic air release valve or a hand operated shutoff valve may be installed in a bypass line.

If a Gorman-Rupp automatic air release valve has been installed, close the throttling valve in the discharge line. The Gorman-Rupp valve will automatically open to allow the pump to prime, and automatically close when priming has been accomplished. After the pump has been primed, and liquid is flowing steadily from the bypass line, open the discharge throttling valve.

If a hand operated shutoff valve has been installed, close the throttling valve in the discharge line, and open the bypass shutoff valve so that the pump will not have to prime against the weight of the liquid in the discharge line. When the pump has been primed, and liquid is flowing steadily from the bypass line, close the bypass shutoff valve and open the discharge throttling valve.

Lines Without a Bypass

Open all valves in the discharge line and start the power source. Priming is indicated by a positive reading on the discharge pressure gauge or by a quieter operation. 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 it and check the suction line for leaks.

After the pump has been primed, partially close the discharge line throttling valve in order to fill the line slowly and guard against excessive shock pres-

OPERATION

sure which could damage pipe ends, gaskets, sprinkler heads, and any other fixtures connected to the line. When the discharge line is completely filled, adjust the throttling valve to the required flow rate.

Leakage

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

Liquid Temperature And Overheating

The maximum liquid temperature for this pump is 110°F. Do not apply it at a higher operating temperature.

Overheating can occur if operated with the valves in the suction or discharge lines closed. Operating against closed valves could bring the liquid to a boil, build pressure, and cause the pump to rupture or explode. If overheating occurs, stop the pump and allow it to cool before servicing it. Refill the pump casing with cool liquid.

WARNING

Do not remove plates, covers, gauges, pipe plugs, or fittings from an overheated pump. Vapor pressure within the pump can cause parts being disengaged to be ejected with great force. Allow the pump to cool before servicing.

Strainer Check

If a suction strainer has been shipped with the pump or installed by the user, check the strainer regularly, and clean it as necessary. The strainer should also be checked if pump flow rate begins to drop. If a vacuum suction gauge has been installed, monitor and record the readings regularly to detect strainer blockage.

Never introduce air or steam pressure into the pump casing or piping to remove a blockage. This could result in personal injury or damage to the equipment. If backflushing is absolutely necessary, liquid pressure must be limited to 50% of the maximum permissible operating pressure shown on the pump performance curve. (See Section E, Page 1). If the pump is fitted with a Gorman-Rupp double grease lubricated seal, the maximum incoming pressure must be reduced to 10 p.s.i..

Pump Vacuum Check

With the pump inoperative, install a vacuum gauge in the system, using pipe dope on the threads. Block the suction line and start the pump. At operating speed the pump should pull a vacuum of 20 inches or more of mercury. If it does not, check for air leaks in the seal, gasket, or discharge valve.

Open the suction line, and read the vacuum gauge with the pump primed and at operating speed. Shut off the pump. The vacuum gauge reading will immediately drop proportionate to static suction lift, and should then stabilize. If the vacuum reading falls off rapidly after stabilization, an air leak exists. Before checking for the source of the leak, check the point of installation of the vacuum gauge.

STOPPING

Never halt the flow of liquid suddenly. If the liquid being pumped is stopped abruptly, damaging shock waves can be transmitted to the pump and piping system. Close all connecting valves slowly. On engine driven pumps, reduce the throttle speed slowly and allow the engine to idle briefly before stopping.

CAUTION

If application involves a high discharge head, gradually close the discharge throttling valve before stopping the pump.

After stopping the pump, switch off the engine ignition and remove the key to ensure that the pump will remain inoperative.

Cold Weather Preservation

In below freezing conditions, drain the pump to prevent damage from freezing. Also, clean out any solids by flushing with a hose. Operate the pump for approximately one minute; this will remove any remaining liquid that could freeze the pump rotating parts.

If the pump will be idle for more than a few hours, or if it has been pumping liquids containing a large amount of solids, drain the pump, and flush it thoroughly with clean water. To prevent large solids from clogging the drain port and preventing the pump from completely draining, insert a rod or stiff wire in the drain port, and agitate the liquid during the draining process. Clean out any remaining 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. Switch off the engine ignition and remove the key
// to ensure that the pump will remain inoperative.
// 3. Allow the pump to cool if overheated.
// 4. Vent the pump slowly and cautiously.
// 5. Close the suction and discharge valves.
// 6. Check the temperature before opening any covers,
// plates, or plugs.
// 7. Drain the pump.
//
////////////////////////////////////
    
```

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME	Not enough liquid in casing.	Add liquid to casing. See PRIMING.
	Suction check valve contaminated or damaged.	Clean or replace check valve.
	Air leak in suction line.	Correct leak.
	Lining of suction hose collapsed.	Replace suction hose.
	Leaking or worn seal or pump gasket.	Check pump vacuum. Replace leaking or worn seal or gasket.
	Suction lift or discharge head too high.	Check piping installation and install bypass line if needed. See INSTALLATION.
	Strainer clogged.	Check strainer and clean if necessary.
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Suction check valve or foot valve clogged or binding.	Clean valve.
	Air leak in suction line.	Correct leak.
	Suction intake not submerged at proper level or sump too small.	Check installation and correct submergence as needed.

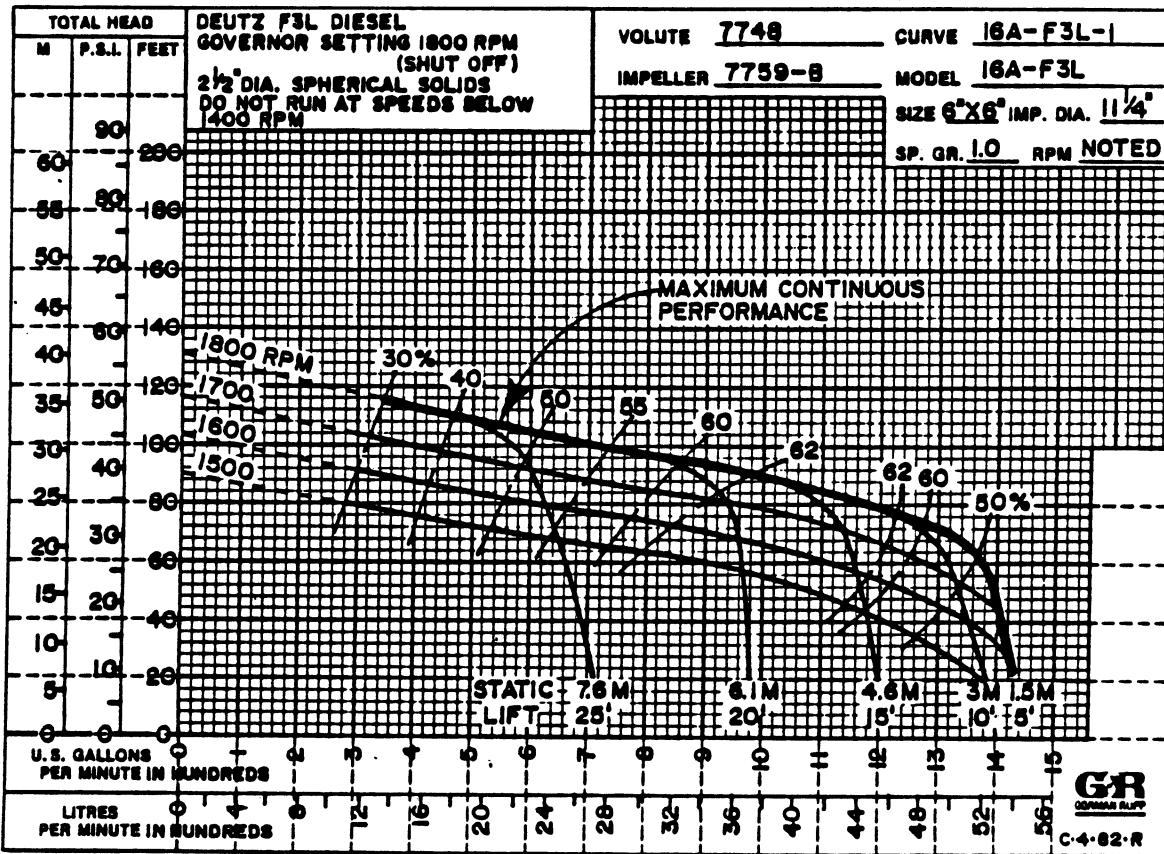
TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE(cont.)	<p>Lining of suction hose collapsed.</p> <p>Impeller or other wearing parts worn or damaged.</p> <p>Impeller clogged.</p> <p>Suction lift or discharge head too high.</p> <p>Strainer clogged.</p> <p>Pump speed too slow.</p> <p>Leaking or worn seal or pump gasket.</p>	<p>Replace suction hose.</p> <p>Replace worn or damaged parts. Check that impeller is properly centered and rotates freely.</p> <p>Free impeller of debris.</p> <p>Check piping installation and install bypass line if needed. See INSTALLATION.</p> <p>Check strainer and clean if necessary.</p> <p>Check engine output; consult engine operation manual.</p> <p>Check pump vacuum. Replace leaking or worn seal or gasket.</p>
PUMP REQUIRES TOO MUCH POWER	<p>Pump speed too high.</p> <p>Discharge head too low.</p> <p>Liquid solution too thick.</p> <p>Bearing(s) frozen.</p>	<p>Check engine output.</p> <p>Adjust discharge valve.</p> <p>Dilute if possible.</p> <p>Disassemble pump and check bearing(s).</p>
PUMP CLOGS FREQUENTLY	<p>Discharge flow too slow.</p> <p>Suction check valve or foot valve clogged or binding.</p> <p>Liquid solution too thick.</p>	<p>Open discharge valve fully to increase flow rate, and run engine at maximum governed speed.</p> <p>Clean valve.</p> <p>Dilute if possible.</p>

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
EXCESSIVE NOISE	<p>Cavitation in pump.</p> <p>Pumping entrained air.</p> <p>Pump or drive not securely mounted.</p> <p>Impeller clogged or damaged.</p>	<p>Reduce suction lift and/or friction losses in suction line. Record vacuum and pressure gauge readings and consult local representative or factory.</p> <p>Locate and eliminate source of air bubble.</p> <p>Secure mounting hardware.</p> <p>Clean out debris; replace damaged parts.</p>
BEARINGS RUN TOO HOT	<p>Bearing temperature is high, but within limits.</p> <p>Low or incorrect lubricant.</p> <p>Suction and discharge lines not properly supported.</p> <p>Drive misaligned.</p>	<p>Check bearing temperature regularly to monitor any increase.</p> <p>Check for proper type and level of lubricant.</p> <p>Check piping installation for proper support.</p> <p>Align drive properly.</p>

PUMP MAINTENANCE AND REPAIR - SECTION E

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



* STANDARD PERFORMANCE FOR PUMP MODEL 16A2-F4L/S1

*Based on 70°F clear water at sea level with minimum suction lift. Since pump installations are seldom identical, your performance may be different due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

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.

CAUTION

Pump speed and operating condition points must be within the continuous performance range shown on the curve.

SECTIONAL DRAWING

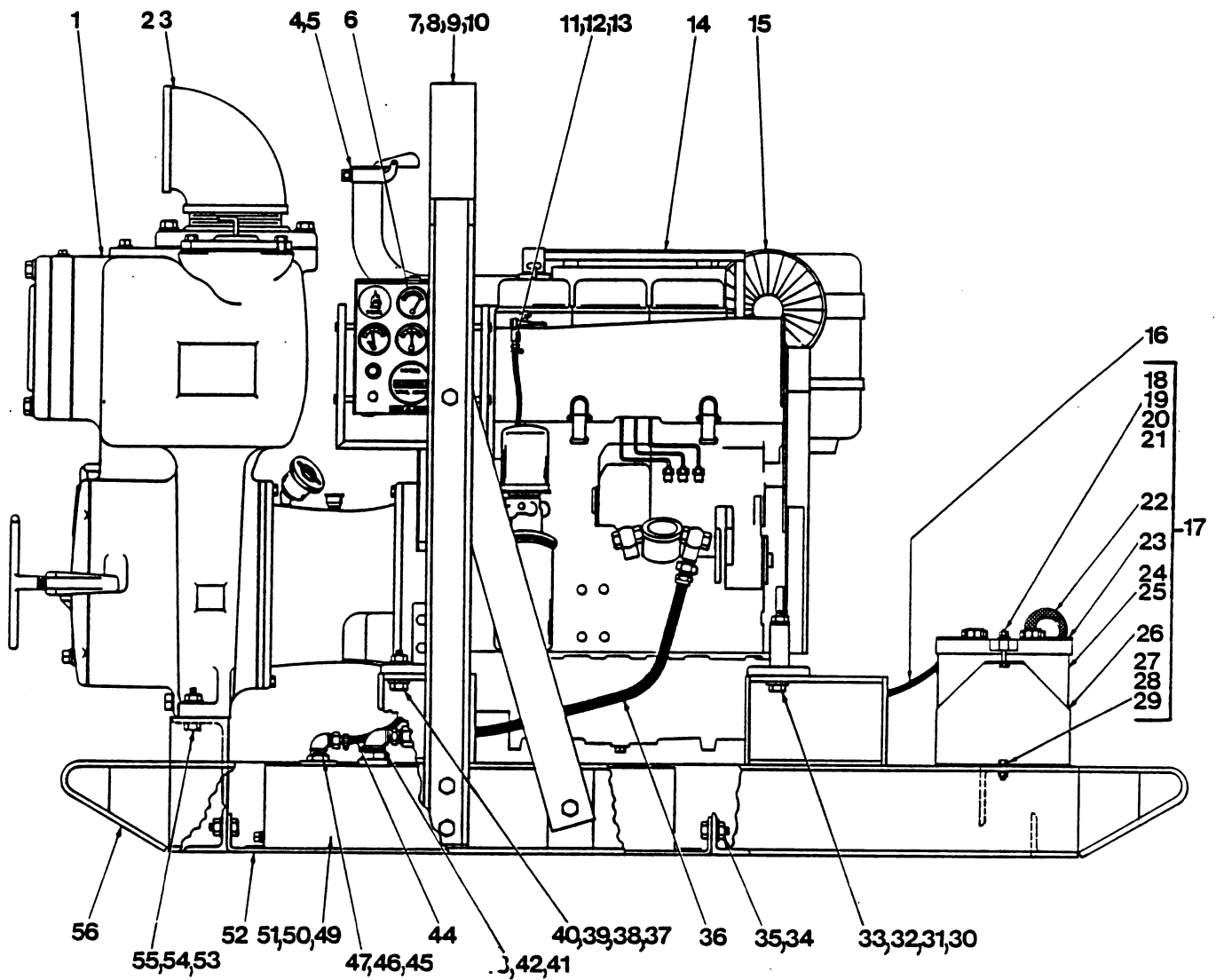


Figure 1. Model 16A2-F4L/S1 Pump Assembly

PARTS LIST
Pump Model 16A2-F4L /S1
 (From S/N 923346 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	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	PUMP END	16A2-(F4L)	-----	1	31	HEX HD CAPSCREW	B1018	15991	2
2	PIPE NIPPLE	T96	15070	REF	32	LOCKWASHER	J10	15991	2
3	PIPE ELBOW	R96	11990	REF	33	HEX NUT	D10	15991	2
4	EXHAUST ELBOW	31912-023	15130	1	34	HEX HD CAPSCREW	B0604	15991	10
5	WEATHER CAP	S1331	-----	1	35	FLANGED HEX NUT	21765-314	-----	10
6	TACHOMETER KIT	48312-606	-----	1	36	HOSE ASSY	9072	-----	1
7	HOISTING BAIL	13351-AK	24000	1	37	BEVELED WASHER	21167-011	-----	4
8	HEX HD CAPSCREW	B1006	15991	8	38	HEX HD CAPSCREW	B1008	15991	4
9	HEX NUT	D10	15991	8	39	LOCKWASHER	J10	15991	4
10	LOCKWASHER	J10	15991	8	40	HEX NUT	D10	15991	4
11	FUEL RETURN LINE	11308-A	-----	1	41	FUEL OUTLET ASSY	10765	24030	1
12	HOSE CLAMP	26518-642	-----	1	42	REDUCING ELBOW	Q0604	11990	1
13	HOSE BARB FITTING	26523-441	-----	1	43	MALE CONNECTOR	S1447	-----	1
14	MUFFLER GUARD ASSY	42331-031	-----	1	44	HOSE CLAMP	26518-642	-----	1
15	DEUTZ F4L ENGINE	29217-043	-----	1	45	HOSE CONNECTOR	26523-402	-----	1
16	POS CABLE ASSY	6926-S	24040	1	46	REDUCING ELBOW	Q0402	11990	1
17	BATTERY BOX ASSY	GRP40-08B	-----	1	47	FUEL RETURN ASSY	14294	24030	1
18	-HEX HD CAPSCREW	B0605	15991	2	48	FUEL TANK & GRD ASSY	46711-033	-----	1
19	-LOCKWASHER	J06	15991	2	49	-FUEL TANK ASSY	46711-034	24150	1
20	-FLAT WASHER	K06	15991	2	50	-FLAT WASHER	K06	15991	4
21	-HEX NUT	D06	15991	2	51	-FLANGED HEX NUT	21765-314	-----	4
22	-GROUND CABLE ASSY	5795-AC	24040	1	52	-GUARD ASSY	42381-017	24150	1
23	-LID ASSY	42113-012	24150	1	53	HEX HD CAPSCREW	B1010	15991	2
24	-OPTIONAL 12V BATT	29331-506	-----	REF	54	LOCKWASHER	J10	15991	2
25	-BATTERY TAG	38818-506	-----	1	55	HEX NUT	D10	15991	2
26	-BATTERY BOX	42431-030	24150	1	56	COMBINATION BASE	41566-575	24150	1
27	-HEX HD CAPSCREW	B0605	15991	4	NOT SHOWN:				
28	-LOCKWASHER	J06	15991	4	BELT FAN GRD KIT	48157-701	-----	1	
29	-HEX NUT	D06	15991	4	CAUTION DECAL	2613-FJ	-----	1	
30	BEVELED WASHER	21167-011	-----	2					

* INDICATES PARTS RECOMMENDED FOR STOCK

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

CANADIAN SERIAL NO. AND UP

SECTIONAL DRAWING

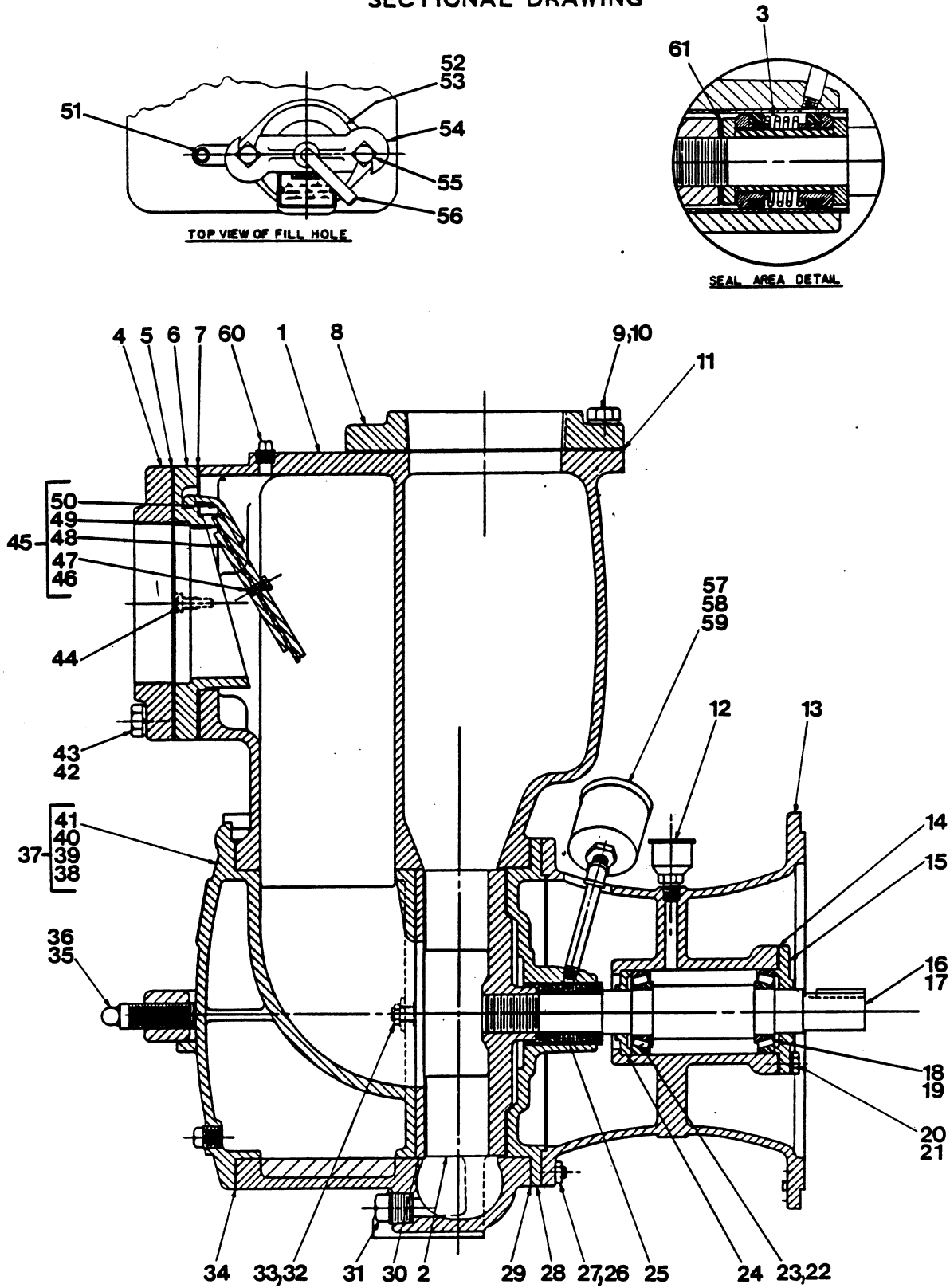


Figure 2. Pump End Assy 16A2-(F4L/S1)

PARTS LIST
Pump End Assy 16A2-(F4L/S1)

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	PUMP CASING	7748	10010	1	36	COVER CLAMP BAR	2547	11000	1
2	*IMPELLER	7759-B	11000	1	37	*BACK COVER ASSY	42111-932	-----	1
3	*SEAL ASSY	GS1500	-----	1	38	-WARNING PLATE	2613-EV	13990	1
4	SUCTION FLANGE	1758	10010	1	39	-COVER PLATE	NOT AVAILABLE		1
5	*SUCT FLANGE GSKT	1679-G	18000	1	40	-DRIVE SCREW	BM#04-03	15990	4
6	*CHECK VALVE SEAT	7261	10010	1	41	-DRAIN PLUG	P08	11990	1
7	*SEAT GASKET	7261-G	18000	1	42	HEX HD CAPSCREW	B1212	15991	8
8	DISCHARGE FLANGE	1758	10010	1	43	LOCKWASHER	J12	15991	8
9	HEX HD CAPSCREW	B1208	15991	8	44	RD HD MACH SCREW	X0404	17090	2
10	LOCKWASHER	J12	15991	8	45	*CHECK VALVE ASSY	7265	-----	1
11	*DISCH FLANGE GSKT	1679-G	18000	1	46	-HEX HD CAPSCREW	B0403	17000	2
12	INTERM GREASE CUP	S35	-----	1	47	-LOCKWASHER	J04	17090	2
13	INTERMEDIATE	36	10010	1	48	-CHK VLV WEIGHT	7263	15990	1
14	*BRG ADJ SHIM SET	48261-031	-----	1	49	-CHK VLV GASKET	7264	19070	1
15	*BEARING CAP	43-X	10010	1	50	-CHK VLV WEIGHT	7262	24000	1
16	IMPELLER SHAFT	13486	16040	1	51	PIPE PLUG	P04	11990	1
17	*SHAFT KEY	N0607	15990	1	52	FILL COVER ASSY	42111-344	-----	1
18	*BEARING CUP	S1086	-----	1	53	*FILL COVER GSKT	50-G	19210	1
19	*BEARING CONE	S1087	-----	1	54	FILL COVER	38111-004	11000	1
20	HEX HD CAPSCREW	B0604	15991	4		CLAMP BAR			
21	LOCKWASHER	J06	15991	4	55	MACHINE BOLT	A1014	15991	2
22	*BEARING CUP	S1086	-----	1	56	FILL COVER	31912-009	15000	1
23	*BEARING CONE	S1087	-----	1		CLAMP SCREW			
24	*BEARING CLOSURE	44	10010	1	57	HEAVY PIPE NIPPLE	THA0416	15070	1
25	*SEAL LINER	7408	14010	REF	58	PIPE ELBOW	AG04	11990	1
26	STUD	C0809	15991	8	59	*SEAL GREASE CUP	S1509	-----	1
27	HEX NUT	D08	15991	8	60	PIPE PLUG	P04	11990	1
28	*SEAL PLATE	11895-A	10010	1	61	*IMPELLER SHIM SET	5091	17090	REF
29	*CASING GSKT SET	34-G	18000	1		NOT SHOWN:			
30	*WEAR PLATE	2545	15990	1		PIPE NIPPLE	T96	15070	1
31	CASING DRAIN PLUG	P16	11990	1		PIPE ELBOW	R96	11990	1
32	HEX NUT	D08	15991	2		STRAINER	7823-A	24000	1
33	LOCKWASHER	J08	15991	2		NAME PLATE	38818-023	13990	1
34	*COVER GSKT	7668-G	20000	1		DRIVE SCREW	BM#04-03	15990	4
35	COVER CLAMP SCREW	2536	24000	1		WARNING DECAL	38816-096	-----	1

*INDICATES PARTS RECOMMENDED FOR STOCK

SECTIONAL DRAWING

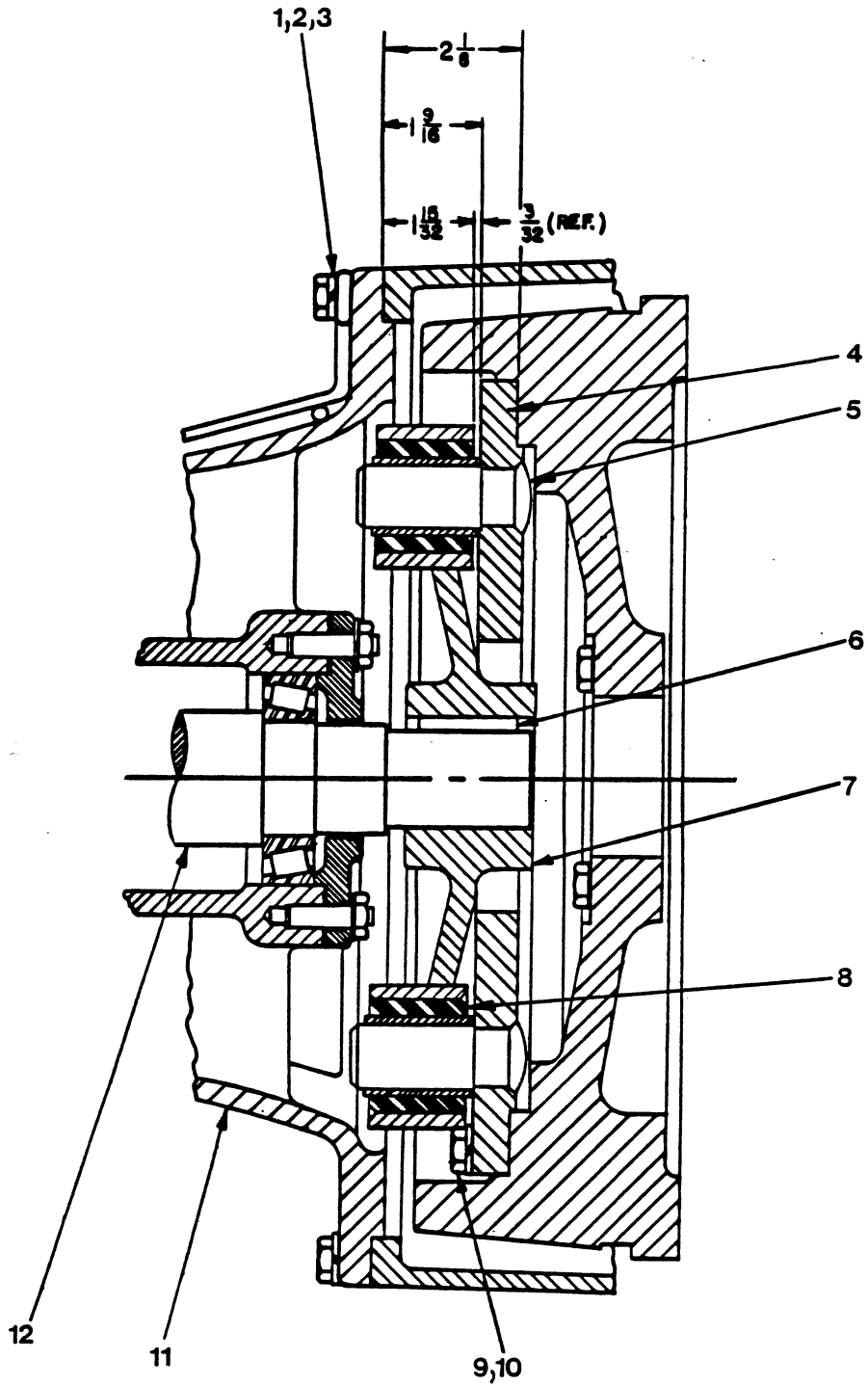


Figure 3. Drive Assembly For 16A2-F4L/S1

PARTS LIST
Drive Assembly For 16A2-F4L/S1

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	HEX HD CAPSCREW	22645-164	-----	12
2	LOCKWASHER	21171-511	-----	12
3	INTERMEDIATE GUARD	42381-031	24150	2
4	DRIVE PLATE ASSEMBLY	44131-005	24150	1
5	* -DRIVE PIN	13819	15030	2
6	* SHAFT KEY	N0607	15990	REF
7	DRIVE ARM ASSEMBLY	13817-D	-----	1
8	* -DYNA FLEX JOINT	S2110	-----	2
9	HEX HD CAPSCREW	22645-164	-----	8
10	LOCKWASHER	21171-511	-----	8
11	INTERMEDIATE	36	10010	REF
12	IMPELLER SHAFT	13486	16040	REF

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

Most service functions, such as wear plate, impeller and seal replacement, may be performed by draining the pump and removing the back cover assembly. However, the following instructions assume complete disassembly is required.

The pump is powered by a Deutz Diesel engine, model F3L-912. For service information on the engine, consult the literature supplied with the engine, or contact your local Deutz engine representative.

Before attempting to service the pump, switch off the engine ignition and remove the key to ensure that the engine will remain inoperative, and close all valves in the suction and discharge piping.

WARNING

Before attempting to open or service the pump:
1. Familiarize yourself with this manual.
2. Switch off the engine ignition and remove the key to ensure that the pump will remain inoperative.
3. Allow the pump to cool if overheated.
4. Vent the pump slowly and cautiously.
5. Close the suction and discharge valves.
6. Check the temperature before opening any covers, plates, or plugs.
7. 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. The bail is intended for use in lifting the pump assembly only. Suction and discharge hoses and piping MUST be removed from the pump when lifting the pump by the bail.

Back Cover Removal

(Figure 2)

The wear plate (30) is easily accessible and may be serviced by removing the back cover assembly (37). Before removing the assembly, remove the casing drain plug (31) and drain the pump. Clean and reinstall the drain plug.

MAINTENANCE AND REPAIR

Loosen the cover clamp screw (35) and clamp bar (36) securing the back cover. Pull the back cover and assembled wear plate from the pump casing (1). Remove the back cover gasket (34).

Inspect the wear plate and replace it if badly scored or worn. To remove the wear plate, disengage the hardware (32 and 33).

Suction Check Valve Removal

(Figure 2)

The check valve assembly may be serviced by removing the suction flange (4). To remove the flange, disengage the hardware (42 and 43) and separate the suction flange from the check valve seat (6). Remove the machine screws (44) and pull the seat and assembled check valve from the suction port. Pull the check valve out of the seat.

Inspect the check valve components for wear or damage. If replacement is required, disengage the hardware (46 and 47) and separate the valve weights (48 and 50) and gasket (49).

Replace the flange gaskets (5 and 7) as required.

Pump Casing Removal

(Figure 1)

To service the impeller or seal assembly, disconnect the suction and discharge piping. Remove the hardware (53, 54 and 55) securing the pump casing to the base (56).

(Figure 2)

Remove the discharge flange and gasket (8 and 11), and fill cover and gasket (52 and 53) from the pump casing. Loop a suitable chain or cable through the discharge port and back out the priming port, and attach to a hoist.

CAUTION

<p>Make certain the chain or cable is positioned so that the pump will not be damaged, and so that the load will be balanced.</p>

Remove the nuts (27) securing the pump casing to the seal plate (28) and intermediate (13). Use a hoist of sufficient capacity to safely separate the pump casing from the seal plate and intermediate.

WARNING

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////////////////////////////////////
//
// Suction and discharge piping MUST BE REMOVED before at- //
// tempting to lift or move the pump casing. Use lifting //
// and moving equipment in good repair and with adequate //
// capacity to prevent injuries to personnel or damage to //
// equipment. Do not attempt to lift the complete pump //
// unit in this manner. Additional weight may result in //
// damage to the pump and/or injury to personnel. //
//
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After the pump is removed, tie and tag any leveling shims used under the casing mounting feet for ease of reassembly.

Impeller Removal

(Figure 2)

Turn the cross arm on the automatic lubricating grease cup (59) clockwise until it rests against the cover (see Figure 5). This will prevent the grease from escaping when the impeller is removed.

To loosen the impeller (2), tap the vanes in a counterclockwise direction (when facing impeller) with a block of wood or a soft-faced mallet. Unscrew the impeller and replace it if cracked or badly worn. Use caution when removing the impeller; tension on the seal spring will be released as the impeller is unscrewed.

Slide the impeller adjusting shims (61) off the impeller shaft (16). For ease of reassembly, tie and tag the shims, or measure and record their thickness.

Seal Removal

(Figure 2)

To remove the seal assembly (3), remove the grease cup and piping (57, 58 and 59), and slide the seal plate (28) and seal parts off the shaft as a single unit. **Be careful not to drop or damage any seal parts.**

Carefully remove the stationary and rotating seal elements, packing rings, seal spring, and shaft sleeve from the seal plate.

NOTE

The seal assembly may be removed without completely disassembling the pump by removing the impeller through the back cover opening and using a stiff wire with a hooked end to pull the seal parts out of the seal plate.

Inspect the seal liner (25) for wear or grooves which could cause leakage or damage to the seal packing rings. The seal liner is a press fit in the seal plate (28), and does not normally require replacement. If replacement is necessary, see **Seal Installation**.

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

Separating Intermediate And Drive Assembly From Engine

(Figure 3)

If it is necessary to separate the intermediate and drive assemblies from the engine, support the intermediate using a hoist and sling, and remove the hardware (1 and 2) securing the intermediate (11) and guards (3) to the engine bellhousing. Separate the assemblies by pulling the intermediate straight away from the engine.

As the assemblies are separated, the drive pins (5) will disengage from the drive arm assembly (7). The drive arm assembly and the impeller shaft key (6) are a tight press fit on the shaft (12), and will remain on the shaft.

Use a bearing puller to remove the drive arm assembly from the impeller shaft. Remove the shaft key.

Inspect the dyna flex joints (8), and replace them if worn. The dyna flex joints are a press fit in the drive arm.

It is not necessary to remove the drive plate assembly (4) from the engine flywheel unless the drive pins are bent or worn and must be replaced. To remove the drive plate assembly, remove the hardware (9 and 10) and remove the drive plate.

The drive pins are secured into the drive plate by a tight press fit and peening. To remove the pins, drill through from the peened end and drive the pins out using a drift pin.

Shaft And Bearing Removal And Disassembly

(Figure 2)

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 hardware (20 and 21) securing the bearing cap (15) to the intermediate, and remove the bearing cap and bearing shim set (14). Tie and tag the bearing shims or measure and record their thickness for ease of reassembly.

Place a block of wood against the impeller end of the shaft (16), and tap the shaft and assembled bearings out of the intermediate. **Be Careful** not to damage the shaft.

NOTE

There are no provisions for draining the grease from the intermediate cavity. Place a drip pan under the intermediate before removing the shaft and bearings.

Remove the outboard bearing cup (18) from the bearing cone (19). Use a bearing puller to remove the inboard and outboard bearing cones (19 and 23) from the impeller shaft.

Place the intermediate on a level surface with the drive side down, and press the bearing closure (24) and inboard bearing cup (22) from the intermediate bore.

Shaft and Bearing Reassembly And Installation

(Figure 2)

Clean the intermediate, shaft and all component parts (except the bearings) with a soft cloth soaked in cleaning solvent. Inspect the parts for wear or damage and replace as necessary.

WARNING

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

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Inspect the shaft for distortion, nicks or scratches or thread damage on the impeller end. Dress small nicks and burrs with a fine file or emery cloth. Replace the shaft if defective.

Clean the bearings thoroughly in **fresh** cleaning solvent. 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 rollers. If rotation is rough or the rollers are 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 rollers or roller cage and cause premature bearing failure.

The bearing tolerances provide a tight press fit onto the shaft and a snug slip fit into the intermediate. Replace the shaft or intermediate if the proper bearing fit is not achieved.

Pre-pack the bearings by hand (or use a bearing packer if available) with No. 0 lithium base grease.

Position the inboard and outboard bearing cones on the impeller shaft with the high side of the tapered roller bearings toward the lubrication cavity.

Press the cones onto the shaft until seated squarely against the shaft shoulders.

CAUTION

When installing the bearings onto the shaft, NEVER press or hit against the roller or roll cage. Press ONLY on the inner race.

Press the bearing closure (24) and inboard bearing cup (22) into the intermediate until seated squarely against the intermediate shoulder.

CAUTION

When installing the bearing cups into the bearing bore, push against the outer race. NEVER hit the rollers or roll cage.

Slide the shaft and assembled bearing cones into the intermediate bore until the inboard bearing cone (23) fully engages the inboard bearing cup. Press the outboard bearing cup (18) over the outboard bearing cone (19).

Install the same thickness of bearing adjusting shims (14) as previously removed and secure them with the bearing cap (15) and hardware (20 and 21).

NOTE

Shaft endplay should be between .003 and .005 inch. Add or remove bearing shims to establish the correct endplay.

Lubricate the bearings as indicated in LUBRICATION.

Securing Intermediate And Drive Assembly To Engine

(Figure 3)

If the drive pins (5) were removed from the drive plate assembly (4), install new pins by pressing them into the drive plate and peening the ends. Secure the drive plate assembly to the engine flywheel with the hardware (9 and 10).

Install the impeller shaft key (6) and press the drive arm assembly (7) onto the impeller shaft.

CAUTION

Make certain that the drive plate and drive arm assemblies are mounted in accordance with the dimensions shown in Figure 3. If the drive assembly is not properly positioned on the impeller shaft, a preload condition can occur and cause premature bearing failure.

Align the drive arm assembly so that the drive pins will engage the dyna flex joints, and secure the intermediate (11) and guards (3) to the engine bellhousing with the hardware (1 and 2).

Seal Installation

(Figures 2 and 4)

Clean the seal cavity and shaft with a cloth soaked in fresh 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 precautions printed on solvent containers.

The seal is not normally reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an emergency, carefully wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.

Handle the seal parts with extreme care to prevent damage. Be careful not to contaminate precision finished faces; even fingerprints on the faces can shorten seal life. If necessary, clean the faces with a non-oil based solvent and a

clean lint free tissue. Wipe **lightly** in a concentric pattern to avoid scratching the faces.

Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. Clean and polish the seal spacer sleeve, or replace it if there are nicks or cuts on either end. If any components are worn, replace the complete seal; **never mix old and new seal parts.**

If a replacement seal is being used, remove it from the container and inspect the precision finished faces to ensure that they are free of any foreign matter.

To ease installation of the seal, lubricate the packing rings and seal liner with water or a very **small** amount of oil, and apply a drop of light lubricating oil on the finished faces. Assemble the seal as follows, (see Figure 4).

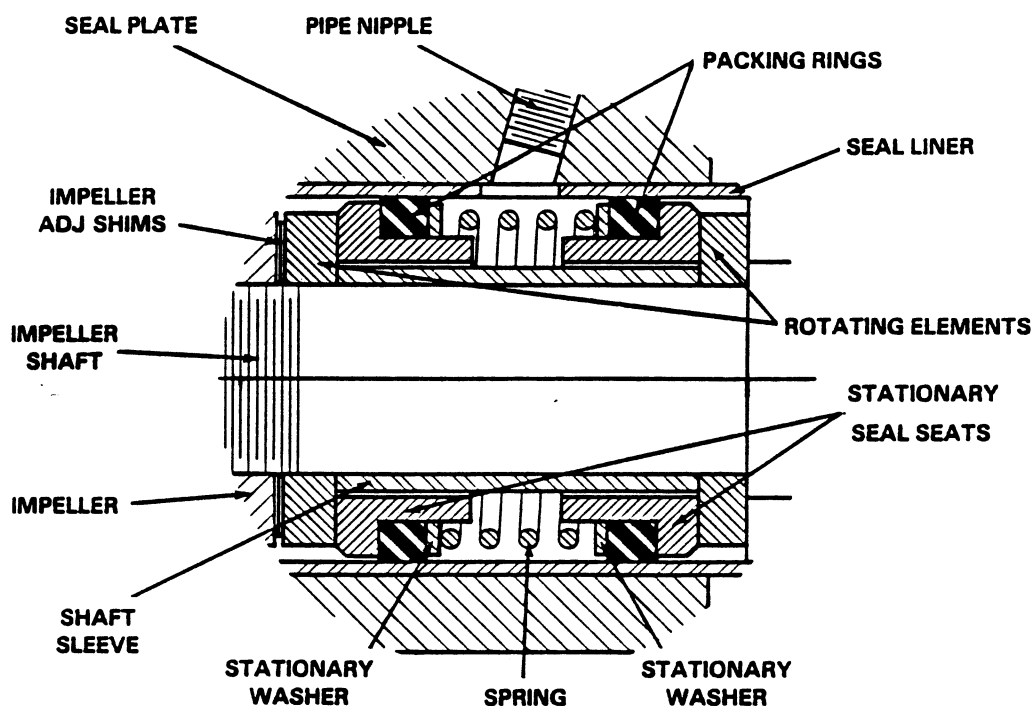


Figure 4. GS1500 Seal Assembly

CAUTION

This seal is not designed for operation at temperatures above 110°F. Do not use at higher operating temperatures.

Inspect the seal plate, the seal liner, and the impeller shaft for burrs or sharp corners, and remove any that exist. Replace the seal liner (25) if wear or grooves exist which could cause leakage or damage to the seal packing rings. To replace the seal liner, position the seal plate (28) on the bed of an arbor (or

hydraulic) press and use a new sleeve to force the old one out. After the new liner is properly installed, a 1/4 inch diameter hole must be drilled through it to permit the flow of lubricant to the seal assembly. **Be careful** to center the drill in the threaded grease pipe hole and not damage the threads. Deburr the hole from the inside of the seal liner after drilling.

Slide the seal plate onto the shaft until fully seated against the intermediate. Align the threaded seal lubricant hole with the intermediate opening and temporarily secure the seal plate to the intermediate with two capscrews and nuts (1/2 UNC X 1 1/2 inch long, not supplied).

Slide the inboard rotating element onto the shaft with the chamfered side facing the shaft shoulder.

Subassemble the inboard stationary seat, packing ring and spring washer and press this subassembly into the lubricated seal liner. A push tube cut from a length of plastic pipe would aid this installation. The O.D. of the pipe should be approximately the same as the O.D. of the seal spring.

Install the spacer sleeve and spring. Subassemble the outboard stationary seat, packing ring and spring washer and press this subassembly into the lubricated seal liner.

Install the outboard rotating element with the chamfered side facing the impeller.

Reinstall the automatic grease cup and piping (57, 58, and 59).

Lubricate the seal as indicated in LUBRICATION, after the impeller has been installed.

Impeller Installation And Adjustment

(Figure 2)

Inspect the impeller, and replace it if cracked or badly worn.

Slide the same thickness of impeller adjusting shims (61) as previously removed onto the shaft and screw the impeller on until tight.

A clearance of .020 to .040 inch between the impeller and the seal plate is necessary for maximum pump efficiency. Measure this clearance, and add or remove impeller shims until it is reached.

Remove the two capscrews temporarily holding the seal plate and install the same thickness of casing gaskets (29) as previously removed. Use the lifting device to position the pump casing over the impeller, and secure the casing and seal plate to the intermediate with the nuts (11). **Do not** fully tighten the nuts (27) until the impeller face clearance has been set.

A clearance of .010 to .020 inch between the impeller and the wear plate is also recommended for maximum pump efficiency. This clearance must be set after installing the back cover, by adding or removing gaskets in the pump casing gasket set (29) until the impeller binds against the wear plate when the shaft is turned. After the impeller binds, add .015 inch of gaskets.

NOTE

An alternate method of adjusting this clearance is to reach through the discharge port with a feeler gauge and measure the gap. Add or subtract pump casing gaskets accordingly.

(Figure 1)

Install any leveling shims used under the casing mounting feet, and secure the casing to the base with the hardware (53, 54 and 55).

Remove the lifting device and install the discharge elbow and gasket (14 and 25). Reinstall the fill cover plate (52) and gasket (53) after the pump is completely reassembled and primed.

Suction Check Valve Installation**(Figure 2)**

Inspect the check valve components, and replace the parts as required. Subassemble the check valve gasket (49) and weights (48 and 50). Position the assembled check valve in the mounting slot in the seat.

Replace the seat gasket (7) and secure the check valve and seat to the pump casing with the round head machine screws (44).

Replace the suction flange gasket (5) and secure the suction flange to the check valve seat and pump casing with the hardware (42 and 43).

Back Cover Installation**(Figure 2)**

If the wear plate (30) was removed for replacement, carefully center it on the back cover and secure it with the hardware (32 and 33). The wear plate must be concentric to prevent binding when the back cover is installed.

Clean any scale or debris from the contacting surfaces in the pump casing that might prevent a good seal with the back cover. Replace the back cover gasket (34) and slide the back cover assembly into the pump casing. Be sure the wear plate does not bind against the impeller.

NOTE

To ease future disassembly, apply a film of grease or 'Never-Seez' on the back cover shoulder, or any surface which contacts the pump casing. This action will reduce rust and scale build-up.

Secure the back cover assembly by installing the clamp bar (36) and tightening the cover clamp screw (35). **Do not** over-tighten the clamp screw; it should be just tight enough to ensure a good seal at the back cover shoulder.

Final Pump Reassembly

(Figure 1)

Be sure the pump is secured to the base and engine.

Install the suction and discharge lines, and open all valves. Make certain that all piping connections are tight, properly supported and secure.

Be sure the pump end and engine have been properly lubricated, see LUBRICATION.

Fill the pump casing with clean liquid. Reinstall the fill cover plate and tighten it.

Refer to OPERATION, Section C, and start the pump.

LUBRICATION

Seal Assembly

(Figure 2)

Fill the grease cup (59) through the grease fitting with No. 2 lithium base grease until grease escapes from the relief hole. Turn the grease cup arm counterclockwise until it is at the top of the stem; this will release the spring to apply grease to the seal (see Figure 5).

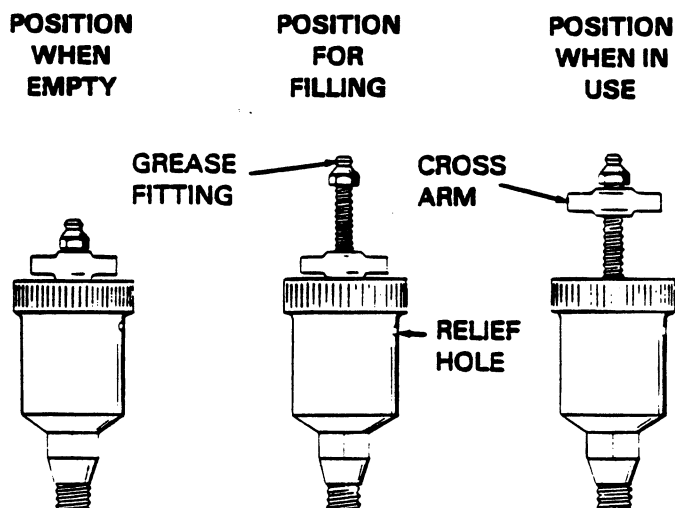


Figure 5. Automatic Lubricating Grease Cup

Bearings

(Figure 2)

The intermediate was fully lubricated when shipped from the factory. Under normal conditions, turn the cap on the grease cup three complete turns to add grease to the intermediate after each 250 hours of operation (or once each month, whichever comes first). **Do not over-lubricate.** Over-lubrication can cause the bearings to over-heat, resulting in premature bearing failure. When the grease cup is empty, refill it with No. 0 lithium base grease.

CAUTION

If grease is forced out around the shaft as new grease is added, the bearing cavity is full and should be disassembled and cleaned immediately.

There are no provisions in the bearing cavity to drain or flush the lubricant. The pump and intermediate must be disassembled to completely clean and maintain this cavity.

Under normal conditions, change the grease after each 5000 hours of operation, or at 12 month intervals, whichever comes first. Change the grease more frequently if the pump is operated continuously or installed in an environment where variable hot and cold temperatures are common.

When lubricating a dry (overhauled) intermediate, fill the cavity through the grease cup with approximately one-sixth of a pound of grease (approximately one-third full).

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

Engine

Consult the literature supplied with the engine, or contact your local Deutz 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**