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



0 SERIES PUMP

MODEL
04E1-GHH

THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

www.grpumps.com

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RECORD YOUR PUMP MODEL AND SERIAL NUMBER

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Pump Model: _____

Serial Number: _____

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INTRODUCTION

Thank You for purchasing a Gorman-Rupp pump. **Read this manual** carefully to learn how to safely install and operate your pump. Failure to do so could result in personal injury or damage to the pump.

This pump is an 0 Series, enclosed impeller, centrifugal model, with straight-in suction and without a suction check valve. It is designed for vehicular mounting in petroleum service. The basic material of construction is aluminum, with cast iron wear rings.

The pump is close-coupled to an integral, 1950 RPM split-shaft gearbox speed increaser with a 2.56:1 ratio. Power is transmitted to the gearbox through a customer-installed universal shaft assembly.

This manual will alert personnel to known procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel. However, this manual cannot possibly anticipate and provide detailed precautions for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner/maintenance personnel to ensure that **only** safe, established maintenance procedures are used, and that any procedures not addressed in this manual are performed **only** after establishing that neither personal safety nor pump integrity are compromised by such practices.

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

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:

The Gorman-Rupp Company
P.O. Box 1217
Mansfield, Ohio 44901-1217
Phone: (419) 755-1011

or:

Gorman-Rupp of Canada Limited
70 Burwell Road
St. Thomas, Ontario N5P 3R7
Phone: (519) 631-2870

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:



Immediate hazards which WILL result in severe personal injury or death. These instructions describe the procedure required and the injury which will result from failure to follow the procedure.



Hazards or unsafe practices which COULD result in severe personal injury or death. These instructions describe the procedure required and the injury which could result from failure to follow the procedure.



Hazards or unsafe practices which COULD result in minor personal injury or product or property damage. These instructions describe the requirements and the possible damage which could result from failure to follow the procedure.

NOTE

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

SAFETY – SECTION A

This information applies to 0 Series split-shaft refueler pumps. Gorman-Rupp has no control over or particular knowledge of the truck chassis which will be used. Refer to the manual accompanying the truck before attempting to begin operation.

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for each specific application. Therefore, it is the owner/installer's responsibility to ensure that applications not addressed in this manual are performed only after establishing that neither operator safety nor pump integrity are compromised by the installation.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Switch off the vehicle ignition and remove the key, or take other action to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



This pump is designed for vehicular mounting in petroleum service. Do not

attempt to pump corrosive materials, or any liquids which may damage the pump or endanger personnel as a result of pump failure.



Be certain proper safety practices are followed before operating or servicing the pump. Provide adequate ventilation, prohibit smoking, wear static-resistant clothing and shoes. Clean up all fuel spills immediately after occurrence.



Do not operate the pump against a closed discharge valve for long periods of time. If operated against a closed discharge valve, pump components will deteriorate, and the liquid could come to a boil, build pressure, and cause the pump casing to rupture or explode.



Overheating may produce dangerous fumes. Take precautions to ensure the area surrounding the pump is adequately ventilated. Allow the pump to cool and use extreme caution when venting the pump, or when removing covers, plates, plugs, or fittings.



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.

**WARNING!**

After the vehicle is positioned for pump maintenance, block the wheels and set the emergency brake before attempting to disconnect the drive shaft or remove the pump. Be sure the pump is properly reinstalled and secure before operation.

**WARNING!**

Never tamper with the governor to gain more power. The governor establishes safe operating limits that should not be exceeded. Limit the maximum input speed (1950 RPM) and performance as indicated on the performance curve on Page E-1.

**WARNING!**

The gearbox provided on this pump is designed for operation at a maximum input speed of 1950 RPM. If operated at a higher RPM, pump or gearbox components may be destroyed.

**WARNING!**

Decals and tags vital to pump operation were shipped loose with the pump. Affix these decals in a prominent place visible to the pump operator.

**WARNING!**

Decals and tags vital to pump operation were shipped loose with the pump. Affix these decals in a prominent place visible to the pump operator.

**CAUTION**

Never run the pump dry of pumping medium. There must be a supply of liquid to the pump at all times to prevent destruction of the shaft seal faces.

**CAUTION**

This pump has been shipped dry of gearbox lubrication, except for a residual coating from the testing process of 90 weight gear oil and Dow Corning "Molykote® M Gear Guard" (an anti-wear additive, consisting of molybdenum disulphide solid lubricants suspended in petroleum oil). The gearbox must be lubricated before the pump is operated (see **LUBRICATION** in Section E).

INSTALLATION – SECTION B

Review all SAFETY information in Section A.

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



Do not test or operate this pump and integral gearbox before reading the installation and operation instructions on this manual.

This pump is an 0 Series, self-priming centrifugal model with an integral split-shaft gearbox assembly. The entire unit is designed for midship mounting between the frame members of a petroleum handling vehicle, where the liquid is supplied to the pump under pressure. The gearbox replaces a part of the main drive shaft connecting the transmission to the rear axle.

This design permits full utilization of engine power to selectively operate either the pump or the rear driving wheels on the vehicle. **Both cannot be operated at the same time.**

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

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 gearbox for cracks, dents, damaged threads, and other obvious damage.
- b. Check for and tighten loose attaching hardware. Since gaskets tend to shrink after dry-

ing, check for loose hardware at mating surfaces.

- c. Carefully read all tags, decals, and markings on the pump assembly, and perform all duties indicated. Note the direction of rotation indicated on the pump. Check that the pump shaft rotates in the required direction.



Only operate this pump in the direction indicated on the gearbox and/or the accompanying decal. Reverse rotation of the shaft will adversely effect pump performance, and the pump and/or gearbox could be seriously damaged.

- d. **The gearbox assembly was shipped dry of lubricant.** Refer to **LUBRICATION** in the **MAINTENANCE AND REPAIR** section of this manual and perform duties as instructed.
- e. If the pump and gearbox 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.

PUMP INSTALLATION

Pump Specifications

See Table 1 for the typical pump specifications and gearbox data.

Table 1. Pump Specifications

Pump Type	Self-priming, centrifugal with enclosed impeller
Suction	4-inch "Victaulic" fitting
Discharge	4-inch "Victaulic" fitting
Nominal Capacity	See the Performance Curve, Page E-1
Impeller Shaft Seal	Mechanical self-lubricated
Gearbox (Air Shift)	
Air Pressure Required at Shift Cylinder	70-140 psi (5,1-10,2 kg/cm ²) through 1/4" line
Gear Ratio	2.56:1 Speed Increase
Input shaft Rotation	Clockwise (when viewed from the trunnion end)
Maximum Input Speed	1950 RPM (See the Performance Curve, Page E-1)
Input & Output Shaft	Heavy-duty 2-3/4 inch - 10 spline
Input & Output Flanges	"Dana" Heavy-Duty 1800 Series
Lubrication	68 U.S. ounces (2011 ml) - See LUBRICATION , Section E for SAE grade 6 fl. oz. (18 ml) 'Molykote® M Gear Guard' (Dow Corning)
Approx. Net Weight (pump and gearbox)	285 pounds (129,3 kg)

Table 2. Through Torque Capacity Based On Shaft and Spline Size

Type of Engine	Transmission	Max Through Torque (ft.-lbs.)
Diesel	Automatic	11,000
	Manual	10,000
Gasoline	Automatic	13,300
	Manual	12,300

Pump and Mounting Dimensions

A trunnion mount is provided for the input end. This design provides a flexible three-point suspension.

The trunnion mount prevents the chassis frame twist from being transmitted through the gearbox.

See Figure 1 on page B-3 and Figure 2 on page E-4 for the physical dimensions of the pump.

DIMENSIONAL DRAWING

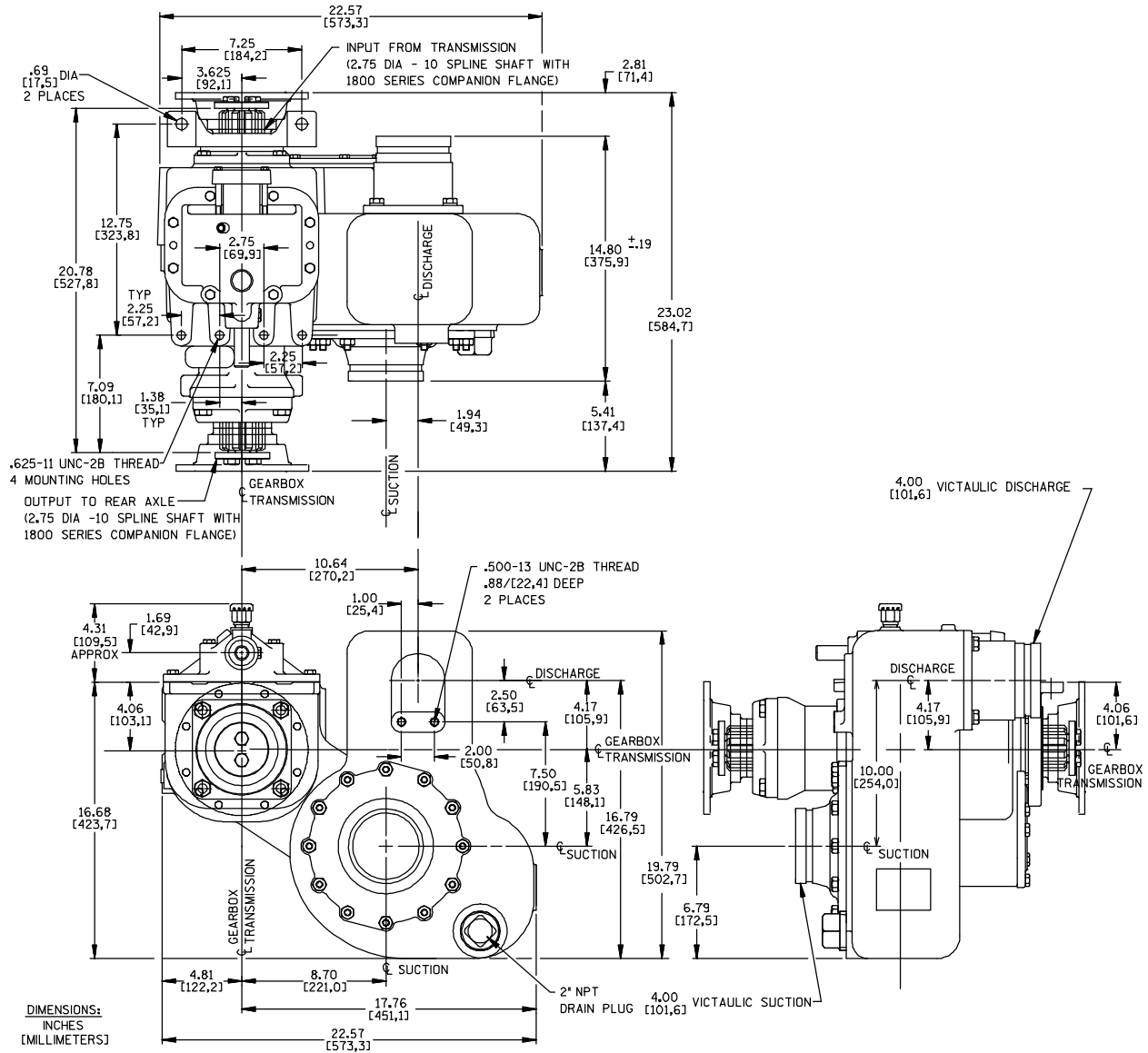


Figure 1. Pump Model 04E1-GHH Dimensions

VEHICLE REQUIREMENTS

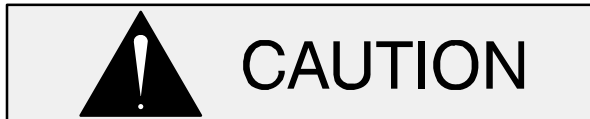
The following instructions apply equally to new installations, rebuilds or retrofits.



After installation, do not attempt to test run or operate the pump and integral gearbox before reading **OPERATION**, Section B. The gearbox was shipped dry of lubrication, except for a residual coating from the testing process of Dow Corning 'Molykote[®] M Gear Guard' (an anti-wear additive, consisting of molybdenum disulfide solid lubricants suspended in petroleum oil). Lubricate the gearbox as instructed in **LUBRICATION**, Section E before attempting to operate the pump.

Tank Preparation

It is **essential** that any tank scale, dirt, or other foreign material be removed from the tank and piping prior to pump installation. Failure to do so could result in clogging or damage to the pump.



Damage to the pump resulting from debris in the suction line **will not** be covered by the pump warranty.

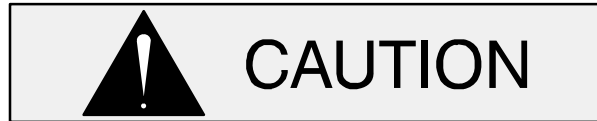
Before connecting the suction and discharge piping, carefully check the storage tank and piping for construction debris such as nuts, bolts, wire, weld slag, and other foreign material. Install a commercially available 80 mesh screen in the suction line to prevent debris from entering the pump.

Vehicle Configuration

If the pump is to be used in tractor-trailer or straight-truck plus trailer service, either a liquid fifth wheel or jumper hoses are required. **Be sure** the drive line of the tractor-trailer is long enough to al-

low installation of the gearbox at the proper angle, and that jumper hoses are long enough to allow a full turning radius.

Brake Installation



When shifting from vehicle drive to pump mode, or vice versa, **input shaft rotation must be limited to no less than 2 RPM or no more than 15 RPM at the time of the shift.** Stopping the input shaft entirely may cause a "butt-shift" condition, which will prevent the shift from occurring. Shaft rotation in excess of 15 RPM causes raking of the gears. **Either of these conditions can damage gears, resulting in premature gearbox failure.**

Vehicles with automatic transmissions should be equipped with a brake on the transmission shaft to slow, but not stop, shaft rotation during shifting.

Air Cylinder Pressure

For proper operation of the gearbox, the air shift device requires air pressure of 70 to 140 psi (482 to 965 kPa). See **Gear Shift Connections** for further information.

POSITIONING PUMP

Lifting

Pump unit weights will vary depending on the mounting and drive provided. Check the shipping tag on the unit packaging for the actual weight, and use lifting equipment with appropriate capacity. Drain the pump and remove all customer-installed equipment such as suction and discharge hoses or piping before attempting to lift existing, installed units.



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.

Due to the confined mounting location, specialized equipment such as a transmission jack with custom brackets should be used to lift and position the pump and gearbox.

Mounting Location

The following factors must be considered when selecting a mounting location for the pump.

- a. Mounting brackets
- b. Universal joint angles
- c. Shift linkage
- d. Piping
- e. Ground clearance
- f. . Accessibility of pump and gearbox for service.

Any damage to the pump or gearbox resulting from improper mounting and installation is **not** covered by the Gorman-Rupp Warranty.

Mounting Brackets

The customer must furnish three cross members which fit between the vehicle chassis side rails (see

Figure 2). They must be heavy enough to support the weight of the pump assembly and provide easy access for pump maintenance.

Secure the rear cross member rigidly to the pump and gearbox using a fabricated mounting bracket (customer-furnished). The mounting bracket must fasten to the threaded holes located in the pump casing above the pump suction, and in the top of the gearbox housing. The bracket and cross member must not obstruct pump operation or impede removal of the pump casing during maintenance.



The rear cross member or mounting bracket must not interfere with movement of the air shift indicator shaft (located on top of the gearbox). If necessary, drill a 1-inch (25,4 mm) diameter hole through the cross member or bracket to provide clearance.

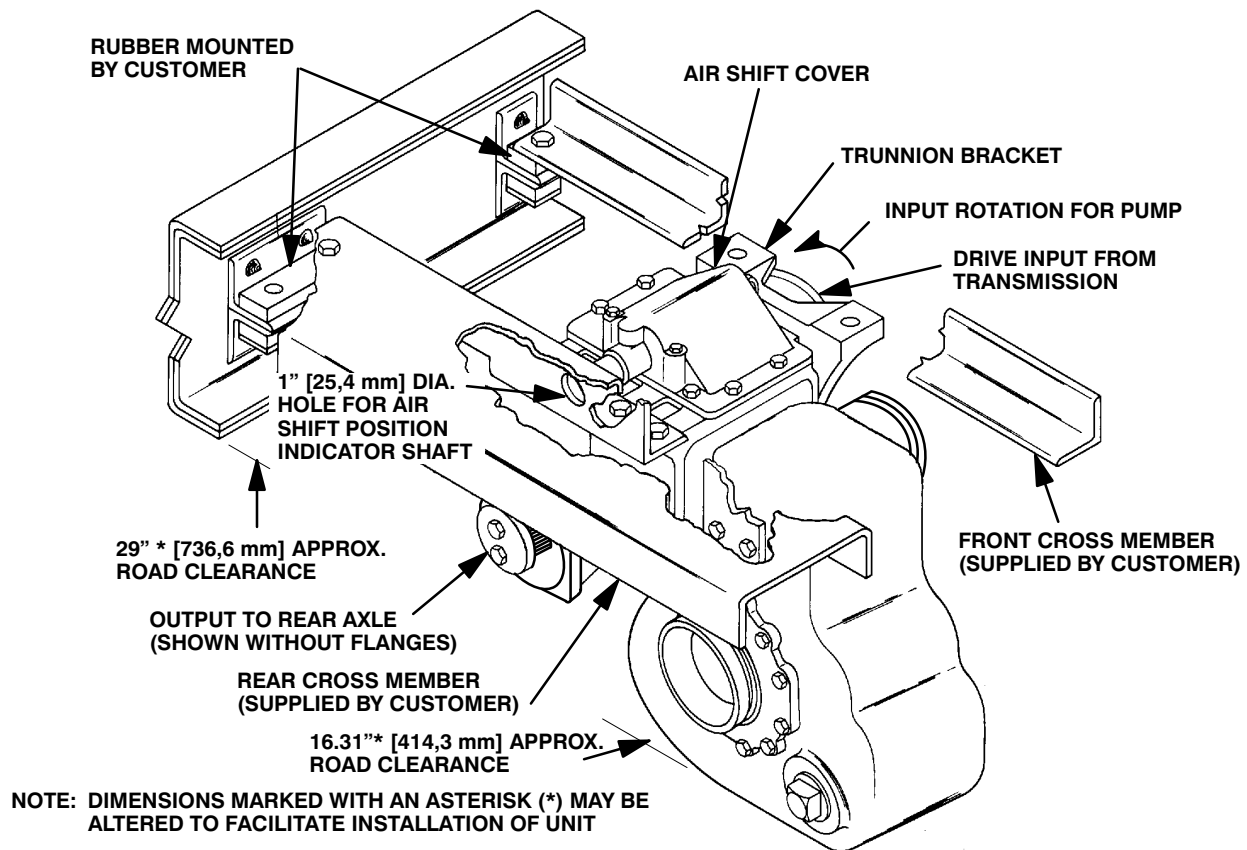


Figure 2. Typical Pump Mounting on Vehicle Chassis

The drive input end of the gearbox is fitted with a trunnion which prevents chassis frame twist from being transmitted through the gearbox. Mount the trunnion to the front cross member (not supplied) to support the drive input end of the pump. When mounting the trunnion, make certain that it will not interfere with the input drive flange. The trunnion mounting foot **must** be directed toward the input flange.

Position the cross members and mounted pump on the side rails of the chassis. The cross members **must** be mounted with rubber or other vibration-dampening material when secured to the side rails.

Do not secure the cross members to the side rails before establishing the exact location and position of the air shift rod and shift indicator connections. Be careful not to put the pump in a bind from front to rear during mounting. Improper alignment could result in bearing or gear failure, or gearbox breakage (see **Drive Shaft Alignment**).

Drive Flanges

The input and output shafts on the gearbox (2-3/4 inch, 10-spline) are equipped with heavy-duty Dana 1800 Series flanges. The shaft splines are designed to produce a tight interference fit with the drive flange. This fit is intentional to eliminate fretting corrosion.

For instructions on installing or removing drive flanges and universal joints, see the specific areas in **MAINTENANCE AND REPAIR**, Section E.

DRIVE SHAFT AND LINKAGE CONNECTIONS

Drive Shaft Alignment

To promote maximum universal joint and bearing life, the universal joint angles must be kept to a minimum. A joint angle of 1° is **required** for proper needle bearing circulation, but excessive angles cause accelerated wear and require a lower maximum operating speed (see Table 3).

Table 3. Joint Angle/Maximum RPM

JOINT ANGLE	MAXIMUM SPEED
5°	5000 RPM
6°, 30'	4000 RPM
8°	3000 RPM

Align the gearbox with the transmission and the rear axle to obtain the optimum universal joint angles. See Figure 3 for drive shaft alignment.



Be certain the rear axle position when the vehicle is empty or fully loaded will not cause excessive universal joint angles, or cause the drive shaft slip joints to bottom out.



When installing and/or aligning universal shaft assemblies, shut off the vehicle ignition and remove the key to ensure that the pump will remain inoperative.

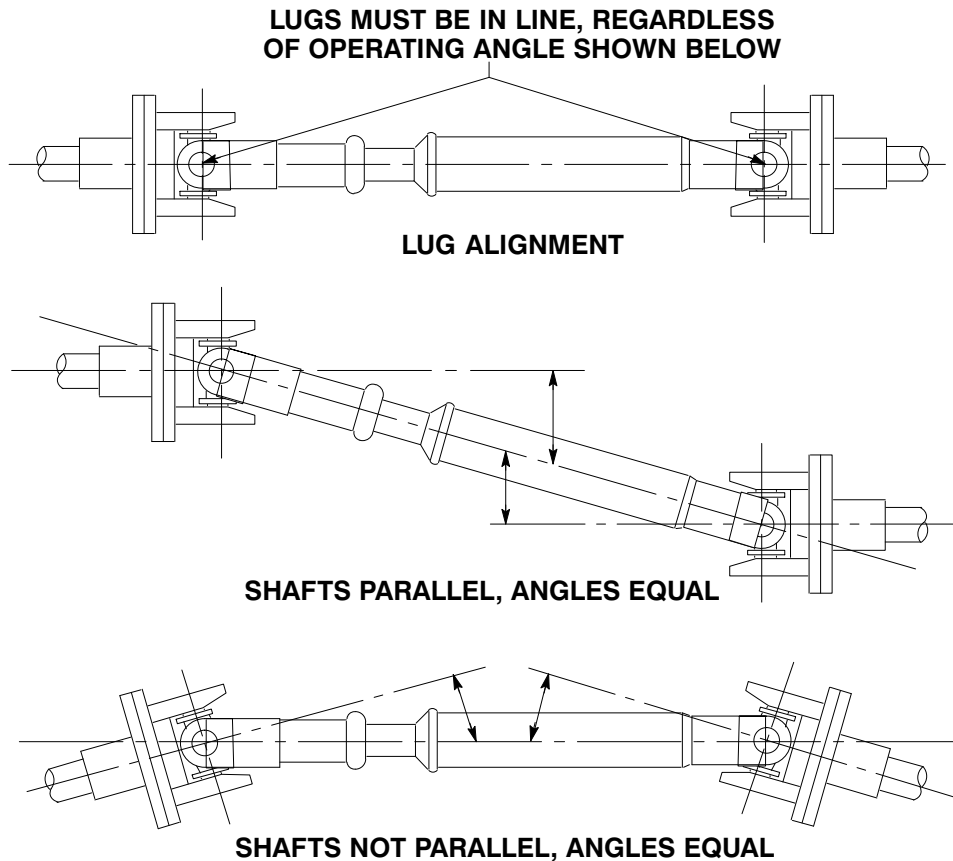


Figure 3. Drive Shaft Alignment

The alignment of the pump and its power source is critical for trouble-free mechanical operation. Before checking alignment, make sure that the gearbox mounting bolts are tight.

When connecting the universal joint drive shaft assembly to a PTO unit, install, support, and align the drive shaft in accordance with the manufacturer's instructions. The pump and the drive power source

are generally positioned so that shaft centerlines are parallel and horizontal.

Make sure the horizontal and vertical joints are equal. Limit the angles to 1 to 3° using a short coupled joint, and less than 8° with a double joint assembly. The maximum operating angle should not exceed 15° (see Figure 3).

NOTE

Install a short coupled slip joint on the input side and a double joint with slip on the output side of the gearbox to attain the prescribed angles and eliminate tensile stress on the shaft.

The input and output shafts should be completely subassembled and checked for straightness and balance before installation. Also check the universal joint yokes for proper alignment.

Check the direction of rotation of the PTO unit before starting the pump. The drive shaft must rotate in the direction shown on the body of the pump, gearbox, and/or decals, tags, and labels.

Gear Shift Connections

After the pump is mounted to the chassis, hook up the air shift rod to the proper control stations.

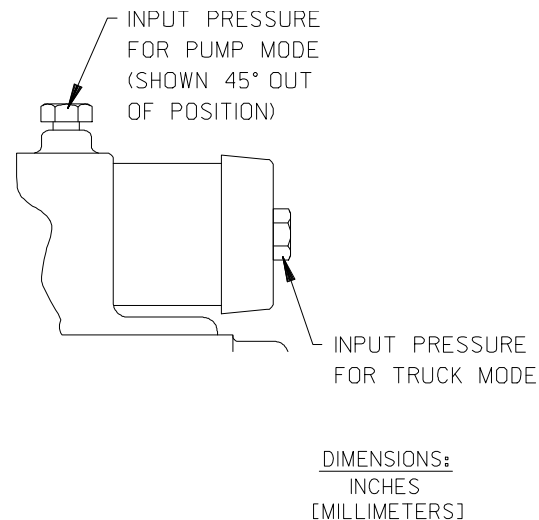
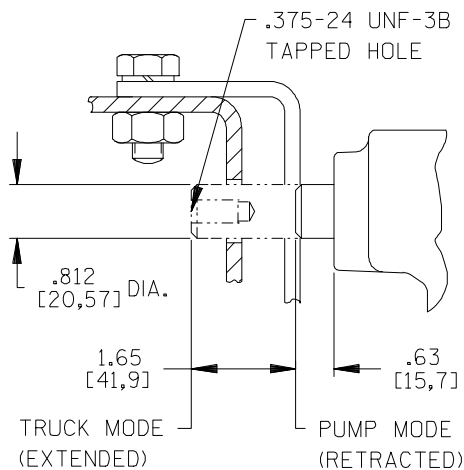


Figure 4. Air Shifter Shaft Detail



Decals and tags vital to pump operation were shipped loose with the pump. These decals must be affixed in a prominent place visible to the pump operator.

Proper operation of the gearbox air shift requires air pressure of 70 to 140 psi (5,1 to 10,2 kg/cm²) and 1/4" air lines. The air line connection at the end cap of the air cylinder is for vehicle operation, and the air line connection at the top of the air shifter cover is for pump operation. Seal all hose fittings with "Permatex" or equivalent compound.

When activated, the shifter rod travels through a hole in the rear cross member. A customer-supplied shift indicator (mechanical, electrical, or air operated device) should be installed in this area to indicate shifter mode to the pump operator. A tapped hole is provided in the shaft for convenience.

See Figures 4 and 5 for the approximate shaft travel and hole size. See Figure 4, Section E for Air Shift Kit parts.

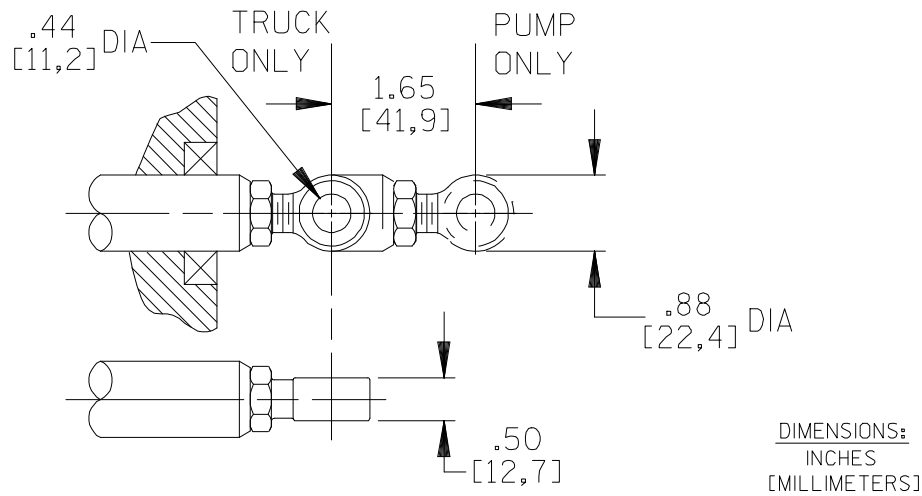


Figure 5. Optional Manual Shifter

SUCTION AND DISCHARGE PIPING

Typical System Installation

Most petroleum handling vehicles perform both fueling and defueling operations. This requires a

system utilizing flow-directing (FDF) valves, educators, related piping and safety accessories. Some of the accessories are available from Gorman-Rupp as optional equipment.

Refer to Figures 6 and 7 for illustrations of typical piping systems used on refueling vehicles.

SCHEMATIC SYSTEM USING EDUCTOR FOR DISPENSING AND FILLING

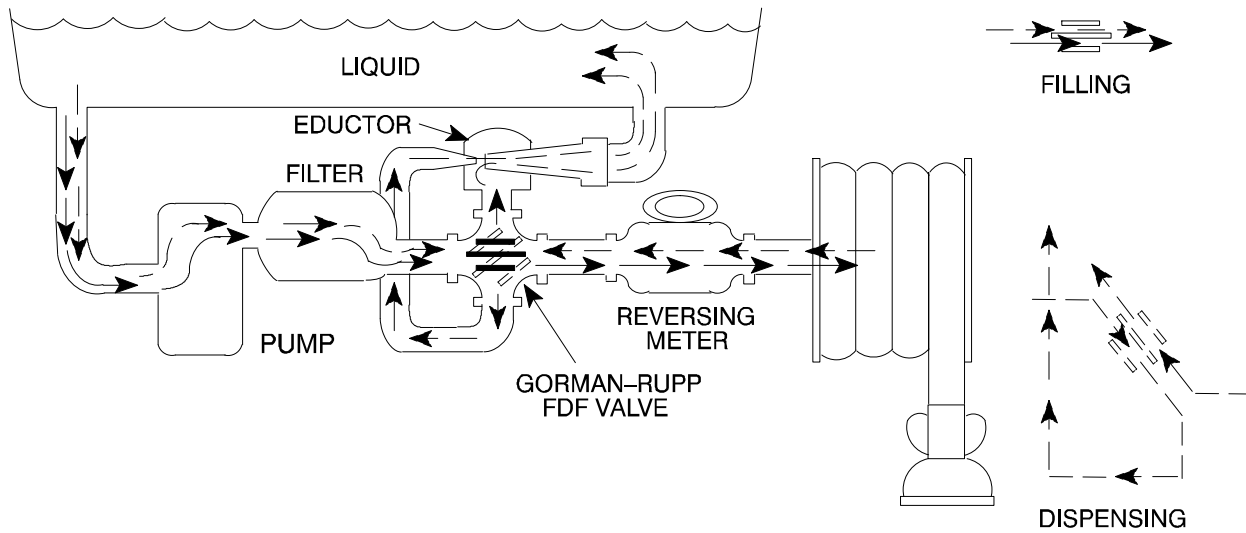
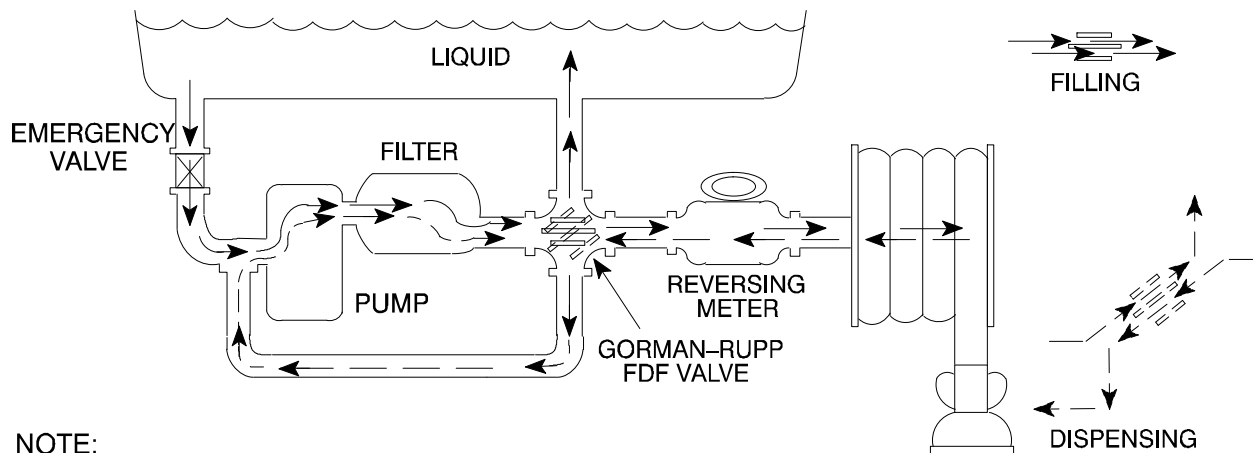


Figure 6. Typical Installation Using Eductor For Filling And Dispensing

SCHEMATIC SYSTEM USING PUMP FOR DISPENSING AND FILLING



NOTE:
EMERGENCY VALVE OPEN FOR FILLING
EMERGENCY VALVE CLOSED FOR DISPENSING

Figure 7. Typical Installation Using Pump For Filling And Dispensing

Piping

All piping material 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.

Run the 4-inch suction piping from the tank sump to the pump inlet. The suction lines should be as short and straight as possible to minimize friction loss.

NOTE

This pump is fitted with straight-in "Victaulic" type suction and discharge fittings as standard equipment.

A suction strainer was not furnished with this pump since it is **not** designed to handle liquids containing solids. However, to protect the pump from accidental damage a commercially available 80 mesh screen should be installed in the suction line. Make certain that the total open area of the screen is at least three or four times the cross section of the suction line to ensure an adequate supply of liquid to the pump.



Damage to the pump resulting from debris in the suction line will not be covered by the pump warranty.

Before connecting the suction and discharge piping, carefully check the storage tank and piping for construction debris such as nuts, bolts, wire, weld slag, and other foreign material. Install a commercially available 80 mesh screen in the suction line to prevent debris from entering the pump.

The pump discharge is a 4-inch "Victaulic" type fitting. The discharge should be mounted just below the top of the chassis frame. It can easily be piped to the filter inlet, discharge manifold, valves, etc.

To avoid wracking, flexible connections or bellows **must** be installed in the pump suction and discharge.

Do not tighten connecting flanges unless they are properly aligned. Never pull a pipe into place by tightening the flange bolts.



Valves

Gorman-Rupp manufactures several sizes of flow-diverting (FDF) valves for use in truck-mounted pumping applications. The valves are designed to reverse the flow of liquid with only the turn of a handle. This allows the same pump to fill or dispense from the tank.

The FDF valve is designed for directing flow only. It will not serve as a positive shut-off or throttling valve.

See Figures 8 and 9 illustrating the installation dimensions and theory of operation for a typical FDF valve. Consult the factory for further assistance or other sizes.

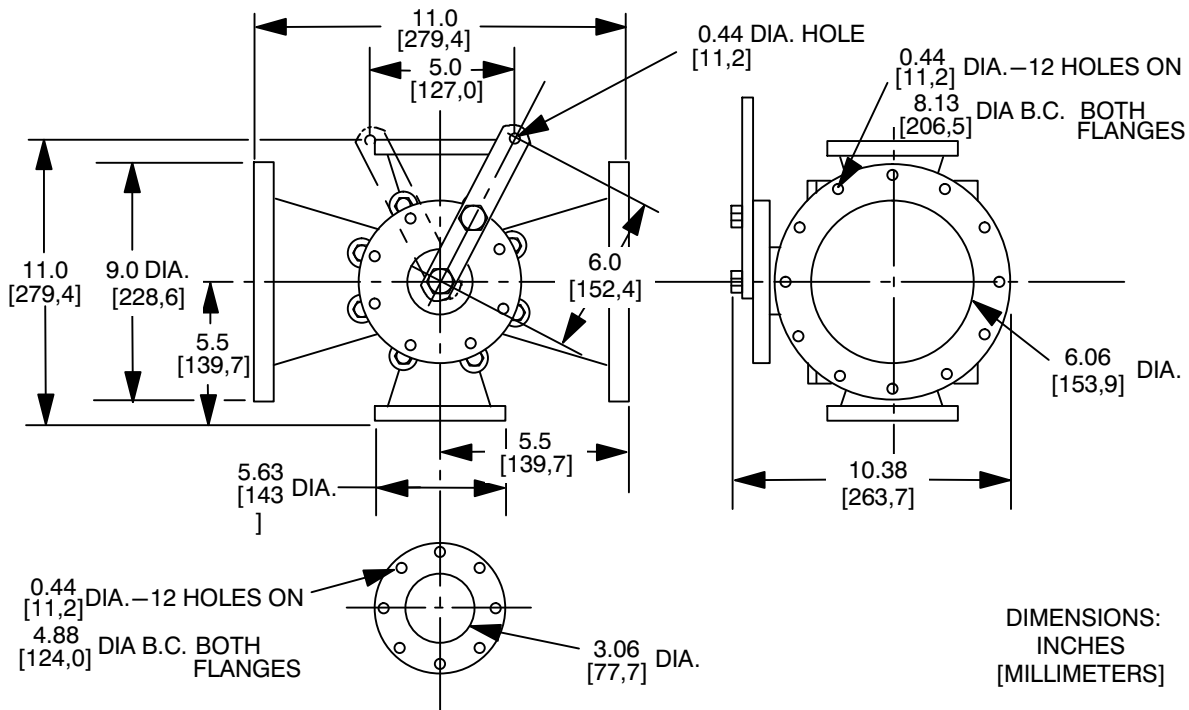


Figure 8. Typical FDF Valve Installation Dimensions

When the center web of the valve is aligned with the 6-inch ports (fueling position), the flow passes straight through. When the handle is turned to the

defueling position, the web blocks the straight flow and opens two paths of flow through the 6-inch and 3-inch ports.

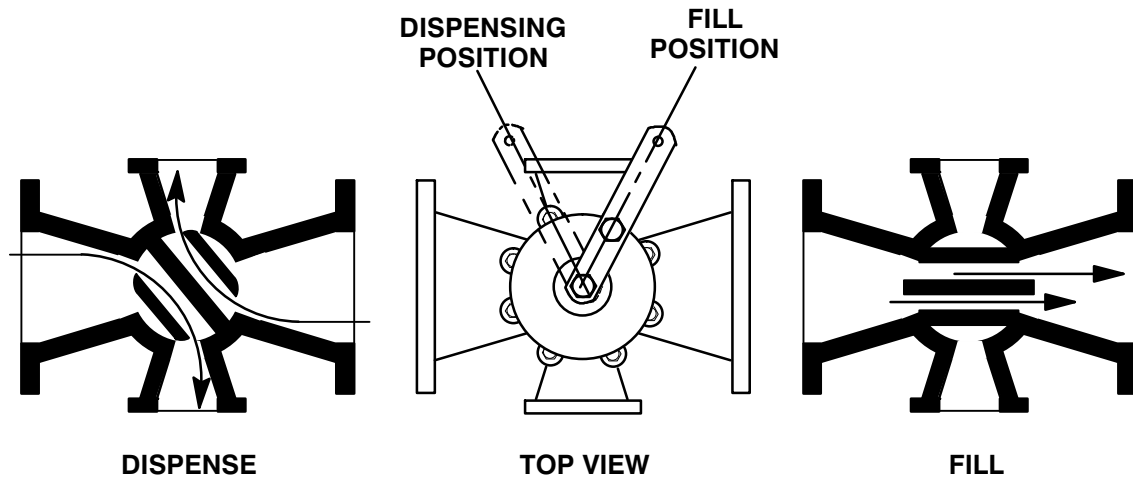


Figure 9. FDF Valve Theory of Operation

Eductors

An eductor may be used in conjunction with an FDF valve to increase dispensing rates and improve efficiency. An eductor may also be used to

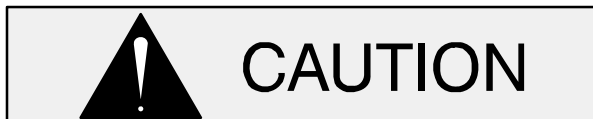
collapse the tank service hose after the tank has been filled or emptied.

Contact the Gorman-Rupp Company or an authorized distributor for specifications and performance data on eductors or FDF valves.

OPERATION – SECTION C

Review all SAFETY information in Section A.

Follow the instructions on all tags, labels and decals attached to the pump.



Whether new installation or rebuild of re-fueler, the following requirements apply:

1. It is essential that tank scale, dirt, and any other foreign elements be removed from the tank and piping prior to pump installation.
2. The gearbox was shipped dry of lubricant. Lubrication **must** be added before any operation.
3. The pump must **not** be run dry of product at any time.



This pump is designed for vehicular mounting in petroleum service. Do not attempt to pump corrosive materials, or any liquids which may damage the pump or endanger personnel as a result of pump failure.



Never tamper with the governor to gain more power. The governor establishes safe operating limits that should not be exceeded. The gearbox provided on this pump is designed for operation at a maximum input speed of 1950 RPM. If operated at a higher RPM, pump or gearbox components may be destroyed.

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 and gearbox are properly lubricated (see **LUBRICATION** in **MAINTENANCE AND REPAIR**).

This pump is not self-priming, and should never be operated unless there is liquid in the pump casing.



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

When installed in a flooded suction application, simply open the system valves and permit the incoming liquid to evacuate the air. After the pump and piping system have completely filled, evacuate any remaining air pockets in the pump or suction line by loosening a pipe plug or opening bleeder valves.

Once the pump casing has been filled, the pump will prime as long as positive suction head is available.

GROUNDING

To eliminate electrostatic build-up by the liquid being pumped, the pump must be grounded by attaching a ground wire to a ground rod (grounding is not required if pumping water). Install the ground rod in accordance with the National Electrical Code and all local codes. Be sure the clamp or fastener has made a tight electrical connection with the rod.



Inspect and test the ground wire assembly for conductivity. Replace broken or frayed wire before resuming operation.

STARTING

Consult the operations manual furnished with the vehicle.

Rotation

The correct direction of pump rotation is clockwise when facing the gearbox input shaft. The pump could be damaged and performance adversely affected by incorrect rotation. If pump performance is not within the specified limits (see the curve on page E-1), check the direction of rotation before further troubleshooting.



Only operate the input shaft in a clockwise direction when facing the input shaft. Otherwise, pump performance will be adversely affected, and the pump and/or gearbox could be seriously damaged.

Drive

The pump and gearbox assembly are designed to be mounted midship between the chassis frame members. The gearbox split shaft replaces a part of the vehicle drive shaft connecting the transmission to the rear axle.

The gearbox assembly has a ratio of 2.56:1, and is designed for operation at a maximum input speed of 1950 RPM. **Do not** operate at a higher input speed.



The gearbox provided on this pump is designed for operation at a maximum input speed of 1950 RPM. If operated at a higher RPM, pump or gearbox components may be destroyed.

OPERATION



Do not operate the pump against a closed discharge valve for long periods of time. If operated against a closed discharge valve, pump components will deteriorate, and the liquid could come to a boil, build pressure, and cause the pump casing to rupture or explode.

The split drive shaft of the pump gearbox provides for selective operation of either the pump or the vehicle; **both cannot be operated at the same time.**

Operating Controls

Since Gorman-Rupp has no control over the actual installation, it is the obligation of the tank builder or the installer to devise controls to **safely** operate the pump from inside the cab, or from a remote control panel. All instructions and operational procedures for the pump and system **must** be provided to the pump operator.



Decals and tags vital to pump operation were shipped loose with the pump. These decals must be affixed in a prominent place visible to the pump operator.

The shift mode indicator **must** be visible to the operator.

Shifting Sequence

In shifting to vehicle operation, the air shift rod linkage is activated to engage the output shaft and provide direct drive (1:1 ratio) through the gearbox to the rear axle of the vehicle.

In shifting to pump operation, activate the air shifter to disengage the gearbox drive output shaft, and to engage the drive input shaft to the gear train which operates the pump. **Never** shift from “drive” to “pump” unless the vehicle is completely stopped.

The pump air cylinder must maintain air pressure of 70 to 140 psi (5,1 to 10,2 kg/cm²) **at the gearbox** for air shift operation.



When shifting from vehicle drive to pump mode, or vice versa, **input shaft rotation must be limited to no less than 2 RPM or no more than 15 RPM at the time of the shift.** Stopping the input shaft entirely may cause a “butt-shift” condition, which will prevent the shift from occurring. Shaft rotation in excess of 15 RPM causes raking of the gears. **Either of these conditions can damage gears, resulting in premature gearbox failure.**



When this pump is operated by a diesel engine, low idle speed should be increased approximately 200 RPM, or to a speed ensuring even, vibration-free operation of the drive shaft to prevent excessive wear of components.

OPERATING CHECKS

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.

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).

Liquid Temperature And Overheating

The **maximum** liquid temperature for this pump is 160° F (71° C). 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.



Allow an over-heated pump to cool before servicing. 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. After the pump cools, drain the liquid from the pump by removing the casing drain plug. Use caution when removing the plug to prevent injury from hot liquid.

Pump Vacuum Check

Since the pump does not have a suction check valve, the discharge line must be fitted with a check valve if a pump vacuum reading is taken.

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 15 to 17 inches (381 to 432 mm) or more of mercury when pumping petroleum. 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 operation 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.

NOTE

Petroleum products are very sensitive to changes in temperature. Warmer temperatures elevate the product vapor pressure resulting in low vacuum readings. Do not mistake temperature problems for faulty pump installation or performance.

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.



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

After stopping the pump, take precautions to ensure that the pump will remain inoperative.

GEARBOX TEMPERATURE CHECK

The gearbox runs higher than ambient temperatures because of heat generated by friction and churning of the lubricating oil. Temperatures of approximately 250°F (121°C) are considered normal. During continuous operation, the oil temperature can exceed 300°F (149°C).

NOTE

*For continuous duty operation (when the pumping period exceeds 30 minutes without a 20 minute minimum cool-down period between pumping cycles), see **CONTINUOUS DUTY PUMPING** in **MAINTENANCE AND REPAIR**, Section E for lubrication instructions.*

Checking gearbox temperatures by hand is inaccurate. Place a contact-type thermometer against the housing and record this temperature for future reference. The temperature of the lubricating oil will be approximately 10°F (6°C) higher than the housing surface temperature.



Gearbox components may be damaged by excessive heat. Limit continuous operation to 30 minutes or less to prevent heat build-up. See **Continuous Duty Pumping** in **MAINTENANCE AND REPAIR**, Section E for specific lubrication instructions if the pump is operated on a longer duty cycle.

A sudden increase in gearbox temperature is a warning that the bearings are at the point of failing. Make certain that the bearing lubricant is of the proper viscosity and at the correct level (see **LUBRICATION** in Section E). 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 within 20 minutes or less.

COLD WEATHER PRESERVATION

Normal freezing conditions will not damage the pump. However, during extremely severe conditions care should be exercised during start-up, especially if the pump has been idle for more than a few hours.

TROUBLESHOOTING – SECTION D

Review all SAFETY information in Section A.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Switch off the vehicle ignition and remove the key, or take other precautions to ensure that the pump will remain inoperative.
3. Allow the pump to cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME	<p>Not enough liquid in casing.</p> <p>Air leak in suction line.</p> <p>Lining of suction hose collapsed.</p> <p>Leaking or worn seal or pump gasket.</p> <p>Pump speed too slow.</p> <p>Strainer clogged.</p>	<p>Add liquid to casing. See PRIMING.</p> <p>Correct leak.</p> <p>Replace suction hose.</p> <p>Check pump vacuum. Replace leaking or worn seal or gasket.</p> <p>Check driver output; consult vehicle operation manual.</p> <p>Check strainer and clean if necessary.</p>
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	<p>Air leak in suction line.</p> <p>Suction intake not submerged at proper level or sump too small.</p> <p>Strainer clogged.</p> <p>Pump speed too slow.</p> <p>Lining of suction hose collapsed.</p>	<p>Correct leak.</p> <p>Check installation and correct submergence as needed.</p> <p>Check strainer and clean if necessary.</p> <p>Check driver output; consult vehicle operation manual.</p> <p>Replace suction hose.</p>

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE (cont.)	<p>Impeller or other wearing parts worn or damaged.</p> <p>Suction lift or discharge head too high.</p> <p>Discharge throttling valve partially closed: check valve is installed improperly.</p> <p>Discharge line clogged or restricted; hose kinked.</p>	<p>Replace worn or damaged parts. Check that impeller is properly centered and rotates freely.</p> <p>Check piping installation and install bypass line if needed. See INSTALLATION.</p> <p>Open discharge valve fully; check piping installation.</p> <p>Check discharge lines; straighten hose.</p>
PUMP REQUIRES TOO MUCH POWER	<p>Universal joint drive misaligned.</p> <p>Pump speed too high.</p> <p>Discharge head too low.</p>	<p>Align drive.</p> <p>Check driver output; check that sheaves or couplings are correctly sized.</p> <p>Adjust discharge valve.</p>
EXCESSIVE NOISE	<p>Cavitation in pump.</p> <p>Pumping entrained air.</p> <p>Pump or drive not securely mounted.</p> <p>Universal joint drive misaligned.</p> <p>Low or incorrect lubricant.</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>Align drive.</p> <p>Check for proper type and level of lubricant.</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; piping improperly installed.</p> <p>Bearings in power source or gearbox worn or binding.</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>Realign drive and piping at operating temperature. Add expansion joints if required.</p> <p>Check bearings.</p>

PREVENTIVE MAINTENANCE

Since pump applications are seldom identical, and pump wear is directly affected by such things as the abrasive qualities, pressure and temperature of the liquid being pumped, this section is intended only to provide general recommendations and practices for preventive maintenance. Regardless of the application however, following a routine preventive maintenance schedule will help assure trouble-free performance and long life from your Gorman-Rupp pump. For specific questions concerning your application, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

Record keeping is an essential component of a good preventive maintenance program. Changes in suction and discharge gauge readings (if so

equipped) between regularly scheduled inspections can indicate problems that can be corrected before system damage or catastrophic failure occurs. The appearance of wearing parts should also be documented at each inspection for comparison as well. Also, if records indicate that a certain part (such as the seal) fails at approximately the same duty cycle, the part can be checked and replaced before failure occurs, reducing unscheduled down time.

For new applications, a first inspection of wearing parts at 250 hours will give insight into the wear rate for your particular application. Subsequent inspections should be performed at the intervals shown on the chart below. Critical applications should be inspected more frequently.

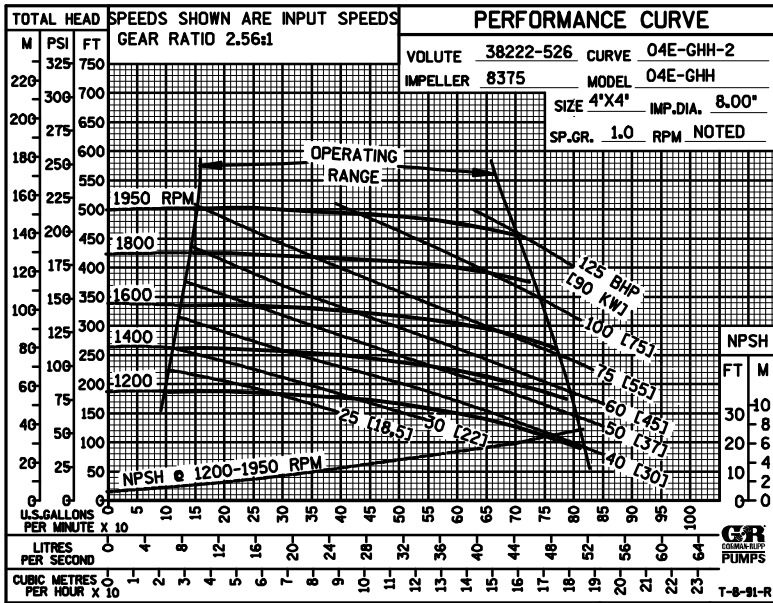
Preventive Maintenance Schedule					
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Pump Performance (Gauges, Speed, Flow)	I				
Bearing Lubrication		I			R
Seal Lubrication (And Packing Adjustment, If So Equipped)		I			R
V-Belts (If So Equipped)			I		
Air Release Valve Plunger Rod (If So Equipped)			I	C	
Front Impeller Clearance (Wear Plate)				I	
Rear Impeller Clearance (Seal Plate)				I	
Check Valve					I
Pressure Relief Valve (If So Equipped)					C
Pump and Driver Alignment					I
Shaft Deflection					I
Bearings					I
Bearing Housing					I
Piping					I
Driver Lubrication – See Mfgr’s Literature					I

Legend:
 I = Inspect, Clean, Adjust, Repair or Replace as Necessary
 C = Clean
 R = Replace

* Service interval based on an intermittent duty cycle equal to approximately 4000 hours annually. Adjust schedule as required for lower or higher duty cycles or extreme operating conditions.

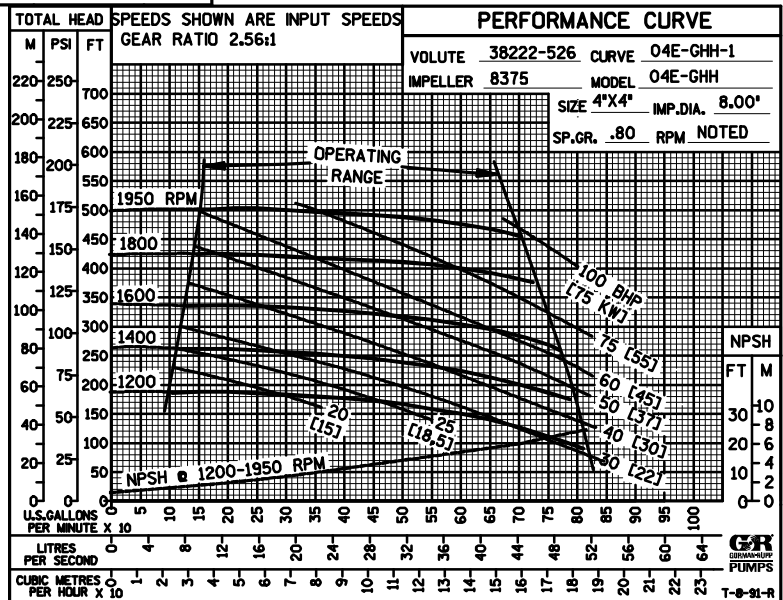
PUMP MAINTENANCE AND REPAIR – SECTION E

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



PERFORMANCE BASED ON WATER

PERFORMANCE BASED ON PETROLEUM



* STANDARD PERFORMANCE FOR PUMP MODEL 04E1-GHH

* Based on 70° F (21° C) 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.

Contact the Gorman-Rupp Company to verify part numbers.



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

SECTION DRAWING

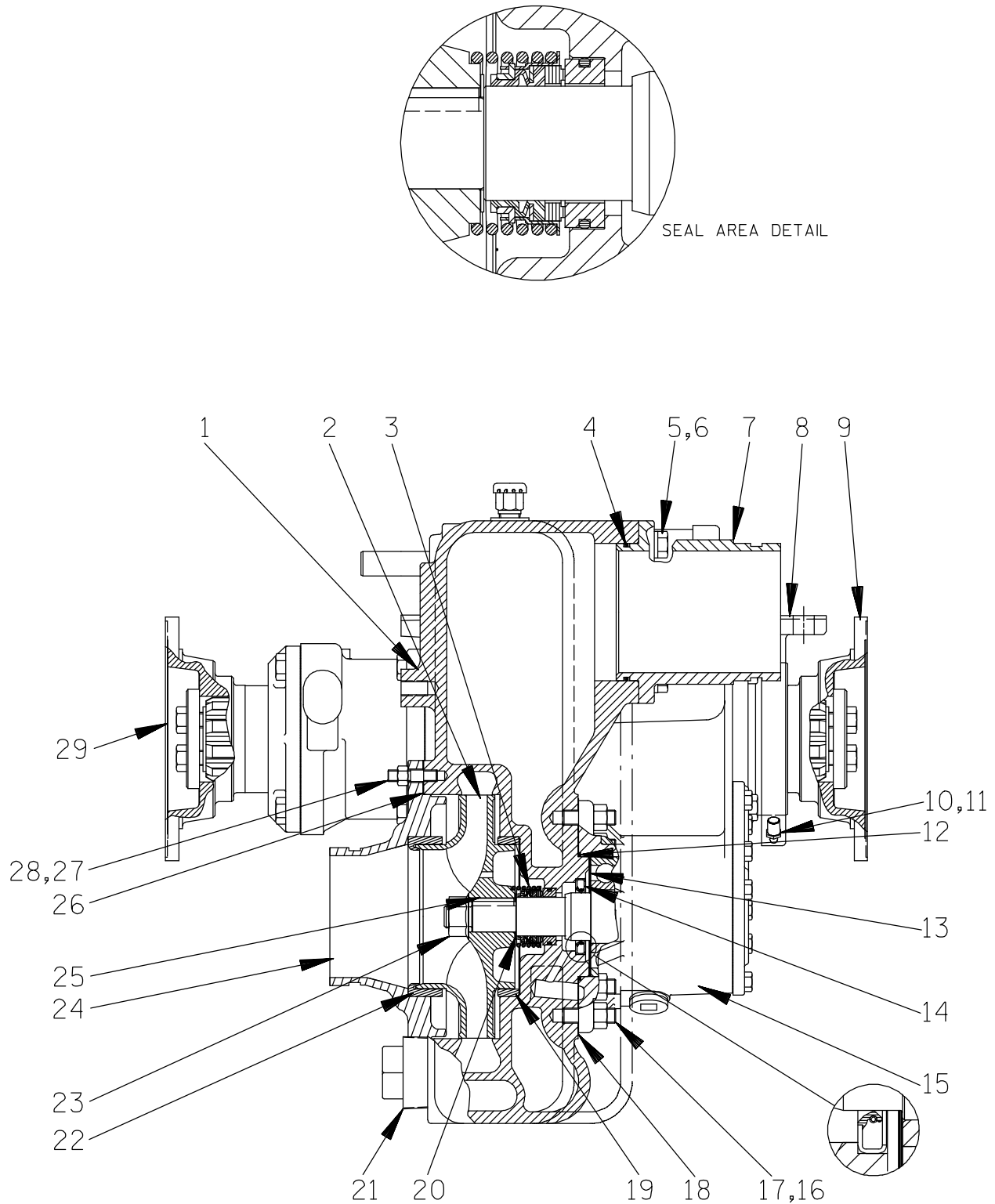


Figure 1. Pump Model 04E1-GHH

PARTS LIST
Pump Model 04E1-GHH
 (From S/N 1076270 Up)

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	REPAIR PUMP CASING	38222-526	13000	1
2	* IMPELLER	8375	1304R	1
3	* SEAL ASSEMBLY	25271-192	---	1
4	DISCHARGE FLANGE O-RING	25154-244	---	1
5	HEX HD CAPSCREW	B0805	15991	4
6	LOCKWASHER	J08	15991	4
7	DISCHARGE FLANGE	38641-314	13000	1
8	TRUNNION	38151-023	11010	1
9	INPUT FLANGE	24571-912	---	1
10	LUBE FITTING	S186	---	1
11	CAP PLUG	25141-151	---	1
12	* PUMP CASING O-RING	25152-155	---	1
13	* BEARING SHIM SET	8545	15990	1
14	* OIL SEAL	S2007	---	1
15	REPAIR GEARBOX ASSY	44161-146	---	1
16	STUD	C0807	15991	6
17	HEX NUT	D08	15991	6
18	* PUMP CASING GASKET	38683-464	18000	1
19	* PUMP CASING WEAR RING	8464	10018	1
20	* IMPELLER SHIM SET	2X	17090	1
21	PUMP CASING DRAIN PLUG	P32	10009	1
22	* SUCTION HEAD WEAR RING	64H5	10018	1
23	* IMPELLER NUT	22565-307	---	1
24	SUCTION HEAD	38247-206	13040	1
25	* KEY	N0405-1/4	15990	1
26	* SUCTION HEAD GASKET	8376G	20000	1
27	STUD	C0605-1/2	15991	12
28	HEX NUT	D06	15991	12
29	OUTPUT FLANGE	24571-912	---	1
NOT SHOWN:				
	NAME PLATE	38819-004	13000	1
	DRIVE SCREW	BM#04-03	17000	4
	INSTRUCTION TAG	38817-041	---	1
	SUCTION STICKER	6588AG	---	1
	DISCHARGE STICKER	6588BJ	---	1
OPTIONAL:				
	CROSS MEMBER KIT	48123-401		1
	BRONZE FITTED:			
	-IMPELLER	8375	14000	1
	-WEAR RING	8464	14000	1
	-WEAR RING	64H5	14000	1

* INDICATES PARTS RECOMMENDED FOR STOCK

SECTION DRAWING

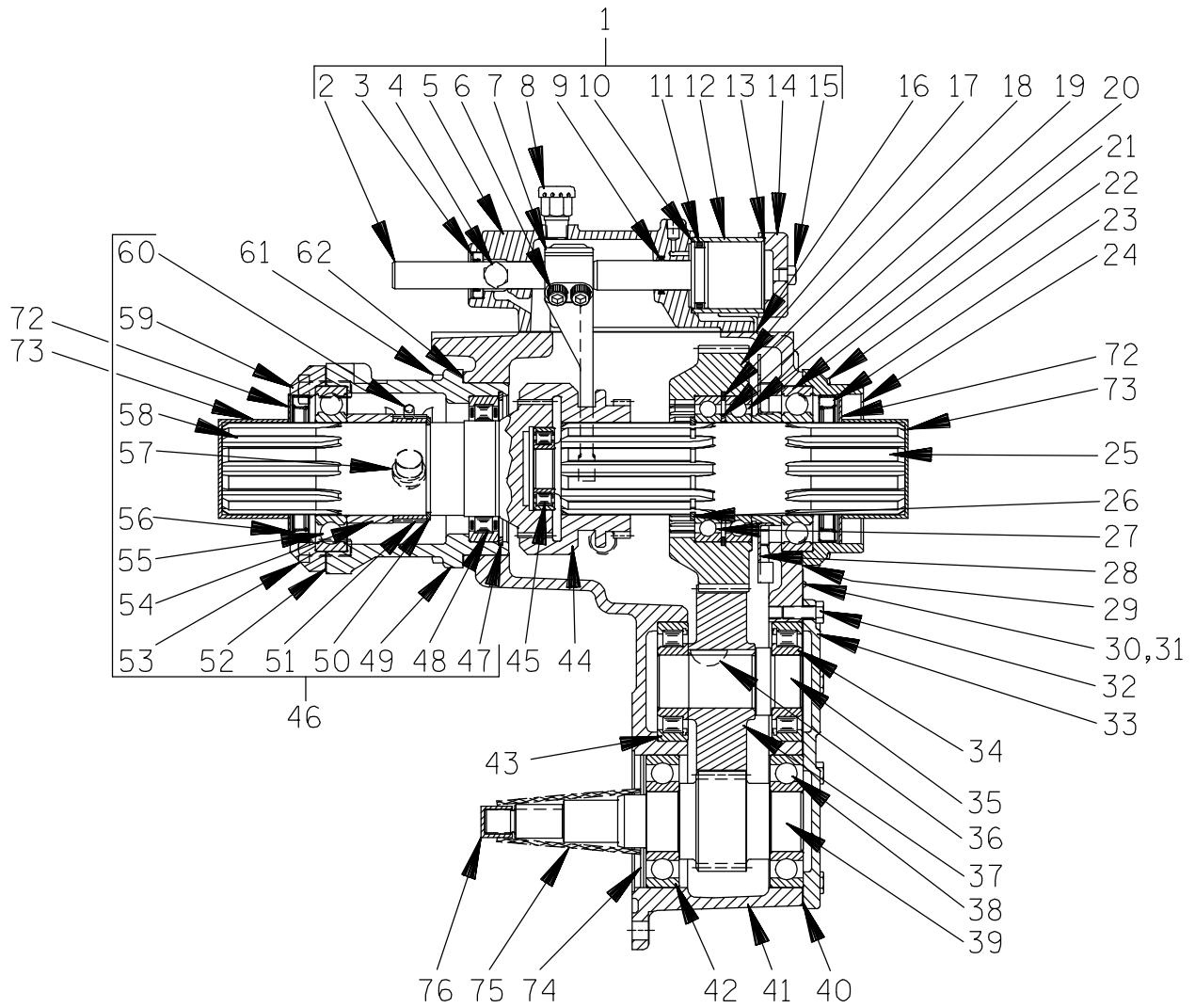


Figure 2. 44161-146 Repair Gearbox Assembly

PARTS LIST

44161-146 Repair Gearbox Assembly

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
1	AIR SHIFT COVER ASSY	44231-501	----	1	37	IDLER GEAR	38541-405	16000	1
2	-SHIFTER SHAFT ASSY	44231-502	----	1	38 *	BALL BEARING	S1088	----	1
3 *	-OIL SEAL	25228-506	----	1	39	IMPELLER SHAFT	38521-201	16000	1
4	-O-RING BOSS PLUG	38649-039	15079	1	40 *	BEARING CAP GASKET	38688-018	19060	1
5	-SHIFTER COVER	38354-041	10000	1	41	GEARBOX HOUSING	38313-026	10000	1
6	-SOC HD CAPSCREW	21472-478	----	2	42 *	BALL BEARING	S1088	----	1
7	-SHIFTER FORK	38584-003	1101X	1	43 *	ROLLER BEARING	23529-001	----	1
8	-AIR VENT	S1703	----	1	44	SLIDING CLUTCH	38521-714	16000	1
9 *	-O-RING	25154-212	----	1	45	ROLLER BEARING	23528-002	----	1
10 *	-CYLINDER GASKET	38681-215	19060	1	46	TAIL SHAFT ASSY	44732-902	----	1
11 *	-AIR CYLINDER O-RING	25154-326	----	1	47	-RETAINING RING	S1165	----	1
12	-CYLINDER	31417-063	14000	1	48 *	-ROLLER BEARING	23529-021	----	1
13 *	-CYLINDER CAP GSKT	38681-215	19060	1	49	-BEARING RETAINER	38325-012	10000	1
14	-CYLINDER CAP	38326-002	10000	1	50	-RETAINING RING	24125-051	----	1
15	-HEX HD CAPSCREW	21472-087	----	2	51	-GEAR	38541-004	15000	1
16 *	SHIFTER COVER GSKT	38673-312	19060	1	52 *	-BEARING CAP GASKET	38687-549	19060	1
17	DRIVE GEAR	38541-404	16000	1	53	-HEX HD CAPSCREW	21472-139	----	4
18	RETAINING RING	S1165	----	1	54	-SPACER	31144-034	15210	1
19	SPACER	31134-103	15210	1	55 *	-BALL BEARING	23251-019	----	1
20 *	BALL BEARING	23231-515	----	1	56 *	-OIL SEAL	25228-648	----	1
21 *	BALL BEARING	23251-019	----	1	57	-PLUG W/FIB WASHER	22638-001	----	1
22	HEX HD CAPSCREW	21472-139	----	4	58	-OUTPUT SHAFT	38521-716	16000	1
23 *	OIL SEAL	25228-648	----	1	59	-BEARING CAP	38325-013	10000	1
24	BEARING CAP	38325-014	10000	1	60	-BUSHING	24571-109	----	1
25	INPUT SHAFT	38521-715	16000	1	61	HEX HD CAPSCREW	21472-139	----	4
26	RETAINING RING	24125-051	----	1	62 *	BRG CAP GASKET	38687-548	19060	1
27 *	BALL BEARING	23231-515	----	1	72 ●	WASHER	31133-131	18010	2
28	SPACER/SLINGER	44148-007	----	1	73 ●	PROTECTIVE CAP	25141-251	----	2
29 *	BEARING CAP GASKET	38687-548	19060	1	74 ●	WASHER	31133-131	18010	1
30	NAME PLATE	38818-123	13000	1	75 ●	TUBING .500 FT	18523-502	----	1
31	DRIVE SCREW	BM#04-03	17000	2	76 ●	PROTECTIVE COVER	31133-224	18010	1
32	HEX HD CAPSCREW	21472-070	----	7	NOT SHOWN:				
33	BEARING CAP	38325-015	10000	1	●	PROTECTIVE CAP	25141-261	----	2
34 *	ROLLER BEARING	23529-001	----	1		GEAR LUBE DECAL	38816-086	----	1
35	IDLER SHAFT	31711-049	16000	1		LK PLATE WASHER	31215-042	15000	2
36 *	WOODRUFF KEY	AV1009	15990	1		HEX HD CAPSCREW	22434-552	----	4

● NOTE: ITEMS ARE PROVIDED FOR SHIPPING PURPOSES ONLY. THESE PARTS MUST BE REMOVED BEFORE INSTALLATION.

* INDICATES PARTS RECOMMENDED FOR STOCK

SECTION DRAWING

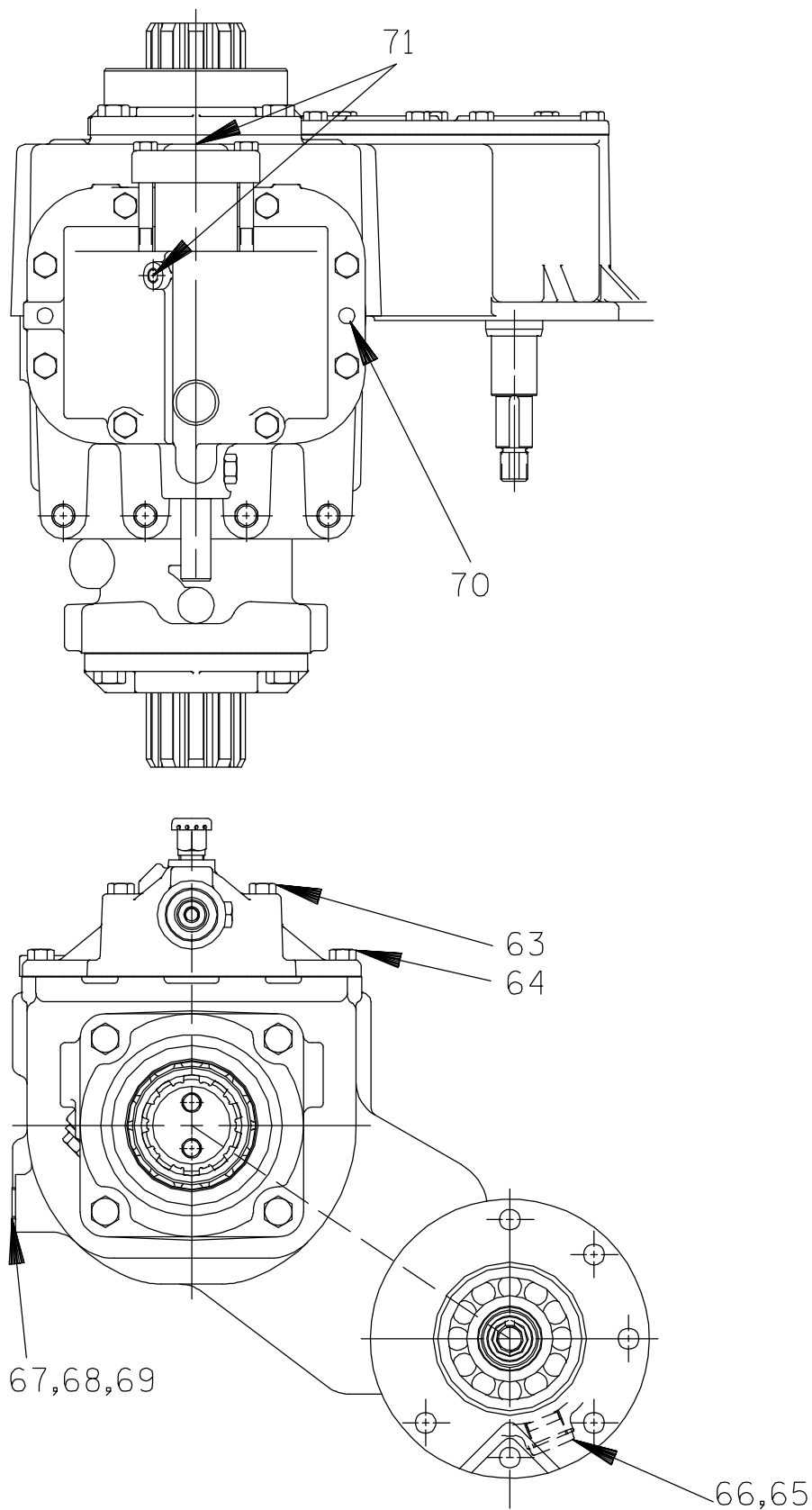


Figure 2A. 44161-146 Gearbox Assembly (Cont'd)

PARTS LIST
44161-146 Gearbox Assembly (Cont'd)

ITEM NO.	PART NAME	PART NUMBER	MAT'L CODE	QTY
63	HEX HD CAPSCREW	21472-114	---	2
64	HEX HD CAPSCREW	21472-099	---	6
65	CERAMIC/MAG PLUG	22618-001	---	1
66	WASHER	25123-041	---	1
67	PIPE PLUG W/PATCH	25355-061	---	1
68	OIL LEVEL PLATE	38816-233	13000	1
69	DRIVE SCREW	BM#04-03	17000	2
70	STR DOWEL PIN	AA0704	15990	2
71	● FLANGED PLUG	24571-174	---	2
OPTIONAL:				
	SPEEDOMETER GEAR DRIVE KIT	48123-010	---	1
	AUXILIARY STUB SHAFT P.T.O. ASSY	44161-149	---	1

* INDICATES PARTS RECOMMENDED FOR STOCK

PUMP AND SEAL DISASSEMBLY

Review all **SAFETY** information in Section A.

Follow the instructions on all tags, labels and decals attached to the pump.



Be certain proper safety practices are followed before operating or servicing the pump. Provide adequate ventilation, prohibit smoking, wear static-resistant clothing and shoes. Clean up all fuel spills immediately after occurrence.

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 (Figures 1, 2 and 2A) and the accompanying parts list.

Most service functions, such as wear ring, impeller, and seal replacement, may be performed by draining the pump and removing the suction head. However, due to the confined mounting location of the pump, it is recommended that the pump be removed from the vehicle for service. The following instructions assume complete disassembly is required.

If the gearbox requires repair, proceed with **PUMP AND SEAL DISASSEMBLY**, followed by **GEARBOX DISASSEMBLY**.

This manual will alert personnel to known procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel. However, this manual cannot possibly anticipate and provide detailed precautions for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner/maintenance personnel to ensure that **only** safe, established maintenance procedures are used, and that any procedures not addressed in this manual are performed **only** after establishing that neither personal safety nor pump integrity are compromised by such practices.

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



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 completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



After the vehicle is positioned for pump maintenance, block the wheels and set the emergency brake before attempting to disconnect the drive shaft or remove the pump. Be sure the pump is properly reinstalled and secure before operation.

Unless otherwise specified, the instructions in this section are keyed to Figure 1 and the accompanying parts list.

Removing Pump and Gearbox

Due to the confined mounting location of the pump, it is recommended that the pump be removed from the vehicle for service.



Due to the confined mounting location,

specialized equipment such as a transmission jack with custom brackets should be used to lift and position the pump and gearbox.

Close all valves in the suction and discharge lines. Remove the casing drain plug (21), and drain the pump. Clean and reinstall the drain plug.

Remove the suction piping. Remove the hardware securing the pump discharge flange to the vehicle tank.

Remove the hardware securing the input and output drive flanges to the drive shafts. Disconnect the air lines from the air shift cylinder assembly on the gearbox.

Remove the hardware securing the gearbox to the rear cross member. Remove the hardware securing the trunnion to the front cross member.

Move the pump and gearbox to a clean, well-equipped shop for maintenance and repair.

Suction Head and Wear Ring Removal

The wear ring (22) and impeller (2) are easily accessible and may be serviced by removing the suction head (24).

Remove the nuts (28), and pull the suction head and wear ring out of the pump casing. Remove the suction head gasket (26).



Use caution not to damage the suction head when removing the wear ring (22).

Inspect the wear ring for excessive wear or scoring. If replacement is required, use a chisel or other suitable tool to cut it from the suction head. **Be careful** not to damage the suction head bore.

Impeller Removal

To remove the impeller, block impeller rotation by inserting a brass rod through the pump discharge and between the impeller vanes. **Use caution** not

to damage the impeller. Remove the impeller nut (23).

Install 1/4–20 UNC by 4-inch long capscrews in the tapped holes in the impeller, and use a suitable puller to remove the impeller from the shaft. Use caution when removing the impeller; tension on the seal spring will be released. Retain the impeller key (25).

Remove the impeller adjusting shims (20). For ease of reassembly, tie and tag the shims, or measure and record their thickness.

Seal Removal

Remove the seal spring. Lubricate the shaft adjacent to the seal, and work oil up under the rubber bellows. Slide the rotating portion of the seal off the shaft.

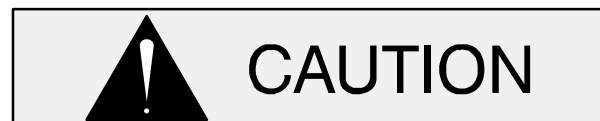
Use a pair of stiff wires with hooked ends to remove the stationary element and O-ring from the casing bore.

Pump Casing Removal

The presence of gearbox lubricant in the seal cavity behind the stationary element indicates failure of the gearbox oil seal (14). Before attempting to remove the seal, remove the gearbox drain plug and gasket (63 and 64, Figure 2A) and drain the gearbox lubricant. Reinstall the drain plug and gasket.

If the oil seal, wear ring (19), O-ring (12) or gasket (18) require replacement, or if the gearbox is to be disassembled, remove the nuts (17), and slide the pump casing off the shaft.

Remove the O-ring and gasket (12 and 18). Use a set of screwdrivers or other suitable tools to pry the oil seal (14) from the back of the pump casing.



Use caution not to damage the pump casing when removing the wear ring (19).

Inspect the wear ring (19) for excessive wear or scoring. If replacement is required, use a chisel or other suitable tool to cut it from the pump casing. **Be careful** not to damage the pump casing bore.

If replacement is required, remove the hardware (5 and 6), and separate the discharge flange and O-ring (4 and 7) from the pump casing.

If the pump casing is to be replaced, see Figure 3 and remove the hardware securing the cross member kit (30) to the pump casing.

If no further disassembly is required, proceed with **PUMP AND SEAL REASSEMBLY**. If the gearbox requires disassembly, do not reassemble the pump components at this time. Refer to **GEARBOX DISASSEMBLY** and **GEARBOX REASSEMBLY**, followed by **PUMP AND SEAL REASSEMBLY**.

PUMP AND SEAL REASSEMBLY

If the gearbox requires disassembly, refer to **GEARBOX DISASSEMBLY** and **GEARBOX REASSEMBLY**, followed by **PUMP AND SEAL REASSEMBLY**.

Unless otherwise specified, the instructions in this section are keyed to Figure 1 and the accompanying parts list.

Pump Casing Installation

If the wear ring (19) was removed, position the replacement ring in the pump casing with the chamfered end toward the bore shoulder. Press the wear ring into the pump casing until fully seated.

NOTE

*The wear ring **must** seat squarely in the pump casing; otherwise, binding and/or excessive wear will occur as the shaft turns.*

Apply a thin coat of “Permatex Aviation No. 3 Form-A-Gasket” to the contact surfaces of the oil seal (14) and the casing bore. Position the oil seal in the pump casing bore with the lip positioned as shown in Figure 1. Press the oil seal into the bore until fully seated against the bore shoulder.

Install the stationary seal element and O-ring in the seal bore as described in **Seal Reassembly and Installation** before securing the pump casing to the adaptor.

With the stationary seal seat installed in the seal bore of the pump casing, lubricate the O-ring (12), and slide it onto the pump casing shoulder.

Align the drain hole in the pump casing gasket (18) with the drain passage in the pump casing, and install it over the casing studs (16).

Before further reassembly, calculate the thickness of bearing adjusting shims (13) required to obtain a shaft end play of .001 to .005 inch (0,025 to 0,127 mm). Use a depth micrometer to measure the height of the pump casing shoulder (with the gasket installed), and the depth of the bearing in the gearbox housing from the gasket mating surface. Select a combination of shims to make up the difference between the two measurements, and install the bearing shims in the bearing bore.

Lubricate the lip of the oil seal (14) to ease installation. Apply “Never-Seeze” or equivalent compound to the casing studs (16). Carefully slide the pump casing over the shaft until fully seated against the gearbox housing. **Be careful** not to damage the lip of the oil seal or the stationary seal element.

Secure the pump casing to the gearbox housing with the nuts (17).

If the discharge flange (7) was removed, lightly oil the new O-ring (4), and install it in the groove in the flange. Slide the flange into the pump casing, using caution not to cut the O-ring. Secure the flange with the hardware (5 and 6).

If removed, secure the cross member kit (30) to the pump casing with the previously removed hardware (see Figure 3).

Seal Reassembly and Installation

(Figures 1 and 4)

Clean the seal cavity and shaft with a cloth soaked in fresh cleaning solvent.



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. 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 bellows and stationary element O-ring with water or a very **small** amount of light lubricating oil, and apply a drop of light lubricating oil on the finished faces. Assemble the seal as follows, (see Figure 4).

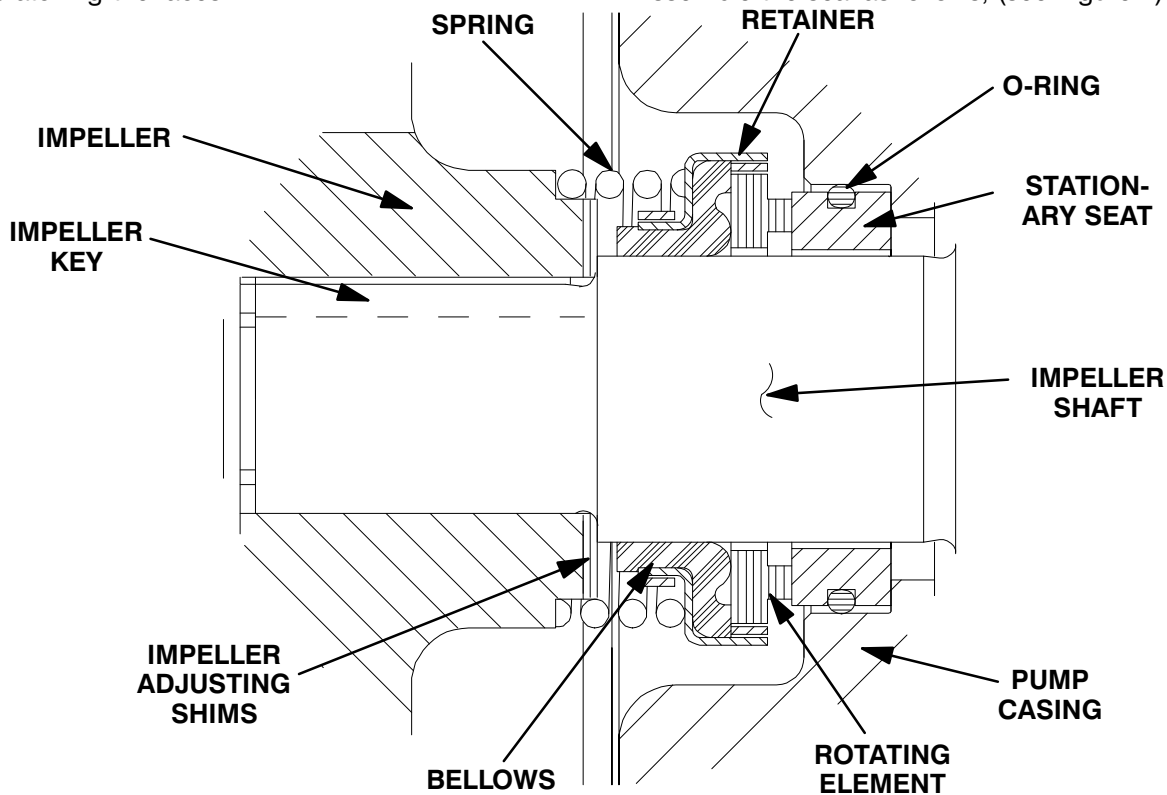


Figure 4. 25271-192 Seal Assembly



This seal is not designed for operation at temperatures above 160°F (71°C). Do not use at higher operating temperatures.

Inspect the impeller shaft for distortion, nicks, scratches, or damage to the shaft keyway. Dress small nicks and burrs with a fine file or emery cloth.

If the shaft is defective, refer to **GEARBOX DISASSEMBLY** and replace the shaft.

Lubricate the stationary element O-ring with a light coat of oil. Place a clean, lint-free tissue over the seal face, and use thumb pressure to press the element and O-ring into the pump casing until fully seated. Be careful not to damage the seal face. After installation wipe the seal face in a concentric pattern with a clean, lint-free cloth to remove any fingerprints.

NOTE

If the pump casing was removed, install the casing O-ring and gasket (12 and 18) on the pump casing studs. Carefully slide the casing over the shaft, and secure it to the gearbox with the nuts (17).

Install a tapered sleeve (see Figure 5) over the shaft keyway to ease installation of the rotating portion of the seal. This tool can be made from steel tubing or pipe.

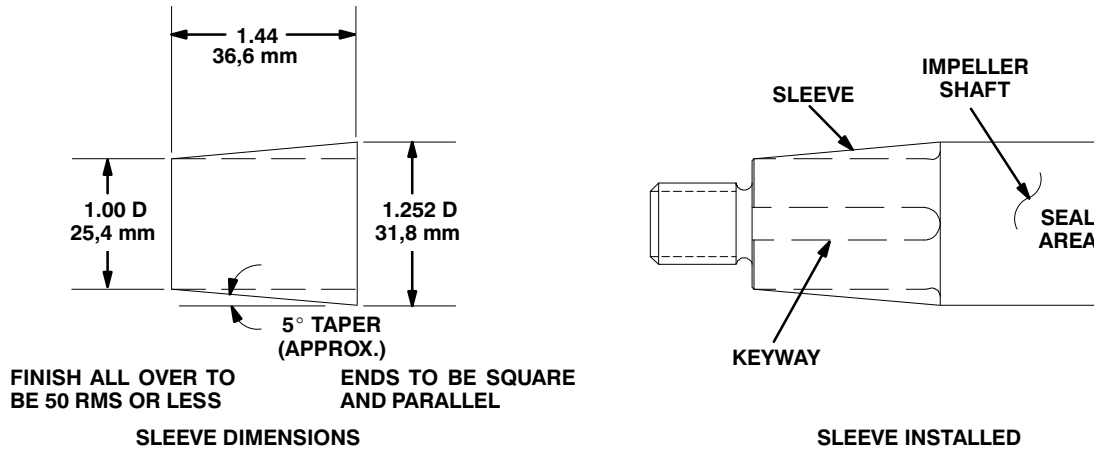


Figure 5. Seal Installation Sleeve

Lubricate the tapered sleeve and position it on the shaft. Position the rotating portion of the seal (consisting of the retainer, bellows and rotating element) on the sleeve, and apply even pressure against the shoulder of the seal retainer until the rotating subassembly slides onto the shaft and the seal faces contact. A push tube cut from a piece of plastic tubing would aid this installation. The I.D. of the tube should be approximately the same diameter as the I.D. of the seal spring.

Impeller Installation

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

For maximum pump efficiency, the impeller must be centered within the volute scroll. Center the impeller by adding or removing adjusting shims (20).

To verify impeller positioning, measure the pump casing and impeller as shown in Figure 6. Use these measurements to calculate the required impeller location (dimension E). Add or remove impeller adjusting shims until dimension E is obtained.

Remove the tapered sleeve and install the seal spring.

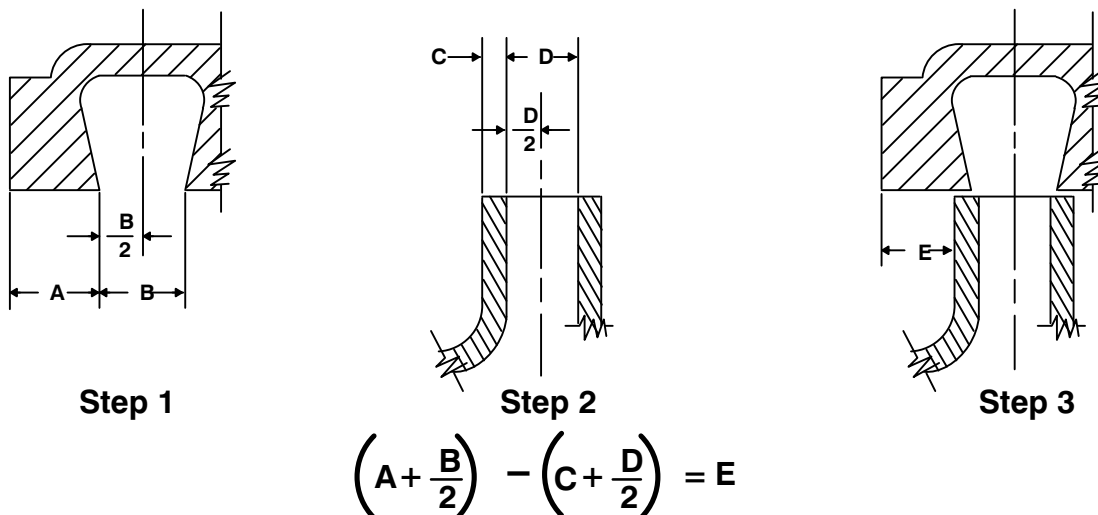


Figure 6. Centering Impeller Within Volute Scroll

NOTE

After the impeller has been properly positioned, check for free rotation. Correct any scraping or binding before further reassembly.

With the correct thickness of impeller adjusting shims installed, apply “Loctite Primer Grade T” to the keyway, key (12) and shaft threads. Apply “Loctite No. 242” to the key and keyway and install the key. Align the impeller and press it onto the shaft until fully seated.

NOTE

*It is not recommended that substitute locking materials be used in this application. Use **only** the recommended “Loctite” products.*

After the impeller is installed, secure the impeller by torquing the impeller nut (23) to 125 ft. lbs. (1500 in. lbs. or 17,3 m. kg.).

Suction Head and Wear Ring Installation

If the wear ring (22) was removed, position the replacement ring in the suction head (24) with the chamfered end toward the bore shoulder. Press the wear ring into the suction head until fully seated.

NOTE

*The wear ring **must** seat squarely in the suction head; otherwise, binding and/or excessive wear will occur as the shaft turns.*

Apply “Never-Seez” or equivalent compound to the studs (27). Slide the suction head gasket (26) and suction head over the studs, and secure with the nuts (28).

Installing Pump and Gearbox

Due to the confined mounting location, specialized equipment such as a transmission jack with custom brackets should be used to lift and position the pump and gearbox.

Install the hardware securing the input and output drive flanges (9 and 29) to the drive shafts. Install the air lines from the air shift cylinder assembly on the gearbox.

Install the hardware securing the gearbox to the rear cross member. Install the hardware securing the trunnion to the front cross member.

Connect the pump suction head and discharge flange.

Final Pump Assembly

Open all valves. Make certain that all piping connections are tight, properly supported and secure.

Be sure the gearbox has been properly lubricated, see **LUBRICATION** at the end of this section.

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

GEARBOX DISASSEMBLY

Unless otherwise specified, the instructions in this section are keyed to Figures 2 and 2A, and the accompanying parts lists.

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



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

Due to the confined mounting location of the pump, it is recommended that the pump be removed from the vehicle for service.



Due to the confined mounting location, specialized equipment such as a transmission jack with custom brackets should be

used to lift and position the pump and gearbox.

Refer to **Removing Pump and Gearbox** under **PUMP AND SEAL DISASSEMBLY** and remove the pump and gearbox from the vehicle. Move the pump and gearbox to a clean, well-equipped shop for maintenance and repair.

Disassemble the pump components as indicated in **PUMP AND SEAL DISASSEMBLY**.

Air Shift Cover Disassembly

To remove the air shift cover assembly (1), disengage the capscrews (63 and 64) securing the assembly to the gearbox housing (41).

The cylinder cap (14) and shifter fork (7) must be removed before the shifter shaft assembly (2) can be removed. To remove the cylinder cap, disengage the capscrews (15).

To remove the shifter fork, disengage the socket head capscrews (6) securing the fork to the shifter shaft. Remove the shifter fork.

Remove and inspect the shifter shaft assembly and piston O-ring (11) and replace any parts as required. Remove the oil seal (3) and shaft O-ring (9).

Drive Flange Removal

Disengage the capscrews and remove the lock-plate washers. Use a suitable puller to remove the input and output drive flanges (9 and 29, Figure 1).

Output Shaft Disassembly

To remove the tail shaft assembly (46), which includes the output drive shaft (65) and related components, remove the capscrews (61) and pull the assembly from the gearbox housing. Remove the bearing retainer gasket (62).

Disengage the hardware (53) and separate the bearing cap (59) and gasket (52) from the bearing retainer (49). Inspect the oil seal (56) and, if replacement is required, press it from the bearing cap.



The output shaft cannot be removed from the bearing retainer without first removing the ball bearing (55) and roller bearing (48) from the shaft. The bearings may be damaged during removal.

To remove the output shaft (58), tap against the splined end of the shaft with a soft-faced mallet or brass bar until the shaft is driven approximately 3/4 inch (19 mm) into the bearing retainer. From the opposite end of the shaft, use the mallet to tap the shaft back into the bearing retainer. This will unseat the ball bearing (55) from the retainer.

Use a suitable bearing puller to remove the ball bearing from the shaft.

Push the shaft through the roller bearing (48) until the retaining ring (50) seats squarely against the bearing. Remove the retaining ring (47), and gently tap the splined end of the shaft until the roller bearing is out of the bearing retainer. Carefully slide the bearing retainer off the shaft. Slide the spacer sleeve (51) off the shaft. Remove the snap ring (50) and pull the roller bearing off the shaft.

Use a suitable puller to remove the bearing (45) from the output shaft.

Input Shaft Disassembly

To remove the input drive shaft (25), disengage the capscrews (22) and separate the bearing cap (24) and gasket (29) from the gearbox housing. Inspect the oil seal (23) and, if replacement is required, press it from the bearing cap.

Reach through the tailshaft end of the gearbox housing and remove the sliding clutch (44). Remove the retaining ring (26) from the shaft.

Position the gearbox housing on an arbor (or hydraulic) press with the drive flange (splined) end of the input shaft facing up. Insert a spacer tool (G-R P/N 33144—011) between the drive gear (17) and the internal wall of the gearbox housing so that the drive gear is held in place as the shaft is pressed through. Press the shaft from the housing while reaching through the top of the gearbox housing to remove the drive gear, bearings (20), and spacer/slinger (28).



To prevent damage during removal, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the gearbox is disassembled.

Clean and inspect the bearings (20 and 27) as outlined in **Cleaning and Inspecting Bearings**. If the bearings require replacement, use a suitable puller to remove them from the drive gear. Remove the retaining ring (18), and spacer (19) from the drive gear.

If replacement is required, use a suitable puller to remove the bearing (21) from the gearbox housing.

Idler Shaft Disassembly

Position the gearbox housing on a solid surface with the bearing cap (33) facing up. Support the housing on wooden blocks while in this position.

Disengage the capscrews (32) and remove the bearing cap and gasket (40). There is a tapped hole (3/4–10 UNC by 5/8 inch deep) in the end of the idler shaft (35) to accommodate a specially-designed puller (G-R P/N 48781–007). Use this tool to pull the shaft and key (36) through the idler gear (37), and remove the idler gear through the top of the gearbox.



To prevent damage during removal, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the gearbox is disassembled.

Separate the outer race of the front roller bearing (34) from the inner race. Slide the inner race of the roller bearing (43) out of the outer race.

Clean and inspect the inner and outer bearing races as outlined in **Cleaning and Inspecting Bearings**. If bearing replacement is required, pull the inner race of the front bearing (34) off the shaft.

Pull the outer race of the roller bearing (43) from the gearbox cavity using a suitable puller.

Impeller Shaft Disassembly

With the pump end disassembled (see **PUMP AND SEAL DISASSEMBLY**) and idler shaft removed, the impeller shaft (39) and bearings (38 and 42) can be pressed out from either side of the gearbox.



To prevent damage during removal, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the gearbox is disassembled.

Clean and inspect the bearings as outlined in **Cleaning and Inspecting Bearings**. If the bearings require replacement, use a suitable puller to remove them from the shaft.

Cleaning and Inspecting Bearings

It is recommended that bearings be cleaned and inspect **in place** as follows.



To prevent damage during removal from shaft, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the gearbox is disassembled.

Clean the gearbox housing, shafts 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.



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 the bearings thoroughly in **fresh** cleaning solvent. Dry the bearings with filtered compressed air and coat with light oil.



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.

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

The bearing tolerances provide a tight press fit onto the shafts or a snug slip fit into the gearbox housing. Replace the bearings, shafts, or gearbox housing if the proper bearing fit is not achieved.

Although bearings should be cleaned and inspected in place to prevent damage during removal, it is **strongly** recommended that bearings be replaced any time the gearbox is disassembled.

GEARBOX REASSEMBLY

Unless otherwise specified, the instructions in this section are keyed to Figures 2 and 2A, and the accompanying parts lists.

Clean and inspect the bearings as indicated in **Cleaning and Inspecting Bearings**.



To prevent damage during removal from the shaft, it is recommended that bearings be cleaned and inspected **in place**. It is **strongly** recommended that the bearings be replaced **any** time the gearbox is disassembled.

Inspect the shafts for distortion, damaged keyways, nicks or scratches, or for damage on the impeller or drive ends. Dress small nicks and burrs with a fine file or emery cloth. Replace the shafts if defective.

Check all oil seal and gasket seating surfaces for nicks and scratches. Dress small nicks and burrs with a fine file or emery cloth. Be careful not to distort the shape of the surfaces.

When reassembling the gearbox, replace all gaskets and O-rings. Apply a light coating of oil on mating surfaces shafts, gears and oil seals to ease reassembly.

Impeller Shaft Reassembly

Use two 3/8-16 UNC by 1-1/2 inch long cap screws (not supplied) to secure the bearing stop (G-R P/N 29511-904) to the housing diagonally across the opening for the bearing cap (33).

Position the gearbox housing on the bed of an arbor (or hydraulic) press with the opening for the bearing cap (33) facing down. Support the gearbox housing on wooden blocks while in this position.

Use the bearing driver (G-R P/N 29511-903) to press the front bearing (38) into the gearbox housing until seated against the bearing stop.



To prevent damage to the bearings during reassembly, **do not** tap or drive bearings into place with a hammer. Install bearings on shafts and into bores using the designated driving tools and an arbor or hydraulic press.

Use the bearing driver (G-R P/N 29511-905) to press the rear bearing (42) onto the impeller shaft (39) until fully seated against the shaft shoulder.

Use the bearing driver (G-R P/N 29511-905) to press the assembled impeller shaft and bearing into the gearbox housing until the shaft shoulder seats squarely against the front bearing (38).

Idler Shaft Reassembly

Reposition the gearbox housing with the opening for the bearing cap (33) facing up. Support the

gearbox housing on wooden blocks while in this position. Remove the bearing stop from the gearbox housing.

Position the outer race of the rear roller bearing (43) in the gearbox housing. Note that one side of the outer race is solid; this solid outer ring **must** be positioned toward the **outside** of the gearbox housing. When installed, the inner race must have the shouldered side positioned toward the gear.

Use the bearing driver (G-R P/N 29511–907) to press the outer race into the gearbox housing bore until fully seated. Slide the inner race into the outer race until fully seated.

Position the inner race of the front roller bearing (34) on the shaft so that the shoulder on the race is toward the shaft shoulder.

Use the bearing driver (G-R P/N 29511–908) to press the race onto the shaft until seated squarely against the shaft shoulder.

Pre-heat the idler gear to 220–230°F (104–110°C). Use heavy gloves to reach through the top of the gearbox and lay the idler gear (37) in position next to the rear bearing. Position the spacer fork (G-R P/N 29511–915) between the idler gear and the rear bearing.

Install the key (36) in the idler shaft. Coat the idler shaft and idler gear bore lightly with “Never-Seez Black Moly”.

Use one end of the spacer fork tool to align the gear and rear bearing concentrically. **Be sure** that the fork is positioned so the larger diameter (3–9/16 inch or 90 mm) recess faces the bearing. Insert the idler shaft, making sure the key is properly aligned with the slot in the gear. Press the shaft through the idler gear until the shaft shoulder is snug against the gear.

Remove the spacer fork and press the shaft and gear into the rear bearing (43) until the gear shoulder contacts the bearing.

Position the outer race of the front bearing (34) in the gearbox housing bore. Note that one side of the outer race is solid; this solid outer ring **must** be positioned toward the **inside** of the gearbox housing.

Screw the pin in the bearing driver (G-R P/N 29511–909) into the tapped hole in the idler shaft. Use the driver to press the outer race of the bearing into the housing until fully seated against the inner race.

Replace the bearing cap gasket (40), and secure the bearing cap (33) to the gearbox housing by torquing the capscrews (32) to 35 ft. lbs. (420 in. lbs. or 4,8 m. kg.).

Input Shaft Reassembly

Use the bearing driver (G-R P/N 29511–910) to press the bearing (21) into the gearbox housing until fully seated.

Reposition the gearbox housing with the opening for the output shaft facing up. Support the gearbox housing on wooden blocks while in this position.

Install the retaining ring (18) in the gear. Use the bearing driver (G-R P/N 29511–911) to press the inner bearing (27) into the drive gear until squarely seated against the lock ring.

Position the spacer (19) against the inner bearing, and use the bearing driver (G-R P/N 29511–912) to press the outer bearing (20) into the gear until squarely seated against the lock ring and spacer.

Before installing the input shaft, position the spacer/slinger (28) in the gearbox with the flat side away from the input shaft opening (facing up). Position the drive gear assembly in the gearbox housing with the exposed bearing next to the spacer/slinger.

Install the retaining ring (26) in the groove on the input shaft. Use the bearing driver (G-R P/N 29511–913) in combination with the bearing support stop (G-R P/N 29511–920) to press the shaft through the tail shaft opening until the lock ring seats against the inner bearing.

Reposition the gearbox housing with the input splines on the shaft facing up. Support the gearbox housing on wooden blocks while in this position.

Use the seal driver and stop (G-R P/N 29511–902) to press the oil seal (23) into the bearing cap (24) until fully seated. Install the gasket (29) and secure the cap to the gearbox housing by torquing the capscrews (22) to 90 ft. lbs. (1080 in. lbs. or 12,4 m.

kg.). **Use caution** not to damage the oil seal lip on the shaft splines.

Reposition the gearbox housing with the opening for the tail shaft facing up. Support the gearbox housing on wooden blocks while in this position.

Push the sliding clutch (44) over the long splined end of the input shaft. The narrow row of teeth must face toward the retaining ring (26). Check for free movement by sliding the clutch back and forth over the full length of the splines.

Output Shaft Reassembly

Press the roller bearing (48) into the bearing retainer (49) until fully seated and install the retaining ring (47).

Position the roller bearing (45) in the geared end of the output shaft (58) and press it into the shaft bore until fully seated.

Slide the splined end of the output shaft through the bearing until the bearing seats squarely against the shaft shoulder.

Install the retaining ring (50), and slide the gear (51) and spacer (54) onto the shaft.

Position the spacer (G-R P/N 29511—913) over the geared end of the output shaft, and rest the retainer, shaft and spacer on the bed of the press with the splined end of the shaft facing up. Use the bearing driver (G-R P/N 29511—913) to press the bearing (55) over the shaft until fully seated in the bearing retainer bore.

Install the bearing retainer gasket (62). Slide the tail shaft assembly into the gearbox housing until the bearing retainer seats squarely against the housing shoulder, and the bearing (45) is positioned over the end of the input shaft. Secure the bearing retainer to the gearbox housing by torquing the capscrews (61) to 90 ft. lbs. (1080 in. lbs. or 12,4 m. kg.).

Use the seal driver and stop (G-R P/N 29511—902) to press the oil seal (56) into the bearing cap (59) until fully seated. Install the gasket (52) and secure the cap to the bearing retainer by torquing the capscrews (53) to 50 ft. lbs. (600 in. lbs. or 7 m. kg.).

Air Shift Cover Reassembly

Reinstall the shifter shaft O-ring (9) and oil seal (3). Be sure the lip of the oil seal is directed toward the shifter fork.

Replace the plunger O-ring (11). Lubricate the O-rings, piston and cylinder I.D. with “Dexron II or Delvac I” automatic transmission fluid, and reinstall the shifter shaft assembly (2). Secure the cylinder cap (14) by tightening the capscrews (15) equally to prevent cocking the cylinder body; torque the capscrews to 35 ft. lbs. (420 in. lbs. or 4,8 m. kg.). Check for free movement of the shaft and piston.

Inspect the shifter fork (7) and replace as necessary. Position the shifter fork on the shifter shaft. Secure the fork to the shaft by torquing the allen head screws (6) to 45 ft. lbs. (540 in. lbs. or 6,2 m. kg.).

Engage the shifter fork with the sliding clutch, and secure the air shift cover to the gearbox housing by torquing the capscrews (63 and 64) to 35 ft. lbs. (420 in. lbs. or 4,8 m. kg.).

Apply “Permatex” or equivalent compound on the hose fittings before installing the air supply lines to the air cylinder. Air check all possible leak points with 120 to 150 psi (8,4 to 10,5 kg/cm²) before further reassembly.

Check the shifter fork and sliding clutch alignment by working the shifter fork back and forth. The shaft should travel approximately 1—5/8 inches (41,3 mm) between the two positions.

Pressure Testing

The gearbox should be pressure tested any time a sealed surface is disturbed. This includes flange, gasket or oil seal removal, as well as a complete overhaul.

To pressure test the gearbox, install the pressure test sleeves (G-R P/N 29511—914) over the input and output shafts, and secure them with the capscrews and lockplate washers; torque the capscrews to 90 ft. lbs. (1080 in. lbs. or 12,4 m. kg.).

Remove the breather vent (8) and install a valve stem and air pressure gauge in the hole. Apply “Loctite Pipe Sealant with Teflon” or equivalent compound to the threads before installation.

Use filtered compressed air to pressurize the gearbox until it stabilizes at 6 psi (0,4 kg/cm²), then shut off the air flow and observe the pressure gauge. If the pressure drops more than 1 psi (0,07 kg/cm²) in 15 seconds, an unacceptable air leak exists at one of the sealing surfaces.

To find the leak, repressurize the gearbox, and apply a liberal amount of commercially available window cleaner or liquid detergent to each sealing surface. Watch for air bubbles to appear indicating a leak. Correct any leaks that are found, and retest the gearbox.

Drive Flange Installation

The shaft splines are designed to produce a slight interference fit with the drive flanges. This fit is required to prevent fretting corrosion.

Coat the input and output shaft splines with light oil. Apply oil to the leading area of the drive flanges where the oil seal lips seat. Position the input and output flanges (9 and 29, Figure 1) on the shafts.

It is recommended that a sleeve be used to drive the flanges onto the shaft until fully seated. The sleeve must be sized to fit over the shaft and into the flange counterbore.

After the flanges have been installed, secure them to the shafts with the capscrews and lockplate washers; torque the capscrews to 90 ft. lbs. (1080 in. lbs. or 12,4 m. kg.).

Lubricate the gearbox as indicated in **LUBRICATION** at the end of this section. Install the pump and gearbox assembly onto the vehicle as described in **Installing Pump and Gearbox** at the end of **PUMP AND SEAL REASSEMBLY**.

LUBRICATION

Seal Assembly

The seal assembly is lubricated by the liquid being pumped. No additional lubrication is required.

Trunnion Bracket

(Figure 1)

To lubricate the trunnion (11) and bearing retainer, add SAE No. 2 lithium-based pressure gun grease

through the lubrication fitting (12) until grease escapes from the trunnion area.

Gearbox Assembly

(Figure 2A)

The gearbox was shipped from the factory dry of lubrication, except for a residual coating from the testing process of 90 weight gear oil and Dow Corning "Molykote® M Gear Guard" (an anti-wear additive consisting of molybdenum disulphide solid lubricants suspended in petroleum oil). For initial lubrication of the gearbox, remove the oil level plug (67), and add approximately 68 U.S. ounces (2011 ml) of premium quality, multi-purpose, extreme pressure gear lubricant with an SAE rating per the following ambient temperatures.

Table 1. Lubrication Specifications

Temperature Range	Lubricant
-40°F (-53°C) to 0°F (-18°C)	Delvac I
-10°F (-23°C) to +40°F (+4°C)	80 W 90
+32°F (0°C) and above	80 W 140

Fill the gearbox to the bottom of the fill plug hole as indicated on the oil level plate. If the gearbox is over-filled, foaming may occur with oil loss through the breather vent during continuous duty operation. Under-filling can result in loss of lubrication to the tailshaft bearing, resulting in premature bearing failure. Check the lubricant level regularly, and maintain it at the recommended level. Reinstall the oil level plug.

Intermittent (Normal Refueler) Duty Cycle

Change the lubricant in a new gearbox after an initial break-in period of 24 hours, and before 100 hours of operation. The lubricant should be changed while the pump is at operating temperature.

To change the lubricant, remove the magnetic drain plug and gasket (65 and 66), and drain the gearbox. If operating conditions require changing grades of oil to Delvac I, it is recommended that the gearbox be thoroughly flushed with flushing oil prior to refilling. Always clean the magnetic plug thoroughly before reinstalling it. Add 6 ounces (18 ml) of Dow Corning "Molykote® M Gear Guard", and "top off" with approximately 68 U.S. ounces (2 liters) of oil as previously described.

After the initial change, the lubricant should be changed after every 500 hours of operation or every 6 months, whichever comes first. The lubricant should be changed more frequently when the pump is operated under severe conditions, such as extremely dusty conditions or in areas where extreme temperature changes are regularly experienced.

Check the oil in the gearbox monthly, and maintain it at the proper level. Check the gearbox monthly for leaks.



Contaminated gearbox lubricant or metal shavings on the magnetic drain plug may indicate impending pump or gearbox fail-

ure. Monitor operation closely and schedule maintenance accordingly.

Continuous Pumping Duty Cycle

For duty cycles which do not provide at least a 20 minute cool-down (non-pumping) period after each 30 minutes of continuous pumping, the following lubrication schedule shall apply.

1. Change the lubricant in a new gearbox after an initial break-in period of 10 hours and before 20 hours of operation. The lubricant should be changed while the pump is at operating temperature. Remove the magnetic plug and gasket (65 and 66) and drain the gearbox. Always clean the magnetic plug thoroughly before reinstalling.
2. After the initial change, the lubricant should be changed after every 40 hours of operation or 3 months, whichever comes first.

**For Warranty Information, Please Visit
www.grpumps.com/warranty
or call:
U.S.: 419-755-1280
Canada: 519-631-2870
International: +1-419-755-1352**

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