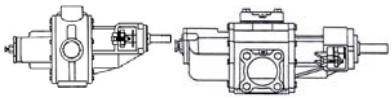
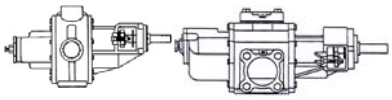


AMERICAN-MARSH PUMPS

INSTALLATION, OPERATION & MAINTENANCE MANUAL FOR SERIES 200 GH HELICAL GEAR PUMPS

01 NOVEMBER 2005



AMERICAN-MARSH PUMPS

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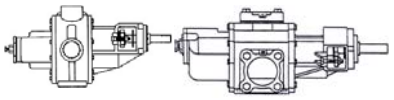
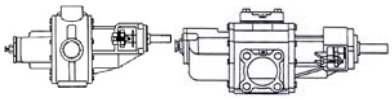
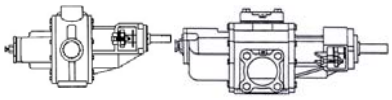






SAFETY CONSIDERATIONS

The American-Marsh GH helical gear pumps have been designed and manufactured for safe operation. In order to ensure safe operation, it is very important that this manual be read in its entirety prior to installing or operating the pump. American-Marsh Pumps shall not be liable for physical injury, damage or delays caused by a failure to observe the instructions for installation, operation and maintenance contained in this manual.

Remember that every pump has the potential to be dangerous, because of the following factors:

- parts are rotating at high speeds
- high pressures may be present
- high temperatures may be present
- highly corrosive and/or toxic chemicals may be present

Paying constant attention to safety is always extremely important. However, there are often situations that require special attention. These situations are indicated throughout this book by the following symbols:

⚠DANGER

DANGER - Immediate hazards which WILL result in severe personal injury or death.

⚠WARNING

WARNING – Hazards or unsafe practices which COULD result in severe personal injury or death.

⚠CAUTION

CAUTION – Hazards or unsafe practices which COULD result in minor personal injury or product or property damage.

Maximum Lifting Speed: 15 feet/second.

If in a climate where the fluid in the casing could freeze, never leave liquid in the pump casing. Drain the casing completely. During winter months and cold weather, the liquid could freeze and damage the pump casing.

Do not run the equipment dry or start the pump without the proper prime (casing flooded).

Never operate the pump for more than a short interval with the discharge valve closed. The length of the interval depends on several factors including the nature of the fluid pumped and its temperature. Contact American-Marsh Engineering for additional support if required.

Never operate the pump with a closed suction valve.

Excessive pump noise or vibration may indicate a dangerous operating condition. The pump must be shutdown immediately.

It is absolutely essential that the rotation of the motor be checked before installation of the coupling spacer and starting the pump. Incorrect rotation of the pump for even a short period of time cause severe damage.

If the liquid is hazardous, take all necessary precautions to avoid damage and injury before emptying the pump casing.

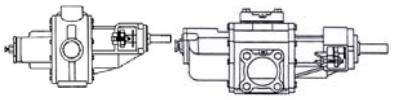
Residual liquid may be found in the pump casing, head and suction line. Take the necessary precautions if the liquid is hazardous, flammable, corrosive, poisonous, infected, etc.

Always lockout power to the driver before performing pump maintenance.

Never operate the pump without the coupling guard and all other safety devices correctly installed.

Do not apply heat to disassemble the pump or to remove the impeller. Entrapped liquid could cause an explosion.

If any external leaks are found while pumping hazardous product, immediately stop operations and repair.



PUMP IDENTIFICATION

MANUFACTURER

American-Marsh Pumps
185 Progress Road
Collierville, TN 38017
United States of America

TYPE OF PUMP

The American-Marsh GH pump is a helical gear, positive displacement, single stage pump. GH pumps are of the flex-coupled type.

DATE OF MANUFACTURE

The date of manufacture is indicated on the pump data plate.

INSTALLATION, OPERATION & MAINTENANCE MANUAL IDENTIFICATION

Prepared: November, 2005 **Edition:** 01
Revision: **Date of Revision:**

NAMEPLATE INFORMATION

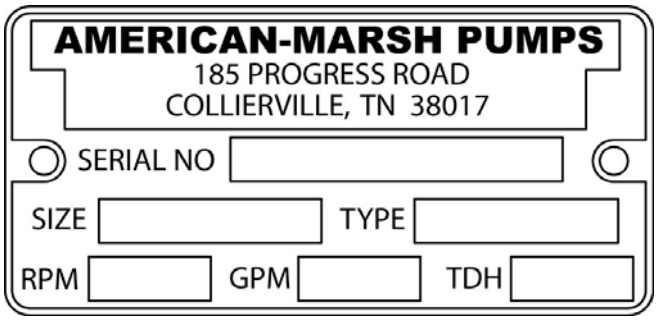


FIGURE 1 – Pump Data Plate

SERIAL NUMBER	:	Serial Number of pump unit (issued by Production Control).
SIZE	:	Size designation of pump (GH-48)
TYPE	:	Pump type (GH).
RPM	:	Speed of pump.
GPM	:	Rated capacity of pump.
TDH	:	Rated Total Dynamic Head of pump.

PUMP NOMENCLATURE

MODEL GH-48 HBORV

The pump model number consists of an eleven digit number. The first digits (GH) indicates the pump arrangement.

GH – Gear Helical

The third and fourth digits (48) indicates the approximate theoretical displacement in U.S. gallons per 100 revolutions.

Gallons/100 Rev. (Liters/100 Rev.)

11 (41.6)
17 (64.4)
22 (83.3)
48 (181.7)

The letter or group of letters (HB) indicates the pump head arrangement.

H – Pump without outboard bearing.

HB – Pump with outboard bearing.

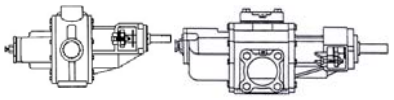
SB – Suspended pump with outboard bearing and auxiliary piping.

GHB – Pump with outboard bearing and built-on gear reduction unit.

The letter (F or A) indicates port style

No letter (F or A) – Pump with threaded ports.
F – Pump with American-Marsh standard flange ports.
A – Pump with flange facings to accept ANSI flanges.

On GHB pumps, the letter (O) indicates pump with outboard bearing and auxiliary mounting provisions. (Does not include built-on gear reduction unit).



On SB pumps, the letter (O) indicates pump without auxiliary piping.
The letters (RV) indicate type of faceplate on pump.

See Section **DIRECTION OF ROTATION AND RELIEF VALVES** on page 15, for an explanation of the four types of valves available.

No letters (RV) – Plain faceplate
RV – RV style relief valve faceplate

The letter or group of letters (X, LX) indicates direction of rotation and shaft position. The letter (L) indicates low drive unit. If the letter (L) is not used, the shaft will be in a high drive position.

No letter or W – Clockwise Rotation (Standard Rotation)
X – Counterclockwise Rotation
Y – Clockwise Rotation
Z – Counterclockwise Rotation
LW – Clockwise Rotation
LX – Counterclockwise Rotation
LY – Clockwise Rotation
LZ – Counterclockwise Rotation

Occasionally, special pumps or configurations are required which are unique for a particular application. These modifications are clarified by a specification number. Identification of any items different than a standard pump can be made by consulting an American-Marsh distributor or American-Marsh Pump Company.

MAXIMUM PUMP RATINGS

The maximum pressure, speed, and temperature limits for this pump SERIES are shown below.

The maximum rating of a pump with a specification number may be different depending on the materials of construction.

Maximum limits for this SERIES:

Pressure:
125 psi (862 kPa) Maximum Inlet
125 psi (862kPa) Maximum Discharge

Speed:
750 rpm Maximum Speed

Temperature:
Mechanically Sealed Pumps: 212°F (100°C)
Packed Box Pumps: 250°F (121°C)

WARRANTY

American-Marsh Pumps guarantees that only high quality materials are used in the construction of our pumps and that machining and assembly are carried out to high standards.

The pumps are guaranteed against defective materials and/or faulty craftsmanship for a period of one year from the date of shipment unless specifically stated otherwise.

Replacement of parts or of the pump itself can only be carried out after careful examination of the pump by qualified personnel.

The warranty is not valid if third parties have tampered with the pump.

This warranty does not cover parts subject to deterioration or wear and tear (mechanical seals, pressure and vacuum gauges, rubber or plastic items, bearings, etc.) or damage caused by misuse or improper handling of the pump by the end user.

Parts replaced under warranty become the property of American-Marsh Pumps.

Contact the American-Marsh Pumps' factory:

American-Marsh Pumps
185 Progress Road
Collierville, TN 38017
United States Of America

Phone: **(901) 860-2300**
Fax: **(901) 860-2323**
www.american-marsh.com

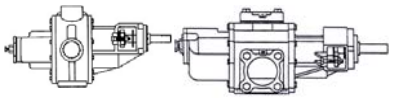
GENERAL INSTRUCTIONS

The pump and motor unit must be examined upon arrival to ascertain any damage caused during shipment. If damaged immediately notify the carrier and/or the sender. Check that the goods correspond exactly to the description on the shipping documents and report any differences as soon as possible to the sender. Always quote the pump type and serial number stamped on the data plate.

The pumps must be used only for applications for which the manufacturers have specified:

- **The construction materials**
- **The operating conditions (flow, pressure, temperature, etc.)**
- **The field of application**

In case of doubt, contact the manufacturer.



HANDLING AND TRANSPORT

METHOD OF TRANSPORT

The pump must be transported in the horizontal position

INSTALLATION

During installation and maintenance, all components must be handled and transported securely by using suitable slings. Handling must be carried out by specialized personnel to avoid damage to the pump and persons. The lifting rings attached to various components should be used exclusively to lift the components for which they have been supplied.

Maximum lifting speed: 15 feet/second

⚠CAUTION

STORAGE

SHORT-TERM STORAGE

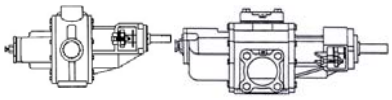
Normal packaging is designed to protect the pump during shipment and for dry, indoor storage for up to two months or less. The procedure followed for this short-term storage is summarized below:
Standard Protection for Shipment :

a. Loose unmounted items, including, but not limited to, oilers, packing, coupling spacers, stilts, and mechanical seals are packaged in a water proof plastic bag and placed under the coupling guard. Larger items are cartoned and metal banded to the base plate. For pumps not mounted on a base plate, the bag and/or carton is placed inside the shipping carton. All parts bags and cartons are identified with the American-Marsh sales order number, the customer purchase order number, and the pump item number (if applicable).
b. Inner surfaces of the bearing housing, shaft (area through bearing housing), and bearings are coated with Cortec VCI-329 rust inhibitor, or equal.
Note: **Bearing housings are not filled with oil prior to shipment.**
c. Regreasable bearings are packed with grease (Royal Purple NLGI#2).
d. After a performance test, if required, the pump is tipped on the suction flange for drainage (some residual water may remain in the casing). Then, internal surfaces of ferrous casings, covers, flange faces, and the gears are sprayed with Calgon Vestal Labs RP-743m, or equal. Exposed shafts are taped with Polywrap.
e. Flange faces are protected with plastic covers secured with plastic drive bolts. 3/16 in (7.8 mm) steel or 1/4 in (6.3 mm) wood covers with rubber gaskets, steel bolts, and nuts are available at extra cost.
f. All assemblies are bolted to a wood skid which confines the assembly within the perimeter of the skid.
g. Assemblies with special paint are protected with a plastic wrap.
h. GH bare pumps, when not mounted on base plates, are packed in hard paper cartons mounted on wood skids.
i. All assemblies having external piping (seal flush and cooling water plans), etc. are packaged and braced to withstand normal handling during shipment. In some cases components may be disassembled for shipment. The pump must be stored in a covered, dry location.

LONG-TERM STORAGE

Long-term storage is defined as more than two months, but less than 12 months. The procedure American-Marsh follows for long-term storage of pumps is given below. These procedures are in addition to the short-term procedure.

Solid wood skids are utilized. Holes are drilled in the skid to accommodate the anchor bolt holes in the base plate, or the casing and bearing housing feet holes on assemblies less base plate. Tackwrap sheeting is then placed on top of the skid and the pump assembly is placed on top of the Tackwrap. Metal bolts with washers and rubber bushings are inserted through the skid, the Tackwrap, and the assembly from the bottom of the skid and are then secured with hex nuts. When the nuts are “snugged” down to the top of the base plate or casing and bearing housing feet, the rubber bushing is expanded, sealing the hole from the atmosphere. Desiccant bags are placed on the Tackwrap. The Tackwrap is drawn up around the assembly and hermetically (heat) sealed across the top. The assembly is completely sealed from the atmosphere and the desiccant will absorb any entrapped moisture. A solid wood box is then used to cover the assembly to provide protection from the elements and handling. This packaging will provide protection up to twelve months without damage to mechanical seals, bearings, lip seals, etc. due to humidity, salt laden air, dust, etc. After unpacking, protection will be the responsibility of the user. Addition of oil to the bearing housing will remove the inhibitor. If units are to be idle for extended periods after addition of lubricants, inhibitor oils and greases should be used.



Every three months, the shaft should be rotated approximately 10 revolutions.

INSTALLATION & ALIGNMENT

FACTORY PRELIMINARY ALIGNMENT PROCEDURE

The purpose of factory alignment is to ensure that the user will have full utilization of the clearance in the motor holes for final job-site alignment. To achieve this, the factory alignment procedure specifies that the pump be aligned in the horizontal plane to the motor, with the motor foot bolts centered in the motor holes. This procedure ensures that there is sufficient clearance in the motor holes for the customer to field align the motor to the pump, to zero tolerance. This philosophy requires that the customer be able to place the base in the same condition as the factory. Thus the factory alignment will be done with the base sitting in an unrestrained condition on a flat and level surface. This standard also emphasizes the need to ensure the shaft spacing is adequate to accept the specified coupling spacer. The factory alignment procedure is summarized below:

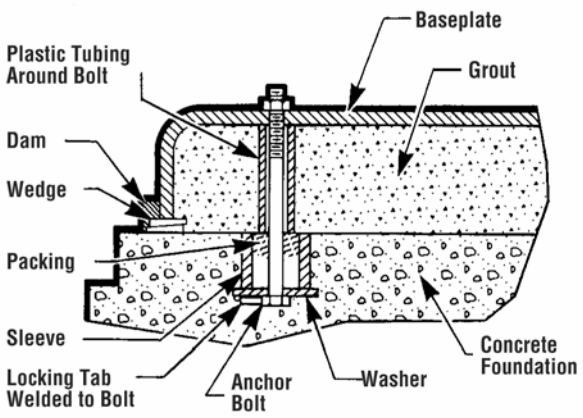
1. The base plate is placed on a flat and level work bench in a free and unstressed position.
2. The base plate is leveled as necessary. Leveling is accomplished by placing shims under the rails (or, feet) of the base at the appropriate anchor bolt hole locations. Levelness is checked in both the longitudinal and lateral directions.
3. The motor and appropriate motor mounting hardware is placed on the base plate and the motor is checked for any planar soft-foot condition. If any is present it is eliminated by shimming.
4. The motor feet holes are centered around the motor mounting fasteners.
5. The motor is fastened in place by tightening the nuts on two diagonal motor mounting studs.
6. The pump is put onto the base plate and leveled. The foot piece under the bearing housing is adjustable. It is used to level the pump, if necessary. If an adjustment is necessary, we add or delete shims between the foot piece and the pump housing.
7. The spacer coupling gap is verified.
8. The parallel and angular *vertical* alignment is made by shimming under the motor.
9. All four motor feet are tightened down.
10. The pump and motor shafts are then aligned *horizontally*, both parallel and angular, by *moving the pump* to the fixed motor. The pump feet are tightened down.
11. Both horizontal and vertical alignment are again final checked as is the coupling spacer gap.

RECOMMENDED PROCEDURE FOR BASE PLATE INSTALLATION & FINAL FIELD ALIGNMENT

NEW GROUTED BASE PLATES

1. The pump foundation should be located as close to the source of the fluid to be pumped as practical. There should be adequate space for workers to install, operate, and maintain the pump. The foundation should be sufficient to absorb any vibration and should provide a rigid support for the pump and motor. Recommended mass of a concrete foundation should be three times that of the pump, motor and base. Note that foundation bolts are imbedded in the concrete inside a sleeve to allow some movement of the bolt.
2. Level the pump base plate assembly. If the base plate has machined coplanar mounting surfaces, these machined surfaces are to be referenced when leveling the base plate. This may require that the pump and motor be removed from the base plate in order to reference the machined faces. If the base plate is without machined coplanar mounting surfaces, the pump and motor are to be left on the base plate. The proper surfaces to reference when leveling the pump base plate assembly are the pump suction and discharge flanges. DO NOT stress the base plate. Do not bolt the suction or discharge flanges of the pump to the piping until the base plate foundation is completely installed. If equipped, use leveling jackscrews to level the base plate. If jackscrews are not provided, shims and wedges should be used (see Figure 2). Check for levelness in both the longitudinal and lateral directions. Shims should be placed at all base anchor bolt locations, and in the middle edge of the base if the base is more than five feet long. Do not rely on the bottom of the base plate to be flat. Standard base plate bottoms are not machined, and it is not likely that the field mounting surface is flat.

FIGURE 2 – Base Plate Foundation



3. After leveling the base plate, tighten the anchor bolts. If shims were used, make sure that the base plate was shimmed near each anchor bolt before tightening. Failure to do this may result in a twist of the base plate, which could make it impossible to obtain final alignment. Check the level of the base plate to make sure that tightening the anchor bolts did not disturb the level of the base plate. If the anchor bolts did change the level, adjust the jackscrews or shims as needed to level the base plate. Continue adjusting the jackscrews or shims and tightening the anchor bolts until the base plate is level.
4. Check initial alignment. If the pump and motor were removed from the base plate proceed with step 5 first, then the pump and motor should be reinstalled onto the base plate using American-Marsh's Factory Preliminary Alignment Procedure, and then continue with the following. As described above, pumps are given a preliminary alignment at the factory. This preliminary alignment is done in a way that ensures that, if the installer duplicates the factory conditions, there will be sufficient clearance between the motor hold down bolts and motor foot holes to move the motor into final alignment. If the pump and motor were properly reinstalled to the base plate or if they were not removed from the base plate and there has been no transit damage, and also if the above steps where done properly, the pump and driver should be within 0.015 in (0.38 mm) FIM (Full Indicator Movement) parallel, and 0.0025 in/in (0.0025 mm/mm) FIM angular. If this is not the case first check to see if the driver mounting fasteners are centered in the driver feet holes. If not, recenter the fasteners and perform a preliminary alignment to the above tolerances by shimming under the motor for vertical alignment, and by moving the pump for horizontal alignment.
5. Grout the base plate. A non-shrinking grout should be used. Make sure that the grout fills the area under the base plate. After the grout has cured, check for voids and repair them. Jackscrews, shims and wedges should be removed from under the base plate at this time. If they were to be left in place, they could rust, swell, and cause distortion in the base plate.
6. Run piping to the suction and discharge of the pump. There should be no piping loads transmitted to the pump after connection is made. Recheck the alignment to verify that there are no significant loads.
7. Perform final alignment. Check for soft-foot under the driver. An indicator placed on the coupling, reading in the vertical direction, should not indicate more than 0.002 in (0.05 mm) movement when any driver fastener is loosened. Align the driver first in the vertical direction by shimming underneath its feet. When satisfactory alignment is obtained the number of shims in the pack should be minimized. It is recommended that no more than five shims be used under any foot. Final horizontal alignment is made by moving the driver. Maximum pump reliability is obtained by having near perfect alignment. American-Marsh recommends no more than 0.002 in (0.05mm) parallel, and 0.0005 in/in (0.0005 mm/mm) angular misalignment.
8. Operate the pump for at least an hour or until it reaches final operating temperature. Shut the pump down and recheck alignment while the pump is hot. Piping thermal expansion may change the alignment. Realign pump as necessary.

EXISTING GROUTED BASE PLATES

When a pump is being installed on an existing grouted base plate, the procedure is somewhat different from the previous section "New Grouted Base Plates."

1. Mount the pump on the existing base plate.
2. Level the pump by putting a level on the discharge flange. If not level, add or delete shims between the foot piece and the bearing housing.
3. Check initial alignment. (Step 4 above)
4. Run piping to the suction and discharge flanges of the pump. (Step 6 above)
5. Perform final alignment. (Step 7 above)

6. Recheck alignment after pump is hot. (Step 8 above)

All piping must be independently supported, accurately aligned and preferably connected to the pump by a short length of flexible piping. The pump should not have to support the weight of the pipe or compensate for misalignment. It should be possible to install suction and discharge bolts through mating flanges without pulling or prying either of the flanges. All piping must be tight. Pumps may air-bind if air is allowed to leak into the piping. If the pump flange(s) have tapped holes, select flange fasteners with thread engagement at least equal to the fastener diameter but that do not bottom out in the tapped holes before the joint is tight.

PRE-OPERATION CHECKS

Read and understand the instructions and recommendations contained in this manual.

Disconnect the coupling between the driver and pump.

Test the rotation of the driver to make sure it will operate the pump in the desired direction of rotation. Rotation is shown on the pump faceplate if the pump has an integral relief valve. When an integral relief valve is used, make sure it is positioned and adjusted as discussed in Section **DIRECTION OF ROTATION AND RELIEF VALVES** on page 15**.** After the unit is mounted and the piping is connected, the pump should be checked to be sure it operates freely without binding. After operation is proved satisfactory, both pump and driver should be tightly secured and the alignment rechecked before operation.

Before starting, make sure all guards are in place and the inlet and discharge valves are opened

After starting the unit, check to see that the pump is delivering liquid. If not, stop the driver immediately and refer to Section **TROUBLESHOOTING** on page 18. After the pump is delivering liquid, check the unit for excessive vibration, localized heating, and excessive shaft seal leakage. Check the pressure or vacuum by installing gauges at both the inlet and discharge sides of the pump to make sure the pressure or vacuum conforms to specifications.

⚠WARNING

If there is no pressure relief device in the system, NEVER block the discharge line. If there is a relief valve in the system, NEVER block the discharge line between the relief valve and the pump. High pressure will occur, resulting in possible damage or breakage to the pump or system parts and possible injury to personnel. DO NOT operate the pump for more than one minute with the discharge line blocked downstream of the relief valve. Rapid heating and possible damage will occur. Even an open discharge line does not prevent the possibility of high pressure. Discharge line length, diameter, and arrangement along with fluid viscosity and velocity also can create a high-pressure situation at the pump.

TRUCK MOUNTING

The mounting pads for truck mounted pumps must be rigid and properly aligned with the driver. When PTO drives are used, always check with the manufacturer of the PTO equipment to determine the alignment required for proper operation of the PTO and the type of guarding that must be used.

The GHB, HB, and H pumps are designed to be mounted by the feet. These pumps may be mounted with the feet in the three, nine, or twelve o'clock position as well as the standard six o'clock position. **DO NOT** use these pumps with a port type mount as is used with a GH-22 SBF pump.

The 3622 SBF pump is designed to be suspended by the top port. **DO NOT** suspend a GH-22 SBF by the side port.

The suspended truck mount assembly for the GH-22 SBF is designed to be bolted to the truck frame rails. The pump is then mounted to the pipe flange by the top port.

PIPING CONNECTION – SUCTION & DISCHARGE

All piping must be independently supported, accurately aligned and preferably connected to the pump by a short length of flexible piping. The pump should not have to support the weight of the pipe or compensate for misalignment. It should be possible to install suction and discharge bolts through mating flanges without pulling or prying either of the flanges. All piping must be tight. Pumps may air-bind if air is allowed to leak into the piping. If the pump flange(s) have tapped holes, select flange fasteners with thread engagement at least equal

to the fastener diameter but that do not bottom out in the tapped holes before the joint is tight.

⚠WARNING

Piping Forces: *Take care during installation and operation to minimize pipe forces and/or moments on the pump casing.*

SUCTION PIPING

To avoid NPSH and suction problems, suction pipe sizes must be at least as large as the pump suction connection. **Never** use pipe or fittings on the suction that are smaller in diameter than the pump suction size. In most cases, horizontal reducers should be eccentric and mounted with the flat side up with a maximum of one pipe size reduction. Never mount eccentric reducers with the flat side down. Horizontally mounted concentric reducers should not be used if there is any possibility of entrained air in the process fluid. Vertically mounted concentric reducers are acceptable. In applications where the fluid is completely deaerated and free of any vapor or suspended solids, concentric reducers are preferable to eccentric reducers.

Avoid the use of throttling valves and strainers in the suction line. Start up strainers must be removed shortly after start up. When the pump is installed below the source of supply, a valve should be installed in the suction line to isolate the pump and to permit pump inspection and maintenance. However, never place a valve directly on the suction nozzle of the pump.

Refer to the American-Marsh Pump Engineering Manual and the Centrifugal Pump IOM Section of the Hydraulic Institute Standards for additional recommendations on suction piping.

DISCHARGE PIPING

Install a valve in the discharge line. This valve is required for regulating flow and/or to isolate the pump for inspection and maintenance.

⚠WARNING

When fluid velocity in the pipe is high, for example, 10 ft/s (3 m/s) or higher, a rapidly closing discharge valve can cause a damaging pressure surge. A dampening arrangement should be provided in the piping.

PUMP AND SHAFT ALIGNMENT CHECK

After connecting piping, rotate the pump drive shaft clockwise (view from motor end) by hand several complete revolutions to be sure there is no binding and that all parts are free. Recheck shaft alignment. If piping caused unit to be out of alignment, correct piping to relieve strain on the pump.

MECHANICAL SEAL

When the pump is intended to be equipped with a mechanical seal, it is American-Marsh's standard practice to install the mechanical seal in the pump prior to shipment. Specific order requirements may specify that the seal be shipped separately, or none be supplied. It is the pump installer's responsibility to determine if a seal was installed. If a seal was supplied but not installed, the seal and installation instructions will be shipped with the pump.

⚠WARNING

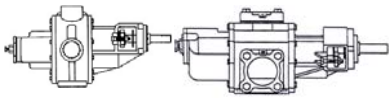
Failure to ensure that a seal is installed may result in serious leakage of the pumped fluid.

Seal and seal support system must be installed and operational as specified by the seal manufacturer.

The stuffing box/seal chamber/gland may have ports that have been temporarily plugged at the factory to keep out foreign matter. It is the installer's responsibility to determine if these plugs should be removed and external piping connected. Refer to the seal drawings and/or the local American-Marsh representative for the proper connections.

PACKING

When the pump is intended to be equipped with shaft packing, it is not American-Marsh's standard practice to install the packing in the stuffing box prior to shipment. The packing is shipped with the pump. It is the pump installer's responsibility to install the packing in the stuffing box.



BEARING LUBRICATION

Reasonable care and proper lubrication of American-Marsh Pump bearings will result in many years of service.

GREASE LUBRICATED BEARING

GH pumps can be supplied with grease packed bearings and are shipped from the factory pre-lubricated. Before the pump is started the bearings must be filled with Royal Purple NLGI #2 or other high quality equivalent grease.

DRIVER BEARINGS

Consult the driver manufacturer's maintenance instructions for lubricants and re-lubrication procedures for the driver.

COUPLING

A direction arrow is cast on the front of the casing and on the Bearing Housing. Make sure the motor rotates in the same direction before coupling the motor to the Pump.

⚠CAUTION

It is absolutely essential that the rotation of the motor be checked before connecting the shaft coupling. Incorrect rotation of the pump, for even a short time, can cause serious damage to the pump.

The coupling should be installed as advised by the coupling manufacturer. Pumps are shipped without the spacer installed. If the spacer has been installed to facilitate alignment, then it must be removed prior to checking rotation. Remove protective material from the coupling and any exposed portions of the shaft before installing the coupling.

⚠CAUTION

Make sure there is no chance of the driver becoming energized while aligning driver and pump. Getting caught in rotating parts of the drive system will cause serious personal injury or death. DO NOT start or operate pump without guards in place.

PUMP OPERATION

ROTATION CHECK

⚠CAUTION

It is absolutely essential that the rotation of the motor be checked before connecting the shaft coupling. Incorrect rotation of the pump, for even a short time, can damage the gears, casing, shaft and shaft seal.

BELTS AND SHEAVES

Some applications involving low discharge pressure and slow speeds may permit the mounting of the driven sheave directly on the pump shaft. However, it is recommended that all belt drive assemblies be designed with a separate jackshaft mounted on pillow blocks to carry the side loads of the sheaves and belts and a flexible coupling connecting the jackshaft to the pump shaft.

The driver and pump shafts must be parallel, and the belts at right angles to these shafts. Misalignment will cause undue belt wear, or turn-over in the grooves. *Approximate* alignment should be checked by placing along straight edge evenly across the rims of both sheaves. If the faces of the sheaves are not of equal width, the alignment may be checked by resting the straight edge across the rim of the widest sheave and measuring the distance from the straight edge to the nearest belt groove with a scale. Adjust either sheave on the shaft to equalize these dimensions.

The driver should be mounted with adequate provision for belt center distance adjustment. Provide a minus adjustment to permit belt installation without stretching and a plus allowance to provide belt take-up.

DO NOT pry, twist, or force the belts over the sheave grooves. This will damage the belts and greatly reduce the belt life. Shorten the drive by moving the driver enough to permit fitting the belts in the proper grooves. When the belts are in place, increase the center distance until proper belt tension is obtained. Adjust take-up until only a slight bow appears on the slack side of the drive when it is operating. All the belts must be pulling evenly. Belt tension should be reasonable. It is not necessary to have belts excessively tight.

During the first few days of operation, the belts will seat themselves in the sheave grooves. After that, the drive

must be adjusted to take up the slack. Slipping belts will result in lowered capacity. Squealing or smoking belts are sometimes a clue to the slipping of belts.

Keep belts clean and free from oil. Stop drive to clean belts. **DO NOT** attempt to clean belts while the drive is operating. Clean oily bests with a cloth dampened with soap and water. Never install new belts on the same drive with used belts. **DO NOT** use sheaves with chipped or worn grooves. For hazardous locations, check to see if an antistatic belt should be used. When purchasing replacement belts, the same size and type should be ordered as furnished originally.

POWER TAKE-OFF DRIVE SYSTEMS

When mounting a pump on a vehicle with a PTO drive, always check with the manufacturer of the PTO equipment to determine the alignment required for proper operation of the PTO. The mount for the pump must be rigid. The pump must be mounted the way it was designed to be mounted. SBF pumps must be mounted be the top flange only. DO NOT use the pump side port to mount an SBF pump. Pumps with feet must be mounted by the feet. DO NOT use the pump ports to mount a pump that has feet. It is acceptable to mount a foot mounted pump in the three, nine, or twelve o'clock position as well as the standard six o'clock position as long as proper shaft alignment is maintained.

Serious injuries and deaths have resulted from persons becoming caught in power take-off (PTO) drive systems. Loose or dangling clothing and slippery or unsure footing are factors in many PTO accidents. **DO NOT** work on or adjust a pump driven by a PTO drive system while it is operating or has a chance of the driver becoming energized except as specified in Section **DIRECTION OF ROTATION AND RELIEF VALVES** on page 15. Unless properly designed, guarded, and maintained, all drive systems are dangerous.

DO be careful near rotating PTO drive systems. Contacting a PTO drive system may cause serious injury or death.

DO install and maintain proper guard(s) for PTO drive systems.

DO NOT operate **PTO** drive systems without proper guards in place.

DO NOT work on or adjust a pump driven by a **PTO** drive system while it is operating or has a chance of the driver becoming energized except as specified in Section **DIRECTION OF ROTATION AND RELIEF VALVES** on page 15.

DO NOT work on a **PTO** drive system while it may become energized,

DO NOT wear loose or dangling clothing or jewelry near the equipment. It could become caught and possibly cause serious injury or death.

GUARDING PTO DRIVE SHAFTS

PTO drive systems can be dangerous and when used, additional safety precautions, including guarding, may be required and must be provided by the drive system installer. American-Marsh Pump Company has no responsibility for recommending or providing proper guarding or other safety measures in any particular application.

The installation of proper guards for the power take-off and its associated equipment is the responsibility of the drive system designer and the installer who know the particular product application and the user's exposure to danger. *The ultimate responsibility for the safe application and installation is the user's.*

ADDITIONAL IMPORTANT WARNINGS AND INFORMATION

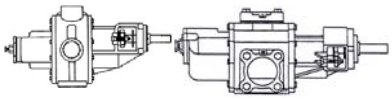
This manual contains general information concerning the use, inspection, adjustment, testing and safety considerations of the pump furnished. For certain applications and installations, other precautions and safety measures may be appropriate and are the responsibility of the product installer and user. Installers and users of this pump must have sufficient knowledge and training to apply sound safety and operating practices that may not be mentioned in the manual, and American-Marsh's sale of this pump is in reliance on such installer and user knowledge and training.

American-Marsh pumps are general-purpose pumps for a wide range of uses; yet, they are not designed nor intended for use with every known substance. Maximum ratings are shown in Section **MAXIMUM PUMP RATINGS** on page 6. American-Marsh sales brochures contain standard ratings.

Review this manual to determine the proper union of the pump into the total plant or system operating programs.

Unless designed, built, and used properly, systems may be unsafe or dangerous. Installers and users should check and comply with all applicable federal, state, local, and other regulations and recommendations such as: NFPA, UL, OSHA, API, etc.

In particular, installers and users must check the pumped liquid properties and take proper precautions. Among other things, consider the following:



Decide the results of spillage or leakage (all pumps or systems may fail sometime).

Explosion
Corrosion
Chemical Bums
High Pressure Spray
Toxic Exposure
Fire
Exposure to Extreme Temperatures
Environmental Impact
System Impact Other

Are proper safeguards being used?
Temperature Controls
Pressure Controls
Leak Detectors
Shutoff Devices
High or Low Pressure Safeguards
Alarm Devices
Overfill or Overflow Detection
Driver Overload Controls
Consider all possible methods and series of failure.
Are any other methods needed to control a hazard?
Regular scheduled inspection for the wear and tear of parts.

Identify all possible hazards. Decide upon and install the required controls. Only the installer and user can fully understand the product and system characteristics. *The ultimate responsibility for the safety of the application and the system characteristics is with the installer and end user.*

Particularly note the chance of fire and burns from flammable or hot liquid spillage from burst hoses and take proper precautions.

Properly guard all exposed rotating parts of the drive to the pump.
Install a pressure-relieving device in the system discharge piping to protect the equipment and crew from accident due to too much pressure. **NEVER** place a shutoff valve between the pump and system relief valve. Read Section **PRE-OPERATION CHECKS** on page 10.

Spillage or overflow, from overfilling or putting too much pressure on any component of a system incorporating this pump, may result in an accident. Proper measures and precautions must be taken to avoid spillage or overflow from overfilling or putting too much pressure on any component of the system. This includes the receiver and lines.

Prior to starting pump, read sections on **INSTALLATION & ALIGNMENT; INSTALLATION OF PIPES; THREADED PORT CONNECTIONS;** and **PREOPERATION CHECKS.**

INSTALLATION OF PIPES

DO NOT connect raised face flanges to the ports of a cast iron pump.

DO use flat faced flanges with cast iron pumps.

Piping must be installed and checked carefully.

Allow for any expansion or contraction.

Any external force or moment (torque or twist) applied on the pump ports by the piping will cause stresses in the pump and its foundation. This may cause misalignment that could result in hot bearings, worn couplings or excessive vibration. Such forces or moments may be caused by improperly aligned piping or by thermal expansion of the piping when pumping hot or cold fluids. The piping should be supported independently. Use flexible piping connectors and insure that they are properly anchored.

If an expansion joint is installed in the piping between the pump and the nearest point of anchor in the piping, a force equal to the area of the expansion joint (which may be considerably larger than the normal pipe size) times the pressure in the pipe will be transmitted directly to the pump. Pipe couplings that do not provide an axially rigid connection have the same effect. This reaction force can be so large that it would be impractical to design suitable components to withstand the force. If an expansion joint or non-rigid coupling is used, install a pipe anchor between it and the pump. If properly installed, this will eliminate the forces mentioned above.

The pump port size does not necessarily establish the correct pipe size. Piping must be sized and arranged to provide ample inlet pressure at the pump and to insure that the discharge pressure will be at least as low as the rated pressure of the pump. If the fluid to be pumped is viscous, or the piping long, or the suction lift or static discharge head somewhat high, piping one or two sizes larger may be required. Friction losses should be carefully calculated (see Hydraulic Institute Engineering Data Book or similar 'authority for friction loss data) and compared to the pump ratings) before the installation is made. Where valves are used in the piping system, gate, ball, or butterfly valves are preferable to globe or angle valves 90° long radius elbows or 45° elbows are preferable to standard short radius elbows. **NEVER** place a valve between the pump and system relief valve.

THREADED PORT CONNECTIONS

American National Standard Taper Pipe Threads (NPT) are standard for pipe plugs and threaded ports of the pump. British Standard Pipe Threads (BSP) are available upon request for most pump sizes.

To produce a pressure tight joint, a thread sealant must be used. TFE tape is generally not recommended where cast iron is used as one or more parts of the joint. The use of TFE tape for installing cast iron fittings may cause damage to the pump or fittings.

The following is a partial list of sealants that may be used when making up joints on the pump.

PST Pipe Sealant No.567 -Locite Corp.

Rectorseal No.5 -The Rectorseal Gorp .

Leak Lock- Highside Chemical, Inc.

Follow the sealant manufacturer's instructions when making up a joint.

DIRECTION OF ROTATION AND RELIEF VALVES

There are three types of integral relief valves available. The standard RV is designated by the letters "RV" in the pump nomenclature. The spec number is used to identify which RV relief valve is used.

STANDARD RV

This relief valve is externally adjustable by means of an adjusting screw located in the center of the relief valve cap. The range of adjustment is approximately 30 psi (207 kPa) to 125 psi (862 kPa). The actual capability is dependent on pump speed and liquid viscosity. The settings are for full bypass; that is, all of the fluid is circulating back to the inlet through the relief valve. The end user must set the relief valve for conditions that exactly match the application.

⚠WARNING

DO NOT REVERSE ROTATION

Reversing rotation of the pump without reversing the position of the relief valve faceplate will cause the relief valve to be inoperable. Discharge pressure will be holding the valve closed instead of pushing it open. Running the pump against the relief valve can cause very high pressure buildup on the discharge side of the pump and in the system downstream of the pump. High pressure can cause the pump or any other system component to break or leak causing liquid in the system to escape resulting in possible injury or death.

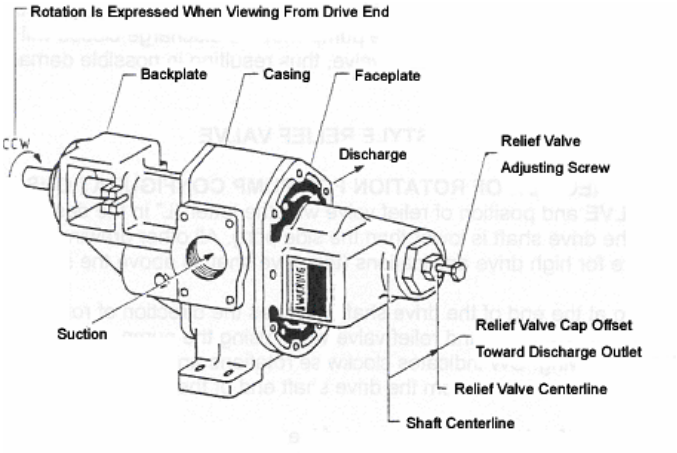


FIGURE 3 – Proper Pump Orientation

PUMP INLET AND PUMP DISCHARGE

On the RV style relief valve, either the “pump inlet” or “pump discharge” arrow will always point directly to one side port on the cases that have one side port and one top port. The top port is connected to the side of the pump that is opposite the side port. The “pump inlet” and “pump discharge” arrows will always point directly to the inlet and discharge ports on the pump with straight through port cases.

An integral relief valve should not be used on applications where the discharge must be closed for more than one minute. Prolonged operation of the pump with the discharge closed will cause rapid overheating of the liquid circulating through the relief valve, thus resulting in possible damage.

DIRECTION OF ROTATION FOR THE RV STYLE RELIEF VALVE

Figure 4 shows directions of rotation for pump configurations using the RV style relief valve. Views B, D, F & H are for low drive applications (the drive shaft is lower than the side port). Views A, C, E & G are for high drive applications (the drive shaft is above the side port).

The arrow in the drawing at the end of the drive shaft indicates the direction of rotation needed to achieve proper operation of the pump and relief valve when using the pump and relief valve orientation shown in the drawing. CW indicates clockwise rotations and CCW indicates counterclockwise rotation when viewed from the drive shaft end of the pump.

To determine the correct relief valve position for any of the pump orientations, use Figure 4 shown on page 16.

Find the group of Views with the proper drive shaft position (high or low drive). Views B, D, F & H are for low drive applications (the drive shaft is lower than the side port). Views A, C, E & G are for high drive applications (the drive shaft is above the side port). Eliminate all other drawings.

In the drawings remaining, find the group of drawings with the proper direction of rotation arrow at the end of the drive shaft. Eliminate all other drawings. CW indicated clockwise rotation and CCW indicates counterclockwise rotation when viewed from the drive shaft end of the pump. Views A, D, F & G are CW and Views B, C, E & H are CCW.

DO NOT operate a pump with a relief valve that is not positioned correctly. The relief valve will be inoperable. This can allow high pressure buildup on the discharge side of the pump and in the system downstream of the pump. High pressure can cause the pump or any other system component to break or leak causing liquid in the system to escape, resulting in possible injury or death.

NOTE: The fact that the pump has the correct rotation and pumps liquid in the correct direction does not insure that the relief valve is installed in the correct position, or that it has the correct setting for the application.

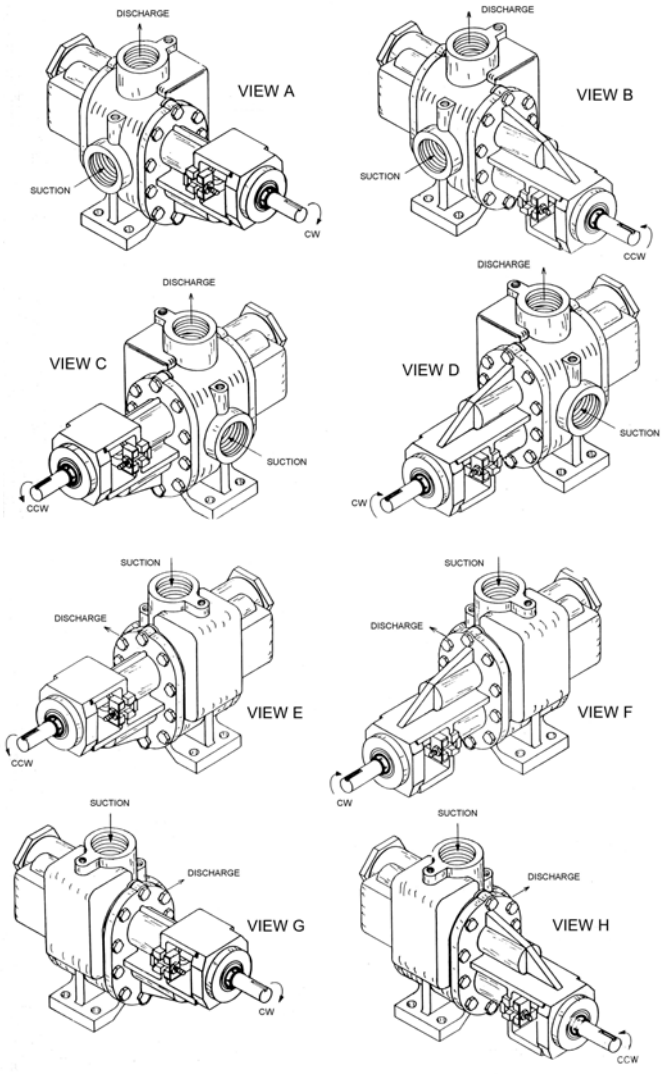


FIGURE 4 – Pump Rotation

PRE START-UP CHECKS

Prior to starting the pump it is essential that the following checks are made. These checks are all described in detail in the Maintenance Section of this booklet.

- Pump and Motor properly secured to the base plate
- All fasteners tightened to the correct torques
- Coupling guard in place and not rubbing
- Rotation check, see above
  THIS IS ABSOLUTELY ESSENTIAL.
- Shaft seal properly installed
- Seal support system operational
- Bearing lubrication
- Pump is primed
- Rotation of shaft by hand

As a final step in preparation for operation, it is important to rotate the shaft by hand to be certain that all rotating parts move freely, and that there are no foreign objects in the pump.

ENSURING PROPER $NPSH_A$

Net Positive Suction Head – Available ($NPSH_A$) is the measure of the energy in a liquid above the vapor pressure. It is used to determine the likelihood that a fluid will vaporize in the pump. It is critical because a gear pump is designed to pump a liquid, not a vapor. Vaporization in a pump will result in damage to the pump, deterioration of the Total Differential Head (TDH), and possibly a complete stopping of pumping.
Net Positive Suction Head – Required ($NPSH_R$) is the decrease of fluid energy between the inlet of the pump, and the point of lowest pressure in the pump. This decrease occurs because of friction losses and fluid accelerations in the inlet region of the pump, and particularly accelerations as the fluid enters the impeller vanes. The value for $NPSH_R$ for the specific pump purchased is given in the pump data sheet, and on the pump performance curve.

For a pump to operate properly the $NPSH_A$ must be greater than the $NPSH_R$. Good practice dictates that this margin should be at least 5 ft (1.5 m) or 20%, whichever is greater.

⚠CAUTION

Ensuring that $NPSH_A$ is larger than $NPSH_R$ by the suggested margin will greatly enhance pump performance and reliability. It will also reduce the likelihood of cavitation, which can severely damage the pump.

STARTING THE PUMP AND ADJUSTING FLOW

1. Open the suction valve to full open position. It is very important to leave the suction valve open while the pump is operating. Any throttling or adjusting of flow must be done through the discharge valve. Partially closing the suction valve can create serious NPSH and pump performance problems.

⚠DANGER

Never operate pump with both the suction and discharge valves closed. This could cause an explosion.

2. A standard gear pump will not move liquid unless the pump is primed. A pump is said to be "primed" when the casing and the suction piping are completely filled with liquid. Open discharge valve a slight amount. This will allow any entrapped air to escape and will normally allow the pump to prime, if the suction source is above the pump. When a condition exists where the suction pressure may drop below the pump's capability, it is advisable to add a low pressure control device to shut the pump down when the pressure drops below a predetermined minimum.
3. All cooling, heating, and flush lines must be started and regulated.
4. Start the driver (typically, the electric motor).
5. Slowly open the discharge valve until the desired flow is reached, keeping in mind the minimum flow restrictions listed above.

⚠DANGER

It is important that the discharge valve be opened within a short interval after starting the driver. Failure to do this could cause a dangerous build up of heat, and possibly an explosion.

6. *Reduced capacity*
   Avoid running a centrifugal pump at drastically reduced capacities or with discharge valve closed for extended periods of time. This can cause severe temperature rise and the liquid in the pump may reach its boiling point. If this occurs, the mechanical seal will be exposed to vapor, with no lubrication, and may score or seize to the stationary parts. Continued running under these conditions when the suction valve is also closed, can create an explosive condition due to the confined vapor at high pressure and temperature. Thermostats may be used to safeguard against over heating by shutting down the pump at a predetermined temperature.

   Safeguards should also be taken against possible operation with a closed discharge

valve, such as installing a bypass back to the suction source. The size of the bypass line and the required bypass flow rate is a function of the input horsepower and the allowable temperature rise.

OPERATION IN SUB-FREEZING CONDITIONS

When using the pump in sub-freezing conditions where the pump is periodically idle, the pump should be properly drained or protected with thermal devices which will keep the liquid in the pump from freezing.

SHUTDOWN CONSIDERATIONS

When the pump is being shutdown, the procedure should be the reverse of the start-up procedure. First, slowly close the discharge valve, shutdown the driver, then close the suction valve. Remember, closing the suction valve while the pump is running is a safety hazard and could seriously damage the pump and other equipment.

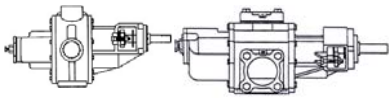
TROUBLESHOOTING

The following is a guide to troubleshooting problems with American-Marsh pumps. Common problems are analyzed and solutions are offered. Obviously, it is impossible to cover every possible scenario. If a problem exists that is not covered by one of the examples, then contact a local American-Marsh Sales Engineer or Distributor/Representative for assistance.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED REMEDY
Problem #1 Pump not reaching design flow rate.	1.1 Insufficient $NPSH_A$. (Noise may not be present)	Recalculate NPSH available. It must be greater than the NPSH required by pump at desired flow. If not, redesign suction piping, holding number of elbows and number of planes to a minimum to avoid adverse flow rotation as it approaches the pump.
	1.2 Pump not primed.	Open all suction valves to ensure that liquid is being delivered to the pump.
	1.3 Suction lift too high.	Reconfigure suction piping or move the pump closer to the liquid level.
	1.4 Inlet pipe not submerged.	Reconfigure suction piping.
	1.5 Viscosity of liquid too high.	1. Reconfigure piping layout. 2. Select a larger pump.
	1.6 Direction of rotation wrong.	After confirming wrong rotation, reverse any two of three leads on a three phase motor. The pump should be disassembled and inspected before it is restarted.
	1.7 Faulty pressure relief valve in system.	Replace faulty pressure relief valve.
	1.8 Plugged pump, suction line or casing which may be due to a product or large solids.	1. Reduce length of fiber when possible. 2. Reduce solids in the process fluid when possible. 3. Consider larger pump.
	1.9 Wet end parts (casing, gears) worn, corroded or missing.	Replace part or parts.
Problem #2.0 Pump not reaching design head (TDH).	2.1 Refer to possible causes under Problem #1.0.	Refer to remedies listed under Problem #1.0 and #3.0.
Problem #3.0 No discharge or flow	3.1 Not properly primed.	Repeat priming operation, recheck instructions. If pump has run dry, disassemble and inspect the pump before operation.
	3.2 Direction of rotation wrong.	After confirming wrong rotation, reverse any two of three leads on a three phase motor. The pump should be disassembled and inspected before operation.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED REMEDY
Cont. Problem #3.0 No discharge or flow	3.3 Entrained air. Air leak from atmosphere on suction side.	Refer to recommended remedy under Problem #1.0, Item #1.3.
	3.4 Plugged pump, suction line or casing which may be due to a fibrous product or large solids.	Refer to recommended remedy under Problem #1.0, Item #1.8.
	3.5 Damaged pump shaft, gear.	Replace damaged parts.
Problem #4.0 Pump operates for short period, then loses prime.	4.1 Insufficient NPSH.	Refer to recommended remedy under Problem #1.0, Item #1.1.
	4.2 Entrained air. Air leak from atmosphere on suction side.	Refer to recommended remedy under Problem #1.0, Item #1.3.
Problem #5.0 Excessive noise from wet end.	5.1 Cavitation - insufficient NPSH available.	Refer to recommended remedy under Problem #1.0, Item #1.1.
	5.2 Abnormal fluid rotation due to complex suction piping.	Redesign suction piping, holder number of elbows and number of planes to a minimum to avoid adverse fluid rotation as it approaches the impeller.
	5.3 Gears rubbing.	1. Check pump assembly for axial end play.
	5.4 Relief valve chatter.	1. Re-set pressure relief valve. 2. Disassemble and rebuild pressure relief valve.
Problem #6.0 Excessive noise from power end.	6.1 Bearing contamination appearing on the raceways as scoring, pitting, scratching, or rusting caused by adverse environment and entrance of abrasive contaminants from atmosphere.	1. Work with clean tools in clean surroundings. 2. Remove all outside dirt from housing before exposing bearings. 3. Handle with clean dry hands. 4. Treat a used bearing as carefully as a new one. 5. Use clean solvent and flushing oil. 6. Protect disassembled bearing from dirt and moisture. 7. Keep bearings wrapped in paper or clean cloth while not in use. 8. Clean inside of housing before replacing bearings. 9. Check oil seals and replace as required. 10. Check all plugs and tapped openings to make sure that they are tight.
	6.2 Brinelling of bearing identified by indentation on the ball races, usually caused by incorrectly applied forces in assembling the bearing or by shock loading such as hitting the bearing or drive shaft with a hammer.	When mounting the bearing on the drive shaft use a proper size ring and apply the pressure against the inner ring only. Be sure when mounting a bearing to apply the mounting pressure slowly and evenly.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED REMEDY
Cont. Problem #6.0 Excessive noise from power end.	6.3 False brinelling of bearing identified again by either axial or circumferential indentations usually caused by vibration of the balls between the races in a stationary bearing.	1. Correct the source of vibration. 2. Where bearings are oil lubricated and employed in units that may be out of service for extended periods, the drive shaft should be turned over periodically to re-lubricate all bearing surfaces at intervals of one-to three months.
	6.5 Misalignment identified by fracture of ball retainer or a wide ball path on the inner race and a narrower cocked ball path on the outer race. Misalignment is caused by poor mounting practices or defective drive shaft. For example bearing not square with the centerline or possibly a bent shaft due to improper handling.	Handle parts carefully and follow recommended mounting procedures. Check all parts for proper fit and alignment.
	6.6 Bearing damaged by electric arcing identified as electro-etching of both inner and outer ring as a pitting or cratering. Electrical arcing is caused by a static electrical charge eminating from belt drives, electrical leakage or short circuiting.	1. Where current shunting through the bearing cannot be corrected, a shunt in the form of a slip ring assembly should be incorporated. 2. Check all wiring, insulation and rotor windings to be sure that they are sound and all connections are properly made. 3. Where pumps are belt driven, consider the elimination of static charges by proper grounding or consider belt material that is less generative.
	6.7 Bearing damage due to improper lubrication, identified by one or more of the following: 1. Abnormal bearing temperature rise. 2. A stiff cracked grease appearance. 3. A brown or bluish discoloration of the bearing races.	1. Be sure the lubricant is clean. 2. Be sure proper amount of lubricant is used. The constant level oiler supplied with REF pumps will maintain the proper oil level if it is installed and operating properly. In the case of greased lubricated bearings, be sure that there is space adjacent to the bearing into which it can rid itself of excessive lubricant, otherwise the bearing may overheat and fail prematurely. 3. Be sure the proper grade of lubricant is used.



MAINTENANCE

PREVENTIVE MAINTENANCE

The following sections of this manual give instructions on how to perform a complete maintenance overhaul. However, it is also important to periodically repeat the "Pre start-up checks" listed on page 13. These checks will help extend pump life as well as the length of time between major overhauls.

NEED FOR MAINTENANCE RECORDS

A procedure for keeping accurate maintenance records is a critical part of any program to improve pump reliability. There are many variables that can contribute to pump failures. Often long term and repetitive problems can only be solved by analyzing these variables through pump maintenance records.

NEED FOR CLEANLINESS

One of the major causes of pump failure is the presence of contaminants in the bearing housing. This contamination can be in the form of moisture, dust, dirt and other solid particles such as metal chips. Contamination can also be harmful to the mechanical seal (especially the seal faces) as well as other parts of the pumps. For example, dirt in the impeller threads could cause the impeller to not be seated properly against the shaft. This, in turn, could cause a series of other problems. For these reasons, it is very important that proper cleanliness be maintained. Some guidelines are listed below.

After draining the oil from the bearing housing, periodically send it out for analysis. If it is contaminated, determine the cause and correct. The work area should be clean and free from dust, dirt, oil, grease, etc. Hands and gloves should be clean. Only clean towels, rags, and tools should be used.

INSTRUCTIONS FOR DRAINING PUMP

Refer to the Figures 8, 9 & 10 on pages 38, 39 & 40.

⚠WARNING

Relieve all internal fluid and air pressure inside the pump before attempting to drain the pump.

Take necessary precautions to prevent the pump from becoming energized while draining the pump.

Take necessary precautions to prevent injury or physical damage that could be caused by any loss of the product being pumped while draining the pump.

The extent to which a pump can be drained is dependent upon the product being pumped. Low viscosity products such as solvents will drain quickly and easily. High viscosity products such as molasses and tar will drain very slowly. Also, the draining of high viscosity products will be less complete.

Regardless of the product pumped, the areas at the blind end of the bearing bores and the mechanical seal chamber will not drain.

1. Read sections on **SAFETY PRECAUTIONS** and **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION** before starting draining procedure.
2. There are two pipe plugs (#22) in the faceplate (Figure 8, #34 or #35 / Figure 9, #33 or #34). Remove one that is in lowest position.
3. Rotate drive shaft very slowly by hand. Each time that flow from drain increases, stop turning shaft until flow stops; then resume until flow increases again. Be sure to rotate shaft several complete revolutions in each direction until all flow from drain has stopped.
4. Reinstall and tighten pipe plug(s).

CHANGING THE RV STYLE RELIEF VALVE POSITION

Refer to the Figures 8, 9 & 10 on pages 38, 39 & 40.

⚠WARNING

DO NOT *remove the relief valve cap (Figure 8, #41 or Figure 9, #38) without reading the instructions below for disassembling the relief valve. The relief valve contains a powerful compressed spring (Figure 8, #38 or Figure 9, #42) that may cause injury or death if released suddenly.*

⚠WARNING

Relieve all internal fluid and air pressure inside the pump before disassembly

Take necessary precautions to prevent the pump from rotating while working on the relief valve.

Fluid may spill out of the pump when the relief valve faceplate (Figure 8, #35 & 9, #34) is removed. Take all necessary precautions to protect yourself, others, and the nearby area from any harm this fluid may do.

You should have already checked the Views from Figure 4 on page 16 to find the correct way to position your relief valve, based on the pump's direction of shaft rotation and position and the location of the inlet and discharge ports. If you have not checked, do it now to decide whether or not you should change the position of our relief valve.

If the relief valve position needs to be changed, follow the instructions below and refer to Figure 4.

FOR GH-11, GH-17 & GH-22 PUMPS (FIGURE 8)

1. Turn off pump and lock out energy source to driver.
2. Close suction and discharge valves.

To drain pump, follow procedure in Section **INSTRUCTIONS FOR DRAINING PUMP** on page 23.

3. Remove two washer head cap screws and eight hex head cap screws (#2) securing the faceplate (#35) to the casing (#28). Remove the faceplate (#35).
4. While viewing the faceplate (#35) from end with relief valve cap (#41), turn the faceplate so that orientation of relief valve cap to pump matches direction of rotation drawing previously selected from Figure 4 on page16.
5. Install two hollow dowel pins (#8) on faceplate end of casing (#28) if they were removed during disassembly. Place appropriate number of case gaskets (#7) on end of casing (#28). Align the faceplate (#35) on hollow dowel pins (#8), maintaining proper orientation as determined above. Secure the faceplate (#35) to the casing (#28) using two washer head cap screws and eight hex head cap screws (#2).

FOR GH-48 PUMPS (FIGURE 9)

1. Turn off pump and lock out energy source to driver.
2. Close suction and discharge valves.

To drain pump, follow procedure in Section **INSTRUCTIONS FOR DRAINING PUMP** on page 23.

3. Remove two washer head cap screws and eight hex head cap screws (#1) securing faceplate (#34) to the casing (#26). Remove the faceplate (#34).
4. While viewing the faceplate (#34) from end with relief valve cap (#38), turn the faceplate so that orientation of relief valve cap to pump matches direction of rotation drawing previously selected from Figure 4 on page 16.
5. Install two hollow dowel pins (#6) on faceplate end of casing (#26) if they were removed during disassembly. Place appropriate number of case gaskets (#7) on end of casing (#26). Align the faceplate (#34) on hollow dowel pins (#7), maintaining proper orientation as determined above. Secure the faceplate (#34) to the casing (#26) using two washer head cap screws and eight hex head cap screws (#1).

DISASSEMBLY OF RV STYLE RELIEF VALVE

Refer to the Figures 8, 9 & 10 on pages 39, 40 & 41.

⚠WARNING

DO NOT *remove the relief valve cap (Figure 8, #41 or Figure 9, #38) without reading the instructions below for disassembling the relief valve. The relief valve contains a powerful compressed spring (Figure 8, #38 or Figure*

9, #42) that may cause injury or death if released suddenly.

⚠WARNING

Relieve all internal fluid and air pressure inside the pump before disassembly

Take necessary precautions to prevent the pump from rotating while working on the relief valve.

Fluid may spill out of the pump when the relief valve faceplate (Figure 8, 35 & 9, #34) is removed. Take all necessary precautions to protect yourself, others, and the nearby area from any harm this fluid may do.

FOR GH-11, GH-17 & GH-22 PUMPS (FIGURE 8)

1. Turn off pump and lock out energy source to driver.
2. Close suction and discharge valves.

To drain pump, follow procedure in Section **INSTRUCTIONS FOR DRAINING PUMP** on page 23.

3. Decrease pressure on spring (#38) by loosening lock and seal nut (#42 & #43) and unscrewing adjusting screw (#43) until adjusting screw turns freely.
4. After decreasing pressure on spring (#38), remove the relief valve cap (#41) by unscrewing it from the faceplate (#35). Remove the relief valve cap gasket (#40).
5. Remove the spring (#38), poppet (36), spring washer (#37) and spring guide (#39).

Inspect all parts and replace worn or damaged parts as required.

FOR GH-48 PUMPS (FIGURE 9)

1. Turn off pump and lock out energy source to driver.
2. Close suction and discharge valves.

To drain pump, follow procedure in Section **INSTRUCTIONS FOR DRAINING PUMP** on page 23.

3. Decrease pressure on spring (#36) by loosening lock and seal nut (#40 & #41) and unscrewing adjusting screw (#41) until adjusting screw turns freely.
4. After decreasing pressure on spring (#38), remove the relief valve cap (#41) by unscrewing three hex head cap screws (#43) from the faceplate (#34). Remove the relief valve cap o-ring (#37).
5. Remove the springs (#42 & #36), poppet (35), and spring guide (#35).

Inspect all parts and replace worn or damaged parts as required.

ASSEMBLY OF RV STYLE RELIEF VALVE

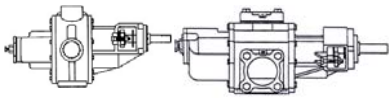
FOR GH-11, GH-17 & GH-22 PUMPS (FIGURE 8)

1. Install poppet (#36) into faceplate (#35).
2. Install the spring (#38) into the faceplate (#35) making sure that spring is centered on the poppet (#36) and resting on the spring washer (#37).
3. Place the pilot of the spring guide (#39) into the I.D. of the spring (#38).
4. Screw the adjusting screw (#43) with lock and seal nut (#42) assembled into hole in relief valve cap (#41).
5. Place the relief valve cap gasket (#40) onto the relief valve cap (#41).
6. Place the small end of the adjusting screw (#43) into the hole in the spring guide (#39) and screw the relief valve cap (#40) into the faceplate (#35).

FOR GH-48 PUMPS (FIGURE 9)

1. Install poppet/spring guide (#35) into faceplate (#34).
2. Install the spring (#36 or #42) into the faceplate (#34) making sure that spring is centered on the poppet/spring guide (#35).
3. Place the pilot of the poper/spring guide (#35) into the I.D. of the spring (#29).
4. Screw the adjusting screw (#41) with lock and seal nut (#40) assembled into hole in relief valve cap (#38).
5. Place the relief valve cap o-ring (#37) onto the relief valve cap (#38).
6. Place the small end of the adjusting screw (#41) into the hole in the spring guide (#35) and screw the relief valve cap (#38) into the faceplate (#34).

Adjust relief valve by following steps below on how **TO ADJUST THE RV STYLE RELIEF VALVE**.



TO ADJUST THE RV STYLE RELIEF VALVE

Refer to the Figures 8, 9 & 10 on pages 39, 40 & 41.

⚠WARNING

Take necessary precautions to prevent personal injury or physical damage that could be caused by any loss of the product being pumped while adjusting the relief valve. ***DO NOT*** *adjust the relief valve without coupling guards in place.*

The relief valve must be adjusted under conditions identical to the operating conditions (viscosity, rpm, etc.)

FOR GH-11, GH-17 & GH-22 PUMPS (FIGURE 8)

1. Connect a pressure gauge near pump in discharge line between pump and point where discharge line will be closed.
2. Loosen the locknut (#42) on the adjusting screw (#43).
3. Back adjusting screw (#43) out to point where end of adjusting screw will be 1-¾ inches (44.5 mm) from plug cap (#41).
4. **WARNING! DO NOT** start the pump until all rotating shafts and couplings are properly guarded. After all rotating shafts and couplings are properly guarded. Start the pump and close the discharge line slowly. **DO NOT** exceed the pressure rating of pump or other equipment between the pump and the discharge line valve. If this pressure is reached while closing the discharge valve, **DO NOT** close any further. **DO NOT** run the pump with a closed discharge line for more than one minute at a time.
5. With discharge valve closed, turn adjusting screw clockwise in ½ turn increments until pressure gauge shows desired pressure setting.
6. Tighten locknut (#42).
7. Open discharge line and turn off pump.

FOR GH-48 PUMPS (FIGURE 9)

1. Connect a pressure gauge near pump in discharge line between pump and point where discharge line will be closed.
2. Loosen the locknut (#40) on the adjusting screw (#41).
3. Back adjusting screw (#41) out to point where end of adjusting screw will be 1-½ inches (38 mm) from plug cap (#38).
4. **WARNING! DO NOT** start the pump until all rotating shafts and couplings are properly guarded. After all rotating shafts and couplings are properly guarded. Start the pump and close the discharge line slowly. **DO NOT** exceed the pressure rating of pump or other equipment between the pump and the discharge line valve. If this pressure is reached while closing the discharge valve, **DO NOT** close any further. **DO NOT** run the pump with a closed discharge line for more than one minute at a time.
5. With discharge valve closed, turn adjusting screw clockwise in ½ turn increments until pressure gauge shows desired pressure setting.
6. Tighten locknut (#40).
7. Open discharge line and turn off pump.

JACKETED PUMPS

Jacketed faceplates and backplates are available on GH helical gear series pumps. They look similar to the standard non-jacketed ones described in this manual except for the four threaded taps on the jacketed faceplates and backplates. Two of the four taps are piped as inlet and outlet for the heating or cooling medium. It is recommended that steam, when used, be piped into the jacket from a top tap and out through a bottom tap. Liquid, when used, should be piped into the jacket from a bottom tap and out a top tap. In addition to the two taps on both endplates not used for piping, two ¼" NPT taps on the jacketed backplate are provided to facilitate clean out of scale.

The heating or cooling medium should be steam or a non-corrosive, non-clogging liquid. A steam medium is limited to 350°F (177°C) maximum. A liquid medium is limited to 450°F (232°C) maximum. The jacketing is limited to 125 psi (862 kPa) maximum.

⚠WARNING

Other special parts will be required to operate at temperatures up to 450°F (232°C).

The jacketed RV style relief valve faceplate, similar to non-jacketed, must have the adjusting screw offset toward the discharge side of the pump.

CONVERTING FROM HIGH DRIVE TO LOW DRIVE

Prior to operating the pump, make sure that the shaft rotation, pipe connections, and the relief valve position are in accordance with the appropriate illustrations shown in Figure 4 on page16. In order to change the rotation and/or piping orientation, it may be necessary to remove the piping from the pump or the pump from the mounting.

Whenever changing rotation, inspect all parts before reassembly. Replace all worn parts and install new gaskets in appropriate numbers as removed.

FOR GH-11, GH-17 & GH-22 PUMPS (FIGURE 8)

1. Remove coupling or universal joint and drive key (#30) from drive shaft (#31). Remove all burrs and sharp edges from drive shaft and keyway.
2. To reverse pump rotation and keep piping arrangement the same, the drive shaft (#31) position must be changed. Follow steps 3 -10.

   To reverse pump rotation and leave drive shaft (#31) and casing (#28) in same position; liquid flow through pump will be reversed. Follow steps 11 -12.

   To change port to opposite side on pumps with a right angle port arrangement and maintain same pump rotation, follow steps 13 -20.

   To change port to opposite side, maintain same pump rotation and drive shaft (#31) in same position; liquid flow through pump will be reversed. Follow steps 21 -26.

REVERSE ROTATION, SAME PIPING ARRANGEMENT

3. To reverse the pump rotation and keep the piping arrangement the same, it is necessary to change from high drive to low drive or low drive to high drive or vice versa.
4. Remove two washer head cap screws and eight hex head cap screws (#2) securing the backplate (#6) to casing (#28) and separate backplate assembly (#6) from casing assembly (#28). On “H”, the drive gear (#32) will pullout with the backplate assembly. On HB, SB and GHB pumps, the drive gear (#32) may remain in case assembly.
5. Switch the drive gear (#32) and idler gear/shaft (#33 & #29) positions in casing (#28).
6. Position appropriate number of case gaskets (#7) on casing (#28) (oil or grease may be used to hold gaskets in place).
7. Rotate backplate (#6) assembly 180°.
8. Slide the drive shaft (#31) and gear key (#30) into shaft hole of drive gear (#32).
9. Slide the backplate (#6) assembly into position and secure.
10. On GH series pumps with gear reduction unit, mount oil cup (Figure 10, #AB) in top hole in gear case (Figure 10, #44) and petcock (Figure 10, #AC) in second hole from bottom.

REVERSE ROTATION, SAME DRIVE SHAFT AND CASE ARRANGEMENT

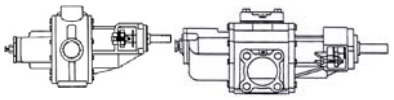
11. To reverse flow of liquid through pump ports, reverse rotation of drive shaft (#31), maintain the original positions of the drive shaft and casing (#28) or vice versa.
12. On pumps with relief valve, relief valve faceplate (#35) must be removed and rotated 180° and remounted.

CHANGE PORT AND DRIVE SHAFT LOCATION, SAME ROTATION

13. To change the port to the opposite side and maintain same pump rotation, change drive shaft (#31) from high drive to low drive.
14. Remove two washer head cap screws and eight hex head cap screws (#2) securing backplate (#6) to casing (#28) and separate backplate assembly (#6) from casing assembly (#28). On GH “H” pumps, the drive gear (#32) will pull out with the backplate assembly. On HB, SB and GHB pumps, the drive gear (#32) may remain in case assembly.
15. Remove the faceplate (#34 or #35).
16. Rotate the casing (#28) 180°, (front to back).
17. Switch the drive gear (#32) and idler gear/shaft (#33 & #29) positions in casing (#28).
18. If a plain faceplate (#34) is used, remount to the casing (#28) in same position. If a relief valve faceplate (#35) is used, rotate the faceplate (#35) 180° and remount to the casing (#28).
19. Rotate the backplate (#6) assembly 180° and remount on casing (#28).
20. On pumps with gear reduction unit, mount oil cup (Figure 10, #AB) in top hole of gear case (Figure 10, #44) and petcock (Figure 10, #AC) on next bottom hole.

SAME ROTATION, CHANGE PORT LOCATION, SAME DRIVE SHAFT LOCATION

21. To change port to opposite side, maintain same pump rotation and drive shaft (#32) in same position; the flow of liquid through the pump will be reversed.
22. Remove two washer head cap screws and eight hex head cap screws (#2) securing the backplate (#6) to the casing (#28) and separate backplate assembly (#6) from casing assembly (#28). On GH “H” pumps, the drive gear (#32) may remain in casing assembly (#28).
23. Remove the faceplate (#34 or #35).
24. Remove the casing (#28) and rotate 180° (front to back).
25. Remount and secure casing (#28) to faceplate (#34 or #35).
26. Remount the backplate (#6) assembly to casing (#28).



FOR GH-48 PUMPS (FIGURE 9)

1. Remove coupling or universal joint and drive key (#29) from drive shaft (#28). Remove all burrs and sharp edges from drive shaft and keyway.
2. To reverse pump rotation and keep piping arrangement the same, the drive shaft (#28) position must be changed. Follow steps 3 -10.

   To reverse pump rotation and leave drive shaft (#28) and casing (#26) in same position; liquid flow through pump will be reversed. Follow steps 11 -12.

   To change port to opposite side on pumps with a right angle port arrangement and maintain same pump rotation, follow steps 13 -20.

   To change port to opposite side, maintain same pump rotation and drive shaft (#28) in same position; liquid flow through pump will be reversed. Follow steps 21 -26.

REVERSE ROTATION, SAME PIPING ARRANGEMENT

3. To reverse the pump rotation and keep the piping arrangement the same, it is necessary to change from high drive to low drive or low drive to high drive or vice versa.
4. Remove two washer head cap screws and eight hex head cap screws (#1) securing the backplate (#5) to casing (#26) and separate backplate assembly (#5) from casing assembly (#26). On “H”, the drive gear (#31) will pullout with the backplate assembly. On HB, SB and GHB pumps, the drive gear (#31) may remain in case assembly.
5. Switch the drive gear (#31) and idler gear/shaft (#32 & #27) positions in casing (#26).
6. Position appropriate number of case gaskets (#7) on casing (#26) (oil or grease may be used to hold gaskets in place).
7. Rotate backplate (#5) assembly 180°.
8. Slide the drive shaft (#28) and gear key (#29) into shaft hole of drive gear (#31).
9. Slide the backplate (#5) assembly into position and secure.
10. On GH series pumps with gear reduction unit, mount oil cup (Figure 10, #AB) in top hole in gear case (Figure 10, #44) and petcock (Figure 10, #AC) in second hole from bottom.

REVERSE ROTATION, SAME DRIVE SHAFT AND CASE ARRANGEMENT

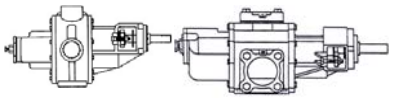
11. To reverse flow of liquid through pump ports, reverse rotation of drive shaft (#28), maintain the original positions of the drive shaft and casing (#26) or vice versa.
12. On pumps with relief valve, relief valve faceplate (#34) must be removed and rotated 180° and remounted.

CHANGE PORT AND DRIVE SHAFT LOCATION, SAME ROTATION

13. To change the port to the opposite side and maintain same pump rotation, change drive shaft (#28) from high drive to low drive.
14. Remove two washer head cap screws and eight hex head cap screws (#1) securing backplate (#5) to casing (#26) and separate backplate assembly (#5) from casing assembly (#26). On GH “H” pumps, the drive gear (#32) will pull out with the backplate assembly. On HB, SB and GHB pumps, the drive gear (#32) may remain in case assembly.
15. Remove the faceplate (#33 or #34).
16. Rotate the casing (#26) 180°, (front to back).
17. Switch the drive gear (#31) and idler gear/shaft (#32 & #27) positions in casing (#28).
18. If a plain faceplate (#33) is used, remount to the casing (#26) in same position. If a relief valve faceplate (#34) is used, rotate the faceplate (#34) 180° and remount to the casing (#26).
19. Rotate the backplate (#5) assembly 180° and remount on casing (#26).
20. On pumps with gear reduction unit, mount oil cup (Figure 10, #AB) in top hole of gear case (Figure 10, #44) and petcock (Figure 10, #AC) on next bottom hole.

SAME ROTATION, CHANGE PORT LOCATION, SAME DRIVE SHAFT LOCATION

21. To change port to opposite side, maintain same pump rotation and drive shaft (#28) in same position; the flow of liquid through the pump will be reversed.
22. Remove two washer head cap screws and eight hex head cap screws (#1) securing the backplate (#5) to the casing (#26) and separate backplate assembly (#5) from casing assembly (#26). On GH “H” pumps, the drive gear (#31) may remain in casing assembly (#26).
23. Remove the faceplate (#33 or #34).
24. Remove the casing (#26) and rotate 180° (front to back).
25. Remount and secure casing (#26) to faceplate (#33 or #34).
26. Remount the backplate (#5) assembly to casing (#26).



PUMP DISASSEMBLY

Refer to the parts list shown in Figures 8, 9 & 10 on pages 39, 40 & 41 for item number references used throughout this section.

1. Read sections on **SAFETY PRECAUTIONS** and **ADDITIONAL IMPORT ANT WARNINGS AND INFORMATION** before starting to disassemble pump. While disassembling pump, always inspect disassembled parts and adjacent parts to see if further disassembly is needed. Replace worn or damaged parts as required. Read sections on replacement parts.
2. If you do not know which pump arrangement you have, collect nameplate data and refer to Section **NAMEPLATE DATA** on page 5, to determine what you have. Consult an American-Marsh distributor or American-Marsh Pump Company if you have any questions.
3. When cleaning or lubricating, use only cleaning solutions and lubricants that are compatible with products being pumped and with sealing elastomers. **DO NOT** use petroleum base products with seals with EPR elastomers. Use a non-petroleum base lubricant with EPR elastomers.
4. Turn off pump and lock out energy source to driver. **DO NOT** proceed further with disassembly of pump if there is the slightest possibility that driver may be started.
5. If used, turn off and disconnect flush from mechanical seal.
6. Close suction and discharge valves.
7. Remove coupling guard and disconnect coupling between driver and pump.
8. Drain suction and discharge lines. Disconnect lines from pump inlet and discharge.
9. Follow the procedure in Section **INSTRUCTIONS FOR DRAINING PUMP** on page 23.
10. To continue disassembly:
    a. For GH “H,” “HB” and "SBFO" pumps, follow steps 11- 20
    b. For GH "GHB" pumps, follow steps 31-42.

FOR GH-11, GH-17 & GH-22 PUMPS (FIGURE 8)

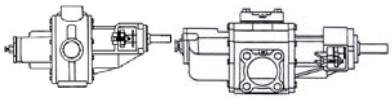
11. Remove two washer head cap screws and eight hex head cap screws (#2) securing the faceplate (#34 or #35) to casing (#28). Remove faceplate (#34 or #35).
12. Remove the two dowel pins (#8) from casing.
13. Remove casing gaskets (#7).
14. A) On “H” pumps, remove the faceplate end retaining ring from drive shaft (#31). Remove drive gear (#32) and key (#30). Remove backplate end retaining ring.
    B) On “HB” and “SBF” pumps, remove drive gear (#32) and key (#30) from drive shaft (#31).
15. Remove idler gear (#33) and key (#30) from idler shaft (#29). Remove idler shaft (#29).
16. Remove two washer head cap screws and eight hex head cap screws (#2) securing backplate (#6) to casing (#28) and separate parts.
17. Remove case gaskets (#7) from opposite side of casing (#28).
18. Remove two dowel pins (#8) from opposite side of casing (#28).
19. Remove drive key (#30) from drive shaft (#31).
20. A) To continue disassembly:
    a. For GH “H”, follow steps 21 -24.
    b. For GH “HB” pumps, follow steps 25-30.
    c. For GH “GHB” gear reduction unit, follow steps 31 -42.

FOR GH-11, GH-17 & GH-22 “H” PUMPS (FIGURE 8)

21. Remove two locknuts (#9) from studs (#17) securing packing gland packing gland clip (#10) and packing gland (#11) in place.
22. Remove packing rings (#14) and packing washer (#15). Remove lantern ring if used Packing hooks are commercially available to assist in removal of packing rings.
23. Remove drive shaft (#31). Clean drive shaft (#31) and adjacent parts. Examine drive shaft (#31). Replace drive shaft (#31) if excessively worn or scored.
24. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets ((#7), if applicable) be installed each time pump is disassembled and reassembled.

FOR GH-11, GH-17 & GH-22 “HB” PUMPS (FIGURE 8)

25. Remove retaining ring from backplate (#6).
26. Loosen setscrews (#5) in ball bearing (#4). Remove ball bearing (#4).
27. Remove two locknuts (#9) from square head bolts (#12) securing packing gland (#11) in place. Remove packing gland clip (#10), packing gland (#11), spring clip (#13), and two square head bolts (#12).
28. Remove packing rings (#14) and packing washer (#15). Remove lantern ring if used. Packing hooks are commercially available to assist in removal of packing.
29. Remove drive shaft (#31). Clean drive shaft (#31) and adjacent parts. Examine drive shaft (#31). Replace drive shaft (#31) if excessively worn or scored.



30. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets (#7, if applicable) be installed each time pump is disassembled and reassembled.

FOR GH-11, GH-17 & GH-22 "GHB" GEAR REDUCTION UNIT PUMPS (FIGURE 10)

31. Drain oil from gear reduction unit.
32. Remove drive key (#A). Remove four hex head cap screws (#U) and slide seal retainer (#37) assembled with lip seal (#39) off end of pinion shaft (#42).
33. Remove seal retainer gasket (#38) between seal retainer (#37) and gear case (#44).
34. Remove pinion shaft (#42) assembly with ball bearing (#41) and retaining ring (#40).
35. Remove six hex head cap screws (#W), twelve flat washers (#X), and six lockwashers (#Y).
36. Remove gear case (#44). Remove gear case gasket (#48).
37. Remove needle bearing (#43). This bearing is installed with a press fit.
38. Remove retaining ring (#45).
39. Remove drive gear (#46). A gear puller may be necessary in removing gear, as a close fit is maintained between gear and shaft.
40. Remove drive gear key (#Z).
41. Remove four socket head cap screws (#AD) securing cover (#49) to backplate (#6). Remove cover gasket (#7).
42. Remove spacer (#47).

FOR GH-48 PUMPS (FIGURE 9)

11. Remove two washer head cap screws and eight hex head cap screws (#1) securing the faceplate (#33 or #34) to casing (#26). Remove faceplate (#33 or #34).
12. Remove the two dowel pins (#6) from casing.
13. Remove casing gaskets (#7).
14. A) On "H" pumps, remove the faceplate end retaining ring from drive shaft (#28). Remove drive gear (#31) and key (#30). Remove backplate end retaining ring.
    B) On "HB" and "SBF" pumps, remove drive gear (#31) and key (#30) from drive shaft (#28).
15. Remove idler gear (#32) and key (#30) from idler shaft (#27). Remove idler shaft (#27).
16. Remove two washer head cap screws and eight hex head cap screws (#1) securing backplate (#5) to casing (#26) and separate parts.
17. Remove case gaskets (#7) from opposite side of casing (#26).
18. Remove two dowel pins (#6) from opposite side of casing (#26).
19. Remove drive key (#30) from drive shaft (#28).
20. A) To continue disassembly:
    a. For GH "H", follow steps 21 -24.
    b. For GH "HB" pumps, follow steps 25-30.
    c. For GH "GHB" gear reduction unit, follow steps 31 -42.

FOR GH-48 "H" PUMPS (FIGURE 9)

21. Remove two locknuts (#8) from studs (#11) securing packing gland packing gland clip (#9) and packing gland (#10) in place.
22. Remove packing rings (#13) and packing washer (#14). Remove lantern ring if used Packing hooks are commercially available to assist in removal of packing rings.
23. Remove drive shaft (#28). Clean drive shaft (#28) and adjacent parts. Examine drive shaft (#28). Replace drive shaft (#28) if excessively worn or scored.
24. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets ((#7), if applicable) be installed each time pump is disassembled and reassembled.

FOR GH-48 "HB" PUMPS (FIGURE 9)

25. Remove retaining ring from backplate (#5).
26. Loosen setscrews (#4) in ball bearing (#3). Remove ball bearing (#3).
27. Remove two locknuts (#8) from square head bolts (#11) securing packing gland (#10) in place. Remove packing gland clip (#9), packing gland (#10), spring clip (#12), and two square head bolts (#11).
28. Remove packing rings (#13) and packing washer (#14). Remove lantern ring if used. Packing hooks are commercially available to assist in removal of packing.
29. Remove drive shaft (#28). Clean drive shaft (#28) and adjacent parts. Examine drive shaft (#28). Replace drive shaft (#28) if excessively worn or scored.
30. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new gaskets (#7, if applicable) be installed each time pump is disassembled and reassembled.

FOR GH-48 "GHB" GEAR REDUCTION UNIT PUMPS (FIGURE 10)

31. Drain oil from gear reduction unit.
32. Remove drive key (#A). Remove four hex head cap screws (#U) and slide seal retainer (#37) assembled with lip seal (#39) off end of pinion shaft (#42).

33. Remove seal retainer gasket (#38) between seal retainer (#37) and gear case (#44).
34. Remove pinion shaft (#42) assembly with ball bearing (#41) and retaining ring (#40).
35. Remove six hex head cap screws (#W), twelve flat washers (#X), and six lockwashers (#Y).
36. Remove gear case (#44). Remove gear case gasket (#48).
37. Remove needle bearing (#43). This bearing is installed with a press fit.
38. Remove retaining ring (#45).
39. Remove drive gear (#46). A gear puller may be necessary in removing gear, as a close fit is maintained between gear and shaft.
40. Remove drive gear key (#Z).
41. Remove four socket head cap screws (#AD) securing cover (#49) to backplate (#5). Remove cover gasket (#7).
42. Remove spacer (#47).

BEARING REMOVAL AND INSTALLATION

BEARING REMOVAL

Pump bearings are available in bronze, iron, carbon, and glass/graphite impregnated PTFE. Any of these bearings may be removed using a Snap-On® tool puller, part number CG45. This tool may be purchased through your local tool dealer or through American-Marsh Pump Company. If you do not have this bearing puller, any of the bearings may be removed by using a hacksaw blade to cut through the bearing in two places 180° apart. This procedure will usually loosen the bearing enough to be pulled out. If this procedure is used, take care to prevent damage to the bore into which the bearing is pressed.

Carbon bearings may also be removed by carefully chipping the bearing out with a chisel. Take care not to scar the endplate bores during the bearing removal process.

⚠WARNING

DO NOT chisel bearings without wearing proper safety glasses.

After removing the bearings, always check the endplate bores for nicks and burrs caused by the removal process. The bores must be clean, smooth, and free of burrs before attempting to install new bearings.

BEARING INSTALLATION

1. Remove all burrs and raised edges from bores for bearings.
2. Place faceplate or backplate on a press base with milled face upward. Support endplate so that milled face is perpendicular (square) with press ram.
3. Position end plate so that one bearing bore is located directly under press ram.
4. A) If iron or bronze bearings are to be installed, lubricate endplate bores with a light oil that is compatible with product to be pumped.
   B) If carbon bearings are to be installed, lubricate bearings by submerging them in cold water prior to installation.
   C) If glass/graphite filled PTFE bearings are to be installed, no lubricant should be used
5. Place end of new bearing at entrance of bore in endplate, taking care to align grooves in bearing with the grooves in face of endplate.
6. Press bearing into endplate bore. *When carbon bearings are being installed, it is important* to *press them in with one slow uninterrupted stroke* to *prevent cracking.* It is best to use a stepped arbor with a few thousandths of an inch clearance between arbor and bore of bearing. Be sure to press bearings in until they are flush to 0.005 of an inch (0.127 mm) below milled face of endplate.
7. Repeat procedure for second bearing.
8. Using a three square file, file shallow grooves in ends of bearings to connect grooves inside bearings with groove on milled face of endplate. If your bearings or end plates do not have grooves, omit this step.

INSTRUCTIONS FOR PUMP ASSEMBLY

Refer to the parts list shown in Figures 8, 9 & 10 on pages 39, 40 & 41 for item number references used throughout this section.

Refer to Section **DIRECTION OF ROTATION AND RELIEF VALVES** on page 15, to assure proper configuration for pump rotation, port location, and relief valve position prior to assembling pump.

FOR GH-11, GH-17 & GH-22 PUMPS (FIGURE 8)

1. Read instructions on **REPLACEMENT PARTS, THREADED PORT CONNECTIONS, SHAFT SEALING,** and **SAFETY PRECAUTIONS** before assembling pump. Visually inspect all parts during assembly. Replace all worn or damaged parts. Although they may appear reusable, it is recommended that new gaskets (#7, if applicable) and lip seals be installed when pump is being reassembled.

WARNING! Only use genuine American-Marsh gaskets. Gasket thickness determines proper clearances. Always check quantity of gaskets removed and replace with exact quantity. Proper material must be used based on application.

2. When cleaning or lubricating, only use products that are compatible with product being pumped and elastomers within pump. **DO NOT** use petroleum base products with seals with EPR elastomers. Clean and lubricate parts with light oil unless EPR elastomers are used. Use a nonpetroleum base lubricant with EPR elastomers.
3. Mechanical seals are precision pieces of equipment. Use extreme care not to damage seal faces or elastomers during assembly.
4. Install two hollow dowel pins (#8) on each side of casing (#28 or #47). Place appropriate number of case gaskets (#7) on faceplate side of casing (#28 or #47). Align faceplate (#34 or #35) on hollow dowel pins (#8). Secure faceplate (#34 or #35) to casing using two washer head cap screws and eight hex head cap screws (#2).
5. Place idler gear (#33) into case bore. Install key (#30) in keyway on idler shaft (#29). Slide idler shaft into (#29) into I.D. of idler gear (#33).
6. A) For GH "H" pumps with shaft packing, follow steps 7- 15.
   B) For GH "HB" and GH "SBFO" pumps with shaft packing, follow steps 16 -25.

FOR GH-11, GH-17 & GH-22 "H" PUMPS (FIGURE 8)

7. Install backplate end retaining ring on drive shaft. Install key (30) on drive shaft. Slide drive gear (#32) onto drive shaft (#31). Install faceplate end retaining ring on drive shaft to secure drive gear.
8. Place appropriate number of case gaskets (#7) on backplate side of casing (#28 or #47). Slide drive gear (#32) assembled with drive shaft (#31) and backplate (#6) into case bore. Align backplate (#6) on hollow dowel pins (#8). Secure backplate (#6) to casing (#28 or #47) using two washer head cap screws and eight hex head cap screws (#2).
9. Install packing washer (#15) over drive shaft (#31) and into packing bore of backplate (#6).
10. Install packing rings (#14) and lantern ring, if used, in backplate bore. Stagger joints on each packing ring 180° apart. Seat each ring before adding next ring. Rings must not be tamped or seated too tightly.
11. Check drive shaft (#31) for free movement after each ring is installed.
12. When packing box is sufficiently full to allow entry of packing gland (#11) about ¼ of an inch (6 mm), reassemble packing gland.
13. Install studs (#12) into backplate (#6). Insert packing gland (#11) into packing box about ¼ of and inch (6 mm). Slide packing gland clip (#10) over studs (#12). Using two locknuts (#9), secure packing gland (#11) in place. Draw locknuts up evenly on packing gland to assure proper seating of packing (#14), then loosen locknuts (#9) about ¼ turn. **DO NOT** cock packing gland. This could cause binding or heating of drive shaft.
14. Install drive key (#30).
15. Read sections on **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION, THREADED PORT CONNECTIONS, INSTALLATION OF PIPES, PREOPERATION CHECKS, SHAFT SEALING,** and **ALIGNING DRIVER AND PUMP** before installing and operating pump.

FOR GH-11, GH-17 & GH-22 "HB" PUMPS (FIGURE 8)

16. Place drive gear (#32) into case bore. Install key (#30) in keyway of drive shaft (#31). Slide drive shaft (#31) into bore of drive gear (#32).
17. Place appropriate number of case gaskets (#7) on backplate side of case (#28 or #47). Align backplate (#6) on dowel pins (#8). Secure backplate (#6) to casing (#28 or #47) using two washer head cap screws and eight hex head cap screws (#2).
18. Install packing washer (#15) over drive shaft (#31) into packing bore of backplate (#6).
19. Install packing rings (#14) and lantern ring, if used, in packing bore of backplate (#6). Stagger joints on each packing ring 180° apart. Seat each ring before adding next ring. Rings must not be tamped or seated too tightly.
20. Check drive shaft (#32) for free movement after each ring is installed.
21. When packing box is sufficiently full to allow entry of packing gland (#11) about ¼ of an inch (6 mm), reassemble packing gland.
22. Place one square head bolt (#12) through each slot in backplate (#6) and through each hole in packing gland (#11). Install packing gland (#11) into packing box about ¼ of an inch (6 mm). Slide packing gland clip (#10) over square head bolts (#12). Using two locknuts (#9), secure packing gland (#11) in place. Install spring clip (#13) across square head bolts (#12). Draw locknuts up evenly on packing gland to assure proper seating of packing (#14), then loosen locknuts about ½ turn. **DO NOT** cock packing

gland. This could cause binding or heating of drive shaft.

23. Install ball bearing (#4) on drive shaft (#31) and into backplate (#6) as shown in the sectional drawing on page 38. The bearings are pre-lubricated and do not require lubrication at time of initial installation. A small amount of grease will be required during regular maintenance. Align setscrews in inner race of ball bearing with wide groove in shaft. Tighten setscrews (#5) in ball bearing (#4) to secure bearing to drive shaft (#31). Install retaining ring (#3) into backplate (#6) to secure ball bearing (#4) to backplate.
24. Install drive key (#30).
25. Read sections on **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION, THREADED PORT CONNECTIONS, INSTALLATIONOF PIPES, PREOPERATION CHECKS, SHAFT SEALING, AND ALIGNING DRIVER AND PUMP** before installing and operating pump.

FOR GH-48 "H" PUMPS (FIGURE 9)

16. Install backplate end retaining ring on drive shaft. Install key (#30) on drive shaft. Slide drive gear (#31) onto drive shaft (#28). Install faceplate end retaining ring on drive shaft to secure drive gear.
17. Place appropriate number of case gaskets (#7) on backplate side of casing (#26). Slide drive gear (#31) assembled with drive shaft (#28) and backplate (#5) into case bore. Align backplate (#5) on hollow dowel pins (#6). Secure backplate (#5) to casing (#26) using two washer head cap screws and eight hex head cap screws (#1).
18. Install packing washer (#14) over drive shaft (#28) and into packing bore of backplate (#5).
19. Install packing rings (#13) and lantern ring, if used, in backplate bore. Stagger joints on each packing ring 180° apart. Seat each ring before adding next ring. Rings must not be tamped or seated too tightly.
20. Check drive shaft (#28) for free movement after each ring is installed.
21. When packing box is sufficiently full to allow entry of packing gland (#10) about ¼ of an inch (6 mm), reassemble packing gland.
22. Install studs (#11) into backplate (#5). Insert packing gland (#10) into packing box about ¼ of and inch (6 mm). Slide packing gland clip (#9) over studs (#11). Using two locknuts (#8), secure packing gland (#10) in place. Draw locknuts up evenly on packing gland to assure proper seating of packing (#13), then loosen locknuts (#8) about ¼ turn. **DO NOT** cock packing gland. This could cause binding or heating of drive shaft.
23. Install drive key (#29).
24. Read sections on **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION, THREADED PORT CONNECTIONS, INSTALLATION OF PIPES, PREOPERATION CHECKS, SHAFT SEALING,** and **ALIGNING DRIVER AND PUMP** before installing and operating pump.

FOR GH-48 "HB" PUMPS (FIGURE 9)

25. Place drive gear (#31) into case bore. Install key (#30) in keyway of drive shaft (#28). Slide drive shaft (#28) into bore of drive gear (#31).
26. Place appropriate number of case gaskets (#7) on backplate side of case (#26). Align backplate (#5) on dowel pins (#6). Secure backplate (#5) to casing (#26) using two washer head cap screws and eight hex head cap screws (#1).
27. Install packing washer (#14) over drive shaft (#28) into packing bore of backplate (#5).
28. Install packing rings (#13) and lantern ring, if used, in packing bore of backplate (#5). Stagger joints on each packing ring 180° apart. Seat each ring before adding next ring. Rings must not be tamped or seated too tightly.
29. Check drive shaft (#28) for free movement after each ring is installed.
30. When packing box is sufficiently full to allow entry of packing gland (#10) about ¼ of an inch (6 mm), reassemble packing gland.
31. Place one square head bolt (#11) through each slot in backplate (#5) and through each hole in packing gland (#10). Install packing gland (#10) into packing box about ¼ of an inch (6 mm). Slide packing gland clip (#9) over square head bolts (#11). Using two locknuts (#8), secure packing gland (#10) in place. Install spring clip (#12) across square head bolts (#11). Draw locknuts up evenly on packing gland to assure proper seating of packing (#13), then loosen locknuts about ½ turn. **DO NOT** cock packing gland. This could cause binding or heating of drive shaft.
32. Install ball bearing (#3) on drive shaft (#28) and into backplate (#5) as shown in the sectional drawing on page 39. The bearings are pre-lubricated and do not require lubrication at time of initial installation. A small amount of grease will be required during regular maintenance. Align setscrews in inner race of ball bearing with wide groove in shaft. Tighten setscrews (#4) in ball bearing (#3) to secure bearing to drive shaft (#28). Install retaining ring (#2) into backplate (#5) to secure ball bearing (#3) to backplate.
33. Install drive key (#29).
34. Read sections on **ADDITIONAL IMPORTANT WARNINGS AND INFORMATION, THREADED PORT CONNECTIONS, INSTALLATIONOF**

PIPES, PREOPERATION CHECKS, SHAFT SEALING, AND ALIGNING DRIVER AND PUMP before installing and operating pump.

GEAR REDUCTION UNIT (FIGURE 10)

ALIGNING GHB PINION SHAFT HEIGHT

Refer to the parts list shown in Figure 10 on page 40 for item number references used throughout this section.

The pinion shaft of the GHB gear reducer can be positioned at any location over a full 360°. This must be done before the gear reducer oil is added. The pinion shaft can be positioned in the following manner.

1. Loosen six hex head cap screws (#W).
2. Rotate gear case (#44) on six slots in cover (#49).
3. If pinion shaft (#42) cannot be moved to proper position at this point, remove six hex head cap screw (#W) along with washer (#X & #Y).
4. Rotate pinion shaft to desired position and reinstall and tighten six hex head cap screws (#W) along with six flat washers (#X) and six lockwashers (#Y).
5. If six threaded holes in gear case (#44) are not fully visible within cast slots on cover (#49), gear reducer will have to be partially disassembled so that cover (#49) can be rotated.
6. Slide gear case (#44) off of cover (#49).
7. Remove retaining ring (#45) from end of pump drive shaft (#28 or #31).
8. Remove drive gear (#46). A gear puller may be necessary.
9. Remove four socket head cap screws (#AD).
10. Rotate cover (#49) 90° and reinstall and tighten four socket head cap screws
11. Install drive gear (#46) on drive shaft (#28 or #31).
12. Install retaining ring (#45).
13. Replace gasket (#48) and slip gear case (#44) complete with pinion assembly onto cover (#49).
14. Rotate pinion to desired position and install and tighten six hex head cap screws (#W) along with six flat washers (#X) and six lockwashers (#Y).
15. If necessary, reposition plugs (#AA), petcock (#AC), and oil cup (#AB). Oil cup should be at uppermost point and petcock at second hole from bottom.
16. Refill with oil to level of petcock (#AC) using Gulf® Senate 375, Mobile® 600 W Cylinder Oil or AGMA No.7 compounded oil.

LUBRICATION INSTRUCTIONS FOR INITIAL START - UP

The oil cup (#AB) is shipped separate to prevent breakage. Before placing the gear reduction unit in operation, install the oil cup (#AB) and check the oil level in unit. The oil level should be maintained even with petcock (#AC) at all times.

SERVICING INSTRUCTIONS

The oil should be clean and free from sludge at all times and should be changed at regular intervals. A drain plug (#AA) has been provided near the bottom of the gear case (#44) for this purpose. The oil (Gulf® Senate 374, Mobil® 600 W Cylinder Oil, or AGMA NO.7 compounded oil) should be changed every 1000 hours or every four months, whichever comes first. Where operating conditions are severe, such as rapid rise and fall of temperature, or the atmosphere is moist or dusty, it may be necessary to change the oil every one or two months or sooner. The oil cup (#AB) at the front of gear case (#44) is for filling the unit with oil and also serves as a breather. **DO NOT** allow the oil cup (#AB) to become clogged. This could cause excessive pressure inside the gear case (#44).

CHANGING RATIO OF GEAR REDUCTION UNIT

Refer to appropriate sectional drawing on page 40 showing internal construction of the gear reduction assembly. The internal construction for all ratios are identical, except for the drive gear (#46) and pinion shaft (#42), which determines the gear ratio of that particular unit. The drive gear (#46) and pinion shaft (#42) are interchangeable in pairs only. See page 38 for ratios available. It is recommended that new gaskets (#8 & #48) and new lip seal (#39) be installed each time unit is disassembled and reassembled.

1. Turn off pump and lock out energy source to driver. **DO NOT** proceed further with disassembly of gear reduction unit if there is slightest possibility that driver may be started.
2. Drain oil from gear reduction unit.
3. If unit is assembled on a baseplate, directly connected to a motor, it will be necessary to remove flexible coupling as follows:
    a. Loosen setscrew on motor half of coupling.
    b. Slide motor coupling half towards motor to clear pump coupling half. (In case coupling cannot be removed in this manner it will be necessary to remove either motor or pump in order to remove pump coupling half).
4. Loosen six hex head cap screws (#W) and rotate gear case (#44) in slots provided until

pump coupling half is clear of motor coupling half.

5. Remove pump coupling half.
6. Remove drive key (#A). Remove four hex head cap screws (#U) and four lockwashers (#V). Slide seal retainer (#37) assembled with lip seal (#39) off the end of pinion shaft (#42).
7. Remove seal retainer gasket (#38) between seal retainer (#37) and gear case (#44).
8. Remove pinion shaft (#42) assembly with ball bearing (#41) and retaining ring (#40).
9. Remove six hex head cap screws (#W), twelve fiat washers (#X) and six lockwashers (#Y).
10. Remove gear case (#44). Remove gear case gasket (#48).
11. Remove retaining ring (#48).
12. **Remove drive gear (#46). A gear puller may be necessary in removing gear, as** a **close fit is maintained between gear and shaft.**
13. Refer to gear ratio chart on page 38 to select desired gear ratio.
14. Slide drive gear (#46) on drive shaft (#32) securing in place using retaining ring (#45). Make sure key (#Z) and spacer (#47) are in place. The number of teeth or part number is stamped on drive gear (#46). On standard units, last two numbers of part number represent number of teeth on gear.
15. Install gear case (#44) and gear case gasket (#48) using six hex head cap screws (#W), twelve flat washers (#X), and six lockwashers (#Y).
16. Press ball bearing (#41) onto pinion shaft (#42) and Install retaining ring (#40).
17. Install pinion shaft assembly by sliding small end of pinion shaft into needle bearing (#43) at same time gears are meshed together.
18. Slide bearing retainer (#37) assembled with lip seal (#39) and bearing retainer gasket (#38) into place. Secure bearing retainer (#37) to gear case (#44) using four hex head cap screws (#U) and four lockwashers (#V).
19. Install drive key (#A).
20. Install pump coupling half and tighten setscrews on drive key (#A).
21. Rotate gear case (#44) until coupling halves are accurately aligned. Tighten six hex head cap screws (#W). Assemble coupling and tighten setscrew in motor coupling half.
22. Refill with oil to level of petcock (#AC) using Gulf® Senate 375, Mobil® 600 W Cylinder Oil, or AGMA No.7 compounded oil.

SHAFT SEALING

STANDARD COMPRESSION PACKING

One type of shaft sealing used in these pumps is formed ring packing with or without a lantern ring. When using a packed box pump, use formed packing rings. **DO NOT** use a one piece spiral wrap of packing. Packing rings are available in a wide selection of materials for various applications and temperatures. Previous experience with the pumped fluid is the best guide in selecting the proper packing ring material for your particular application.

Some backplates are furnished with tapped holes on the stuffing box to provide access to the lantern ring or packing set for either flushing or grease lubrication. An external flush or lubrication of the packing may be necessary for proper operation and to help prolong the life of the packing and shaft.

A flush is recommended when the fluid to be pumped is abrasive or the pump operates with negative inlet pressure (suction lift). Clean water is often used to flush the packing. On applications where clean water is not available or where it is incompatible with the fluid being pumped, other clean, non-hazardous liquids may be used for flushing the packing. The flush should be supplied to the stuffing box at a rate of ¼ to ½ gallons per hour (1 to 2 liters per hour). The pressure of the flushing liquid should exceed the sum of the inlet pressure and half of the differential pressure by 10 to 15 psi (70 to 100 kPa).

If the packing is to be grease lubricated, a good grade of bearing grease should generally be used. Should bearing grease be unacceptable or incompatible with the fluid being pumped, another paste type lubricant may be used. Lubrication of the packing must be performed with the pump stopped. Before daily start-up, if applicable, is a good time.

To lubricate the packing, stop the pump. Carefully clean the stuffing box pipe plugs of any contaminants. After removing the pipe plugs from the stuffing box, install a lubrication fitting into one of the tapped holes. Lubricant now may be injected into the stuffing box through the lube fitting. Inject clean, fresh unused lubricant until it is seen coming out of the other tapped hole. Clean up any excess lubricant and remove the lube fitting. Replace the pipe plugs. This procedure should be performed daily, prior to start-up if the pump is purchased with provisions for grease lubrication. In certain applications, more frequent lubrication of the packing may be necessary. Experience will provide a guide as to how frequently the packing should be lubricated. Applying

lubricant often will extend the life of the packing and shaft.

CARE OF PACKING

DO NOT work on or adjust packing while the pump is running.

If truck mounted, DISENGAGE the PTO or hydraulic drive and shut off the engine

If motor driven, TURN OFF motor and lock out the energy source.

CLOSE VALVES on the inlet and discharge while working on the pump

Packing hooks are commercially available to help in removing packing rings from the stuffing box. It is generally not recommended to reuse old packing rings. When installing packing, use formed packing rings. **DO NOT** use a one piece spiral wrap of packing. Before installing packing, carefully clean the stuffing box and shaft.

Packing rings should be installed one ring at a time, with the joints of adjacent rings staggered approximately 180°. Each ring should be seated firmly before the next ring is installed. **DO NOT** forget to install the lantern ring, if applicable. Three rings of packing, followed by the lantern ring, should allow the lantern ring to be approximately aligned with the flush/lube holes in the stuffing box.

The packing gland nuts should first be evenly tightened with a wrench to seat the packing firmly in the stuffing box and against the shaft. **DO NOT** over-tighten the packing. The gland nuts should then be backed off until finger-tight. Connect the flush or lubricate the packing if either method is used. After the pump is started, note the amount of leakage from the stuffing box. If the packing leakage exceeds ten drops per minute, stop the pump and adjust the gland nuts. The gland nuts should be adjusted evenly in 1/6 to 1/3 turn (1 to 2 flats on the nut) increments. Start the pump and allow it to operate for several minutes. Again, visually examine the stuffing box for excessive leakage. Repeat the above procedure until the stuffing box leakage is between five to ten drops per minute.

DO NOT over-tighten the packing. Slight leakage is a necessary requirement for proper packing operation. Leakage of five to ten drops per minute when the pump is operating is desirable, as it will preserve the packing and avoid scoring of the shaft. Over-tight packing may score shafts, increase torque requirements of the pump, damage couplings and drivers, and generate excessive heat.

The pump should be stopped and the packing gland adjusted whenever leakage exceeds ten drops per minute. The condition of the packing should be checked at regular intervals, the frequency depending on the type of service. Experience will dictate how frequently the inspections should be made.

SPECIAL DRY RUNNING PACKING (GARLOCK® DSA PACKING)

DO NOT work on or adjust packing while the pump is running.

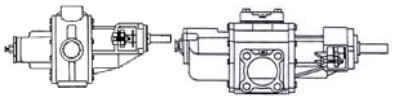
If truck mounted, DISENGAGE the PTO or hydraulic drive and shut off the engine.

If motor driven, TURN OFF motor and lock out the energy source.

CLOSE VALVES on the inlet and discharge while working on the pump.

INSTALLATION AND INITIAL ADJUSTMENT

1. The installation tool may only be used prior to the installation of the outboard ball bearing or when the outboard ball bearing has been removed from the pump.
2. Lubricate I.D. of braided rings with thin film of supplied break-in lubricant.
3. Install the packing rings one at a time with the joints of adjacent rings staggered 90°.
4. Push each ring firmly in place before installing the next ring.
5. The packing nuts (Figure 8, #9 or Figure 9, #8) should first be evenly tightened with a wrench to compress the packing a minimum of 1/16" to 1/8" (1.59 to 3.18 mm).
6. Loosen the gland (Figure 8, #11 or Figure 9, #10) and wait several minutes
7. Tighten the gland (Figure 8, #11 or Figure 9, #10) to a finger-tight condition, then tighten the gland nuts (Figure 8, #9 or Figure 9, #8) one additional flat. Tighten the locking nuts (Figure 8, #9 or Figure 9, #8) against the gland nuts.
8. After installing guards and following all other safety precautions, start the pump and check for leakage. Leakage should be no more than an occasional drop.
9. If leakage is noted, stop the pump, follow all safety precautions, loosen the locking nuts and tighten the gland nuts one additional flat. Tighten the locking nut against the gland nuts (Figure 8, #9 or Figure 9, #8).
10. After installing guards and following all other safety precautions, start the pump and check for leakage. Leakage should be no more than an occasional drop.



Repeat steps 8 through 10 as necessary to initially adjust the packing.

Follow up adjustments during the life of the packing should be infrequent.

MECHANICAL SEALS

Various types of mechanical seals are available to fit most pumps. Due to the various seal types and styles available, the seal manufacturer's instructions for installation and setting should be followed when available.

NOTE: Not all seals will fit or function in all pumps. Modification to the pump backplate, drive shaft, and/or retainer may be required. Consult with an American-Marsh distributor or American-Marsh Pump Company if you are considering a seal change in your pump.

For removal or installation of mechanical seals, refer to disassembly and assembly procedures for pumps.

CONVERSION FROM PACKED BOX TO MECHANICAL SEAL OR MECHANICAL SEAL TO PACKED BOX

Conversion kits are available to convert from a packed box pump to a mechanical seal pump or visa versa. Contact your American-Marsh distributor or American-Marsh Pump Company for availability of conversion kits.

INSTALLATION OF A POSITIVE DRIVE SEAL

Refer to the exploded parts drawing on pages 38 & 39.

1. Machine a counterbore at entrance to seal chamber of backplate (Figure 8, #6 or Figure 9, #5).
2. With drive shaft (Figure 8, #31 or Figure 9, #28) out of pump, install retaining ring (#19) on drive shaft to locate mechanical seal.
3. Carefully remove all burrs and sharp edges on the shaft over which rotating element of seal will slide.
4. Apply a lubricant to seal I.D. and to drive shaft O.D. that is compatible with product being pumped and elastomers within pump. **DO NOT** use petroleum base products with seals with EPR elastomers. Clean and lubricate parts with light oil unless EPR elastomers are used. Use a nonpetroleum base lubricant with EPR elastomers.
5. Slide rotating element of mechanical seal (Figure 8, #18 or Figure 9, #17) onto drive shaft (Figure 8, #31 or Figure 9, #28) before removing three or four clips that are taped to rotating element. Push it back to retaining ring (#19), tighten setscrews in seal, and remove clips that are taped to seal.
6. Slide faceplate end of drive shaft, with mechanical seal attached, into backplate (Figure 8, #6 or Figure 9, #5) through bore for outboard ball bearing (Figure 8, #4 or Figure 9, #3).
7. Use a compatible lubricant to lubricate o-ring on stationary seal face and seal chamber bore.
8. Slide stationary seal face over keyway end of drive shaft (Figure 8, #31 or Figure 9, #28) and down to seal chamber. Be sure lapped (polished) face is toward rotating member of seal.
9. Install outboard ball bearing (Figure 8, #4 or Figure 9, #3) to position drive shaft (Figure 8, 31 or Figure 9, #28).
10. Push stationary seal face into seal chamber.
11. Position locator ring in counterbore of backplate (Figure 8, #6 or Figure 9, #5). Make sure antirotation pin engages in slot in back of stationary seal face.
12. Place one square head bolt (Figure 8, #17 or Figure 9, #16) through each slot in backplate (Figure 8, #6 or Figure 9, #5) and through each hole in seal retainer (Figure 8, #16 or Figure 9, #15). Secure seal retainer against backplate using two locknuts (Figure 8, #9 or Figure 9, #8).
13. Assemble backplate assembly to remainder of pump following correct steps in Section INSTRUCTIONS FOR PUMP ASSEMBLY on page 31.

PUMP REINSTALLATION

The pump is now ready to be returned to service. It should be reinstalled as described in the installation section.

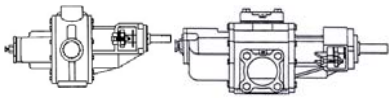
SPARE PARTS

RECOMMENDED SPARE PARTS – STANDARD GH PUMP

The decision on what spare parts to stock varies greatly depending on many factors such as the criticality of the application, the time required to buy and receive new spares, the erosive/corrosive nature of the application, and the cost of the spare part. Figures 8, 9 & 10 give the parts list for a typical GH pump.

HOW TO ORDER SPARE PARTS

Spare parts can be ordered from the local American-Marsh Sales Engineer, or from the American-Marsh Distributor or Representative. The pump size and type can be found on the name plate on the bearing housing. See Figure 3. Please provide the item number, description, and alloy for the part(s) to be ordered.



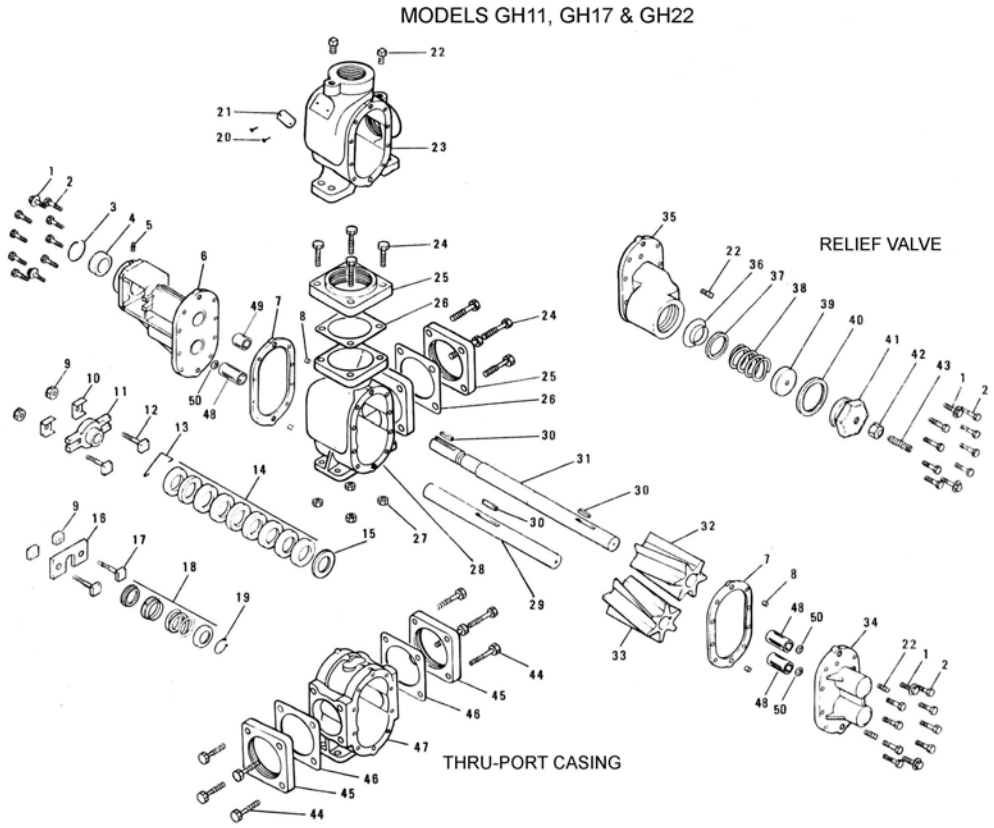
To make parts ordering easy, American-Marsh has created a catalog titled “American-Marsh Pump Parts Catalog.” A copy of this book can be obtained from the local American-Marsh Sales Engineer or Distributor/Representative.

GEAR RATIO CHART

GH-11, GH-17 & GH 22						
Gear Ratio	60 HZ Operation			50 HZ Operation		
	Motor RPM	Pump RPM	Max. HP	Motor RPM	Pump RPM	Max. KW
4.60:1	580	126	2.8	485	105	1.7
3.94:1		147	3.3		123	2.2
3.20:1		181	4.0		152	2.7
4.60:1	870	189	4.2	730	159	2.8
3.94:1		221	4.9		185	3.3
3.20:1		272	6.1		228	4.0
4.60:1	1150	250	5.5	950	206	3.6
3.94:1		290	6.5		241	4.3
3.20:1		360	8.0		296	5.3
4.60:1	1750	380	8.5	1450	315	5.6
3.94:1		445	10.0		368	6.6
3.20:1		545	10.0		453	6.6
4.60:1	3450	750	10.0	2850	620	6.6

GH-48						
Gear Ratio	60 HZ Operation			50 HZ Operation		
	Motor RPM	Pump RPM	Max. HP	Motor RPM	Pump RPM	Max. KW
5.66:1	580	102	4.1	485	86	2.7
4.88:1		119	4.9		99	3.2
4.26:1		136	5.5		114	3.6
5.66:1	870	154	6.3	730	129	4.2
4.88:1		178	7.3		150	4.9
4.26:1		204	8.5		171	5.6
5.66:1	1150	203	8.5	950	168	5.8
4.88:1		235	10.0		194	6.6
4.26:1		270	11.0		223	7.3
5.66:1	1750	309	13.3	1450	256	8.6
4.88:1		360	15.0		297	9.9
4.26:1		410	15.0		340	10.0
5.66:1	3450	609	15.0	2850	504	10.0

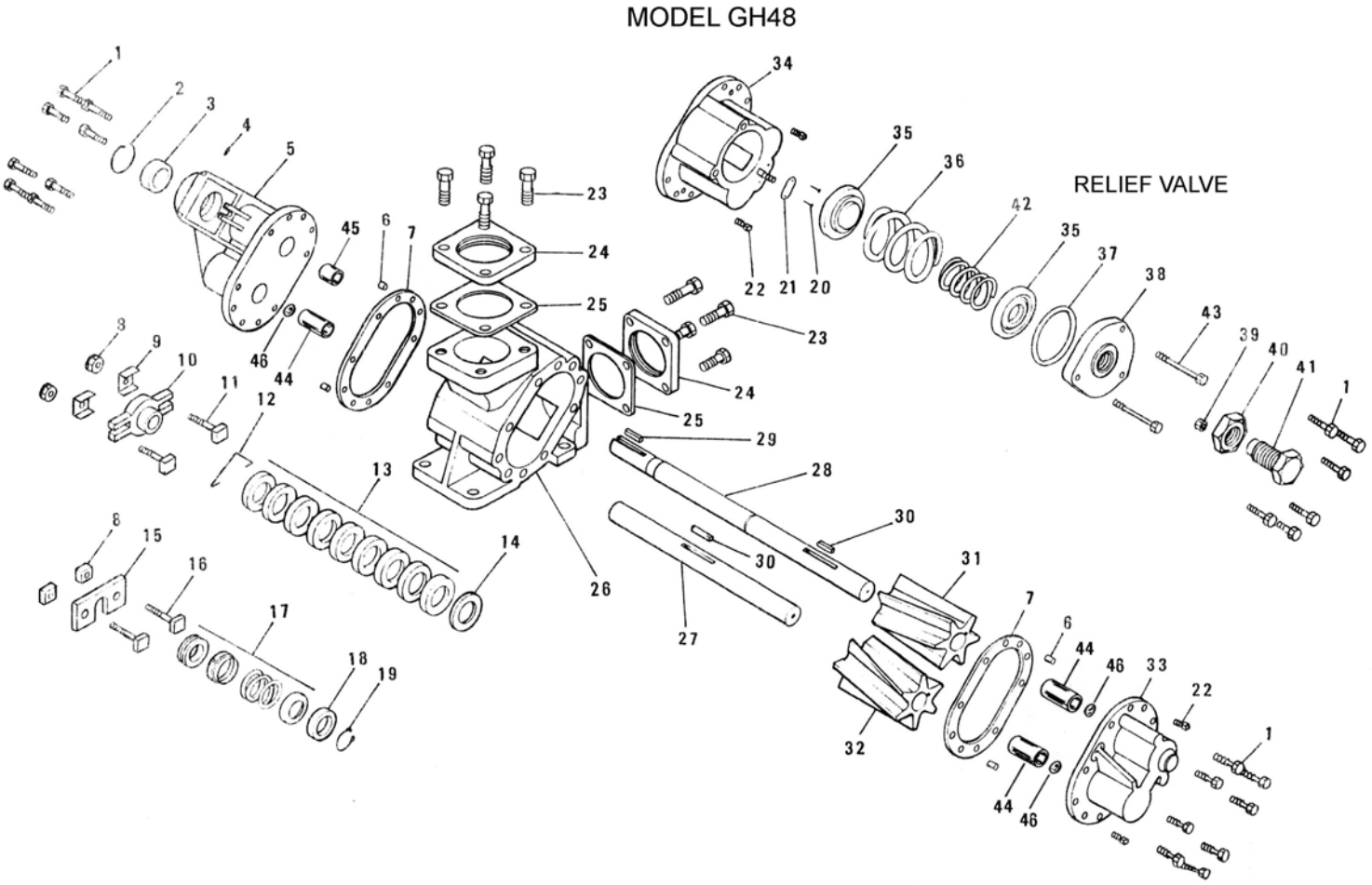
FIGURE 8 – GH Sectional Drawing



Item Number	Item Description	Num. Req.
1	Washer, Hex Head Cap Screw	4
2	Hex Head Cap Screw	16
3	Retaining Ring	1
4	Ball Bearing	1
5	Zerk Fitting	1
6	Backplate Assembly	1
7	Gasket, Case	2
8	Dowel Pin, Hollow	4
9	Locknut	2
10	Clip, Packing Gland	2
11	Gland, Packing	1
12	Bolt, Square Head	2
13	Clip, Spring	1
14	Packing Set	1
15	Washer, Packing	1
16	Retainer, Seal	1
17	Bolt, Square Head	2
18	Mechanical Seal, Complete	1
19	Retainer Ring	1
20	Drive Screw	2
21	Name Plate	1
22	Pipe Plug	4
23	Casing	1
24	Cap Screw, Hex Head	8
25	Flange, Straight	2

Item Number	Item Description	Num. Req.
26	Gasket, Flange	2
27	Nut	8
28	Case	1
29	Shaft, Idler	1
30	Key	3
31	Shaft, Drive	1
32	Gear, Left Hand	1
33	Gear, Right Hand	1
34	Face Plate Assembly, No Relief Valve	1
35	Face Plate Assembly, Relief Valve	1
36	Poppet	1
37	Adapter, Poppet	1
38	Spring, Standard	1
39	Guide, Spring	1
40	Gasket, Cap	1
41	Plug Cap	1
42	Nut, Lock & Seal	1
43	Screw, Adjustment	1
44	Hex Head Cap Screw	8
45	Flange, Straight	2
46	Gasket, Flange	2
47	Case, Thru-Port	1
48	Bushing, Long	3
49	Bushing, Short	1
50	Washer, Expansion	3

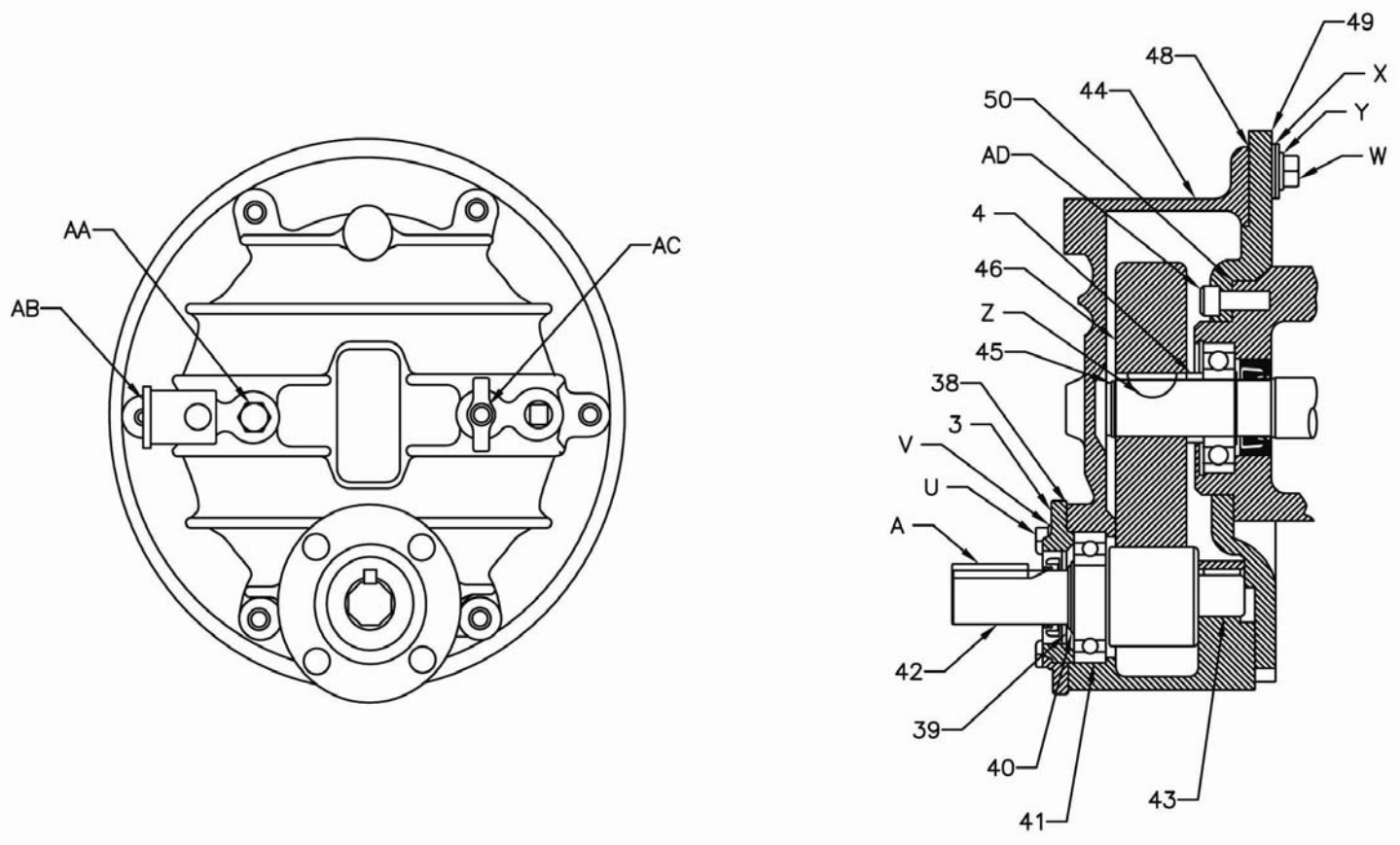
FIGURE 9 – GH Sectional Drawing



Item Number	Item Description	Num. Req.
1	Washer, Hex Head Cap Screw	4
2	Retaining Ring	1
3	Ball Bearing	1
4	Zerk Fitting	1
5	Backplate Assembly	1
6	Dowel Pin	4
7	Gasket, Case	2
8	Locknut	2
9	Clip, Packing Gland	2
10	Gland, Packing	1
11	Bolt, Square Head	2
12	Clip, Spring	1
13	Packing Set	1
14	Washer, Packing	1
15	Retainer, Seal	1
16	Bolt, Square Head	2
17	Mechanical Seal, Complete	1
18	Seal Spacer	1
19	Retainer Ring	1
20	Drive Screw	2
21	Name Plate	1
22	Pipe Plug	4
23	Cap Screw, Hex Head	8

Item Number	Item Description	Num. Req.
24	Flange, Straight	2
25	Gasket, Flange	2
26	Casing	1
27	Shaft, Idler	1
28	Shaft, Drive	1
29	Key	1
30	Key	2
31	Gear, Left Hand	1
32	Gear, Right Hand	1
33	Face Plate Assembly, No Relief Valve	1
34	Face Plate Assembly, Relief Valve	1
35	Poppet & Spring	1
36	Spring, Standard	1
37	O-Ring, Buna	1
38	Plug Cap	1
39	Nut	1
40	Nut, Lock & Seal	1
41	Screw, Adjustment	1
42	Spring, High Pressure	1
43	Hex Head Cap Screw	8
44	Bushing, Long	3
45	Bushing, Short	1
46	Washer, Expansion	3

FIGURE 10 – Gear Reducer Sectional Drawing



Item Number	Item Description	Num. Req.
37	Bearing Retainer	1
38	Bearing Retainer Gasket	1
39	Oil Lip Seal	1
40	Retaining Ring, Ball Bearing	1
41	Ball Bearing	1
42	Pinion Gear and Shaft	1
43	Needle Bearing	1
44	Gear Case	1
45	Retaining Ring, Drive Gear	1
46	Drive Gear	1
47	Spacer	1
48	Gear Case Gasket	1
49	Cover	1

Item Number	Item Description	Num. Req.
50	Cover Gasket	1
A	Key, Drive	1
U	Capscrew, Bearing Retainer to Gear Case	Varies
V	Lockwasher, Bearing Retainer	Varies
W	Cap Screw, Cover to Gear Case	Varies
X	Flat Washer, Gear Case	Varies
Y	Lockwasher, Gear Case	Varies
Z	Key, Drive Gear	1
AA	Pipe Plug, Gear Case	1
AB	Oil Cup, Gear Case	1
AC	Petcock, Gear Case	1
AD	Socket Head Cap Screw, Cover to Backplate	Varies

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