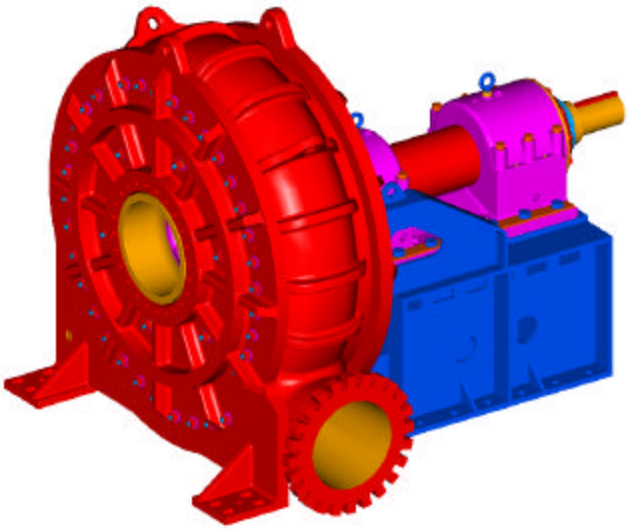
**Maintenance Manual**
**2369.8000/A1-90 G2 (09/01/05)**

**WBC**



Pump Type: _____

Pump Serial Number: _____

Date: _____

Purchaser: _____

Purchaser's Order Number: _____

GIW Work Order Number: _____

Shipped To: _____

Include the pump's serial number when ordering replacement parts.

***Note: This is a standard maintenance manual provided for your convenience.***
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## Contents

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# 1 General

**Caution** This manual contains important information for reliable, proper and efficient operation. Compliance with the operating instructions is of vital importance to ensure reliability and long service life of the pump, and to avoid any risks.

These operating instructions do not take into account local regulations; the operator must ensure that such regulations are strictly observed by all, including the personnel called in for installation.

This pump / unit must not be operated beyond the limit values specified in the technical documentation for the medium handled, capacity, speed, density, pressure, temperature and motor rating. Make sure that operation is in accordance with the instructions given in this manual or in the contract documentation.

The nameplate indicates the type series / size, main operating data and serial number; please quote this information in all queries, repeat orders and particularly when ordering spare parts.

If you need any additional information or instructions exceeding the scope of this manual or in case of damage, please contact your GIW / KSB representative.

# 2 Safety

These operating instructions contain fundamental information, which must be complied with during installation, operation and maintenance. Therefore this operating manual must be read and understood both by the installing personnel and the responsible trained personnel / operators prior to installation and commissioning, and it must always be kept close to the operating location of the machine / unit for easy access.

Not only must the general safety instructions given in this chapter of "Safety" be complied with, but also the safety instructions outlined under specific headings.

### 2.1 Marking of Instructions in the Manual

The safety instructions contained in this manual whose non-observance might cause hazards to persons are specially marked with the general hazard sign, namely

safety sign in accordance with DIN 4844-W9.

The electrical danger warning sign is

safety sign in accordance with DIN 4844-W8.

The word **Caution** is to introduce safety instructions whose non-observance may lead to damage to the machine and its functions.

Instructions attached directly to the machine, such as:
- Arrow indicating the direction of rotation
- Marking for fluid connections

must always be complied with and be kept in legible condition at all times.

### 2.2 Personnel Qualification and Training

All personnel involved in the operation, maintenance, inspection and installation of the machine must be fully qualified to carry out the work involved.

Personnel responsibilities, competence and supervision must be clearly defined by the operator. If the personnel in question are not already in possession of the requisite know-how, appropriate training and instruction must be provided. If required, the operator may commission the manufacturer / supplier to provide such training. In addition, the operator is responsible for ensuring that the contents of the operating instructions are fully understood by the responsible personnel.

### 2.3 Non-compliance with Safety Instructions

Non-compliance with safety instructions can jeopardize the safety of personnel, the environment and the machine itself. Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claims for damages.

In particular, non-compliance can, for example, result in:
- Failure of important machine / unit functions
- Failure of prescribed maintenance and servicing practices
- Hazard to persons by electrical, mechanical and chemical effects
- Hazard to the environment due to leakage of hazardous substances.

### 2.4 Safety Awareness

It is imperative to comply with the safety instructions contained in this manual, the relevant national and local health and safety regulations and the operator's own internal work, operation and safety regulations.

### 2.5 Safety Instructions for the Operator / User

- Any hot or cold components that could pose a hazard must be equipped with a guard by the operator.
- Guards which are fitted to prevent accidental contact with moving parts (e.g. coupling) must not be removed while the machine is operating.
- Leakages (e.g. at the shaft seal) of hazardous media handled (e.g. explosive, toxic, hot) must be contained so as to avoid any danger to persons and the environment. Pertinent legal provisions must be adhered to.
- Electrical hazards must be eliminated. (Refer to the relevant safety regulations applicable to different countries and / or the local energy supply companies.)

### 2.6 Safety Instructions for Maintenance, Inspection and Installation

The operator is responsible for ensuring that all maintenance, inspection and installation work is performed by authorized and qualified personnel who are thoroughly familiar with the manual.

Work on the machine must be carried out only during standstill. The shutdown procedure described in the manual for taking the machine out of service must be adhered to without fail.

Pumps or pump units handling media injurious to health must be decontaminated.

Immediately following completion of the work, all safety / protective devices must be re-installed and / or re-activated.

Please observe all instructions set out in the chapter on "Commissioning" before returning the machine to service.

### 2.7 Unauthorized Modification and Manufacture of Spare Parts

Modifications or alterations of the machine are only permitted after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts can invalidate any liability of the manufacturer for damage or warranty.

### 2.8 Unauthorized Modes of Operation

Any warranty of the operating reliability and safety of the pump / unit supplied is only valid if the machine is operated in accordance with its designated use as described in the following sections. The limits stated in the data sheet must not be exceeded under any circumstances.

## 3 Transport and Interim Storage

### 3.1 Transport

Proper lifting and safety practices must be observed at all times. Lifting the pump assembly requires extreme care, since the center of gravity is not located in the physical center of the unit, but is usually closer to the stuffing box / shaft seal area.

Never lift by a single point and do not use the pump or motor shaft as a lift point. Eyebolt locations on the bearing assembly and motor are intended for lifting those items only and must not be used to lift the pump assembly.

At least four (4) connections are recommended to stabilize the load, and they should be as far apart as practical. Avoid excessive side loads on cast lifting eyes. Note that certain lift points on the pedestal weldment are intended for use in handling the pedestal alone and are not necessarily optimum balance points for the pump assembly.

Always make sure that the unit remains in the horizontal position during transport and cannot slip out of the transport suspension arrangement.

⚠ If the pump / unit slips out of the suspension arrangement, it may cause personal injury and damage to property.

Figures below give suggested lifting methods. Actual safe lifting method will vary with pump configuration and type of lifting equipment. Ensure secure attachments and test lifting method for stability before moving pump.

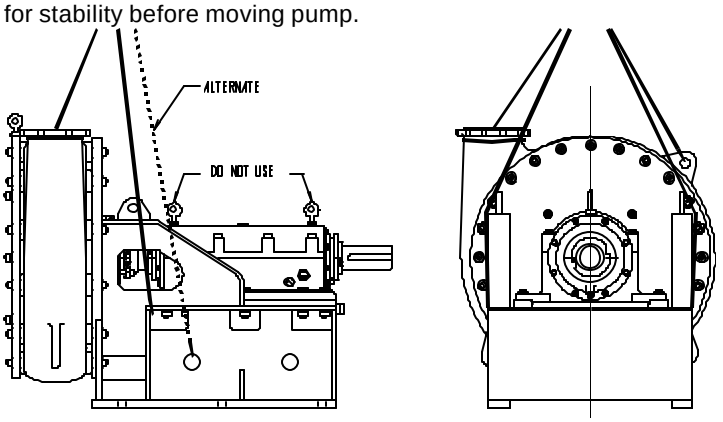



Fig. 3.1-1 Transport of the pump

⚠ **WARNING: Very top heavy**

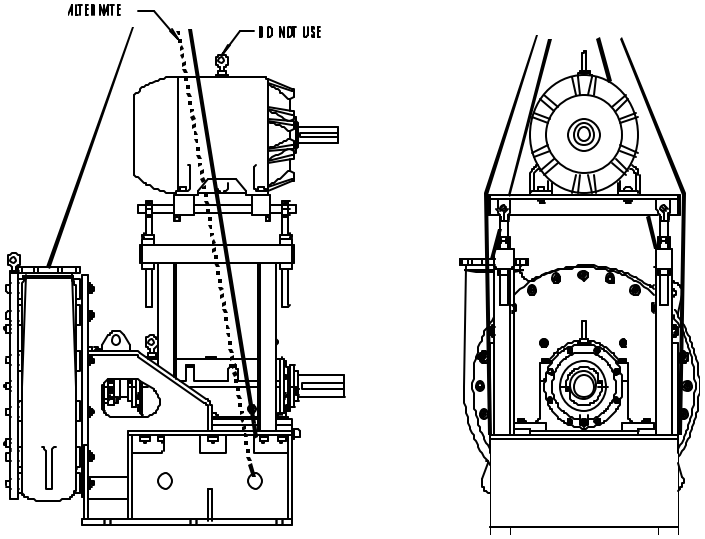



Fig. 3-1-2 Transport of the complete unit

### 3.2 Short Term Storage

The pump / unit should be stored in a dry room where the atmospheric humidity is as constant as possible.

If stored outdoors, the unit and crates must be covered by waterproof material to avoid any contact with humidity.

All openings of the assembled pump / unit components are closed and must only be opened when required during installation.

**Caution** Protect all stored goods against humidity, dirt, vermin and unauthorized access!

See Section 6.3 for long-term storage requirements.

# 4 Description of the Product and Accessories

## 4.1 Technical Specification

Centrifugal pump for handling highly abrasive slurries of coarse or fine particles.

Applications include run-of-mine material transfer, primary grinding circuit recirculation, process pumping and tailings disposal for mining, dredging and other industrial operations.

## 4.2 Designation

LSA- 8x10-32.5 G S L R F T C/4ME H

Pump Type_____|
Discharge Nozzle (inches)___|
Suction Nozzle (inches)_____|
Nominal Impeller Diameter (inches)|
Shaft Size_____|
Plug Code_____|
Shaft Type_____|
Bearing Assembly Type_____|
Impeller Release Ring_____|
Seal Type_____|
LanternRing Material_____|
Shell Hydraulic Type_____|
Impeller Number of Vanes_____|
Impeller Hydraulic Type_____|
Construction Code_____|

Note: Items in ***bold*** print identify ***standard options*** for the **LSA S** pump range.

| **LSA Family Pump Types** | |
|---|---|
| ***LSA*** | ***Standard Slurry Pump*** |
| WSO | High Pressure, Annular Design |
| WBC | High Pressure, Improved Efficiency Design |
| LHD | High Specific Speed Dredge Pump |
| MHD | Conventional Duty Dredge Pump |
| HHD | High Head Dredge Pump |
| TBC | Tie Bolt Design for Pressure and Containment |

| **Shaft Size** | |
|---|---|
| 1 | 2 - 7/16 |
| ***2*** | ***2 - 15/16*** |
| ***3*** | ***3 - 15/16*** |
| ***4*** | ***4 - 7/16*** |
| ***5*** | ***5 - 7/16*** |
| ***6*** | ***6 - 7/16*** |
| ***7*** | ***7 - 3/16*** |
| 8 | ---------- |
| ***9*** | ***9*** |
| 10 | 10 - 1/4 |
| 11 | 11.5 |

| **Plug Type** | |
|---|---|
| B | 1.25 |
| C | 1.75 |
| ***D*** | ***2.0*** |
| E | 9194 |
| ***F*** | ***3.5S*** |
| ***G*** | ***2C4.5*** |
| H | 2C5.0 |
| I | 1652 |
| ***J*** | ***6.5*** |
| ***K*** | ***7.75*** |
| L | 9.0 |
| M | 11.5 |
| N | 13.0 |
| 0 | 16.0 |

| **Shell Hydraulic Type** | |
|---|---|
| A | Annular |
| C | Semi-Volute |
| T | Volute |
| OB | Unconventional |

| **Impeller Hydraulic Type** | |
|---|---|
| RV | Radial Vane |
| ME | Conventional Warped Vane |
| HE | High Efficiency |

| **Seal Type** | |
|---|---|
| F | Packing, Forward Flush |
| K | Packing, Low Flow |
| M | Mechanical Seal |
| B | Throat Bushing |

| **Construction Code** | |
|---|---|
| H | Integral Hub Liner |
| L | Separate Hub Liner |
| OD | TOD Type Suction Liner |
| HP | High Pressure |
| VHP | Very High Pressure |
| GL | Gathane Lined |
| RL | Rubber Lined |

| **Shaft Type** | |
|---|---|
| S | Stiffened |
| W | Straight |

| **Bearing Assembly Type** | |
|---|---|
| L | Limited End Float |
| C | Conventional |
| U | Underwater |

| **Lantern Ring Material** | |
|---|---|
| T | Teflon |
| M | Metal |
| N | Not Applicable |

| **Impeller Release Ring** | |
|---|---|
| R | Impeller Release Ring |
| N | No Impeller Release Ring |

For additional information concerning the LSA family of pumps, contact your GIW / KSB representative.

## 4.3 Design Details

Horizontal, end suction, modified volute casing pump with heavy section thickness and three- or four-vane impellers for the optimum solids passage and performance. Single wall, heavy section, hard metal wet end combined with robust cartridge bearing assembly provides maximum reliability and ease of maintenance.

The standard S range of LSA is a single wall, hard metal configuration in discharge sizes 2 inch (50mm) to 26 inch (650mm). Other custom produced (CP) and custom engineered (CE) configurations are available upon request. These include high pressure and vertical designs, elastomer linings (vulcanized rubber or polyurethane), and discharge sizes ranging from 2 inch (50 mm) to 44 inch (1100 mm).

### 4.3.1 Pump Casing

Refer to pump assembly drawings for flange bolting patterns

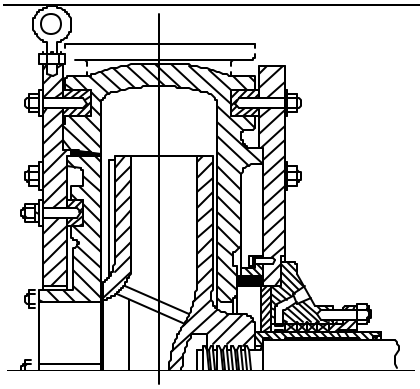


Figure 4.3-1 LSA Hard Metal Wet End, H construction (integral hub liner)

**4.3.2 Impeller Form**

All standard impellers are double shrouded designs as seen in figure 4.3-1.

**4.3.3 Shaft Seal**

Gland packing is standard with either forward flush or low flow "KE" type design. See Figures 7.5-9 and -10. For information on mechanical seals, consult the manufacturer's manual.

**4.3.4 Bearings**

The bearing assembly is a cartridge design mounted on a fabricated pedestal with an adjustment mechanism for setting the impeller axial clearance.

In the standard bearing arrangement, seen in Fig 4.3-2, two double row, spherical roller bearings carry the drive and impeller end radial loads. A separate spherical roller thrust bearing is provided to carry the hydraulic axial thrust without any requirement of thrust compensating clearing vanes on the impeller. The radial bearings are fixed to the shaft with tapered sleeves and locknuts. The thrust bearing is preloaded with springs to provide the constant minimum thrust load required by this type bearing. The bearing housing is split for ease of maintenance and assembly.

A special version of the bearing assembly also exists for mechanical seal applications. In this version, the drive end radial bearing is converted to a taper roller bearing to greatly reduce the shaft end play. In some cases, the shaft itself is stiffened by increasing its diameter between bearings and under the impeller end radial bearing. Also, an impeller release ring may be present. These features are illustrated in Fig 4.3-3

Standard lubrication is oil bath. For lubrication quality and quantity, see Section 7.2. For bearing part numbers refer to the assembly drawing and bill-of-materials

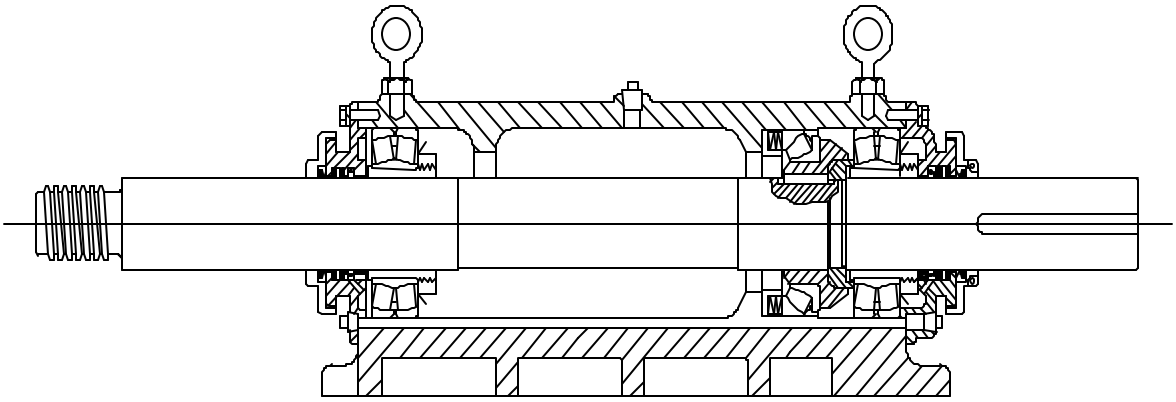


Fig 4.3-2 Cartridge Bearing Assembly

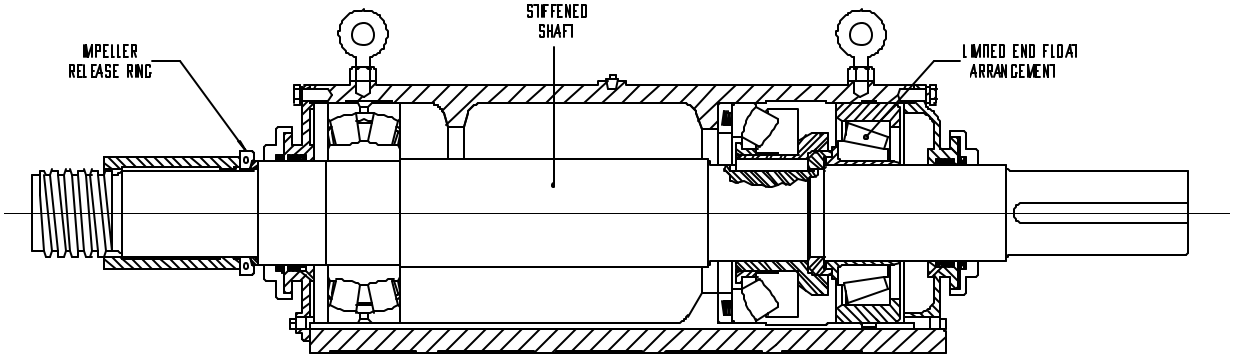
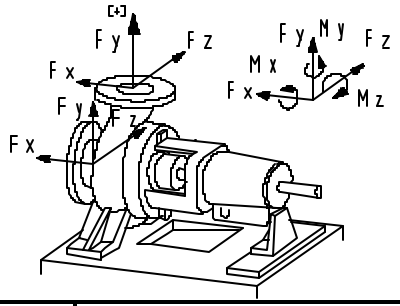


Fig 4.3-3 Cartridge Bearing Assembly Special Features

#### 4.3.5 Permissible Forces and Moments at the Pump Nozzles

The allowable forces and moments are according to a modified version of French Standard NF E 44-145. The data on forces and moments apply to static pipelines only. The values are only applicable if the pump is installed on a completely grouted base plate and bolted to a rigid and even foundation.




| | Pump Flange | Allowable Forces lbs. ( N ) Fx | Fy | Fz | Allowable Moments ft-lbs. ( N-m ) Mx | My | Mz |
|---|---|---|---|---|---|---|---|
| DISCHARGE PIPE | 2 inch (50mm) | 135 ( 600 ) | 150 ( 670 ) | 110 ( 500 ) | 90 ( 120 ) | 75 ( 100 ) | 60 ( 80 ) |
| | 3 inch (75mm) | 200 ( 900 ) | 225 ( 1000 ) | 180 ( 800 ) | 170 ( 230 ) | 140 ( 190 ) | 120 ( 160 ) |
| | 4 inch (100mm) | 270 ( 1200 ) | 305 ( 1350 ) | 235 ( 1050 ) | 280 ( 380 ) | 230 ( 310 ) | 190 ( 260 ) |
| | 6 inch (150mm) | 405 ( 1800 ) | 450 ( 2000 ) | 360 ( 1600 ) | 555 ( 750 ) | 450 ( 610 ) | 385 ( 520 ) |
| | 8 inch (200mm) | 540 ( 2400 ) | 610 ( 2700 ) | 470 ( 2100 ) | 885 (1200) | 750 (1000) | 630 ( 850 ) |
| | 10 inch(250mm) | 675 ( 3000 ) | 750 ( 3350 ) | 600 ( 2700 ) | 1330 (1800) | 1070 (1450) | 920 (1250) |
| | 12 inch(300mm) | 810 ( 3600 ) | 900 ( 4000 ) | 720 ( 3200 ) | 1770 (2400) | 1475 (2000) | 1250 (1700) |
| | 14 inch(350mm) | 945 (4200 ) | 1045 (4650) | 845 ( 3750 ) | 2325 (3150) | 1880 (2550) | 1620 (2200) |
| | 16 inch(400mm) | 1080 (4800 ) | 1190 (5300) | 970 ( 4300 ) | 2875 (3900) | 2360 (3200) | 2030 (2750) |
| | 18 inch(450mm) | 1235 (5490) | 1370 (6100) | 1110 ( 4940) | 3650 (4960) | 2970 (4040) | 2585 (3520) |
| | 20 inch(500mm) | 1370 (6100) | 1520 (6760) | 1235 ( 5490) | 4360 (5910) | 3550 (4810) | 3095 (4210) |
| | 22 inch(550mm) | 1510 (7450) | 1675 (7450) | 1360 (6050) | 5120 (6960) | 4165 (5660) | 3640 (4950) |
| | 26 inch(650mm) | 1785 (7930) | 1980 (8790) | 1610 (7150) | 6795 (9240) | 5520 (7500) | 4850 (6590) |
| SUCTION PIPE | 3 inch (75mm) | 225 ( 1000 ) | 180 ( 800 ) | 200 ( 900 ) | 170 (230 ) | 140 ( 190 ) | 120 ( 160 ) |
| | 4 inch (100mm) | 305 ( 1350 ) | 235 ( 1050 ) | 270 ( 1200 ) | 280 ( 380 ) | 230 ( 310 ) | 190 ( 260 ) |
| | 6 inch (150mm) | 450 ( 2000 ) | 405 ( 1800 ) | 360 ( 1600 ) | 555 (750 ) | 450 ( 610 ) | 385 ( 520 ) |
| | 8 inch (200mm) | 610 ( 2700 ) | 470 ( 2100 ) | 540 ( 2400 ) | 885 (1200) | 750 (1000) | 630 ( 850 ) |
| | 10 inch(250mm) | 750 ( 3350 ) | 600 ( 2700 ) | 675 ( 3000 ) | 1330 (1800) | 1070 (1450) | 920 (1250) |
| | 12 inch(300mm) | 900 ( 4000 ) | 720 ( 3200 ) | 810 ( 3600 ) | 1770 (2400) | 1475 (2000) | 1250 (1700) |
| | 14 inch(350mm) | 1045 ( 4650 ) | 845 ( 3750 ) | 945 ( 4200 ) | 2325 (3150) | 1880 (2550) | 1620 (2200) |
| | 16 inch(400mm) | 1190 ( 5300 ) | 970 (4300 ) | 1080 (4800) | 2875 (3900) | 2360 (3200) | 2030 (2750) |
| | 18 inch(450mm) | 1370 ( 6100 ) | 1110 (4940) | 1235 (5490) | 3650 (4960) | 2970 (4040) | 2585 (3520) |
| | 20 inch(500mm) | 1520 ( 6760 ) | 1235 (5490) | 1370 (6100) | 4360 (5910) | 3550 (4810) | 3095 (4210) |
| | 24 inch(600mm) | 1825 ( 8120 ) | 1480 (6580) | 1650 (7340) | 5935 (8070) | 4820 (6560) | 4230 (5750) |
| | 26 inch(650mm) | 1980 ( 8790 ) | 1610 (7150) | 1785 (7930) | 6795 (9240) | 5520 (7500) | 4850 (6590) |
| | 28 inch(700mm) | 2130 ( 9470 ) | 1730 (7700) | 1920 (8540) | 7700 (10470) | 6250 (8500) | 5500 (7480) |

#### 4.3.6 Noise Characteristics

If running within the normal limits of operation and on clear liquid, the sound pressure level for the pump alone does not exceed 80 dB at one meter.

The addition of coarse solids, froth or cavitating conditions can significantly increase the noise levels in both the pump and piping. If accurate noise levels are required for these conditions, field-testing will be required.

Sound pressure levels from motor and gear reducer must be added to the above in accordance with standard acoustic formulas, taking into account the distance between units. For belt driven units, add an additional 2 dB.

### 4.4 Accessories

Couplings, pulleys, belts, motor mounts and/or base plates may be provided. Refer to the bill-of-materials, data sheets and/or drawings for further information.

### 4.5 Dimensions and Weights

Dimensions and weights are listed on the pump installation plan.

# 5 Installation at Site

## 5.1 Safety Regulations

Electrical equipment operated in hazardous locations must comply with the applicable explosion protection regulations. This is indicated on the motor rating plate. If the equipment is installed in hazardous locations, the applicable local explosion protection regulations and the regulations of the test certificate supplied with the equipment and issued by the responsible approval authorities must be observed and complied with. The test certificate must be kept close to the location of operation for easy access (e.g. foreman's office).

## 5.2 Foundation

All structural work required must have been prepared in accordance with the dimensions stated in the dimension table / installation plan.

The concrete foundation shall have sufficient strength for the pump and be completely cured before installation. The mounting surface must be flat and level. Anchor bolts must be located according to the installation plan. This can be done when the concrete is poured, or by drilling holes in existing foundations and grouting the bolts in place.

## 5.3 Installing the Base Plate and Pump

After placing the base plate on the foundation, it must be leveled by shimming. Shims should be fitted between the base plate and the foundation itself; they should always be inserted to the left and right of the foundation bolts and in close proximity to these bolts. For a bolt-to-bolt clearance of more than 800mm (30 in.), additional shims should be inserted halfway between the adjoining holes. All shims must lie perfectly flush.

Insert the foundation bolts and set them into the foundation using concrete. When the mortar has set, tighten the foundation bolts evenly and firmly and grout the base plate using low shrinkage concrete.

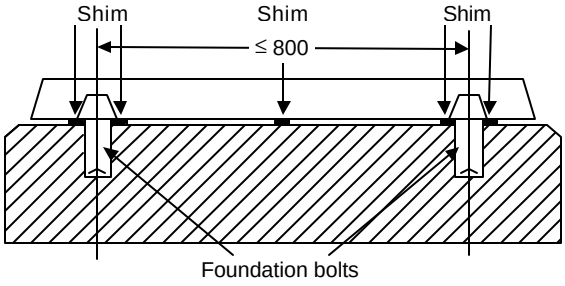



Fig. 5.3-1: Fitting required shims (mm)

### 5.3.1 Aligning the Pump / Drive Train

**Caution** All components must be level during operation unless special provisions for bearing lubrication and oil sealing have been made. After attaching the unit to the foundation and connecting the piping, the pump and drive train must be thoroughly checked and, if necessary, realigned

Coupling check and realignment must be effected even if pump and motor are supplied completely assembled and aligned on a common base plate. The correct distance between the coupling halves as specified in the installation plan must be observed.

The pump set is correctly aligned if a straightedge placed axially on both coupling halves is the same distance from each shaft at all points around the circumference. In addition, the distance between the two coupling halves must remain the same all around the circumference. Use a feeler gauge, a wedge gauge or a dial micrometer to verify (see Figures 5.3.2 and 5.3.3).

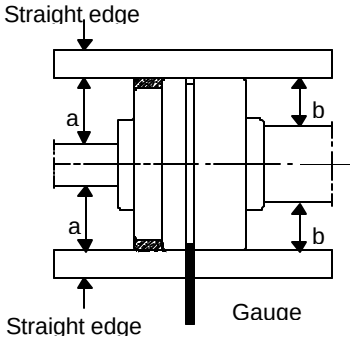



Fig. 5.3-2: Aligning the coupling with the help of a gauge and a straightedge

The radial and axial deviation (tolerance) between the two coupling halves should not exceed 0.1 mm (0.004 inch).

Improper alignment of the unit can cause damage to both the coupling and the unit itself!

For V-belt installations, the pulleys are correctly aligned if a straightedge placed vertically shows a deviation of no more than 1.0 mm (0.04 in.). Both pulleys must be parallel.

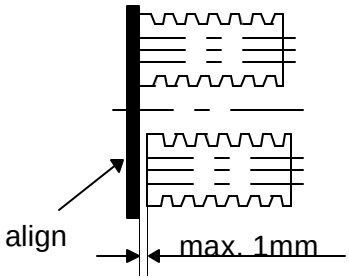



Fig. 5.3-3 Aligning of V-belt pulleys

### 5.3.2 Place of Installation

The volute casing and stuffing box take on roughly the same temperature as the medium handled. The stuffing box, bearing assembly and bearing housing must not be insulated.

Take the necessary precautions to avoid burns to personnel and adjacent equipment.

## 5.4 Connecting the Piping

**Caution** Never use the pump itself as an anchorage point for the piping. The permissible pipeline forces must not be exceeded (see Section

4.3.5).

Suction lift lines should be laid with a rising slope towards the pump and suction head lines with a downward slope towards the pump. The pipelines should be anchored in close proximity to the pump and should be connected without transmitting any stresses or strains. The nominal diameters of the pipelines should be at least equal to the nominal diameters of the pump nozzles. It is recommended to install check and shut-off elements in the system, depending on the type of plant and pump. It must be ensured, however, that the pump can still be drained and dismantled without problems.

Thermal expansions of the pipelines must be compensated by appropriate measures so as not to impose any extra loads on the pump exceeding the permissible pipeline forces and moments.
An excessive, impermissible increase in the pipeline forces may cause leaks on the pump where the medium handled can escape into the atmosphere.

⚠ **Danger of life when toxic or hot media are handled.**

The flange covers on the pump suction and discharge nozzles must be removed prior to installation in the piping.

#### 5.4.1 Auxiliary Connections

The dimensions and locations of the auxiliary connections (cooling, heating, sealing liquid, flushing liquid, etc.) are indicated on the installation plan or piping layout.

**Caution** These connections are required for proper functioning of the pump and are therefore of vital importance!

#### 5.4.2 Safety Guards

⚠ In compliance with the accident prevention regulations the pump must not be operated without coupling and drive guards. If the customer specifically requests not to include guards in our delivery, then the operator must supply them.

### 5.5 Final Check

Re-check the alignment as described in Section 5.3.
It must be easy to rotate the shaft by hand at the coupling.

### 5.6 Connection to Power Supply

A ***trained electrician*** must make the connection to the power supply . Check available mains voltage against the data on the motor rating plate and select the appropriate start-up method.

We strongly recommend the use of a motor protection device.

## 6 Commissioning, Start-up / Shutdown

**Caution** Compliance with the following requirements is of paramount importance. Damage resulting from non-compliance shall not be covered by the scope of warranty.

This manual applies to single stage pumps. Procedures for multistage pumps should be obtained from GIW/KSB sales office.

### 6.1 Commissioning

Before starting up the pump make sure that the following requirements are checked and fulfilled.

The operating data, the oil level, if required (6.1.1), the nose clearance, and the direction of rotation (6.1.4) must be checked. The pump set must be primed (6.1.3).

- Make sure the unit is properly connected to the electric power supply and is equipped with all protection devices.
- Make sure all auxiliary connections (5.4.1) are connected and functioning.
- If the pump has been out of service for a long period of time, proceed in accordance with Section 6.4.

#### 6.1.1 Oil-lubricated bearings

Units may be shipped without oil from the factory. Fill with the supplied GIW Blue 150 oil to the center of the sight gauge.
Before starting the pump, verify that the bearing assembly is correctly filled to the center of the oil level sight gauge**. Do not overfill**. Factory filled units contain GIW Blue ISO 150 synthetic bearing oil. This is available as GIW part number 690-9090-01-B150P. Otherwise, use an equivalent synthetic or a high quality ISO220 or 320 mineral oil suitable for use with heavy industrial equipment, anti-friction bearings and oil circulating systems. Such oil typically has high temperature stability, resistance to oxidation and foaming, and inhibits rust, corrosion, and the formation of deposits. Oils with EP additives are not recommended.

For oil temperatures above 85 $^{o}$C (180 $^{o}$F) or for severe load conditions, a high quality synthetic lubricant should be used. Contact your GIW / KSB representative for a recommendation.

| Bearing Assembly | Approximate Oil Capacity (quarts or liters) |
|---|---|
| 2 7-16 & 2-15/16 | 1 |
| 3-15/16 | 2 |
| 4-7/16 | 3 |
| 5-7/16 | 5 |
| 5-7/16 (PB) | 1.5 Drive end<br>1 Impeller end |
| 6-7/16 | 9 |
| 6-7/16 (PB) | 2.5 Drive end<br>1.5 Radial end |
| 7-3/16 | 9 |
| 7-3/16 (PB) | 2.5 Drive end<br>1.5 Radial end |
| 9 | 18 |
| 9 (PB) | 3 Drive end<br>2 Radial end |
| 10-1/4 | 34 |
| 11-1/2 | 34 |

Do not overfill the bearing assembly. The capacities listed above are approximate. When filling the bearing housing, the oil level must be at the centerline of the oil level sight glass when the shaft is not turning. This is the "cold level" and will change as the pump runs and the oil becomes suspended in the bearings.

The oil should be initially drained after 50 to 100 hours operation. Before refilling, the bearings should be flushed by filling the bearing housing with a lightweight oil, turning the pump shaft several rotations, and then draining. This should be repeated until the flushed oil appears clean. See section 7.2.2 for regular oil change recommendations

Bearing assemblies for use underwater should be completely filled with oil and slightly pressurized by an oil recirculation and filtering system. As a result, their capacities will be several times greater than shown above and a thinner oil will be required. Depending upon the water temperature at the location at which the pumps are operating, the ISO viscosity grade should be altered as follows for mineral oil-based lubricants:

| Water Temperature | ISO Viscosity Grade |
|---|---|
| 0 to 20°C (32 to 70 °F) | 100 |
| 20 to 30°C (70 to 85 °F) | 150 |
| over 30°C (over 85 °F) | 220 |

*GIW Blue oil may be used for all the above temperatures*

For more information on Underwater Bearing Assemblies see section 10.1 and 10.2

**6.1.2 Shaft Seal**

**Packing**

Prior to commissioning, the gland packing supplied with the pump must be adjusted as described in Section 7.5.17. Preformed packing rings sets from GIW / KSB are recommend. For alternate brands, refer to packing manufacturer's instructions regarding installation and use (see Section 2.7).

For gland flush supply, use suitable non-aggressive clean water not liable to form deposits and not containing suspended solids. Hardness should average 5 with a ph>8. It should be conditioned and neutral with regard to mechanical corrosion.

An Inlet Temperature of 10 to 30° C (50 to 85 ° F) should produce a maximum Outlet Temperature 45°C (115 ° F) when the gland is properly adjusted..

**Mechanical Seals**

Mechanical seals are precision devices which require special care for their proper operation. If pump is equipped with a mechanical seal, the instruction manual for the seal should be consulted for special storage, startup, and maintenance requirements.

**6.1.3 Priming the Pump and Other Checks**

Before start-up, the pump, suction line and (if applicable) the tank must be vented and primed with the liquid to be pumped. Any valve in the suction line must be fully open.

Open all auxiliary connections (flushing, sealing, cooling liquid, etc.) and check the through flow.

**Caution** Dry-running will result in increased wear on the gland packing and shaft protecting sleeve or failure of the mechanical seal and must be avoided!

**Caution**

**6.1.4 Checking the Direction of Rotation**

The impeller must rotate in the direction indicated by the arrow on the pump casing. This must be verified by briefly running the motor with the coupling or belt drive disconnected. If the motor runs in the wrong direction of rotation, have it corrected and verify direction of rotation before reconnecting coupling or belts. If a Variable Frequency Drive (VFD) or other controller is used, it is recommended to permanently disable REVERSE and BRAKE function during controller set up.

If motive power is applied to the pump, and it is run in the wrong direction of rotation, even momentarily, the impeller may unscrew causing extensive damage to the entire unit. This is especially important during initial start up as the impeller may not be fully torqued onto the pump shaft.

**6.1.5 Cleaning the Plant Piping**

⚠ Cleaning operations for flushing and pickling service must be matched to the casing and seal materials used. Any chemicals or high temperatures used must be compatible with all pump parts.

**6.1.6 Suction Strainer**

If a suction strainer has been fitted to protect the pumps against dirt and/or to retain contamination from the plant, the strainer's contamination level must be monitored by measuring the differential pressure so as to ensure adequate inlet pressure for the pump.

**6.1.7 Start-up**

Before starting the pump verify that the shut-off element in the suction line is fully open. The pump may be started up against a closed discharge shut-off element. Once the pump has reached full rotational speed, open the discharge valve slowly and adjusted to the duty point. When starting up against an open discharge-side shut-off element, take the resulting increase in input power requirements into account.

⚠ Prolonged operation against a closed shut-off element is not permitted. **Danger of steam generation and explosion!**

**Caution** Once the operating temperature has been reached and / or in the event of leakages, switch off the unit and re-tighten all bolts. Check the coupling alignment as described in Section 5.3.1 and re-align, if necessary.

**6.1.8 Shutdown**

Under no circumstances should the pipe system be equipped with a check valve or other device that can rapidly decelerate the flow rate.

Switch off the drive, making sure that the unit runs smoothly down to a complete stop. Variable Frequency Drive (VFD) and other controllers must not use any braking function to slow the pump. Diesel power trains should disengage the clutch and allow the pump to coast to a stop.

Close any auxiliary connections. Pressurized bearing lubrication systems must remain running until all rotation has stopped. If the any part of the system uses a cooling liquid supply, turn that off only after the pump has cooled down.

Where liquid filled shaft seals are used, consult seal maintenance manual for specific shutdown procedures.

**Caution** In the event of shutdown where a significant static discharge head exists in the system, the impeller can begin to run backwards as the flow reverses in the pipeline. This creates a positive torque on the shaft so the impeller connection will not unscrew. Until the flow stops, do not close any main line valves. A change in fluid velocity can create a negative torque on the impeller and unscrew it from the shaft. This can damage wet end pump parts as well as bearings, seals and other components

Where temperatures may drop below freezing, the pump and system must be drained or otherwise protected against freezing.

### 6.2 Operating Limits

The pump's / unit's application limits regarding pressure, temperature and speed are stated on the data sheet and must be strictly adhered to. If a data sheet is not available, contact your GIW / KSB representative.

#### 6.2.1 Temperature of the Medium Handled, Ambient Temperature, Bearing Temperature

Do not operate the pump at temperatures exceeding those specified on the data sheet or the name plate unless the written permission of the manufacturer has been obtained.

Damage resulting from disregarding this warning will not be covered by the manufacturer's warranty.

Bearing temperatures, as described in Section 7.2.1, must be observed. Excessive bearing temperature could indicate misalignment or other technical problem.

#### 6.2.2 Switching Frequency

To prevent high temperature increases in the motor and excessive loads on the pump, coupling, motor, seals and bearings, the switching frequency should not exceed the following number of start-ups per hour (h):

| Motor rating | max. switchings / hr |
|---|---|
| up to 12kW (16hp) | 25 |
| up to 100kW (135hp) | 20 |
| more than 100kW (135hp) | 10 |

#### 6.2.3 Density of the Medium Handled

The power input of the pump will increase in proportion to the density of the medium handled. To avoid overloading of the motor, pump and coupling, the density of the medium must comply with the data specified on the purchase order.

### 6.3 Shutdown / Storage / Preservation

Each GIW / KSB pump leaves the factory carefully assembled. If commissioning is to take place some time after delivery, we recommend that the following measures be taken for pump storage.

#### 6.3.1 Storage of New Pumps

- Maximum protection for up to 12 months, if the pump is properly stored indoors.
- Store the pump in a dry location
- Rotate the pump rotor by hand once a month.
- Follow manufacturer's instructions for mechanical seals.
- See requirements for rubber liner storage below.

#### 6.3.2 Measures to be taken for Prolonged Shutdown

**1 The pump remains installed; operation check run**

In order to make sure that the pump is always ready for instant start-up and to prevent the formation of deposits within the pump and the pump intake area, start up the pump set regularly once a month or once every 3 months for a short time (approx. 5 minutes) during prolonged shutdown periods. Prior to an operation check run ensure that there is sufficient liquid available for operating the pump.

**2 The pump is dismantled and stored**

Before putting the pump into storage carry out all checks specified in Sections 7.1 to 7.4. It is advisable to close the nozzles (for ex. with plastic caps or similar).

#### 6.3.3 Storage of Elastomer Linings

Pumps with elastomer linings should be stored in a cool dark location free from electrical equipment such as motors, or any other ozone generating devices. Exposure to direct sunlight or temperatures in excess of 50°C (120°F) must be avoided .

Properly stored elastomer parts will retain their properties for about two years for gum rubber, or five years for neoprene or urethane. The parts should be periodically inspected for the presence of a soft chalky layer, easily rubbed off, which would indicate deterioration. Darkening or discoloration of elastomer parts over time is a natural occurrence and does not by itself indicate any loss of properties.

### 6.4 Returning to Service after Storage

Before returning the pump to service carry out all checks and maintenance work specified in Sections 7.1 and 7.2.

The instructions given in the sections on "Commissioning" (6.1) and "Operating Limits" (6.2) must be observed.

Upon completion of the work, all safety-related and protective equipment must be properly refitted and/or reactivated before starting the pump set.

## 7 Maintenance / Repair

### 7.1 General Instructions

Most LSA pumps have been designed to the **ENGLISH** system of units using English dimensioned components, although in some special cases **METRIC** components have been used. Please consult your arrangement drawings and bills-of-material for details concerning your equipment.

Tooling used for assembly and maintenance of fasteners and other components should be according to the correct English or metric standard. Spare parts such as oil seals, O-rings and stuffing box packing should also be purchased in the correct English or metric size. Crossover between English and metric

tools or spare parts is generally not recommended. Contact your GIW / KSB representative for specific problems or questions.

The operator is responsible for ensuring that all maintenance inspection and installation work is carried out by authorized, duly qualified staff who are thoroughly familiar with these operating instructions.

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the pump with a minimum of maintenance expenditure.

**Work on the unit must only be carried out with the electrical connections disconnected and locked out. Make sure that the pump set cannot be switched on accidentally.**

**Pumps handling liquids posing health hazards must be decontaminated. When draining the medium ensure there is no risk to persons or the environment. All relevant laws must be adhered to.**

### 7.2 Maintenance / Inspection

#### 7.2.1 Supervision of Operation

**Caution** The pump should run quietly and free from vibrations at all times. Unusual noise or vibration should be investigated and corrected immediately.

Operational procedures which may cause system water hammer must be avoided. **Sudden and catastrophic failure of pump casing and plates may result.**

When running the pump against a closed discharge-side shut-off element for a short period, the permissible pressure and temperature values must not be exceeded.

Prolonged operation against a closed shut-off element is not permitted. **Danger of steam generation and explosion!**

The bearing oil temperature may exceed room temperature by up to 85°C (150 °F) but should never rise above +100°C (210 °F) except for a brief period during the breaking in of new bearings. The unit must be shut down immediately if temperatures exceed 120°C (250 °F).

Verify correct oil level as described in Section 6.1.1.

The gland packing (if the pump is fitted with one) should drip slightly during operation. The gland should only be gently tightened.
Any stand-by pumps installed should be switched on and off again once a week to keep them operational. Attention should be paid to the correct functioning of the auxiliary connections.

**Caution** If the flexible coupling elements begin to show signs of wear, they should be replaced.

#### 7.2.2 Lubrication and Lubricant Change

The oil should be drained and replaced every 3 to 4 months or when it appears or is suspected of being dirty or contaminated.

Under severe operating conditions, high ambient temperature, high humidity, dust laden air, aggressive industrial atmosphere, etc. the intervals for checking, replenishing and replacing the lubricant should be shortened.

See section 6.1.1 for oil specifications and capacities.

### 7.3 Drainage / Disposal

**Caution** If the pump was used for handling liquids posing health hazards, see to it that there is no risk to persons or the environment when draining the medium. All relevant laws, local codes, and safety procedures must be heeded. If required, wear safety clothing and a protective mask.

If the media handled by the pumps leaves residues which might lead to corrosion when coming into contact with atmospheric humidity, or which might ignite when coming into contact with oxygen, the unit must be flushed thoroughly and neutralized.

The flushing liquid used and any liquid residues in the pump must be properly collected and disposed of without posing any risk to persons or the environment.

### 7.4 Dismantling

Before dismantling, secure the pump so as to make sure it cannot be switched on accidentally. The shut-off elements in the suction and discharge nozzles must be closed. The pump must have cooled down to ambient temperature, it must be drained and its pressure must be released. Observe the safety regulations of Section 7.1.
Repair and maintenance work to the pump must only be carried out by specially trained personnel, using original equipment spare parts (see 2.7)

#### 7.4.1 Sectional Drawings and Bills of Material

**The manual you are reading is a basic manual for all LSA type pumps. For sectional drawings and bills of material relating to your specific pump and equipment, locate an official copy of the documentation provided by GIW / KSB. This may be shipped separately from the pump and will include drawings and bills of material as attachments to this basic manual.**

Dismantling and reassembly must always be carried out in accordance with the relevant sectional drawing. Any work on the motor, gear reducer, mechanical seal or other non-pump equipment shall be governed by the specifications and regulations of the respective supplier.

#### 7.4.2 Dismantling Procedures

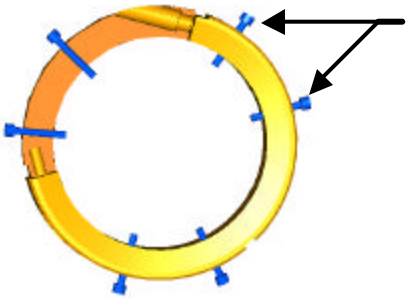
**Impeller**

During normal operation, the impeller becomes tightly screwed onto the shaft by the running torque. A steady torque or mild, yet sudden, torsional jolt is usually required to disengage the impeller. Several methods of achieving this end are possible. One of the easiest methods is outlined below. To order the jigs described here, contact your GIW / KSB representative. Please provide your pump assembly number with the order to insure a good fit.

**Do not apply heat to the impeller hub or nose due to the sealed cavity at the impeller nose. DANGER OF EXPLOSION!**

**For Impellers With Release Rings -** Release Ring Removal

Push off bolts should never be left in the release ring segments during pump operation. There is a chance that the push off bolts could work loose and become a projectile that could cause equipment damage or personal injury. Also, if the push off bolts are turned in too far in the segment in which they are installed, they could keep the ring from fitting properly against the shaft.



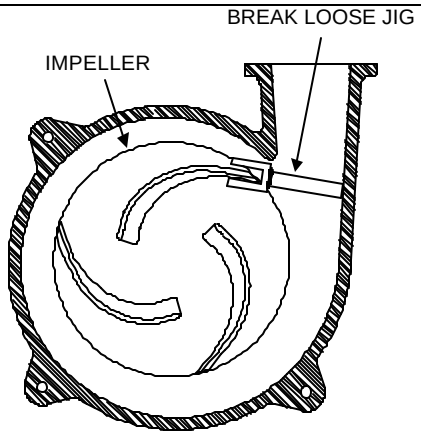

7.4-1 Push Off Bolts

To remove the release ring start by loosening and removing all three of the main fasteners that hold the three segmented pieces together. (See figure 7.4-1) Push off holes are drilled and tapped in the segmented ring so bolts can be used to push the ring segment away from the shaft allowing the segment to be removed. The threaded hole should be cleaned well and lubricated before installing a push off bolt to remove the segment. If necessary, a tap can be used to clean out the threads before using the push off bolts. The push off bolts should be turned in evenly the same amount of turns, so the ring segment is pushed off evenly. We highly recommend sealing the threaded hole with a bit of silicone before operation so the threaded hole will be clean and ready to use when you are ready to remove the segment the next time. **Also always make sure that the three fasteners that hold the segments together are the Extra Strength Fasteners GIW specifies and be sure to replace the fasteners every time the ring is removed.**

**Impellers Without Release Rings -** Break-Loose Jig

Rotate the impeller until the tip of one blade is facing the pump discharge. Insert the jig through the eye of the impeller and attach to trailing edge of blade facing discharge. Rotate the shaft in the direction opposite to normal, using the pump pulley or a spanner wrench.

NOTE: To ensure ease of impeller removal, the shaft threads should be heavily coated with anti-seize compound during re-assembly. Also, **two** aramid paper gaskets should be used between the shaft sleeve and the impeller.




**Impeller Lifting Jig**

For impeller removal or installation, grasp the impeller at the suction eye as shown in Figure 7.4-2. The impeller can be leveled by turning the adjusting bolt which bears against the impeller nose. This is especially useful during re-installation. For impeller removal ensure that the lifting line is tight prior to thread disengagement.

Do not remove, lift, move or re-install impeller without properly using a recommended impeller lifting jig.

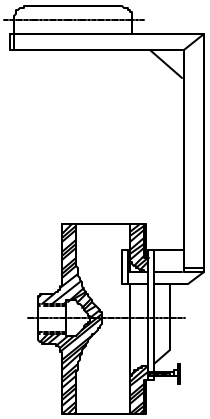


Figure 7.4-3 Impeller Lifting Jig

**Shell**

It is recommended that at least two lift points be used when moving any pump shell. This permits greater safety and control of the component. Where applicable, GIW pump shells are supplied with cast lifting eyes for this purpose. Note that if the chain hook does not fit the lifting eye, an appropriate clevis should be installed. Another acceptable lifting point is a chain secured around the discharge flange, being careful not to damage the bolt flanges.

**Cartridge Bearing Assembly**

Drain the oil (if applicable) by removing the drain plug in the end cover at either end.

Remove the flingers and bearing housing end covers. Inspect the shaft seals, gaskets, and o-rings, and discard any that appear worn or broken.

Remove the bolts holding the bearing housing halves together. Note that the housings halves are tightly doweled together to insure alignment of the bearings and removal of the upper half may be difficult. Install eyebolts and jam nuts. Use a lifting bar or chain spreader to apply a **vertical** force to the eyebolts when lifting, as shown in figure 7.4-3. If necessary, insert a pry bar between the halves and lift evenly, taking care not to damage the sealing surfaces.

⚠ Avoid excessive lifting force which may cause the top half to suddenly break free and bounce against the bearings or injure maintenance personnel. Do not use flexible lifting equipment, such as nylon slings which may stretch and exaggerate bouncing. Failure to use a lifting bar or chain spreader could result in damage to the housing.

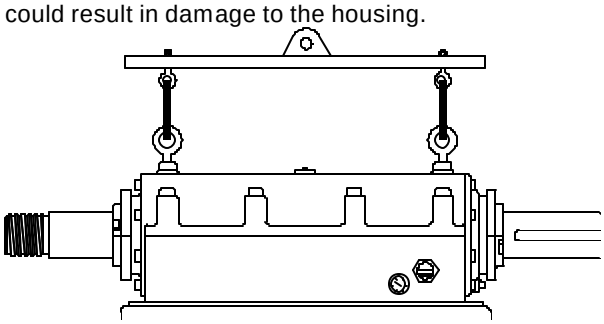


Figure 7.4-3 Recommended Lifting Jig for Bearing Housing

The shaft and bearings may now be removed from the housing. Different methods may be required for removal of the bearings from the shaft.

The **radial bearings** on either end of the shaft are usually of the Double Row, Spherical Roller type and are held to the shaft by a **tapered sleeve with locknut** and lock washer. One tab of the lock washer will be bent into a recess on the lock ring and must be bent back to allow the locknut to be unscrewed. The bearing can then be slipped off the shaft.

In bearing assemblies of the limited end float type, (for mechanical seal applications), the drive end radial bearing will be of the Single Row Taper type. These bearings are hot when installed and are **press fitted** to the shaft. It is difficult to remove them from the shaft undamaged, and they should be removed only if a bearing needs to be replaced. Bearings are normally removed by pressing or heating. Care must be taken to avoid damaging the shaft, especially the bearing seat and shaft oil seal areas.

In bearing assemblies with impeller release rings and some of the limited end float type, the impeller end radial bearing may also be press fitted to the shaft. The same procedures as noted above should be followed.

The **thrust bearing** sits between the radial bearings near the drive end and is of the Spherical Roller type. It is seated on a split ring which is clamped to a thrust groove in the shaft. In larger assemblies, a one piece thrust collar is used between the bearing and the split ring. A small amount of heat on the back of the bearing is usually enough to allow it to be pushed off the split ring and removed from the shaft.

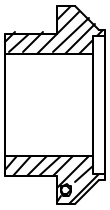


Figure 7.5-1 Split Thrust Collar, sizes $2\text{-}^{15}/_{16}$ to $4\text{-}^{7}/_{16}$

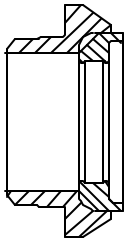


Figure 7.5-2 Split Ring and Thrust Collar, sizes $5\text{-}^{7}/_{16}$ and larger

## 7.5 Reassembly

### 7.5.1 General Instructions

The pump should be reassembled in accordance with the rules of sound engineering practice. Use the sectional drawing and bill of material for guidance.

Before assembly, thoroughly clean all shaft, housing bore, and end cover surfaces with a suitable solvent to remove old grease and any water, dust or grit. Clean all dismantled components and check them for signs of wear. Damaged or worn components are to be replaced by original equipment spare parts. Make sure that the seal faces are clean and the O-rings and gaskets are properly fitted. It is recommended that new seal elements (O-rings/ gaskets) be used whenever the pump is reassembled. Make sure that new gaskets have the same thickness as the old ones. Avoid the use of mounting aids as much as possible. Should a mounting aid be required, use a commercially available contact adhesive.
The adhesive should only be applied at selected points (three to four spots) and in thin layers. Do not use cyanoacryiate adhesives
(quick-setting adhesives). If in certain cases mounting aids or anti-adhesives other than those described are required, please contact the sealing material manufacturer.

### 7.5.2 Mounting of Thrust Bearing

Place the thrust bearing on the shaft. Next, bolt the split thrust collar (or split ring plus thrust collar in larger sizes), into place at the mating groove on the shaft.

The thrust bearing is a drive fit on the thrust collar. The application of a little heat will aid in its seating. The bearing should be pressed fully against the thrust collar shoulder.

| Nominal Shaft Size | Typical Radial Bearing No. | Typical Un-mounted Internal Clearance | | Required Decrease for Mounting |
|---|---|---|---|---|
| | | **Class C3** inches/1000 (mm) | **Class CN** inches/1000 (mm) | inches/1000 (mm) |

| | | | | |
|---|---|---|---|---|
| 2- 15/16 | 22217C3 | 4.4 to 5.7<br>(0.112 to 0.115) | 3.2 to 4.4<br>( 0.081 to 0.112 ) | 1.7 to 2.5<br>(0.046 to 0.064) |
| 3- 15/16 | 22222C3 | 5.3 to 6.9<br>(0.135 to 0.176) | 3.9 to 5.3<br>( 0.099 to 0.135 ) | 2.0 to 2.8<br>(0.051 to 0.071) |
| 4- 7/16 | 22226C3 | 6.3 to 8.1<br>(0.160 to 0.206) | 4.7 to 6.3<br>( 0.119 to 0.160 ) | 2.5 to 3.5<br>(0.064 to 0.089) |
| 5- 7/16 | 22332C3 | 7.1 to 9.1<br>(0.180 to 0.231) | 5.1 to 7.1<br>( 0.130 to 0.180 ) | 3.0 to 4.0<br>(0.076 to 0.102) |
| 6 7/16 | 22336C3 | 7.9 to 10.2<br>(0.201 to 0.259) | 5.5 to 7.9<br>( 0.140 to 0.201 ) | 3.0 to 4.5<br>(0.076 to 0.114) |
| 7- 3/16 | 22340C3 | 8.8 to 11.4<br>(0.226 to 0.290) | 6.3 to 8.8<br>( 0.160 to 0.224 ) | 3.5 to 5.0<br>(0.089 to 0.127) |
| 9 | 23252C3 | 11.8 to 15.6<br>(0.300 to 0.396) | 8.7 to 11.8<br>( 0.221 to 0.300 ) | 4.5 to 6.5<br>(0.114 to 0.165) |
| 10 1/4 | 23256C3 | 11.8 to 15.4<br>(0.300 to 0.391) | 8.7 to 11.8<br>( 0.221 to 0.300 ) | 4.5 to 6.5<br>(0.114 to 0.165) |
| 11 1/2 | 23264C3 | 14.2 to 18.7<br>(0.361 to 0.475) | 10.6 to 14.2<br>( 0.269 to 0.361 ) | 6.0 to 8.5<br>(0.152 to 0.216) |

MOUNTED CLEARANCE = UN-MOUNTED CLEARANCE (actual measured) - REQUIRED DECREASE (from table)

Figure 7.5-3 Mounting Clearances for Taper Bore Spherical Roller Radial BearingS

**7.5.3 Mounting of Taper Lock Bearings**

Before mounting the bearings, the radial bearings should be placed upright on a level surface with one roller at the 12 o'clock position. Use a feeler gauge to measure the internal clearance between this roller and the outer race. Record this value as "Unmounted Clearance".

**7.5.4 Mounting of Press Fit Bearings**

Bearings with straight bores and no locknuts are press fit on the shaft. Heat bearings to 220°F (105 °C) with a suitable bearing heater, oil bath, or other even heating device prior to mounting. Flame heating is not recommended. When mounting, be sure the bearings are fully seated against the locating shaft shoulder and held in place until the bearing cools.

**7.5.5 Mounting of Drive End Radial Bearing**

The radial bearing next to the thrust bearing should be mounted with its inner race in direct contact with the split ring (or split thrust collar).

If it is a taper lock type, first position it on the shaft while loosely mounted on its adapter. The locknut should then be tightened until the internal bearing clearance as determined with a feeler gauge is equal to the actual un-mounted clearance minus the required decrease as specified in figure 7.5-3

The locknut must then be locked in position by bending one tab of the lock washer into one of the recesses on the locknut. Be sure that the radial bearing inner race is still in contact with the split ring (or split thrust collar).

**7.5.6 Parts Between Bearings**

The spring retainer ring should be placed loosely on the shaft from the threaded end of the shaft with the spring holes facing the thrust bearing. If the housing is of the PB type, (separate housings for drive and pump end bearings), then also install the two labyrinth oil seals with their internal flingers, springs, o-rings and v-rings on the shaft at this time. Make sure that the seals are in the proper direction, (see figure 7.5-4).

**Caution** If you are using hand glued o-rings between the seals and the housing, their joints must be of the highest quality or oil leakage and seal failure may occur. Place the o-ring joint at the 12:00 position.

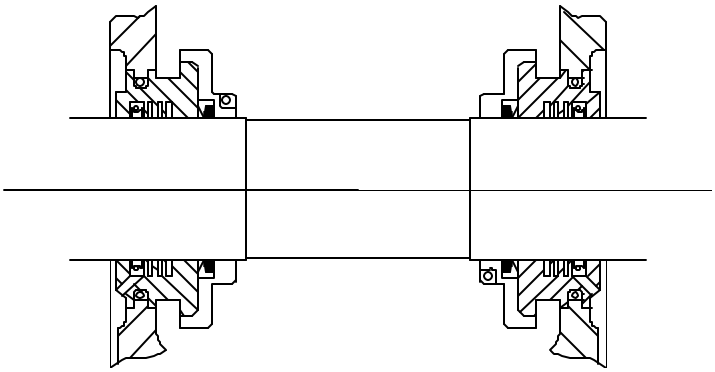


Figure 7.5-4 Mid-shaft seal arrangement, PB housings only.

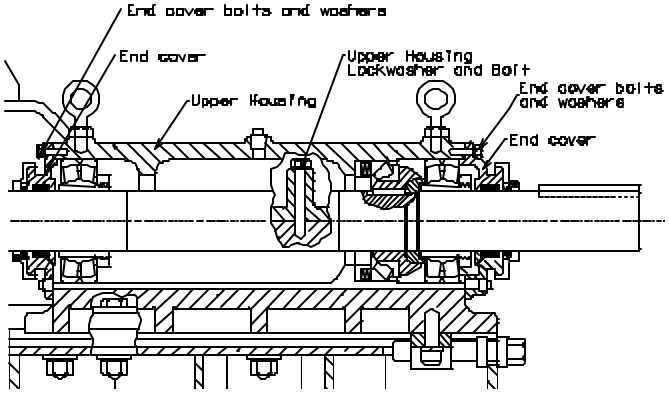
### 7.5.7 Mounting Pump End Radial Bearing

The remaining radial bearing should be mounted last. If it is of the taper lock type, insure that its position after assembly will be 1/4" to 5/16" (6 to 8 mm) from the housing end cover.

### 7.5.8 Closing the Housing

Insert the thrust bearing springs into the retainer ring. A small amount of grease can be used to hold springs in place. Place the shaft and bearings into the housing lower half. Be sure that the thrust bearing outer race and springs are held in their proper place.

Place the lockwashers on the bolts and lightly coat the threads with anti-seize. Slide the end covers and gaskets on the shaft. Just before installing the housing upper half, apply a 1/8" bead of RTV silicone sealant along the bottom half, between inside edge and the bolt holes. Run the silicone bead into the end cover area. Lower the top half and install the dowel pins. Tighten the housing bolts, working from the center out and alternating side to side. Final torque should be verified as 75% of yield for lubricated Grade 5 or Metric 8.8 fasteners, according to the torque chart in the Appendix. For pillow block assemblies, this torque is very important for proper bearing fit. These housings are torqued in a cross or "X" pattern.




### 7.5.9 Installing End Covers and Seals

Before installing the end covers, carefully inspect the labyrinth oil seal grooves for any grease residue, chips, burrs or other debris and clean if necessary. This is essential to their proper operation.

Install the thrust end cover with 0.020" (0.5 mm) gasket to provide the correct pre-loading of the thrust bearing.

Before installing the end cover nearest the pump, a measurement should be made to insure that 1/4" to 5/16" (6 to 8 mm) clearance between the end cover and bearing races will be obtained after assembly. A 0.020" (0.5 mm) gasket is also used with this end cover.

After both end covers are installed, measure the gap between the shaft and the inner diameter of each labyrinth seal with a feeler gauge. A minimum gap of 0.005" (0.13 mm) is required all the way around or shaft damage may occur. If necessary, the end cover may be shifted within the clearance at the housing bore before tightening in order to maintain the minimum seal gap.

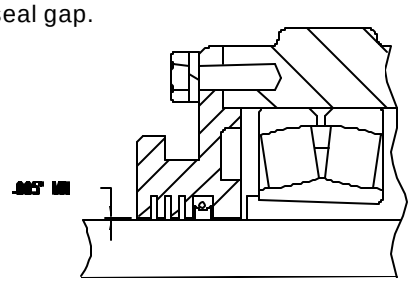


Figure 7.5-5 Labyrinth seal clearance

Apply a thin coating of grease to the end cover faces where the v-ring contact is made and install the v-rings.

Install the flingers so that their outer face is flush with the back of the seal face flange, (see figure 7.5-6). This will insure correct v-ring compression . The split flingers clamp tightly to the shaft when bolted together and care must be taken to insure that the flinger does not cock during tightening or it will run out against the end cover. The best method is to bolt the halves together directly in position rather than sliding over shaft after bolting. Gently tapping the flinger at intervals while tightening will also help insure that it is properly seated. After tightening the flingers, check their radial clearance with the seal flange by running a wire gauge around the gap as shown in figure 7.5-6. A minimum gap of 0.020" ( 0.5 mm) should be present.

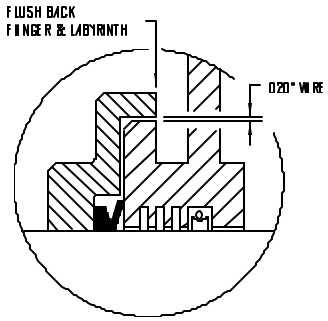



Figure 7.5-6 Flinger clearances

As a final check, rotate the bearing assembly by hand. Check the alignment of the flingers and listen or feel for any rubbing.

**Caution** Flinger and labyrinth seal clearances must be verified according to the above procedures. Failure to do so may result in damage to the seals, overheating, and bearing damage.

For oil lubrication see Section 7.2.2

### 7.5.10 Mounting Shaft Sleeve

For Pumps with Impeller Release Ring **– Mounting Release Ring, Taper Ring, and Shaft Sleeve**

**Caution** The segmented release ring fasteners must be replaced every time they are removed. These fasteners are to be the Resisto-Plate type finish with the following properties:

#6 thru 7/8" Diameter has a 180,000.psi min. Yield Strength (metric up to and including 12mm 1110 MPa, over 12mm 1100 MPa), Elongation is 13% minimum in a 2" specimen for all diameters, Reduction in area is 45% min. for all diameters, and the Tensile Strength is 200,000.psi. (metric up to and including 12 mm min. 1240 MPa, over 12mm min. 1220 MPa). The physical requirements are as per ASTM A-370 and E-8.

**Caution** If either the taper ring or segmented release ring show signs of damage, both should be replaced. Never should just the taper ring or just the segmented ring be replaced. There is a chance of the angle being different on the taper ring or the segmented release ring. This difference in the contact angle would cause a non-uniform loading of the faces on which the axial load is distributed.

Clean the shaft with LPS Instant Super Cleaner (LPS Part # 00720). Slide the taper ring in place by mating the radius of the taper ring to the radius of the shaft. The tapered side of the taper ring should be facing the plug. Slide the release ring onto the shaft making sure that the tapered surface on the release ring mates against the tapered surface on the tapered ring so as to provide complete surface contact of the taper ring on the side facing the release ring. The angle on the release ring and taper ring must match; always replace them in pairs to ensure a correct fit. Any fasteners installed in a release ring must be installed with Loc-tite thread locker 242 and 22477 Primer T. If a fastener is removed from a release ring for any reason after being tightened, the fastener should be replaced with a new fastener. A light coat of anti-seize can be applied inside the shaft sleeve but extreme care should be taken to prevent anti-seize from contacting the faces of the release ring, shaft sleeve, impeller contacting face, and the shaft shoulder. Lubrication of the release ring, shaft sleeve, impeller contacting face, and the shaft shoulder may result in overloading and breakage of the shaft. When installing the shaft sleeve, stop when the release ring face and the shaft sleeve face are approximately 1 " apart. Inspect the faces to be sure they are still clean and free from grease. If grease is present, the faces must be cleaned before the sleeve is slid into place. As the shaft sleeve is pushed into position the o-ring will be completely forced into the sleeve recess.

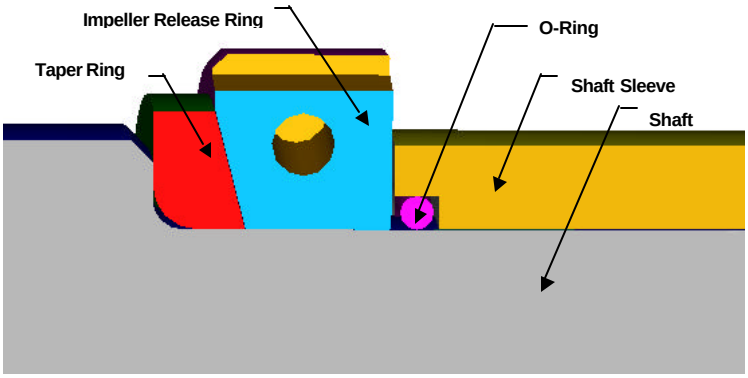
**Torque Information is only for use with the Premier Farnell Supertanium Fasteners**

English

| Nominal Size | Stress Area | Torque With Loctite 242 on Fastener |
|---|---|---|
| 3/8"-16NC | .0775 sq.in | 50 ft.lbs. |
| 1/2"-13NC | .1419 sq.in. | 114 ft.lbs. |
| 5/8"-11NC | .226 sq. in | 227 ft.lbs. |
| 3/4"-10NC | .334 sq.in. | 402 ft.lbs. |
| 1"-10NC | .606 sq.in. | 915 ft.lbs. |

Metric

| Nominal Size | Stress Area | Torque With Loctite 242 on Fastener |
|---|---|---|
| M10 x 1.50 | 58 sq.mm | 74 Nm. |
| M12 x 1.75 | 84.3 sq.mm | 119 Nm. |
| M16 x 2.00 | 157 sq.mm | 310 Nm. |
| M20 x 2.50 | 245 sq.mm | 603 Nm. |




7.5-7 Release Ring Location

**For Pumps with out Release Ring - Mounting Shaft Sleeve**

In mounting the shaft sleeve, do not allow anti-seize compound to come in contact with any of the **axial faces** of the shaft sleeve, including the impeller contacting face, the hook in contact with the shaft shoulder, or the impeller release ring contacting face. If an impeller release ring is present, do not place any lubrication on the release ring, the taper ring, or the abutting shaft shoulder. If necessary for ease of removal, only a light coating of anti-seize compound may be applied only on the outer diameter of the shaft under the shaft sleeve.

⚠ Lubrication at any of shaft sleeve, release ring, or shaft shoulder faces may result in overloading and breakage of the shaft.

In many cases, there will be an o-ring which must be placed on the shaft first, As the shaft sleeve is pushed into position, this o-ring should be completely forced into the shaft sleeve recess.

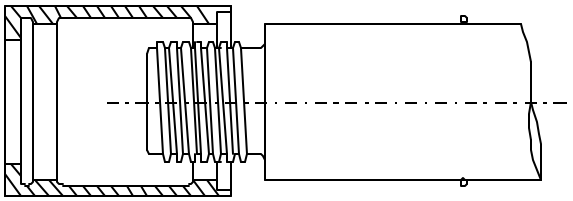


Figure 7.5-8 Hook Type Shaft Sleeve Arrangement

**7.5.11 Mounting Stuffing Box**

The stuffing box should be mounted so that the sealing water tap is on or near the vertical centerline. This will position the gland studs at 9 o'clock and 3 o'clock for easy access. Note that the small stuffing boxes have a single inlet while the larger sizes have a second port that can be used for additional flow or have a pipe plug installed.

Clearance is provided between the stuffing box rabbet fit and the pedestal to allow centering of the stuffing box to the shaft sleeve. During installation, the packing space should be equalized to within 0.010" (0.25 mm) at all locations before fully tightening the stuffing box flange bolts.

In some cases, a separate stuffing box wear plate may be provided. This should be fastened into place with a fresh gasket.

**Caution** Failure to center the stuffing box may result in greatly reduced service life for the packing and shaft sleeve.

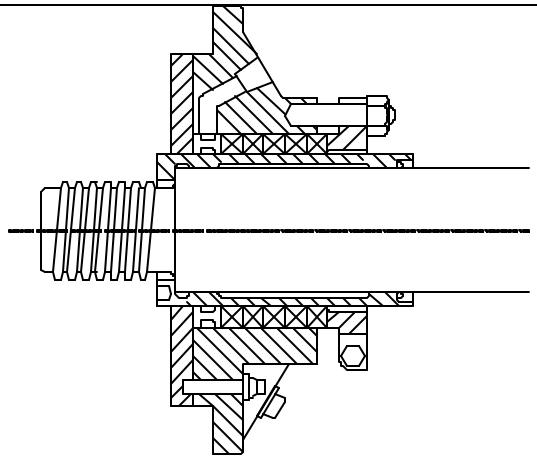


Figure 7.5-9 Standard Forward Flush Stuffing Box

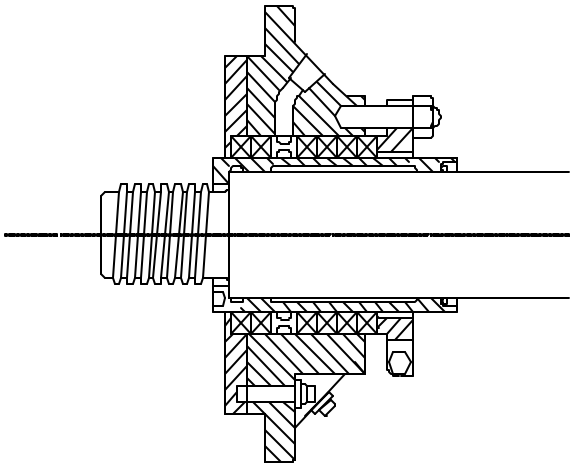


Figure 7.5-10 Type KE Low Flow Stuffing Box

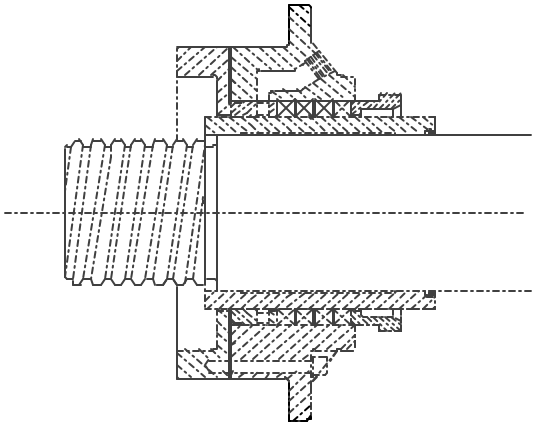


Figure 7.5-11 Throat Bushing Stuffing Box

**7.5.12 Mounting the Bearing Assembly to the Pedestal**

For best results, it is recommended that the pedestal and bearing housing saddles be clean and dry with no application of oil or grease.

Mount the bearing housing adjustment nut with adjusting screw onto the bottom of the housing. When placing the

bearing assembly onto the pedestal, insure that the slotted tab on the pedestal fits into the slot of the adjusting screw.

The pedestal and bearing housing saddles should be clean, dry, and free from oil or grease. If corrosion of the saddles is a problem, apply a thin film of preservative. Special care must then be taken in the axial adjustment procedure to ensure that no movement may occur. (See the section on Axial Adjustment of Bearing Housing.)

The bearing housing hold down bolts should now be installed, but should remain slightly loose until the axial adjustment of the bearing housing is complete.

⚠ Failure to install the bearing housing hold down bolts at this time may result in tipping of the bearing assembly and possibly personal injury when the impeller is screwed on to the shaft.

**7.5.13 Mounting Shell**

The alignment of the pump shell with the mechanical end is obtained through a rabbet fit machined into the pedestal and, if present, hub plate. For the best wear and efficiency performance, it is essential that the shell be fully seated in these fits.

Ensure that the proper gasket is fitted between the shell and pedestal before installing.

If a hub liner is present, it must be bolted to the pedestal, (or hub plate if present), and the proper shell to liner gasket installed before mounting shell. See section 7.5.16 if a snap ring gasket is used.

**7.5.14 Mounting Impeller**

Coat **only** the shaft **threads** with anti-seize compound. **Two** 0.5 mm (0.020 inch) aramid gaskets (400.10) are placed between the shaft sleeve and the impeller hub face to prevent galling and to ensure ease of impeller removal. The gaskets should be installed dry, without grease.

Screw on the impeller tightly by hand. With larger sizes, it may be convenient to hold the impeller stationary while turning the shaft. Impeller lifting jigs are available to assist in this operation (see Figure 7.4-2).

When assembly of the pump is complete, check the impeller to suction wear plate clearance and adjust if necessary, (see section 7.5.17: Axial Adjustment of Bearing Housing).

**7.5.15 Suction Plate and Liner**

Bolt the suction liner to the suction plate and install gasket before mounting to shell. If a snap ring gasket is used, see section 7.5.16.

After mounting, the suction liner should protrude approximately 1/32" to 3/32" ( 0.8 to 2.4 mm) from the suction plate at the suction flange connection. This is normal and provides the sealing surface for the suction piping.

**7.5.16 Snap Ring Gasket**

In many LSA pumps, the liner is sealed against the shell by use of a tapered "snap ring gasket".

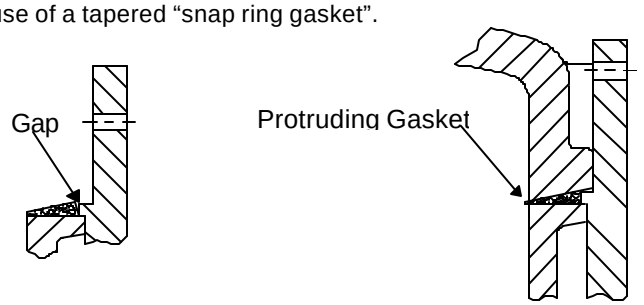



Figure 7.5-12 Snap Ring Gasket Installation

When installing snap ring gaskets, always check to insure that there is a gap behind the back vertical surface of the gasket. If this is not the case, the gasket should be removed and turned inside out. The back vertical surface of the gasket should taper forward 10° to form this gap.

The pump shell side opening is tapered at 10°; therefore, as the nuts are tightened there is a ball joint action. Because of this, opposite nuts should be tightened in an alternating pattern and alignment maintained as parts are pulled into place. Visual accuracy of alignment is sufficient.

For longer life, the suction liner may be rotated 180° at approximately half life. It is best to replace the snap ring gasket when this is done or when parts are changed. This will insure better parts life since a partially worn snap ring gasket will not adequately protect the adjoining metal parts. If the snap ring gasket is not badly worn, it may be possible to reuse it by placing something behind its back vertical surface so that after installation, the gasket protrudes into the shell. The protruding gasket should wear off leaving a smooth joint. If the snap ring gasket does not protrude, the resulting gap between metal parts will cause turbulence and result in accelerated wear.

**7.5.17 Axial Adjustment of the Bearing Housing**

In order to maximize the performance of your LSA pump, the clearance between the suction face of the impeller and the suction liner must be adjusted to an allowed minimum depending on the size and type of bearing assembly. This is done by moving the bearing housing assembly with the adjusting screw.

Before adjustment may proceed, the pump wet end must be completely assembled. The stuffing box may be packed before or after the adjustment procedure; however, the axial set of any mechanical seal must be left until **after** adjustment is complete.

After insuring that all of the bearing housing hold down bolts are slightly loosened, run the bearing assembly towards the impeller end by means of the adjusting screw until the impeller first begins to rub the suction liner. It is helpful to slowly rotate the impeller during this procedure.

Next, reverse the adjusting screw until the clearance between the impeller and the suction liner is brought to the recommended values shown in the following table:

| Nominal Shaft Size | Impeller Nose Clearance Standard Bearing Assembly inch (mm) | Limited End Float Bearing Assembly inch (mm) |
|---|---|---|
| 2 - 7/16 | 0.030 *(0.75)* | -NA- |
| 2 - 15/16 | 0.030 *(0.75)* | 0.012 *(0.30)* |
| 3 - 15/16 | 0.050 *(1.25)* | 0.012 *(0.30)* |
| 4 - 7/16 | 0.050 *(1.25)* | 0.012 *(0.30)* |
| 5 - 7/16 | 0.050 *(1.25)* | 0.012 *(0.30)* |
| 6 - 7/16 | 0.070 *(1.75)* | 0.012 *(0.30)* |
| 7 - 3/16 | 0.070 *(1.75)* | 0.012 *(0.30)* |
| 9 | 0.070 *(1.75)* | 0.012 *(0.30)* |
| 10 - 1/4 | 0.080 *(2.03)* | 0.015 *(0.38)* |
| 11 - 1/2 | 0.090 *(2.25)* | -NA- |

**Caution**

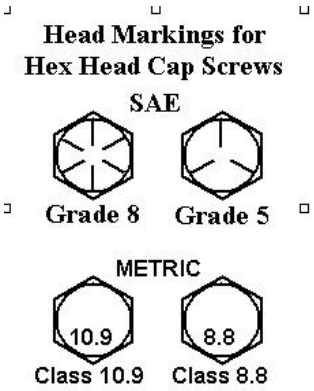
The final movement of the bearing housing during adjustment should always be away from the impeller end, as described above. This ensures that the threads of the adjusting screw will contain no backlash against the forward directed thrust loading that the pump will generate during operation. It is especially important that this convention be followed when a mechanical seal is being used, or when a preservative has been applied to the bearing housing and pedestal mounting saddles.

Once the clearance is correct, tighten the bearing housing hold down bolts according to the requirements of Section 7.5.18 and recheck clearance.

### 7.5.18 Tightening Torques

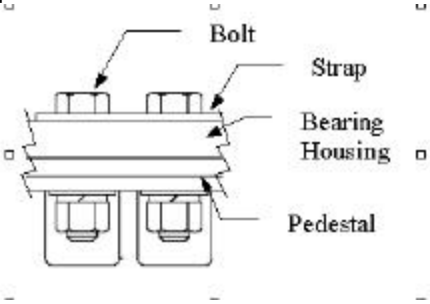
**LSA Bearing Assembly Hold Down Bolts**

The LSA assembly design locates the bearing assembly in machined ways and uses hex head cap screws to clamp the housing down against the pedestal surface. An adjusting bolt is used to set the impeller nose clearance. This bolt should not be considered as part of the locking mechanism.




Preventing the bearing housing from moving during pump operation requires attention to a few important details. First, all mating surfaces must be clean and dry. This means removing any paint, dirt, rust or lubricants from both the housing and the pedestal to provide solid metal to metal contact. Next, be sure to use the correct fasteners. Most applications can use SAE Grade 5 or Metric Class 8.8 bolts, but pumps operating at higher duty conditions should use SAE Grade 8 or Metric Class 10.9 bolts. Beginning in 2003, all GIW factory assembled pumps include these high strength fasteners. In all cases, use a heavy hex nut that meets or exceeds the requirements of ASTM A194-2H. When properly torqued, these fasteners will provide the clamping force required to hold the housing in place. Never replace any fastener with one of a lesser grade.

Fastener preparation and proper torque are most important. Clean the bolt and nut, and check the threads. Replace any parts that show signs of damage, wear or galling. Thread lubrication is crucial for obtaining the correct torque, and there are different values for various lubes. GIW recommends coating the threads with either copper or nickel based anti-seize. This provides thread lubrication for correct clamp load at a lower applied torque and assists in routine fastener removal for future maintenance. If an alternate lube such as heavy oil is used, torque values must be adjusted accordingly. Moly lube is not recommended, since bolts can easily be over torqued.




The bearing assembly hold down bolts are typically installed from the top. While this is not ideal for torque, it makes assembly much easier. The flat strap is used to help distribute the bolt forces along the cast bearing housing. Make sure that this junction also has clean metal to metal contact. Flat washers and lock washers are used under the nut distribute load. The nut should be held with a box wrench while the bolt is tightened. As with any high torque bolted joint, the fasteners should be brought up to the required specification in two or three stages.

**TORQUE**

Verify the size of the bolts and use the following chart to determine required torque value to achieve 75% yield for Grade 8 fasteners. Grade 5 information is included for older units. Note that values are given for the preferred anti-seize as well as heavily oiled fasteners. GIW Part Numbers are given as reference examples only, as actual part number requires the material code. The correct fastener size is identified with a '901' item number on the GIW pump assembly drawing.

Fastener torque must be accurately measured to achieve the proper clamping force. Air impact wrenches rarely deliver the correct torque due to variations in air pressure and tool condition. These can be used to tighten the bolts, but the final torque values should be achieved with a calibrated torque wrench. The use of a Hydraulic Torque Wrench is recommended for larger fasteners, and these tools can be calibrated to produce the necessary accuracy.

**Other Bolts**

No special torque requirements exist for the remaining LSA nuts and bolts unless specifically called for on the assembly drawing. Bolts and nuts for which torque is not specified should be tightened enough to ensure a firm mating between parts in accordance with good maintenance practice. Where possible, the use of an air driven impact wrench is recommended for bolts over one inch (25 mm) in diameter.

| Torque for Grade 8 UNC Hold Down Bolts<br>New standard, Jan 2003 (Recommended for replacement and rebuilds) | | | | | | |
|---|---|---|---|---|---|---|
| **Bolt Thread** | | **Wrench Size** | | **Torque in FtLb** | | **Nominal Shaft Size** |
| Diameter | Pitch | Bolt | Hvy Hex Nut | Anti-Seize | Oiled | |
| 3/4 | 10 | 1 1/8 | 1 1 /4 | 225 | 280 | 2 7/16, 2 15/16, 3 15/16 |
| 1 | 8 | 1 1/2 | 1 5/8 | 550 | 680 | 4 7/16, 5 7/16, 6 7/16, 7 3/16 |
| 1 1/8 | 7 | 1 11/16 | 1 13/16 | 800 | 960 | 4 7/16, 5 7/16, 6 7/16, 7 3/16 |
| 1 1/4 | 7 | 1 7/8 | 2 | 1150 | 1360 | 4 7/16, 5 7/16, 6 7/16, 7 3/16 |
| 1 1/2 | 6 | 2 1/4 | 2 3/8 | 1900 | 2660 | 9 |
| 1 3/4 | 5 | 2 5/8 | 2 3/4 | 3000 | 4600 | 10 1/4 |
| 2 | 4.5 | 3 | 3 1/8 | 4500 | 6500 | 10 ¼ 11 1/2 |

| Torque for Grade 5 UNC Hold Down Bolts – Reference Only<br>(Originally supplied before 2003 as standard) | | | | | | |
|---|---|---|---|---|---|---|
| **Bolt Thread** | | **Wrench Size** | | **Torque in FtLb** | | **Nominal Shaft Size** |
| Diameter | Pitch | Bolt | Hvy Hex Nut | Anti-Seize | Oiled | |
| 3/4 | 10 | 1 1/8 | 1 1/4 | 160 | 170 | 2 7/16, 2 15/16, 3 15/16 |
| 1 | 8 | 1 1/2 | 1 5/8 | 390 | 405 | 4 7/16, 5 7/16, 6 7/16, 7 3/16 |
| 1 1/2 | 6 | 2 1/4 | 2 3/8 | 1150 | 1220 | 9 |

**7.5.19 Mounting the Gland Packing** Use this reference for hold down bolts: 9702P-XX, 9703P-XX, 9702R-XX, 9702F-XX

The stuffing box is equipped with two tapped holes for sealing water located 180° apart. Either tap can be used; however, normal practice is to pipe sealing water to both taps. In order to keep the stuffing box free from abrasive particles, the sealing water pressure and gland (452) tightness should be adjusted to maintain a small flow of cool or lukewarm leakage out of the stuffing box. If the leakage becomes hot, the gland should be loosened to allow a greater flow. If cloudiness is seen in the leakage, greater water pressure is needed.

**Caution**

Purge water must be non-aggressive, not liable to form deposits and not containing suspended solids. (Hardness: on average 5; pH > 8, or conditioned and neutral with regard to mechanical corrosion).
Inlet temperature $t_E$ = 10 to 30°C (50 to 85 °F)
Outlet temperature $t_A$ max. 45°C (115 °F)

The sealing water pressure required to maintain satisfactory stuffing box operation will vary with pump operating pressure, slurry properties, condition of the packing, and the type of stuffing box. In general, a supply pressure of 10 psi over the discharge pressure of the pump should be available. In many cases, further adjustments to any lower pressures needed in actual operation can be made with a manual valve.

**Caution**

The stuffing box purge water should be controlled. The amount of flow from the box should be adjusted to the minimum amount required to provide cooling. This often results in flow rates considerably less than those given in the table below, which are maximum requirements for worn packing. Flow control of stuffing boxes is not recommended. It may result in abnormally high sealing pressures and lead to jamming of the packing, excessive heat and wear.

**Stuffing Box Maximum Seal Water Requirements**

| Shaft | | | Maximum Sealing Water Requirements | | | | | |
|---|---|---|---|---|---|---|---|---|
| Nominal Shaft Size | Typical Sleeve Outer Diam. [in] | *[mm]* | Forward Flush [gpm] | *[l/s]* | KE [gpm] | *[l/s]* | Throat Bushing [gpm] | *[l/s]* |
| 2 - 7/16 | 3.5 | *88.9* | 10 | *0.6* | 2 | *0.1* | 5 | 0.3 |
| 2 - 15/16 | 3.938 | *100* | 12 | *0.8* | 3 | *0.2* | 6 | 0.3 |
| 3 - 15/16 | 4.938 | *125.4* | 20 | *1.3* | 4 | *0.3* | 10 | 0.6 |
| 4 - 7/16 | 5.438 | *138.1* | 25 | *1.6* | 5 | *0.3* | 13 | 0.8 |
| 5 - 7/16 | 6.438 | *163.5* | 30 | *1.9* | 6 | *0.4* | 15 | 0.9 |
| 6 - 7/16 | 8.5 | *215.9* | 55 | *3.5* | 11 | *0.7* | N/A | N/A |
| 7- 3/16 | 8.5 | *215.9* | 55 | *3.5* | 11 | *0.7* | 28 | 1.7 |
| 9 | 10.5 | *266.7* | 85 | *5.4* | N/A | *N/A* | 43 | 2.7 |
| 10- 1/4 | 11.9 | *303.2* | 110 | *6.9* | N/A | *N/A* | 55 | 3.4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10- 1/4 Extra | 14 | *355.6* | 150 | *9.5* | N/A | *N/A* | 75 4.7 |
| 11- 1/2 | 14 | *355.6* | 150 | *9.5* | N/A | *N/A* | 75 4.7 |
| 13 | 17 | *431.8* | 225 | *14* | N/A | *N/A* | N/A *N/A* |

### 7.6 Spare Parts Stock

Due to the erosive action of the slurry, many of the wet end components of the pump may require replacement during normal maintenance. Inspection or overhaul of the mechanical components may also warrent the replacement of certain parts.

The following are recommended lists of parts to have on hand for normal maintenance and inspection. The quantities of parts kept in store will depend upon the severity of the slurry duty and the number of units operating. Maintenance practices may also favor keeping fully built sub-assemblies or complete pumps on hand in some cases. Previous experience in similar duties often provides the best experience. If in doubt, contact your GIW / KSB representative for specific recommendations.

**Wet End**

- Casing
- Impeller
- Side Liner(s)
- Gasket Kit

**Bearing Assembly**

- Bearings
- Gasket Kit
- Lubricant

**Stuffing Box**

- Shaft Sleeve
- Seal Water Ring
- Packing
- Gasket Kit

#### 7.6.1 Maintenance Procedures for Maximum Parts Life

The wear of slurry pump parts is influenced by many factors and the following procedures are designed to help you get the most out of your wet end wear parts. If problems occur, contact your GIW / KSB representative for a review of your application.

Also see section 7.7: “Operational Problems and Solutions”.

**Suction Liner**

The suction liner should be rotated 180° at approximately half life if localized wear occurs. If localized wear is severe, repair as recommended by GIW / KSB before rotation.

When the liner is rotated, the snap ring gasket may need replacing. If gasket wear is uniform, the snap ring gasket may be reused by placing a 1/4" (6.4 mm) spacer such as an o-ring or packing behind its back vertical surface. This will cause the gasket to protrude into the shell after suction plate installation. The protruding gasket should wear off leaving a smooth joint between liner and shell. If the gasket does not protrude, the resulting gap between metal parts will cause turbulence which results in accelerated wear.

A new snap ring gasket should always be used with a new suction liner or new shell.

**Impeller**

The impeller to suction liner clearance should be adjusted forward several times during its life cycle for maximum impeller and suction liner life. See section 7.5.17.

In general, an impeller does not require replacement until it fails to produce sufficient head for the application. Impellers are sometimes changed too soon based on appearance. Vibration caused by an impeller wearing out of balance is rare but possible. If this occurs, the impeller may be statically balanced by hand grinding on back shroud.

The impeller should never be repaired by welding.

**Shell**

If wear is localized with a deep gouge, repair or replace as recommended by GIW / KSB.

### 7.7 Operational Problems and Solutions

Many pump wear problems are caused by unstable system operation, or off duty pump operation. Although the dynamics of slurry piping systems cannot be fully addressed in this manual, the following items should be considered. Also refer to section 8: “Trouble Shooting”

**Sump Design**

A minimum sump capacity of one minute at the expected flow conditions should be provided. Sump design should prevent any uneven flow of the solids to the suction. Often, a flat bottom sump is best since it will allow the solids to assume a natural slope of repose. The sump should be observed during operation to insure that solids are not building up and sluffing off.

Sump design should prevent the formation of a vortex, or other means of introducing air into the pump. Where a submerged suction is available, the depth of water level above the pump suction is more important than the cross-sectional area of the sump. Frothing of the sump should be eliminated by the installation of baffles, a submerged inlet pipe or other methods to prevent air becoming entrained in the slurry. If unavoidable, frothing must be accounted for in the system design and operation.

If the sump is runs dry, the system will surge causing accelerated pump wear. Pump speed or impeller diameter should be decreased or make up water increased. If the flow variations are too great, a variable speed motor may be required.

**Cavitation / NPSH Performance**

The NPSH available must always be greater than the NPSH required by the pump or cavitation will occur resulting in head loss (drop in discharge pressure), increased wear rate of the pump parts, and shock loading of the pump bearing assembly. If in doubt, consult your GIW / KSB representative for the NPSH requirements of your pump.

To maximize the NPSH available to the pump, insure that the suction line is as short and straight as possible and the sump level is as high as possible, (or the suction lift as small as possible in the case of a pump located above the water level). Minimizing the number of valves or short radius fittings and attaching a suction inlet bell will also reduce entrance losses. A larger diameter suction pipe may help, but one must be careful not to reduce the flow velocity below safe carrying levels or bedding of the slurry will occur and result in increased suction liner and impeller wear.

In dredging applications where a free suction pipe or suction cutter head is lowered into the solids to be pumped, it is useful to have pressure gauges attached to the pump suction and discharge. An operator, by observing the gauges, will be able to maintain a maximum suction vacuum without cavitating the pump.

**Piping System Design**

With coarse settling slurries, the pipelines should be vertical or horizontal. Inclined pipelines may surge due to a backward drift or build up of solids. Also, an increase in slurry friction loss may be experienced in these sloped lines, further reducing performance.

Piping diameters must be properly sized to maintain sufficient carrying velocity. Oversized pipelines may result in the formation of a sliding bed of slurry which can greatly accelerate the wear of pumps and pipelines.

**Operating Conditions of Flow and Head**

It should be noted that the pump always operates at the intersection of the pump curve and the pipeline "system" curve.

During the initial stages of operation, motor load on the pump should be checked. If there is an excess amount of power being drawn by the pump, it may be caused by the system head (TDH) being lower than predicted thus resulting in higher flow rates and power consumption. This sometimes happens when a safety factor is applied to the head during the design of the system. Cavitation may also occur under these high flow conditions. The pump speed should be slowed down to reduce flow, or the total discharge head against the pump should be increased (resulting in reduced flow and power consumption).

If actual supply flow rates are lower than predicted, the sump may run dry causing the system to surge and accelerating pump wear. Pump speed or impeller diameter should be decreased or make up water increased to keep the sump at the highest stable level possible. If the flow variations are too great, a variable speed motor may be required. This problem is especially common in applications with a high proportion of static head, such as mill discharge and cyclone feed. It can be further aggravated by operation well below the best efficiency flow rate of the pump where the pump head curve is relatively flat. Under these conditions, minor fluctuations in the system resistance caused by normal variations in solids concentration or size can result in surging flow rates.

Whenever possible, avoid prolonged operation at flows well below the optimum flow rate. This causes recirculation of slurry within the pump and encourages localized wear.

In the event problems are encountered, contact your GIW / KSB representative. The pump serial number, in addition to the following, should be furnished to assist in evaluation of the problem:

A. Pump serial number (from the nameplate on the pedestal), customer location, and the approximate startup date.

B. Pumped fluid SG (specific gravity), slurry information including SG and particle size, and liquid temperature.

C. The approximate flow rate desired, and the actual minimum and maximum flow rate of the system if known.

D. The system static head (the difference in elevation between the water level on the suction side of the pump and the point of discharge)

E. The length and size of suction and discharge lines, including a description of the general arrangement including fittings, bends and valves

F. If the discharge point is not to atmosphere, what is the pressure, (e.g. cyclone backpressure).

G. If suction is taken from a sump, provide the general arrangement including size dimensions and minimum and maximum sump levels referenced to the suction centerline of the pump.

H. The available driver horsepower, speed of motor and pump or description of the ratio device between the pump and motor.

I. The impeller diameter if different from that supplied with the pump.

The above items of data are especially important when a pump has been transferred from the duty for which it was selected to some other application.

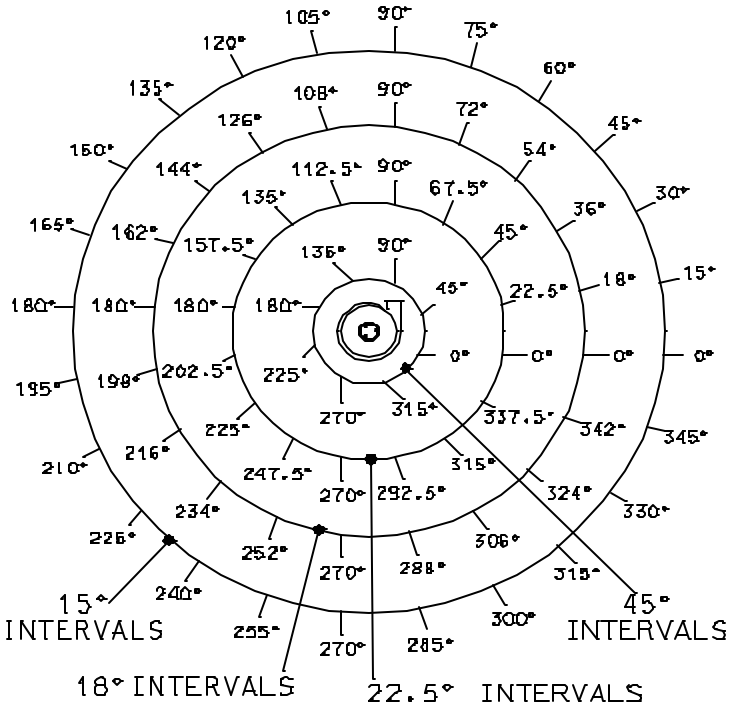
In many instances, it will be found that unusual wear in the pump, or low efficiencies, are caused by a mismatch between the pump and the system application and can be corrected once the operating conditions are known.

Contact your GIW / KSB representative for further specific recommendations regarding system design. A useful reference and textbook has also been published by GIW titled: “Slurry Transport Using Centrifugal Pumps,” by Wilson, Addie & Clift.

**7.8**

**LSA S RANGE PUMP INFORMATION TABLE**

| Assembly Number | Normal Size | | Maximum Operating Pressure | | Free Passage | | Discharge Position Intervals | Vane Number & Type |
|---|---|---|---|---|---|---|---|---|
| | in | mm | psi | bar | in | mm | Degrees | |
| 0517x | 2x3-21 | 50x80-530 | 220 | 15.17 | 1.0x1.5 | 25x40 | 45 | 4RV |
| 0518x | 3x4-21 | 80x100-530 | 220 | 15.17 | 1.0X1.5 | 25X40 | 45 | 4RV |
| 0519x | 4X6-21 | 100x150-530 | 220 | 15.17 | 2.5X2.8 | 63X71 | 45 | 4RV |
| 0500x | 4X6-25 | 100x150-635 | 163 | 11.24 | 1.2x3.5 | 32X89 | 22.5 | 4RV |
| 0516x | 4X6-25 | 100x150-635 | 163 | 11.24 | 1.5x2.3 | 39x58 | 22.5 | 4ME |
| 0501x | 6x8-25 | 150x200-635 | 163 | 11.24 | 2.8x3.6 | 71x92 | 22.5 | 4ME |
| 0521x | 8x10-25 | 200x250-635 | 163 | 11.24 | 2.4x4.9 | 61x125 | 22.5 | 4RV |
| 0502x | 8x10-32 | 200x250-810 | 153 | 10.55 | 3.5x4.7 | 89x120 | 22.5 | 4ME |
| 0503x | 8X10-32 | 200x250-810 | 153 | 10.55 | 4.5x4.7 | 114x120 | 22.5 | 3ME |
| 0504x, 0506x | 8x10-32 | 200x250-810 | 153 | 9.17 | 3.5x4.7 | 89x120 | 15 | 4ME |
| 0505x, 0507x | 8x10-32 | 200x250-810 | 153 | 9.17 | 4.5x4.7 | 114x120 | 15 | 3ME |
| 0522x, 0525x | 10x12-32 | 250x300-810 | 140 | 9.65 | 3.7x6.7 | 95X171 | 15 | 4RV |
| 0508x, 0510x | 10x12-36 | 250x300-910 | 146 | 7.38 | 4.0x6.7 | 102x171 | 15 | 4ME |
| 0509x, 0511x | 10x12-36 | 250x300-910 | 146 | 7.38 | 6.3x6.7 | 160x171 | 15 | 3ME |
| 0514x, 0512x | 12x14-36 | 300x350-910 | 173 | 7.58 | 5.3x8.7 | 133x222 | 15 | 4ME |
| 0513x, 0515x | 12x14-36 | 300x350-910 | 173 | 7.58 | 6.5x8.7 | 167x222 | 15 | 3ME |
| 0527x | 16x16-39 | 400x400-990 | 120 | 5.86 | 5.8x8.2 | 148x209 | 15 | 4ME |
| 0530x, 0532x | 16x16-39 | 400x400-990 | 126 | 6.21 | 4.4x8.7 | 112x222 | 45 | 4ME |
| 0534x, 0536x | 16x18-44 | 400x450-1115 | 165 | 8.07 | 5.5x7.6 | 141x193 | 18 | 4ME |
| 0535x, 0537x | 16x18-44 | 400x450-1115 | 165 | 8.07 | 7.6X8.2 | 193x208 | 18 | 3ME |
| 0538x, 0540x | 18x18-44 | 450x450-1115 | 160 | 7.58 | 6.3x11.6 | 161x295 | 18 | 4ME |
| 0539x, 0541x | 18x18-44 | 450x450-1115 | 160 | 7.58 | 8.8x11.6 | 225x295 | 18 | 3ME |
| 0546x, 0547x | 20x20-48 | 500x500-1220 | 105 | 6.55 | 9.7x11.7 | 247x298 | 45 | 4RV |
| 0548x | 20x20-48 | 500x500-1220 | 130 | 6.55 | 9.7x11.7 | 247x298 | 15 | 4RV |
| 0549x | 20x24-48 | 500x600-1220 | 170 | 5.52 | 6.1x12.8 | 155x326 | 15 | 4ME |
| 0550x | 22x24-54 | 550x600-1370 | 200 | 13.79 | 8.1x13.5 | 208x343 | 18 | 4ME |
| 0551x | 26x28-58 | 650x700-1470 | 86 | 4.34 | 8.6x11.7 | 218x298 | 15 | 4ME |




LSA Discharge Positions
Rotation direction is clockwise from the drive end. A vertical discharge is standard.

## 8 Trouble Shooting

| Pump delivers insufficient flow rate | Motor is overloaded | Excessive pump discharge pressure | Increase in bearing temperature | Leakage at the pump | Excessive leakage at the shaft seal | Vibration during pump operation | Excessive rise of temperature in the pump | Cause | Remedy [1] |
|---|---|---|---|---|---|---|---|---|---|
| ♦ | | | | | | | | Pump delivers against an excessively high discharge pressure. | Re-adjust duty point. |
| ♦ | | | | | | | | Excessively high back pressure. | Check plant for impurities.<br>Increase the speed (turbine, I.C. engine). |
| ♦ | | | | | | ♦ | ♦ | Pump or piping are not completely vented or primed. | Vent and / or prime. |
| ♦ | | | | | | | | Supply line or impeller clogged. | Remove deposits in the pump and / or piping. |
| ♦ | | | | | | | | Formation of air pockets in the piping. | Alter piping layout.<br>Fit a vent valve. |
| | | | ♦ | | ♦ | ♦ | | Pump Is warped or sympathetic vibrations in piping. | Check pipeline connections and secure fixing of pump; if required, reduce the distances between the pipe clamps.<br>Fix the pipelines using anti-vibration material. |
| ♦ | | | | | | ♦ | ♦ | NPSH available is lower than NPSH required by the pump. | Check / raise liquid level suppling the suction pipe. |
| | | | ♦ | | | | | Increased axial thrust. [2] | Correct rotor adjustment. |
| ♦ | | | | | | | | Air intake at the shaft seal. | Fit new shaft seal. |
| ♦ | | | | | | | | Reverse rotation. | Interchange two of the phases of the power supply cable. |
| ♦ | ♦ | | | | | | | Motor is running on two phases only. | Replace the defective fuse.<br>Check the electric cable connections. |
| ♦ | | | | | | | | Speed is too low. [2] | Increase speed. |
| | | | | | | ♦ | | Defective bearings. | Fit new bearings. |
| | | | ♦ | | | ♦ | ♦ | Insufficient rate of flow. | Increase the minimum rate of flow. |
| ♦ | | | | | ♦ | | | Wear of internal pump parts. | Replace worn components by new ones. |
| | ♦ | | | | | ♦ | | Pump back pressure is lower than specified in the purchase order. | Adjust duty point accurately. |
| | ♦ | | | | | | | Density and viscosity of the fluid pumped is higher than stated in the purchase order. | 2) |
| | | | | | ♦ | | | Use of unsuitable materials. | Change the material combination. |
| | ♦ | ♦ | | | | | | Speed is too high. | Reduce the speed. [2] |
| | | | | ♦ | | | | The bolts/seals and gaskets. | Tighten the bolts.<br>Fit new seals and gaskets. |
| | | | | | ♦ | | | Worn shaft seal. | Fit new shaft seal. |
| ♦ | | | | | ♦ | | | Score marks or roughness on shaft protecting sleeve. | Fit new shaft protecting sleeve.<br>Fit new shaft seal/check the balancing line.<br>Check throttling bush/throttling sleeve clearances. |
| | | | | | ♦ | | | Lack of cooling liquid or dirty cooling chamber. | Increase cooling liquid quantity.<br>Clean out cooling chamber.<br>Purify/clean cooling liquid. |
| | | | | | ♦ | | | Stuffing box ring, cover plate, seal cover have been tightened incorrectly; wrong packing material. | Correct. |
| | | | | | ♦ | | | Vibration during pump operation. | Improve suction conditions.<br>Re-align the pump.<br>Re-balance the impeller.<br>Increase the pressure at the pump suction nozzle. |
| | | | ♦ | | ♦ | ♦ | | The unit is misaligned. | Check the coupling; re-align, if required. |
| | | | ♦ | | | | | Insufficient or excessive quantity of lubricant or unsuitable lubricant. | Top up, reduce or change lubricant. |
| | | | ♦ | | | | | Non-compliance with specified coupling distance. | Correct distance according to the installation plan. |
| | ♦ | | | | | | | Operating voltage is too low. | Increase the voltage. |
| | | | | | | ♦ | | Rotor is out-of-balance. | Clean the impeller.<br>Re-balance the impeller. |

1)The pump pressure must be released before attempting to remedy faults on parts which are subject to pressure.
2)Contact GIW/KSB representative

**NOTES**

## 9 General Drawing with List of Components

Pump assembly, bill of material and other drawings or special instructions relevant to each order will be attached to the back of this manual.

# 10 Supplements

Supplements provide additional information for optional equipment. ***These options may not be available for your pump.*** **See your Bill of Materials for options that were included with your pump.**

**10.1 UnderwaterPump Operation with Duo-Cone Bearing Seals**
See page 28

**10.2 Duo-Cone Seal**
See pages 29-30

**10.3 TBC Wet End Assembly Instructions**
See pages 31-32

**10.4 Impeller Release Ring Bolt Replacement**
See page 33

## 10.1 Underwater Pump Operation with Duo-Cone Bearing Seals

The Underwater Cartridge Bearing Assembly (UCBA) uses Duo-Cone seals in the end cover. Sealing is accomplished with two hardened, precision ground faces running against each other. An elastomer toric applies pressure to the faces and allows the seal rings to accommodate axial and radial run out. The contact pressure and shaft speed will generate heat in the seal faces that must be removed by the surrounding water as the pump is running. Correct installation and adjustment is extremely critical to the proper function and life of these seals.

Due to the angular position of ladder mounted pumps in most dredge operations, the UCBA must be completely filled with oil to provide lubrication to the rear thrust bearing when the cutter head is lowered. This requires the use of tank mounted above the deck to detect leaks and accommodate internal pressure changes. A pressurized recirculating system can be used, but the simplest method is an expansion tank suitable for operation within the marine environment. This must be designed to prevent dirt, water or other contaminants from entering the oil system while providing a vent to atmosphere.

This tank keeps a positive pressure on the bearing side of the Duo-Cone seals to counteract the water pressure as the pump is submerged. The tank should be mounted high enough to maintain a pressure of about 7 psi (0.5 bar) above what is created by the maximum water depth. Note that the specific gravity of oil is only about 85% of water and must be taken into account when calculating the mounting height of the tank.

The tank should have an oil level indicator to allow the operator to see if the level changes. After the oil temperature stabilizes, the level should remain constant and any significant change would indicate a leaking seal. This early warning can prevent oil from leaking into the surrounding water and avoid bearing failure.

Dredge pumps are designed to run with the UCBA and Duo-Cone seals fully submerged. This enables the surrounding water to dissipate heat generated by the bearings and seal faces. If the pump will be operated above the water line for extended periods, the bearings can create extra heat in the oil and the seal faces may overheat. Provisions should be made to provide a supply of cooling water to each Duo-Cone seal and a water spray onto the UCBA itself. If the pump will run continuously above water, other sealing systems are recommended, or oil circulating and seal cooling systems will be required.

Care should be taken to operate the pump within the speed limitations specified by GIW on the pump drawing for the particular seal size installed. If a seal is replaced, it must be installed with the correct gap (specified by GIW for each seal size) between the seal holders, as this distance provides the correct seal face pressure for proper operation.

Failure to operate the seals within the above parameters may result in premature seal failure or oil leakage through the Duo-Cone seals. Any change in the operating conditions should be discussed with your GIW / KSB representative to establish if the new conditions are suitable for the equipment.

**10.2 Duo-Cone Seals**


Seal rings, rubber torics and housings must be completely clean and free of any oil or dirt. Use a lint free cloth with a solvent that evaporates quickly and leaves no residue. It must be compatible with rubber toric rings. Isopropyl Alcohol or other mild cleaner will work. Follow all safety guidelines for use according to the solvent Material Safety Data Sheet. Check the rubber toric for surface defects and inspect the entire metal seal face for dirt or marks. Do not place the polished seal ring face on any surface.

Gently stretch the toric over the metal seal rings until it Verify that the toric is not twisted by inspecting the mold diameter. Eliminate any irregularity by gently pulling a radially off the ring and letting it snap back. Twisted nonuniform face load, resulting in leakage and bearing

seats in the radius. flash line on the outside section of the toric torics will cause contamination.

grooves

Tool, parts rapid,

Place the housing end cover and seal holder on a flat, clean surface. Verify that the are clean and free from burrs or sharp edges. Using the correct Seal Installation locate the machined ridge in the tool over the toric and clamp together. Align the squarely with the groove and carefully snap the seal assembly into place using a even push. Isopropyl alcohol can be used as a lubricant. Allow time for the assembly lube to evaporate.

Apply a very thin film of pure Molybdenum Disulfide lubricant or light oil to the seal faces just prior to final assembly. This will lubricate the seals during initial start up. Do not to get any lube on the rubber toric rings. Be sure there is no debris on either of the seal faces, since even a small piece of lint can hold the seal faces apart and cause leakage or damage to the sealing surfaces.

Final assembly is detailed on the Bearing Housing Assembly drawing. Bolt the end covers in place and install the two (2) studs and nuts for the installation tool. Verify that there are no burrs or sharp edges on the shaft that could damage the o-ring. Coat the long set screws with anti-seize and thread them into the tapped holes until the points are 1/8" (3mm) from the inside bore. Install the o-ring in the Seal Holder. Coat the ID of the holder with RTV silicone sealant, including the o-ring and set screw holes. Place a small bead of silicone around the shaft diameter to help the o-ring slide. Use extra care at the shaft keyway. Place the gap spacer over the shaft and carefully slide the holder until it contacts the spacer. Drop the installation tool over the shaft and tighten the nuts ¼ to ½ turn past Hand Tight against the tool. The gap spacer should not move and the holder should contact it evenly on all sides. Tighten the set screws in a criss-cross pattern. Remove the installation tool and gap spacer, and then retorque the set screws. Coat the lock screws with anti-seize and tighten them in the tapped holes. Fill the tapped holes flush to the top with silicone to protect the set screws. This will make removal easier for future maintenance. Rotate the shaft by hand and check for smooth operation. Verify that the holders are square to the end cover. The metal seal rings may appear cocked slightly relative to the holders. This is not a problem, the rings will run true when the pump starts.

After the assembly is complete, remove one of the pipe plugs from the bearing housing. Install an air line fitting and slowly pressurize the unit with dry shop air to 10-15 psi or 1 bar. Check all joints and the Duo-Cone seals for leaks by spraying with a soapy water solution. Do NOT exceed 15 psi, as this could cause the torics to extrude from the seal grooves. If this occurs, disassemble the unit and reinstall the toric. Release the air pressure, replace the pipe plug and prepare the unit for shipping or installation on the pump pedestal.

Units being returned to service must be completely filled with oil. Remove the top filler plug and add oil. If the unit will remain empty during pump installation, be sure it is clearly indicated to ADD OIL prior to start up on both the pump and the control panel. After the day tank is connected, fill the hoses and tank. Allow time for the oil to displace the air in the lines. Mark the oil level in the tank for reference. Note that a single hose system or colder temperatures will require time to bleed all the air from the system. The level should equalize after the pump has been operating for an hour or two. At this point, fill the tank to the correct operating level.

### 10.3 TBC Wet End Assembly Instructions

This supplement ony applies to TBC pumps

The TBC (Through Bolt Construction) design constrains the pump shell between ductile iron plates using long bolts or studs around the perimeter. This enables the pump to operate at significantly higher pressures than a standard design and can provide additional system integrity by including mounting feet on the plates. While maintenance procedures are similar to other designs, there are special techniques that will help expedite assembly of the GIW TBC pump.

Before starting, verify that all necessary hardware, gaskets, sealants and tools are present. An overhead crane with appropriate lifting straps, shackles or chains will be needed to move the parts. Check the pump drawing for assembly details, torque requirements and tightening sequence. It may help to paint the sequence number next to each bolt location on the suction plate. Clean and inspect all threaded fasteners, then lightly lubricate them. Be certain to adjust torque values according to the thread lubricant used. All mating surfaces of pedestal, plates and pump shell must be cleaned and inspected for damage that could interfere with the machined fits.

The best way to assemble the replaceable wear liners and plates is to place them on a flat, level work area. This will make alignment easier as the parts are fit together. Start with the hub side and elevate the liner on stable blocks so the o-ring can be checked just prior to final closure. Install the studs into the liner. Install the o-ring seal and apply a bead of RTV silicone to help hold it in place. Lift the plate over the liner and adjust the lifting straps if necessary to keep it parallel to the liner. Carefully lower it over the studs, check that the o-ring is in place, and seat the plate on the liner. Lubricate the threads, install the washers and nuts on the studs, and tighten in three (3) torque steps in an “X” cross pattern. Begin at one third of the final torque for the first pass, then tighten to two thirds, and finally torque to the required value. Attach the lifting slings to the top of the plate so it can be raised into position.

The suction liner and plate are assembled in the same manner. Note that some designs may not have the o-ring on this side, so that step would not be required. Install the studs and clean all machined surfaces.

The stuffing box is next. Split boxes should be preassembled. Following the instructions in the Maintenance Manual, coat the shaft surface with anti-seize compound, install the shaft sleeve and o-ring with any optional release ring components onto the shaft. Clean and inspect the stuffing box machined surface and bond the gasket in place using an adhesive sealant such as copper coat or Permatex™. Coat the back surface of the gasket with adhesive and carefully slide the box on the shaft. If additional working clearance is desired, the bearing assembly can be moved away from the wet end by loosening the hold down bolts and turning the adjusting bolt.

Lift the hub liner assembly, align the studs with the holes in the pedestal and slide in place. Lubricate the threads, install the washers and nuts on the studs, and tighten in three (3) torque steps in an “X” cross pattern. Begin at one third of the final torque for the first pass, then tighten to two thirds, and finally torque to the required value. Clean the gasket surface and install the shell seal, either an o-ring or gasket. The outer surface of the tapered snap ring gasket will be marked “Outside” and it should be installed on the liner with the thicker section against the hub plate. This will leave a gap between the edge of the gasket and the plate surface. Note that the width of the gasket may be longer than the liner. This will wear away as the pump runs.

Lubricate the bolts and attach the stuffing box to the hub plate. Following the instructions in the Maintenance Manual, align the box with the shaft and torque the fasteners. Install the lantern ring or throat bushing. Packing rings can be installed later from the bearing side. Lubricate the bolts and attach the wear plate to the stuffing box. When using a two piece plate with a split box, align the plate joint 90° from the box split line.

Coat the impeller threads with anti-seize compound as outlined in the Maintenance Manual and install the impeller. Position the hub on the shaft threads and use a spanner wrench to thread the shaft into the impeller until tight. Be sure the bearing assembly is located so the impeller does not contact the hub liner. Note that final torque will be achieved when the pump is operated under load.

Install the studs into the hub side of the shell and attach the lifting slings to the top lifting eyes so it can be raised into position. Lubricate the snap ring gasket and mating surface on the shell using a commercial rubber lubricant, soap solution, or other non-petroleum product. Lift the shell, align the studs with the holes in the hub plate and slide in place. Lubricate the threads, install the washers and nuts on the studs, and tighten in three (3) torque steps in an “X” cross pattern. Begin at one third of the final torque for the first pass, then tighten to two thirds, and finally torque to the required value.

Attach the lifting slings and raise the suction plate assembly upright. Install the snap ring gasket as outlined above and lubricate both the gasket and the mating shell surface. Lift the plate into position, and press the plate into the shell.

Tie bolts are installed into the hub plate by threading the inner jam nut onto one end of the bolt, placing it in the plate, then securing it with the second nut. Do not tighten until the pump is assembled and the tie bolts can be properly aligned with the suction plate. Coat the suction end of the tie bolt with oil or grease to allow easier disassembly for maintenance and install the nut and washer. Adjust the hub plate nuts to allow just a few threads to protrude from the nut on the suction side. Tighten the back two nuts together to lock the tie bolt to the hub plate. Following the sequence on the pump drawing, torque the tie bolts in three stages as outlined above.

If the plates are equipped with mounting feet, these must be shimmed to the surface of the sub-base and bolted securely in place. This connection helps carry pump loads to the foundation.

With the assembly complete, set the impeller nose clearance according to the instructions in the Maintenance Manual. Recheck all fasteners, connect the rest of the system equipment, and put the pump in service.

When routine wet end maintenance requires removal of the suction plate, attach the lifting slings to the plate assembly, remove the fasteners from the mounting feet, remove only the front nuts from the tie bolts and pull the plate and liner out of the pump shell. The tie bolts can remain in place. It may be necessary to loosen some of the hub side nuts for alignment at reassembly.

**10.4 Impeller Release Ring Bolt Replacement**

# Replacing the Fasteners:

Externally scrub the entire release ring area with LPS Instant Super Cleaner, making sure the area is clean and free of all debris and grease. After the release ring is clean, ***only remove and replace one of the three fasteners at a time.*** Always leave two fasteners secure to hold the relese ring in position, while replacing the bolts. After removing the old fastener, thoroughly clean the threaded hole in the release ring with the LPS. Make sure the threaded hole is dry after being cleaned with the LPS Instant Super Cleaner. Each old fastener should be discarded and the new fastener should be installed with Loc-tite thread locker 242 and 22477 Primer T. Make sure the new fastener is brought to full torque before moving on to the next fastener. All three fasteners must be replaced once this process is started and under no circumstances should any combinations of old and new fasteners be used. See chart in section 7.5.10 for correct torque. Bolts are to be replaced every time a release ring is disassembled.

## Required for Installation

1 Can of LPS Instant Super Cleaner (LPS Part # 00720)
1 bottle of Loc-tite Thread Locker 242
1 Can of 22477 Primer T
Detailed instructions with appropriate warnings.
6 SHCSs (twice the amount needed for the replacement) Premier Farnell Supertanium Fasteners.
Procedure for installation.

The spare set of fasteners is for any future removal of the release ring. See section 7.5.10 for fastener properties.