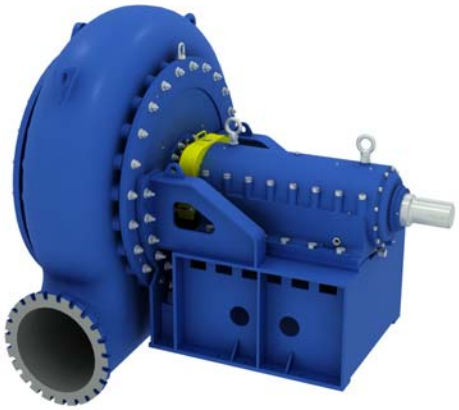
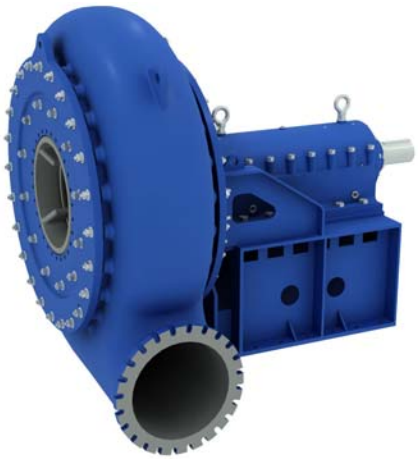
Maintenance Manual

07/2013 **LSA**





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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Additional copies may be purchased. Please contact your sales representative for details.

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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 that 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 Safety Markings

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 the safety sign in accordance with DIN 4844-W8.

Caution 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 Operators

- Any hot or cold components that could pose a hazard must be equipped with a guard by the operator.
- Guards that 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.)
- Mixing unsuitable media may cause a chemical reaction resulting in a pressure buildup and potential explosion.

2.6 Safety Instructions for Maintenance, Inspection & 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 Section 6 “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.

2.9 Assembly & Disassembly Safety

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 rules of sound engineering practice and the relevant sectional drawings. 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.
- Before assembly thoroughly clean all dismantled part mating surfaces 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 and 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.
- 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.
- Repair and maintenance work to the pump must only be carried out by specially trained personnel, using original equipment spare parts.



Proper lifting, rigging and safety practices must be observed at all times.
Do not attempt to lift heavy components by hand as this may result in personal injury and damage to equipment.



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.



Before dismantling or reassembly, 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, drained, and its pressure must be released.



Before dismantling or reassembly of vertical pumps, remove the motor and pull the assembly out of the sump.

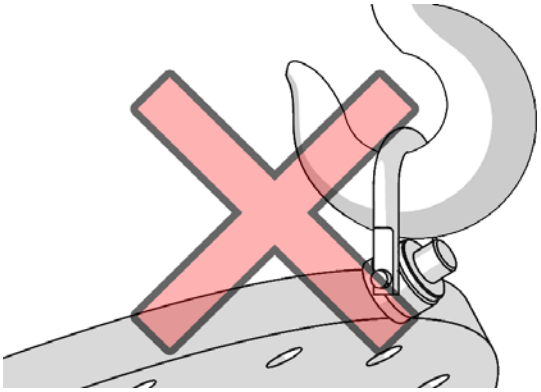


Do not apply heat to the impeller hub or nose due to the sealed cavity at the impeller nose.
DANGER OF EXPLOSION!

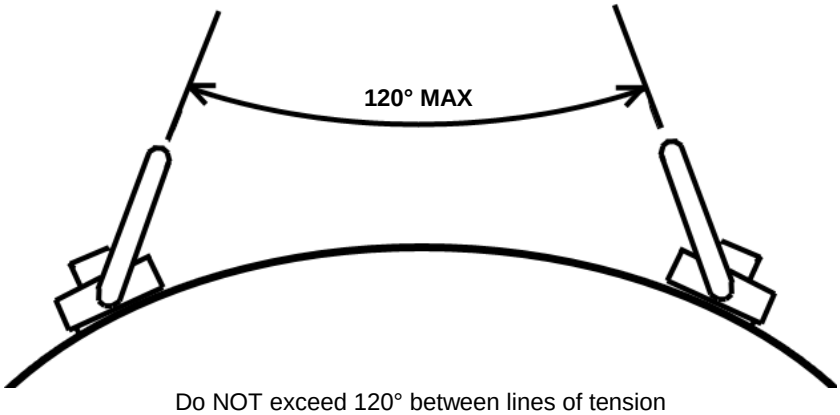


Upon completion of the work, all safety-related and protective equipment must be properly refitted and/or reactivated before starting the pump set.

Always ensure that lifting equipment does not bind the swivel hoist ring. Binding can cause the ring to fail.
When lifting a plate that contains two swivel hoist rings, do not allow the angle between the lines of tension from the rings to exceed 120°. This could cause the hoist rings to fail.



Do NOT bind lifting equipment



Do NOT exceed 120° between lines of tension

3 Transport and Storage

3.1 Transport & Handling Safety



Proper rigging, lifting and safety practices must be observed at all times.



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

- Follow proper lifting practice and safety rules at all times, including:
  - ✓ Verification of the lift weight and load rating of the lift equipment.
  - ✓ Suitability and stability of the attachment points.
- Be aware of the location of the center of gravity, which is usually NOT located at the physical center of the unit. In general, the following guidelines will apply, although common sense and testing of the lift before movement should be used to verify:
  - ✓ Bare shaft pump (without motor): Near the shaft seal area.
  - ✓ Pump with overhead mounted motor: Between the pump and motor, slightly behind (towards the drive end) of the shaft seal.
  - ✓ Vertical pump: between the pump and bearing assembly, but closer to the bearing assembly.
- Space the lifting points evenly about the center of gravity and as far apart as practical. This will result in the most stable lift. Note that certain lift points on the pedestal may be intended for use in handling the pedestal alone and are not necessarily optimum balance points for the entire pump unit.
- See Section 3.3 for suggested lifting methods. Actual safe lifting method will vary with pump configuration and type of lifting equipment.
- Ensure secure attachments and test the lifting method for stability before moving pump.
- Ensure that the unit remains in the horizontal position during lifting and cannot slip out of the suspension arrangement.
- Ensure that the pump is firmly strapped down during shipment. Pump should be protected from direct contact with the elements. Motors and gear reducers may require immediate cover (consult manufacturer). After arrival on site, consult GIW Pump Storage recommendations for further storage instructions.
- In corrosive environments be sure to remove all lifting devices from the pump and store in a non-corrosive environment until needed.
- ***DO NOT:*** Use eyebolt or shackle locations on the bearing assembly, motor or pump plates. These are intended for lifting those items alone and must not be used when lifting the entire pump.
- ***DO NOT:*** Place excessive side loads on cast lifting eyes. The side loading angle on any lifting eye should not exceed 30 degrees.

3.2 Storage Requirements

3.2.1 Storage of New Pumps – Pumps under Warranty

Consult your sales contract documents and/or your GIW representative for detailed instructions. Note that failure to follow proper storage procedures will void your warranty.

3.2.2 Pump Storage

Caution In freezing environments, water must be prevented from collecting in the pump casing.

Caution 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.

Caution If the pump is fitted with a mechanical seal, motor, sheave, bushing, coupling, gear reducer, or other auxilarily equipment be sure to consult the manufacturer's maintenance manual for any additional storage instructions.

Caution Auxiliary systems should be regularly tested according to manufacturer's recommendations.

Storage Upon Receipt and up to 3 Months

- Pump should stored indoors and out of the weather until ready for installation.
- In construction environments where indoor storage is not available, store the pump on blocks or pallets, build a frame around it and cover with tarpaulin.
    - Frame must be able to withstand snow and wind, anchored and built in a manner to last the entire time pump is in storage. Shelter must be continuously maintained in a stable and leak free condition.
    - Ensure the tarpaulin does not touch the pump, since this can lead to condensation. Leave the bottom open for ventilation. Minimum Tarp requirements:
      - 18oz Vinyl - 20mil thick - Water proof - UV resistant

Storage Exceeding 3 Months and up to 12 Months

- If pump is exposed to the weather at any time the frame requirements still stand.
- The Wet End pump parts should be drained and isolated from reaction vessel gasses.
- Check the rust inhibitor coatings on bare metal surfaces and renew exposed areas.
- Check the painted surfaces for any signs of corrosion or breaks in the coatings and touch-up as needed.
- Check that the threaded holes are protected with grease and plugged.
- Oil lubricated bearing assemblies with GIW Blue Oil (requires shaft rotation):
    - GIW Blue Oil supplied with the pump should be added to the bearing housing until the level is halfway of the Oil Sight Glass (642).
    - Pump shaft should be manually rotated approximately 5 turns each month to keep the bearings coated.
    - The oil should be replaced if shutdown duration exceeds 12 months.
- Oil lubricated bearing assemblies with GIW Storage Oil (alternative to shaft rotation):
    - GIW Storage Oil should be added to the bearing housing until the level is halfway of the Oil Sight Glass (642) and rotate the shaft several times. No further shaft rotation is needed
    - The bearing assembly must remain sealed in the factory assembled condition. The oil fill plug must be securely replaced and no breather or other vent added to the bearing housing.
    - The storage oil should be replaced if shutdown duration exceeds 12 months.
- Grease lubricated bearing assemblies do not require monthly rotation.
- If the pump is fitted with a mechanical seal, precautions may need to be taken before rotating the shaft. Refer to the seal manufacturer's maintenance manual for instructions.
- Pumps with InPro/Seal® bearing isolators must be coated externally with white grease or petroleum jelly to seal the gap between the rotor and stator. Units equipped with a vent kit must have the vents either removed and plugged, or blocked to prevent air exchange.
- Vertical pumps may be stored either vertically or horizontally, and the blocking on the shaft should be left in place until the pump is ready to be installed.

Installed Spares (Idle Pumps)

- After being idle to 1 or more months, shafts must be rotated through five (5) or more revolutions, either manually or by a short duration start-up. If regularly exposed to moisture (weather or process related), monthly oil analysis is recommended since idle bearing assemblies are subject to breathing and internal condensation due to ambient temperature fluctuations.
- After being idle for 3 or more months, oil change or oil analysis is recommended for all pumps to ensure against condensation.
- After being idle for 12 months or more, the oil should be replaced.

3.2.3 Pump Parts Storage

Caution

- ✓ All machined surfaces must be coated with rust protector
- ✓ Grease and plug all drilled and threaded holes
- ✓ Check monthly for paint breakdown on casting
- ✓ Check monthly for visible sign of rust on machine surface
- ✓ Check monthly forgeign matter buildup in drilled/threaded holes
- ✓ Remove rust with wire brush and recoat machined surfaces with a rust inhibitor as needed
- ✓ Remove rust with wire brush and repaint casting surfaces as needed

Caution All pump parts must be stored indoors. The only exception is for large castings such as pedestals, pump casings, impellers, etc… See chart below for details.

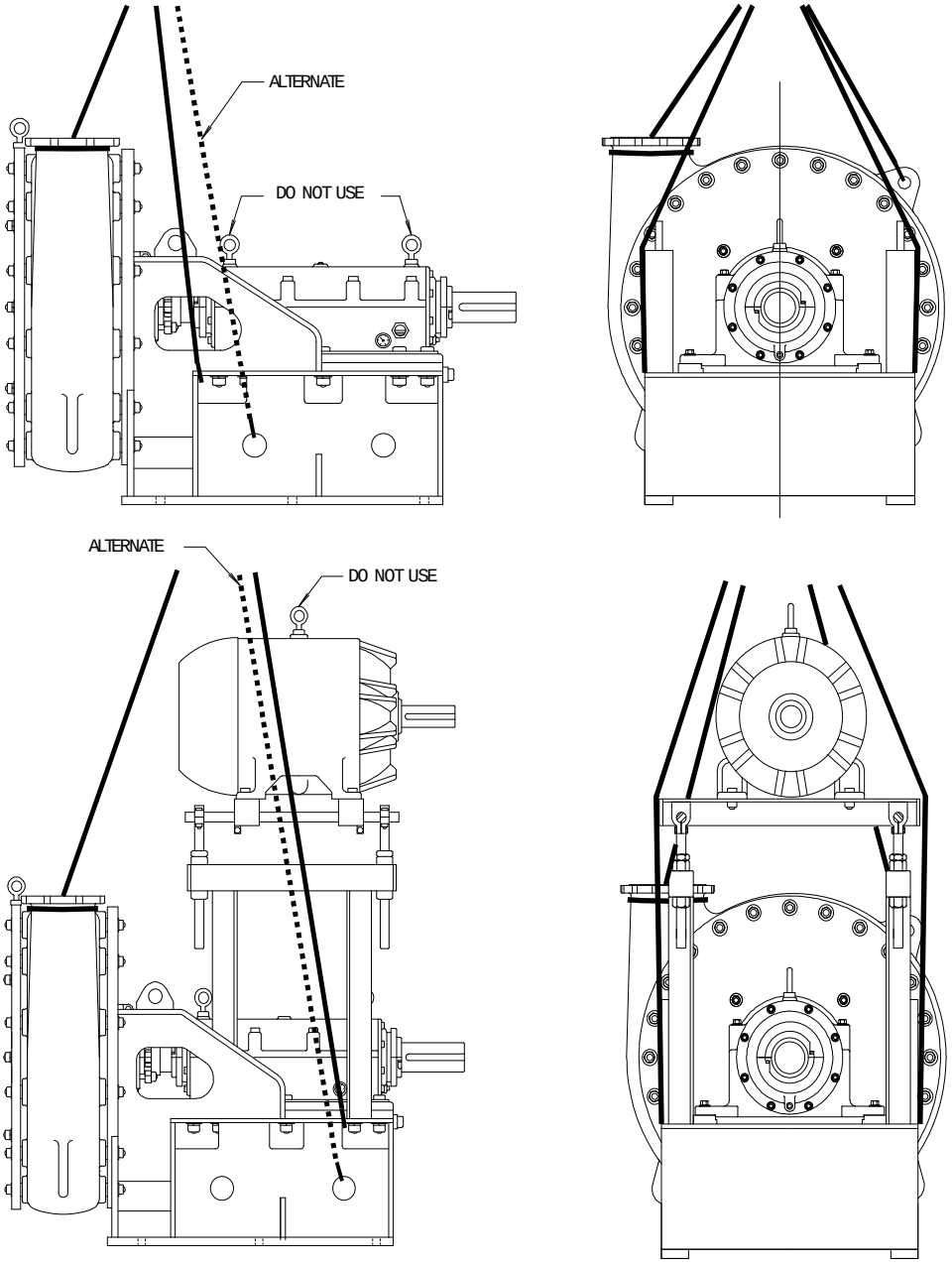
Pump Part	Storage Requirements
Pedestal, Plate, Casing, Impeller, Casing Half, Sub-base, Liner	✓ Outdoor storage with monthly inspection permitted for these parts only ✓ Lay sub-bases flat and do not stack
Rubber, Urethane, Elastomers, Neoprene	✓ Check expiration date (shelf life is 5 years) ✓ Keep dry, out of direct sunlight or other UV sources and away from heat. ✓ Store in the box with part being covered with the black plastic, low density, polyethylene bags (4 mil minimum thickness) and re-seal the boxes. ✓ Periodically inspect 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.
Shaft Sleeve, Lantern Ring, Wear Plate	✓ Coat complete part with rust protector
Shaft	✓ Coat complete part with rust protector and wrap with 6mil VCI plastic
O-Ring, Gasket	✓ Check expiration date (shelf life is typically 5 years) ✓ Keep dry, out of direct sunlight and away from heat
Bearings, InPro Seals, Stat-o-Seals	✓ Check expiration date (shelf life is typically 1 year) ✓ Refer to Manufacturer's Storage guidelines ✓ Keep in unopened box provided by the vendor ✓ Keep dry, out of direct sunlight and lay flat
Motor, Sheave, Gear Reducer, Bushing, Coupling, etc…	✓ Refer to manufacturer's storage guidelines

3.2.4 Removal from Storage

- Remove rust from machined surfaces using a wire brush.
- Remove rust inhibitor from all machined surfaces prior to installation/assembly.
- Check the painted surfaces for any signs of corrosion or breaks in the coatings and touch-up as needed.
- It is recommended that the bearing assembly be drained before shipment and refilled after relocation or installation.
- If GIW Blue Oil with rotation was used and the pump is stored for less than 12 months, the same oil may be used for initial commissioning and break in. Otherwise, it is recommended that the oil be replaced prior to commissioning to remove any moisture.
- If GIW Storage Oil was used, it should be drained and replaced with GIW Blue Oil before startup.
- For grease lubricated units, a fresh application of grease in the amount recommended by the maintenance manual for a normal lubrication interval should be applied.
- Stuffing Box should be checked before start up and replaced if necessary. Packing may have dried out and need multiple readjustments during the start-up process.
- If the pump is fitted with a mechanical seal, motor, sheave, bushing, coupling, gear reducer, or other auxilarily equipment be sure to consult the manufacturer's maintenance manual for any additional storage removal and commissioning instructions.
- Consult the Section 6 "Commissioning" before putting the pump into service.

3.3 Recommended Lifting

Caution Actual safe lifting method will vary with pump configuration and type of lifting equipment.



Transport of the complete pump unit

4. Description

4.1 Technical Specification

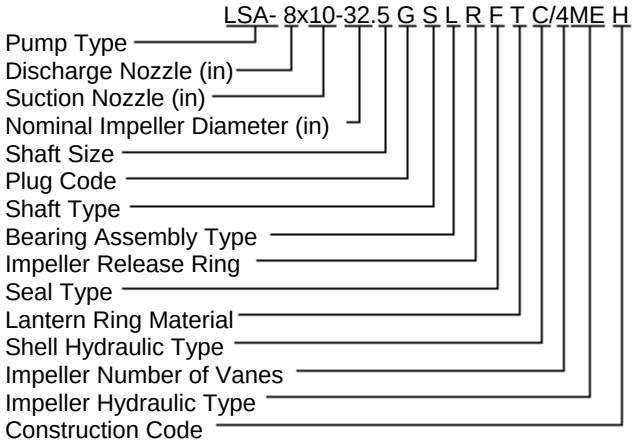
Most LSA pumps have been designed to the **ENGLISH** system of units using English dimensioned components, although in some special cases **METRIC** components have been used. Please consult your arrangement drawings and bills-of-material for details concerning your equipment.

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.

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



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

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 - 1/2

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).

4.4 Noise Characteristics

If running within the normal limits of operation and with clear water, the sound pressure level for the pump alone (with gear box and motor noises shielded) does not exceed 85 dB(A) 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.

4.5 Accessories

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

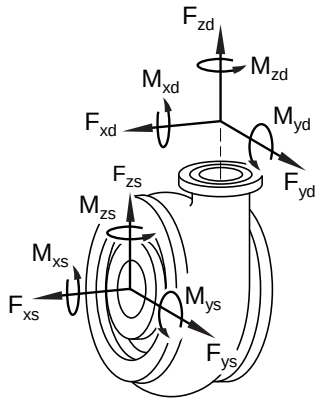
4.6 Dimensions and Weights

Dimensions and weights are listed on the pump installation plan.

4.7 Forces and Moments at Nozzles

Below are the allowable combined branch loads applicable for all GIW slurry pumps. Methods based on ANSI/HI 12.1-12.6-2011 Slurry Pump Standard. Loads generally exceed HI/ANSI 9.6.2-2008 table 9.6.2.1.4a and API 610-2004, Table 4. Higher allowable loads may be possible depending on individual pump configuration and operating conditions. Contact your GIW Application Engineer for more information.

NOTE: Discharge branch coordinate system always moves with the branch angle. (Fz is always along the direction of flow).



	Flange Size		Allowable Forces						Allowable Moments					
			F_X		F_Y		F_Z		M_X		M_Y		M_Z	
	inch	mm	lbs	N	lbs	N	lbs	N	ft-lbs	N-m	ft-lbs	N-m	ft-lbs	N-m
DISCHARGE PIPE	2	50	1600	7110	1280	5690	3250	14450	2640	3570	2640	3570	4000	5420
	3	75	1760	7840	1410	6270	3410	15180	2900	3930	2900	3930	4390	5960
	4	100	1930	8590	1550	6890	3580	15930	3160	4290	3160	4290	4790	6500
	6	150	2270	10110	1820	8090	3920	17450	3680	4990	3680	4990	5580	7570
	8	200	2630	11700	2100	9340	4280	19040	4200	5690	4200	5690	6360	8620
	10	250	3010	13390	2410	10710	4660	20730	4700	6380	4700	6380	7130	9670
	12	300	3420	15230	2740	12180	5070	22560	5210	7070	5210	7070	7900	10710
	14	350	3890	17300	3110	13830	5540	24640	5710	7740	5710	7740	8650	11730
	16	400	4440	19760	3550	15790	6090	27100	6200	8410	6200	8410	9400	12750
	18	450	5110	22750	4090	18190	6760	30090	6690	9070	6690	9070	10140	13750
	20	500	5900	26240	4720	20990	7550	33580	7170	9730	7170	9730	10870	14740
	22	550	6680	29730	5350	23790	8330	37070	7650	10380	7650	10380	11600	15720
	24	600	7350	32720	5890	26190	9000	40060	8120	11020	8120	11020	12310	16700
	26	650	7900	35170	6330	28150	9550	42510	8590	11650	8590	11650	13020	17660
	30	750	8780	39090	7030	31260	10430	46430	9510	12900	9510	12900	14410	19540
	36	900	9860	43890	7890	35090	11510	51230	10850	14710	10850	14710	16440	22290
	38	950	10150	45170	8120	36150	11820	52580	11280	15300	11280	15300	17100	23190
SUCTION PIPE	3	75	3410	15180	1760	7840	1410	6270	4390	5960	2900	3930	2900	3930
	4	100	3580	15930	1930	8590	1550	6890	4790	6500	3160	4290	3160	4290
	6	150	3920	17450	2270	10110	1820	8090	5580	7570	3680	4990	3680	4990
	8	200	4280	19040	2630	11700	2100	9340	6360	8620	4200	5690	4200	5690
	10	250	4660	20730	3010	13390	2410	10710	7130	9670	4700	6380	4700	6380
	12	300	5070	22560	3420	15230	2740	12180	7900	10710	5210	7070	5210	7070
	14	350	5540	24640	3890	17300	3110	13830	8650	11730	5710	7740	5710	7740
	16	400	6090	27100	4440	19760	3550	15790	9400	12750	6200	8410	6200	8410
	18	450	6860	30090	5110	22750	4090	18190	10140	13750	6690	9070	6690	9070
	20	500	7550	33580	5900	26240	4720	20990	10870	14740	7170	9730	7170	9730
	22	550	8330	37070	6680	29730	5350	23790	11600	15720	7650	10380	7650	10380
	24	600	9000	40060	7350	32720	5890	26190	12310	16700	8120	11020	8120	11020
	26	650	9550	42510	7900	35170	6330	28150	13020	17660	8590	11650	8590	11650
	28	700	10020	44590	8370	37250	6700	29800	13720	18600	9050	12280	9050	12280
	30	750	10430	46430	8780	39090	7030	31260	14410	19540	9510	12900	9510	12900
	34	850	11170	49710	9520	42370	7620	33890	15770	21390	10410	14110	10410	14110
	36	900	11510	51230	9860	43890	7890	35090	16440	22290	10850	14710	10850	14710
	38	950	11820	52580	10150	45170	8120	36150	17100	23190	11280	15300	11280	15300

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.

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.

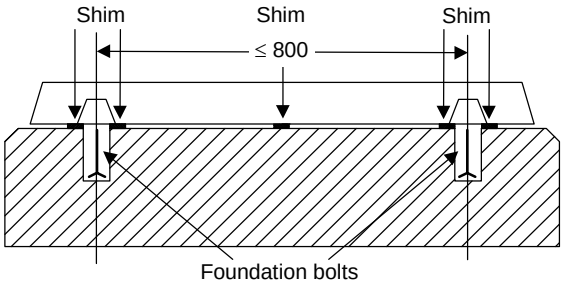
Appropriate personal protective equipment should be worn when handling concrete and grouting materials.

5.3 Installing the Baseplate and Pump

Do not install the baseplate and pump on unpaved or unsupported foundations. Injury can result from vibration or shifting equipment.

After placing the baseplate on the foundation, it must be leveled by shimming. Shims should be fitted between the baseplate 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 baseplate using low shrinkage grout.



5.3.1 Aligning the Pump / Drive Train

Caution All components must be level during system 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.

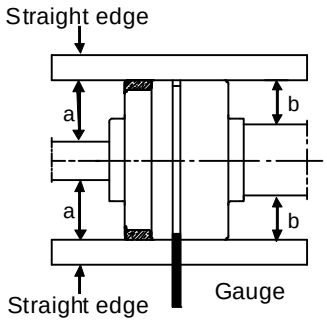
Caution Improper alignment of the unit can cause damage to both the coupling and the unit itself!

Use of the mounting bolts to close gaps between motor feet and the mounting plate (in place of shimming) is not recommended and may result in twisting of the motor frame, “soft foot” mounting and excessive vibration.

Care must be taken when removing drive components to avoid personal injury or damage to the equipment.
Avoid contact with hot surfaces such as couplings, which may heat up during normal operation and cause injury.

- Proper alignment must be taken into consideration when using an overhead motor mount accessory. Motor feet must be firmly supported at each mounting bolt location before the bolts are tightened. Shims should be used to fill any gaps and ensure solid mounting and vibration prevention.
- For optimum performance, the pump should be mounted directly to the baseplate without shims. The rest of the drive train is then aligned to the pump. For this reason, GIW baseplate designs generally allow space for shimming under the gear reducer and motor, but not under the pump itself. The only exception occurs in cases where regular removal and replacement of the entire pump is stipulated during the equipment design stage. In these cases, special instructions for alignment and shimming of the pump may be given on the pump assembly and/or general arrangement drawings.

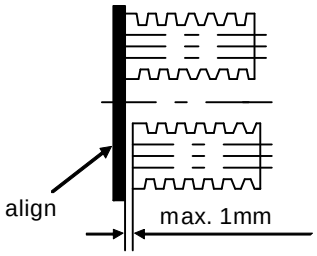
- Coupling check and realignment must be done even if pump and motor are supplied completely assembled and aligned on a common base plate. The correct distance between the coupling halves as specified in the installation plan must be observed.
- The pump set is correctly aligned if a straightedge placed 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.
- The radial and axial deviation (tolerance) between the two coupling halves should not exceed 0.1 mm (0.004 inch).
- 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.



Coupling Alignment

	Angular Misalignment Mils per inch .001/1"		Offset Misalignment Mils .001"	
RPM	Excellent	Acceptable	Excellent	Acceptable
3600	0.3/1"	0.5/1"	1.0	2.0
1800	0.5/1"	0.7/1"	2.0	4.0
1200	0.7/1"	1.0/1"	3.0	6.0
900	1.0/1"	1.5/1"	4.0	8.0

Typical industry standard for coupling alignment



V-belt Pulley Alignment

5.3.2 Place of Installation

The volute casing and mechanical seal take on roughly the same temperature as the medium handled. The mechanical seal, 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. Permissible forces must not be exceeded (see Section 4.7). Refer to your drawing for spool piece recommendation to ease maintenance.

Danger of life when toxic or hot media are handled.

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

5.4.1 Auxiliary Connections

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

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

5.5 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.

5.6 Oil Temperature Monitoring (RTD)

RTD (Resistance Temperature Detector) units are usually shipped separately along with the fittings needed to install them. Care should be taken during assembly. The fittings should be assembled and installed in the bearing housing before installing the RTD units. Use an oil compatible sealer on the threads during installation. Be sure to tighten fittings so that the oil drain plug is facing in the down position. After all fittings are installed, install the RTD unit. Take care not to drop or damage the RTD unit during installation. After the entire assembly is complete, the bearing assembly can be filled with oil. The assembly should be inspected for leaks during oil fill and then after the first few hours of operation.

5.7 Final Check

Verify the alignment as described in Section 5.3.1. It must be easy to rotate the shaft by hand at the coupling.

5.8 Connection to Power Supply



A trained electrician must make the connection to the power supply. Check available main voltage against the data on the motor rating plate and select the appropriate start-up method. The use of a motor protection device is strongly recommended.



An emergency shut off switch should be installed to prevent damage to the personnel and environment in the event of hazardous pump operation.

6 Commissioning / Operation

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 the GIW/KSB sales office.

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

6.1 Commissioning / Return to Service

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

1. If the pump has been in long term storage (more than 3 months), proper storage procedures were followed, including instructions for removing the pumps from storage (see contract documents and/or contact your GIW representative). Failure to follow proper storage procedures will void your warranty.
   See Section 3.2 “Storage Requirements”.
2. The impeller nose clearance has been properly set.
   See Section 10.4 “Setting Impeller Nose Gap” for details.
3. Pump drive train final alignment is complete.
   See Section 5.3.1 “Alignment” for details.
4. Final torquing of all bolts has been completed.
   See Section 11.1 “General Torque” for details.
5. All electrical and power supply connections are in order, including fuses and overload protection devices.
   See Section 5.1 “Safety Regulations” for details.
6. All required auxiliary connections, such as shaft seal water, oil coolers, etc. are made, tested and ready to function.
   See Section 5.4.1 “Auxillary Connection” for details.
7. All safety guards and equipment are in place.
   See Section 5.5 “Safety Guards” for details.
8. Any required instrumentation has been properly installed.
   See Section 5.6 “Oil Temperature Monitoring” for details on RTD installation.
9. Bearing assembly lubrication is completed.
   See Section 6.1.1 “Bearing Lubrication” for details.
10. Shaft seal is ready for operation
    See Section 6.1.2 “Shaft Seal Commissioning” for details.
11. Drive train direction of rotation at the pump is correct.
    See Section 6.1.3 “Checking the Direction of Rotation” for details.
12. The pump set is primed.
    See Section 6.2.1. “Priming the Pump”
13. The desired operating conditions do not exceed those allowed by the pump.
    See Section 6.4 “Operating Limits” for details.

6.1.1 Bearing Lubrication

Pump bearing units are shipped empty of oil. Before starting the pump, fill them to the center of the oil level sight gauge using the GIW Blue 150 synthetic bearing oil (GIW Part No. 690-9090P-01-B150P) supplied with the unit. Otherwise, use an equivalent synthetic or a high quality ISO220 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.

If locally obtained oil is desired, 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 generally recommended. Detailed bearing oil specifications and GIW Blue replacement oil are available from GIW.

Oil operating temperatures for GIW bearing assemblies will depend on pump size, speed and ambient conditions. Under typical conditions, they will run from 50 °C – 85 °C (125 °F – 185°F). For oil temperatures above 85 °C (185 °F) or for severe load conditions, a high quality synthetic lubricant (such as GIW Blue) should be used. At higher speeds, or in hotter ambient conditions, temperatures can rise to 100 °C (210 °F). Slightly higher temperatures may be seen for a brief period during the breaking in of new bearings. The unit should be shut down immediately if temperatures rise to 120 °C (250 °F).

Do not overfill the bearing assembly. The capacities listed 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.

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. See Section 6.5 for more details on Underwater Pump Operation.

Water Temperature	ISO Viscosity Grade
0 °C – 20 °C (32 °F – 70 °F)	100
20 °C – 30 °C (70 °F – 85 °F)	150
> 30 °C (> 85 °F)	200

GIW Blue oil may be used for all the above temperatures

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 1 Impeller end
6-7/16	9
6-7/16 (PB)	2.5 Drive end 1.5 Radial end
7-3/16	9
7-3/16 (PB)	2.5 Drive end 1.5 Radial end
9	18
9 (PB)	3 Drive end 2 Radial end
10-1/4	34
11-1/2	34

6.1.2 Shaft Seal Commissioning

Mechanical Seals

Mechanical seals are precision devices which require special care for their proper operation. The instruction manual for the seal should be consulted for special storage, start-up, and maintenance requirements.

Caution Mechanical seals require safety checks prior to start-up such as removing seal assembly fixtures, checking axial alignment, checking torques etc. Refer to the mechanical seal operating manual for all required safety checks.

Stuffing Box Commissioning

Prior to commissioning, the gland packing supplied with the pump must be adjusted. Preformed packing rings sets from GIW / KSB are recommended. For alternate brands, refer to packing manufacturer's instructions regarding installation and use.

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 regards to mechanical corrosion.

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

6.1.3 Checking the Direction of Rotation

The impeller must rotate in the correct direction of rotation. 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.

Caution 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.

6.1.4 Cleaning the 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.

6.1.5 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.

6.2 Startup

- 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.



Start-up, shutdown, filling and draining procedures must be designed to prevent any possibility of negative torque being experienced on the pump shaft. Negative torque can cause the impeller to unscrew, leading to severe damage throughout the rotating assembly and drive train. In particular, the following practices must be avoided:

1. Any flow through the idle pump, in any direction, in excess of 5% of the normal operating flow rate before the impeller has been tightened by running under normal loads. This includes flow due to filling or draining of the system and/or flow caused by the equalization of different levels between the sump and discharge line after the opening of any valves in the piping.
2. Any attempt to restrict the flow after shutdown, by either manual or automatic systems, until the pump comes to a complete standstill.
3. Any braking or re-energizing of the drive train after shutdown, until the system has reached a complete static condition.



Prolonged operation at zero or low flow, typically due to closed valve or unintended pipeline blockage, is not prohibited. **Danger of steam generation and explosion.**



Start-up and shutdown procedures must be designed to prevent any possibility of water hammer. Water hammer can place excessive loads on the piping, resulting in damage to the pump flanges. The pressure waves generated by water hammer can also cause damage to the pressure containing components of the pump, the mechanical end and/or the mechanical seal.

Caution During the initial commissioning, once the pump and bearing assembly stabilize at normal operating temperature, or in the event of system leaks, stop the unit and re-tighten all bolts. Check the coupling alignment and re-align if necessary.

6.2.1 Priming the Pump

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.



The pump should never be run dry and air intake must be minimized using proper sump design. May result in excess temperatures and escape of medium into the atmosphere due to shaft seal failure. Additionally air intake must be minimized using proper sump design.

6.3 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.
- Where temperatures may drop below freezing, the pump and system must be drained or otherwise protected against freezing.

Caution Pipe system design and pump operation should prevent damage to the pump during a scheduled or emergency shutdown.

Caution In the event of shutdown where a significant static discharge head exists in the system, the impeller can begin to run back-wards 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

6.3.1 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 Section 3.2 “Storage Requirements”. It is advisable to close the nozzles (for ex. with plastic caps or similar).

6.4 Operating Limits



The pump / unit application limits (speed, minimum and maximum flow, head, fluid density, particle size, temperature, pH, chloride content, etc…) as stated on the data sheet must be observed. Failure to do so may result in power overload, excessive vibration, overheating, and/or excessive corrosion or wear. If a data sheet is not available, contact your GIW / KSB representative.

Caution Any make up water or outside water supply for the system must be installed so that the GIW pump will never be exposed to a pressure in excess of its maximum allowable operating pressure.

6.4.1 Temperature Limits

Caution Do not operate the pump at temperatures exceeding those specified on the data sheet or the nameplate 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 must be observed. Excessive bearing temperature could indicate misalignment or other technical problem.

6.4.2 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.

Motor rating	Max switchings per hour
< 12 kW (< 16 hp)	25
12 kW – 100 kW (16 hp – 135 hp)	20
> 100 kW (> 135 hp)	10

6.4.3 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.

6.5 Underwater Pump Operation

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.

7 Maintenance

Refer to Section 2.9 “Assembly & Disassembly Safety” prior to working on the pump

7.1 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.

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

Neglect of maintenance procedures and monitoring can result in failure and leakage of the shaft seal, bearing seals, and wear components.

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

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

- 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.
- Verify the oil level is correct.
- 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.

7.2 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.

7.3 Lubrication and Lubricant Change

- **Refer to Section 6.1.1 “Bearing Lubrication” for bearing oil change instructions, specifications & capacities.**
- 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.

7.3.1 Underwater Operation

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 detailed in Section 6.1.1 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:

For more information on Underwater Bearing Assemblies see Section 6.5 “Underwater Pump Operation”

7.4 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.

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.
- 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 10.4 “Setting the Nose Gap”.
- 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.

Pump Casing

- If wear is localized with a deep gouge, repair or replace as recommended by GIW / KSB. Excessive wear problems are usually indications that the pump is not operating at the flow and head conditions originally specified for the design.

7.5 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.
Refer to Section 12 “Toubleshooting” for additional information.

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 ensure 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 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, ensure 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.

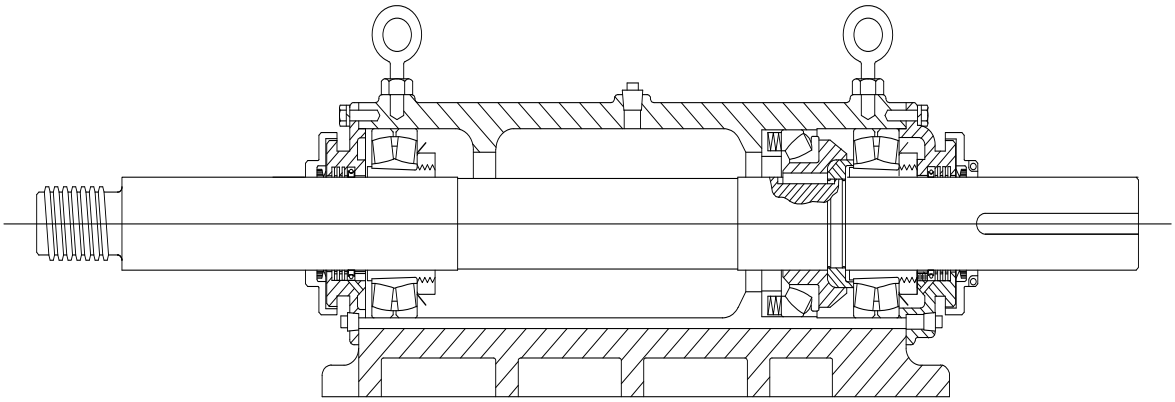
In many instances, it will be found that unusual wear in the pump, or low efficiencies, are caused by a mismatch between the pump and the system application and can be corrected once the operating conditions are known.

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.

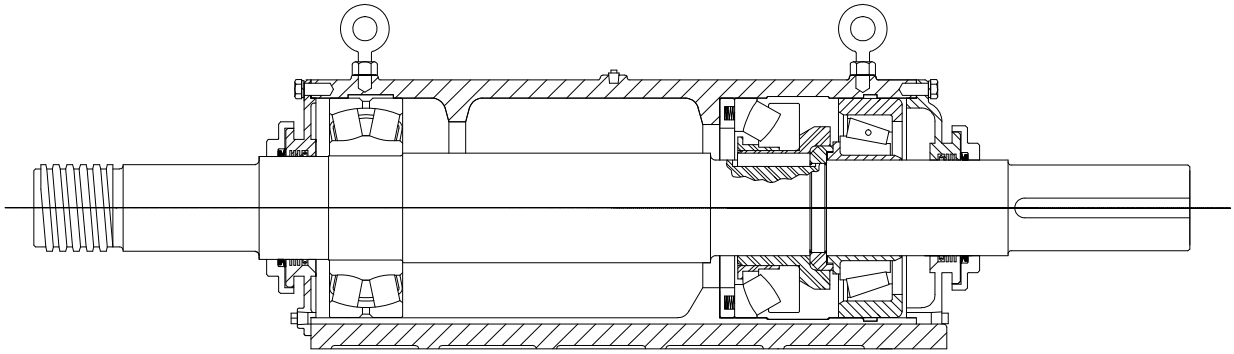
8 Mechanical End

8.1 Mechanical End Overview

- The bearing assembly is a cartridge design mounted on a fabricated pedestal with an adjustment mechanism for setting the impeller axial clearance.
- The conventional bearing arrangement utilizes two double row, spherical roller bearings to 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.
- The Limited End Float (LEF) bearing assembly is used for mechanical seal applications or operations where tight impeller nose clearances are needed. The drive end radial bearing is converted to a taper roller bearing to greatly reduce the shaft end play.
- Standard lubrication is oil bath. See Section 6.1.1 “Bearing Lubrication” for lubrication quality and quantity. For bearing part numbers refer to the assembly drawing and bill-of-materials.



Conventional Bearing Assembly



Limited End Float Bearing Assembly

8.2 Mechanical End Disassembly

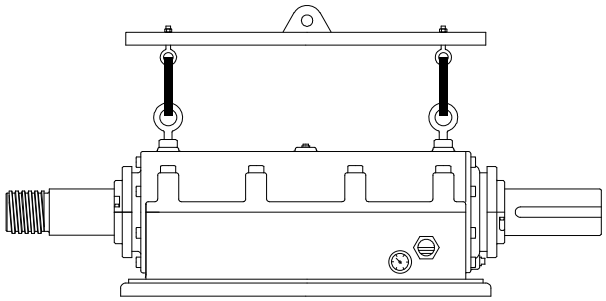
GIW REGEN Service Centers remanufacture bearing assemblies and refurbish pumps.
GIW will rebuild your assembly and return it to its original specifications using genuine OEM replacement parts.
Contact your GIW Sales Representative for details.

Refer to Section 2.9 “Assembly & Disassembly Safety” prior to working on the pump

Caution 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.

- Drain the oil 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, replace if broken or worn.
- Remove the bolts holding the bearing housing halves together. Note that the housings halves are tightly doweled together to ensure 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. 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.



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.
- In Conventional bearing assemblies the radial bearings on either end of the shaft are typically double row, spherical roller bearings 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 Limited End Float (LEF) bearing assemblies the drive end radial bearing will be a single row taper roller bearing. 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 located between the radial bearings near the drive end is a spherical roller bearing. It is seated on a split ring which is clamped to a thrust groove in the shaft. 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 typically enough to allow it to be pushed off the split ring and removed from the shaft.

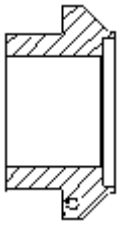
8.3 Mechanical End Assembly

Refer to Section 2.9 “Assembly & Disassembly Safety” prior to working on the pump.

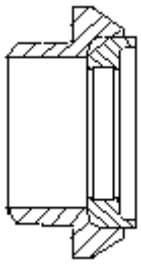
8.3.1 Mounting the Bearings

Care must be taken when handling heated components

- Place the thrust bearing on the shaft.
- 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.



Split Thrust Collar
Sizes 2-$^{15}/_{16}$ to 4-$^{7}/_{16}$

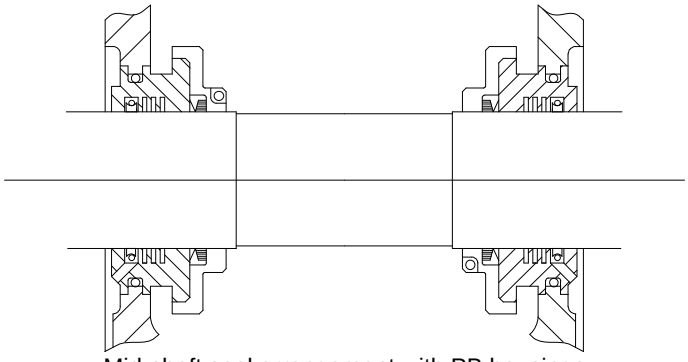


Split Ring and Thrust Collar
Sizes 5-$^{7}/_{16}$ and larger

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

Mounting Clearances for Radial 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 "Un-mounted Clearance".
- Bearings with straight bores and no locknuts are press fit on the shaft. Heat bearings to 105 °C (220 °F) 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.
- The drive end 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 the chart above. 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).
- 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 a PB type ("pillow block" construction with 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



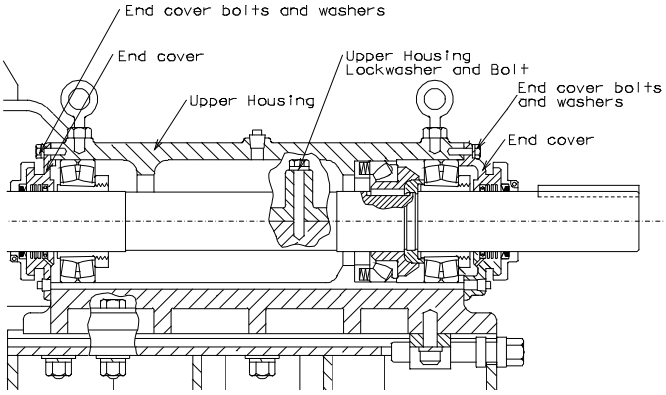
Mid-shaft seal arrangement with PB housings

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

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 o'clock position.

8.3.2 Closing the Housing

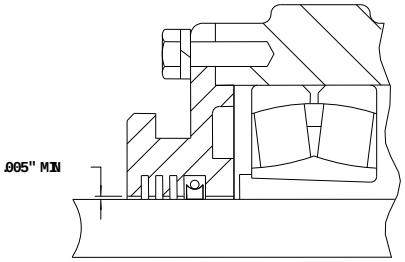
- Limited End Float (LEF) bearing assemblies require an additional shimming procedure to ensure proper operation. The correct number of shims needed is determined prior to closing the housing and installing the end covers with the following procedure:
    - Install the shaft with mounted bearings and spring retainer ring (472) into the housing base (351), but without the springs (950.71) installed.
    - With the bearing housing cap (351) off and without the shims (89-4.71/.72), install the bearing end cover (361.70) and tighten the lower bolts (901.70) until all internal bearing clearance is eliminated and the end cover contacts the taper roller bearind. A gap should remain between the end cover and housing.
    - Dowel and bolt the housing cap to the base and install the remaining end cover bolts.
    - Measure the maximum gap between end cover and housing with a feeler gauge.
    - Select enough 0.010” shims (and 0.005” if included in your bill of materials) to fill this gap plus 0.002” to 0.010” extra interference. These will be used when installing the bearing end cover.
    - Unbolt the end cover and housing cap from the base. Remove the shaft with mounted bearings and spring retainer ring from the base and re-assemble using remaining steps.
- 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.
- Apply an 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.
- For pillow block assemblies, this torque is very important for proper bearing fit. These housings are torqued in a cross or “X” pattern.
- Where a dowel pin has internal threads for removal, protect the threads with RTV silicone or install a matching screw.



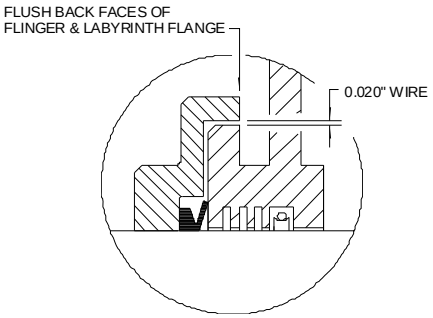
8.3.3 Installing End Covers and Seals

- 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.
- End cover shims used on Limited End Float (LEF) and Duo-Cone seal units require special sealing. After determining the correct number of shims as described in Section 8.3.2 “Closing the Housing”, apply a very thin coat of RTV silicone sealant to each shim as it is stacked on the end cover so each contact surface will be sealed. Remove any excess sealant from the inside of the cover. Install and torque end cover bolts immediately. If sealant begins to cure, it will be necessary to remove it and start over. 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 ensure 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.
- 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. This will ensure correct v-ring compression. The split flingers clamp tightly to the shaft when bolted together and care must be taken to ensure 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 ensure 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. A minimum gap of 0.020" (0.5 mm) should be present.
- As a final check, rotate the bearing assembly by hand. Check the alignment of the flingers and listen or feel for any rubbing.



Labyrinth seal clearance



Flinger clearances

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.

8.4 Bearing Assembly Mounting

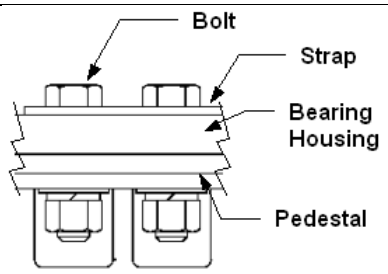
- Mount the bearing housing adjustment nut with adjusting screw onto the bottom of the housing. When placing the bearing assembly onto the pedestal, ensure that the slotted tab on the pedestal fits into the slot of the adjusting screw.
- The pedestal and bearing housing saddles should be clean, dry, 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.
- 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.

The 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.

- 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.
- 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 lubricants. 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 lubricant 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.



- Verify the size of the bolts and use the following chart to determine the tightening torque. Bolts should be SAE Grade 8 or Metric Class 10.9.
- 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.

Bearing Assembly Hold Down Bolts

Head Markings for Hex Head Cap Screws	Torque for Grade 8 UNC Hold Down Bolts						
	Bolt Thread		Wrench Size		Torque in ft-lbs		Nominal Shaft Size
	Diameter	Pitch	Bolt	Hex Nut	Anti-Seize	Oiled	
SAE Grade 8 / Grade 5	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
METRIC 10.9 / 8.8 Class 10.9 / Class 8.8	2	4.5	3	3 1/8	4500	6500	10 1/4, 11 1/2

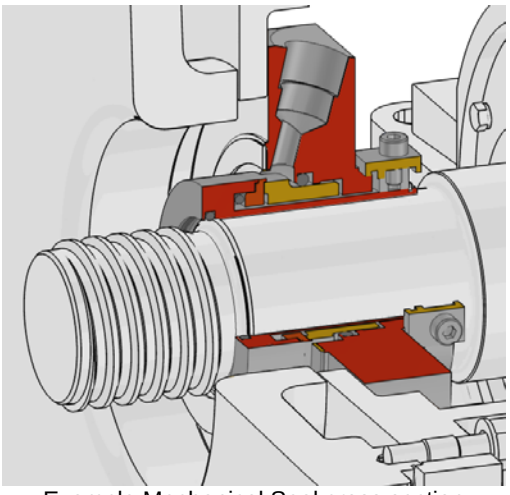
9 Shaft Seal

9.1 Mechanical Seal

Mechanical seals are precision devices which require special care for their proper operation. The instruction manual for the seal should be consulted for special storage, start-up, and maintenance requirements.

Caution Mechanical seals require safety checks prior to start-up such as removing seal assembly fixtures, checking axial alignment, checking torques etc. Refer to the mechanical seal operating manual for all required safety checks.

For information on mechanical seals, consult the manufacturer's manual.



Example Mechanical Seal cross section

9.1.1 Mechanical Seal Assembly and Disassembly

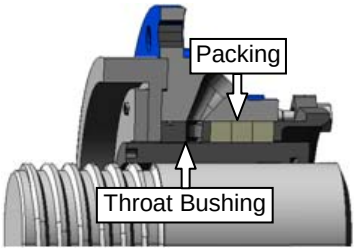
Review the mechanical seal arrangement and determine the layout of the mechanical seal assembly. Some mechanical seals have an adapter which must be placed on the shaft before the hub plate and/or casing is installed while others can be installed after the casing is installed.

Always refer to the mechanical seal maintenance manual for further instructions.

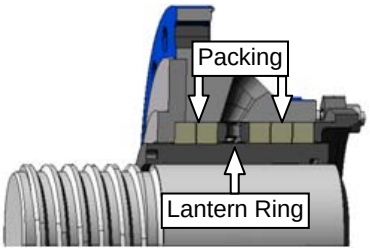
9.2 Stuffing Box

GIW offers three stuffing box designs. In general, more flush water will result in less wear on the packing and sleeve, so the decision of which design to use depends on the severity of the service, quality of the seal water and relative importance of seal life vs. water supply costs.

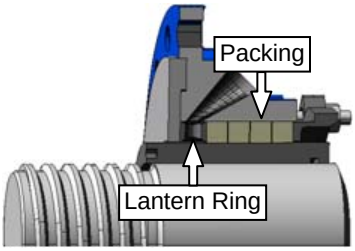
- The **Throat Bushing** design is the standard product offering in GIW's LSA style S & SC pumps. It combines the lantern ring with a longer, tight tolerance collar and provides a compromise between the Forward Flush and KE designs in difficult applications where water reduction is needed. It produces a throttling effect that restricts seal water flow in the pump while maintaining pressure and flow at the packing rings. This reduces the amount of water that enters the process flow while providing an easy-to-maintain stuffing box assembly. The Throat Bushing design is also available in a variation incorporating the **SpiralTrac®** technology. This allows for flowrates to be reduced by more than 50% when compared to the less efficient Forward Flush boxes, while still maintaining acceptable packing life and shaft sleeve wear.
- The **KE** design is used where minimum water usage is desired. One or two rings of packing are located between the lantern ring and the wear plate to restrict seal water flow into the pump cavity, while the packing rings behind the lantern ring seal to atmosphere. It is the most sensitive design to variable operating conditions and abrasive wear, and requires more careful maintenance.
- The **Forward Flush** design design has historically been used where gland water supply is plentiful, and the addition of water to the process flow is not problematic; however, please note that GIW is phasing out the Forward Flush design stuffing box due to global water conservation initiatives. This stuffing box is no longer available on GIW's S and SC pumps.



Throat Bushing



KE Design



Forward Flush

9.2.1 Stuffing Box Packing

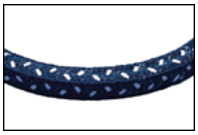
Stuffing box packing is the actual sealing element in most stuffing box assemblies. It experiences considerable friction and will have a limited lifespan. Proper maintenance procedures are essential to avoid premature failure, wear and corrosion to nearby parts, mechanical end contamination and unnecessary downtime. The following provides an introduction to packing basics. Refer to your GIW Pump Maintenance Manual, GIW representative and/or packing supplier for further detail.

The packing type must be compatible with your pumping application. This includes pressure, temperature, pH and solids content. Seal water quality can also affect packing selection. Refer to your Bill of Materials for the packing type supplied with your pump or contact your GIW representative if a change in packing type is needed.

Summary of standard GIW packing types:



Tuf-Pak 100
Vegetable fiber packing impregnated with PTFE for moderate temperature, pressure and pH.



Tuf-Pak 300
Continuous filament polyimide and PTFE yarns for high temperature or pressure and wide range of pH.



Tuf-Pak 400
Graphite particles in an expanded PTFE matrix for extreme chemical service and grease lubricated expeller seals.



Tuf-Pak 500
Graphite particles in an expanded PTFE matrix plus aramid corner braid for high pressure application with hot and/or poor quality seal water.



Tuf-Pak 600
Heat resistant, thermoset fiber for most applications. Commonly supplied with “SpiralTrac®” assemblies

9.2.2 Stuffing Box Assembly

The stuffing box should be mounted so that the sealing water tap is on or near the horizontal centerline. This will position the gland studs at 9 o’clock and 3 o’clock for easy access on smaller shaft sizes. 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.

9.2.3 Stuffing Box Maintenance

- The stuffing box is equipped with 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.
- 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 regards to mechanical corrosion.
- An Inlet Temperature of 10 °C – 30 °C (50 °F – 85 °F) should produce a maximum Outlet Temperature 45 °C (115 °F) when the gland is properly adjusted.

- 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. A supply pressure of 10 psi (0.7 bar) over the discharge pressure of the pump should be available. In most cases, adjustments to supply pressures can be made with a manual valve and gauge near the stuffing box.

Flow Control Option

- The KE stuffing box is a Low Flow design and must be pressure controlled. Flow control can result in burning or jamming the packing. Actual flow in a properly maintained and adjusted stuffing box is considerably less than show.
- Forward Flush and Throat Bushing stuffing boxes are generally pressure controlled, but flow control is an option. Seal water requirements listed in the table show potential flow with worn packing.
- Flow control may be achieved in different ways. A Positive Displacement pump that delivers the correct volume can be used with a safety or “pop-off” valve so the purge pressure can never exceed 10 psi (0.7bar) above the Maximum Working Pressure of the pump. Where water supply is adequate, install a flow meter and regulating valves in the line. A backflow preventer is recommended to prevent reverse flow should the pump pressure exceed supply pressure. All components must have adequate pressure ratings. Verify that components will work with the volume, pressure and water quality supplied to the stuffing box.
- For best performance each pump should be adjusted for minimum water consumption while still providing adequate drip rate. As the volume of water is reduced, the stuffing box gland will need to be loosened slightly to maintain the proper drip rate. This will ensure adequate flush while limiting water use. The temperature of the water exiting the stuffing box can be a better indicator than “drip rate” or volume. This should be at a temperature that would be comfortable for hand washing which indicates that the packing is not overheated.

Stuffing Box Maximum Seal Water Requirements

Nominal Shaft Size	Approx Sleeve OD (inch)	Stuffing Box Sealing Water Requirements (gpm) Stuffing Box Type							
		Throat Bushing		KE Design		Forward Flush		SpiralTrac® Throat Bushing	
		NORMAL OPERATION	MAXIMUM*	NORMAL OPERATION	MAXIMUM*	NORMAL OPERATION	MAXIMUM*	NORMAL OPERATION	MAXIMUM*
2 - 7/16	3.5	4	5	0.4	2	8	10	2.5	3.8
2 - 15/16	3.94	4.8	6	0.6	3	9.6	12	3	4.5
3 - 15/16	4.94	8	10	0.8	4	16	20	5	7.5
4 - 7/16	5.44	10.4	13	1	5	20	25	6.5	9.8
5 - 7/16	6.44	12	15	1.2	6	24	30	7.5	11.3
6- 7/16	8.5	22	27	2	11	44	55	14	21
7 - 3/16	8.5	22	28	2	11	44	55	14	21
9	10.5	34	43	3	17	68	85	21	32
10 -1/4	11.9	44	55	4	22	88	110	27	41
10 -1/4 Extra	14	60	75	6	30	120	150	37	56
11 -1/2	14	60	75	6	30	120	150	37	56
13	17	90	113	9	45	180	225	56	84

* MAXIMUM value is recommended for seal water system design to account for packing and sleeve wear.

Nominal Shaft Size	Approx Sleeve OD (mm)	Stuffing Box Sealing Water Requirements (liters/min) Stuffing Box Type							
		Throat Bushing		KE Design		Forward Flush		SpiralTrac® Throat Bushing	
		NORMAL OPERATION	MAXIMUM*	NORMAL OPERATION	MAXIMUM*	NORMAL OPERATION	MAXIMUM*	NORMAL OPERATION	MAXIMUM*
2 - 7/16	88.9	15	19	1.5	8	30	38	9	14
2 - 15/16	100.1	18	23	2.3	11	36	45	11	17
3 - 15/16	125.5	30	38	3.0	15	64	80	19	28
4 - 7/16	138.2	39	49	3.8	19	72	90	25	37
5 - 7/16	163.6	48	60	4.5	23	88	110	28	43
6- 7/16	215.9	80	100	8	42	168	210	53	79
7 - 3/16	215.9	88	110	8	42	168	210	53	79
9	266.7	128	160	12	60	256	320	80	120
10 -1/4	302.3	168	210	16	80	336	420	100	150
10 -1/4 Extra	355.6	224	280	22	110	456	570	140	210
11 -1/2	355.6	224	280	22	110	456	570	140	210
13	431.8	344	430	34	170	680	850	210	315

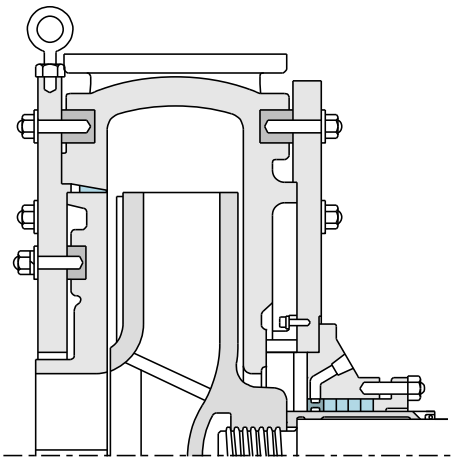
* MAXIMUM value is recommended for seal water system design to account for packing and sleeve wear.

10 Wet End

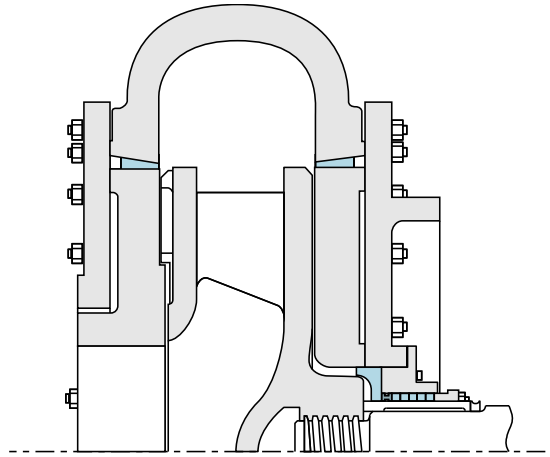
10.1 Wet End Overview

10.1.1 Pump Casing

Refer to pump assembly drawings for flange bolting patterns



LSA Hard Metal Wet End with integrated hub liner construction



LSA Hard Metal Wet End with diverter style impeller and separate hub plate / hub liner construction.

10.1.2 Impeller Form

All standard impellers are double shrouded designs as seen in the figure above.

10.2 Wet End Disassembly

Refer to Section 2.9 “Assembly & Disassembly Safety” prior to working on the pump

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

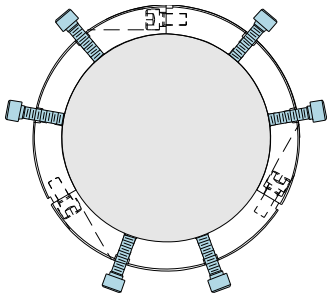
10.2.1 Suction Plate / Liner Removal

Push off bolts provided with the pump can be used to free the plate and liner assembly from the casing. Remove suction plate and liner together as one piece and disassemble liner from plate on flat level surface. Push off bolts should be stored in a clean environment away from the pump after use.

10.2.2 Impeller Removal with Release Ring Assemblies

Energy can be released during disassembly of the tightened impeller. Break loose jigs, lifting jigs and impeller release rings could spring suddenly and injure nearby personnel.

- Remove the release ring:
  - Loosen and remove the three socket head cap screws that hold the three segmented pieces together.
  - Install push off bolts and gently turn the first push off bolt with a wrench 1/8 turn.
  - Move to the next push off bolt in the same segment and repeat. Continue with the next push off bolt in the adjacent segment, proceeding around the shaft multiple times until the segments fall out.
- 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. Impeller release rings come with nylon set screws in push off bolt locations to protect the threads. Ensure the threaded holes are clean 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.

Impeller Release Ring – Push-Off Bolts				
Release Ring Assembly	Required Push-off bolts	Push-off bolt Part #	Size	
0902X-00	6	9702P-23-02STP	3/4" x 3"	
0907X-00	6	9705P-61-24STP	1/2" x 3/4"	
0911X-00	6	9705P-24-24STP	3/8" x 1/2"	
0913X-00	6	9702P-23-02STP	3/4" x 3"	
0918X-00	6	9705P-61-24STP	1/2" x 3/4"	

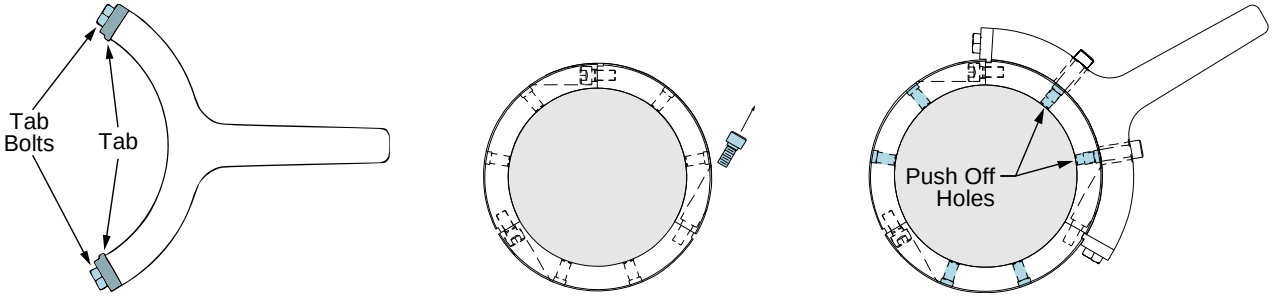
Push off bolts should never be left in the release ring segments during pump operation. There is a chance that the push off bolts could work loose and become projectiles that could cause equipment damage or personal injury. If the push off bolts are turned in too far in the segment in which they are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

10.2.3 Impeller Removal with Optional Release Ring Tool

Energy can be released during disassembly of the tightened impeller. Break loose jigs, lifting jigs and impeller release rings could spring suddenly and injure nearby personnel.

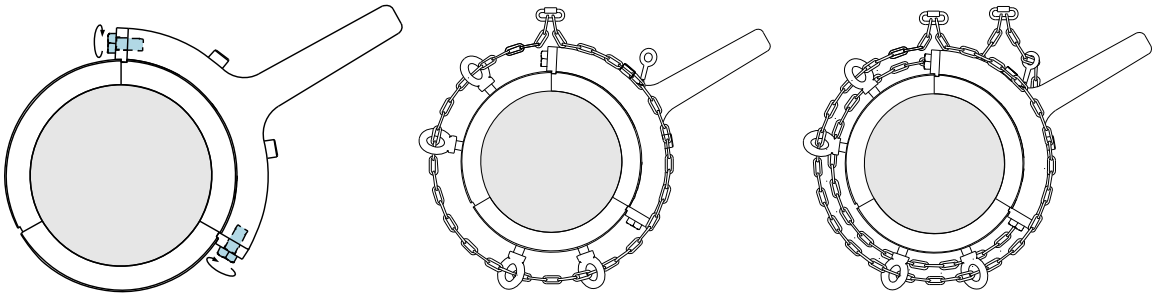
For large highly loaded pumps in corrosive environments, an impeller release ring tool may be more effective. To order this tool, GIW part number 2009B, contact your GIW representative.

- Remove the stuffing box gland if clearance is required for the IRR tool.
- Remove one IRR parting line socket head cap screw (SHCS).
- Loosen the tool tab bolts just enough so the tab can move a little.
- Lay the tool on top of the IRR segment in which the IRR parting line SHCS was removed
- Position the tool such that the tool tabs fit into the grooves at each end of the IRR segment and verifying the slots in the tool align with the push off holes in the IRR (the tool only fits in one direction)

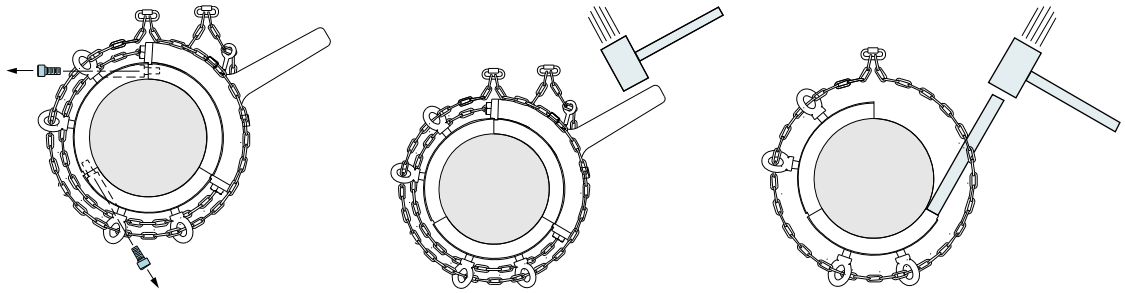


- Screw the two SHCS that come with the tool into the push off holes finger tight.
- Tighten the tab bolts with a wrench while pushing the tabs into the IRR grooves.
- Tighten the SHCS that hold the tool to the IRR.
- Screw in four lifting eyes (finger tight) into the push off holes in the remaining IRR segments until they bottom against the shaft.
- Screw a lifting eye in the tool. Note: some tools already have an eye welded to the tool, so a screw-in lifting eye is not required.
- Thread one chain through the four lifting eyes and around the shaft. Remove the slack in the chain and connect the ends of the chain with a carabineer.
- Thread a second chain through the tool lifting eye and around the shaft.

⚠ The chains are required as a safety precaution and must be used to prevent injury.

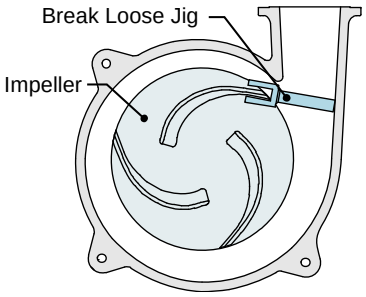


- Remove the slack in the chain and connect the ends of the chain with a carabineer.
- Remove the remaining two IRR parting line SHCS. Note: it may be necessary to move the nearby lifting eye first.
- Hit the tool with a sledge hammer until the IRR segment breaks free. After each hammer blow, re-tighten any loose fasteners and verify the tabs fit snugly into the IRR groove.
- If all three IRR segments break loose, the removal job is complete. Otherwise, remove the tool, the loose IRR segment and the chain. While the other two IRR segments are still chained to the shaft, seat a solid steel bar on the parting line face of either of the two remaining segments, and rap with a hammer until they break free.



10.2.4 Impellers Removal with Break-Loose Jig

Energy can be released during disassembly of the tightened impeller. Break loose jigs, lifting jigs and impeller release rings could spring suddenly and injure nearby personnel.

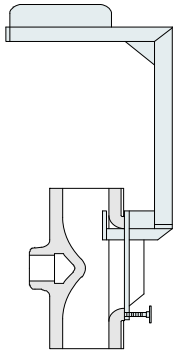


- Rotate the impeller until the tip of one blade is facing the pump discharge.
- Insert the jig through the eye of the impeller and attach to trailing edge of blade facing discharge.
- Rotate the shaft in the direction opposite to normal, using the pump pulley or a spanner wrench.
- For ease of impeller removal, the shaft threads should be heavily coated with anti-seize compound during re-assembly. Two aramid paper gaskets should be used between the shaft sleeve and the impeller.

10.2.5 Impeller Removal with Impeller Lifting Jig

- If present, remove the impeller release ring assembly. See release ring removal in previous section.
- For impeller removal or installation, grasp the impeller at the suction eye. 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.



Impeller Lifting Jig

10.2.6 Casing Removal

It is recommended that at least two lift points be used when moving any pump casing. This permits greater safety and control of the component. Where applicable, GIW pump casings 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.

10.3 Wet End Assembly

Refer to Section 2.9 “Assembly & Disassembly Safety” prior to working on the pump

10.3.1 Mounting the Shaft Sleeve

For Pumps with Impeller Release Ring

The segmented release ring fasteners must be carefully inspected for damage or cracking and replaced if not in good condition. Bolts are made from high grade A286 stainless steel and replacement parts should be obtained from GIW to ensure quality. The use of alternate materials, including standard black or coated socket head cap screws is **not** recommended, due to the possibility of corrosion and/or stress corrosion cracking, which could lead to sudden failure of the release ring in service.

GIW Release Ring Bolt Mechanical Properties

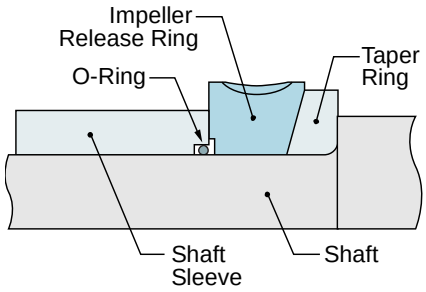
Yield Strength:	120,000 psi (830 MPa)
Elongation:	12% minimum in a 2” specimen for all diameters
Reduction in Area:	45% minimum for all diameters
Tensile Strength:	160,000 psi (1,100 MPa)
Material Specification:	ASTM A286 (FF-S-86E)

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 re-placed. 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. 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.
- Do not allow 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.
- 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 the o-ring will be completely forced into the sleeve recess.

Torque Information is only for use with special high-strength fasteners supplied by GIW

	Nominal Size	Stress Area	Torque with Loctite 242 on Fastener
ENGLISH	3/8"-16NC	0.078 in²	40 ft-lbs
	1/2"-13NC	0.142 in²	105 ft-lbs
	5/8"-11NC	0.226 in²	210 ft-lbs
	3/4"-10NC	0.334 in²	375 ft-lbs
	1"- 8NC	0.606 in²	910 ft-lbs
METRIC	M10 x 1.50	58 mm²	70 Nm
	M12 x 1.75	84 mm²	125 Nm
	M16 x 2.00	157 mm²	310 Nm
	M20 x 2.50	245 mm²	605 Nm

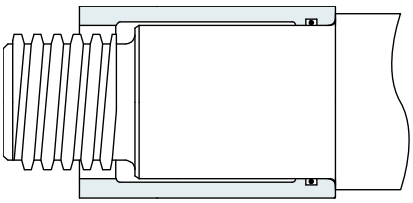


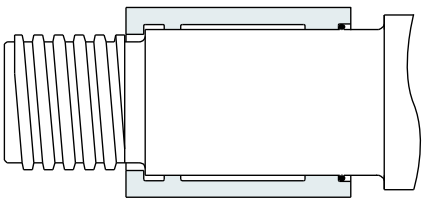
Release Ring Location

For Pumps without Release Ring

- A light coat of anti-seize can be applied inside 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 and the face in contact with the shaft shoulder.
- 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.
- 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.

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


Conventional Type Shaft Sleeve Arrangement


Hook Type Shaft Sleeve Arrangement

10.3.2 Hub Plate (if applicable)

- For open hub casings it is necessary to inspect and clean the sealing areas on both the hub plate and casing. Any burred or rough surfaces must be smoothed manually. Apply lubricant or mild liquid soap to prevent friction during assembly and place the o-ring or snap ring gasket onto hub plate.
- If applicable, insert the fasteners that hold the hub liner to the hub plate into the hub liner. Lift the hub plate and install onto the hub liner using a cross torque bolting pattern.
- Install the studs that hold the hub plate to the pedestal into the hub plate and then mount to the pedestal using a cross torque bolting pattern.

10.3.3 Mounting the Casing

- If the casing has an open hub construction it may be more convenient to mount the impeller prior to mounting the casing. See Section 10.3.4 “Mounting the Impeller” for details.
- Ensure that the proper gasket is fitted between the casing and pedestal, hub plate or hub liner.
- If casing feet are used, lift the casing vertically and loosely bolt the feet to the casing. Lower the casing until the feet pads come in contact with the casing and then torque the bolts.
- Thread the studs that hold the casing to the casing to the pedestal or hub plate and mount using a cross torque bolting pattern.

10.3.4 Mounting the Impeller

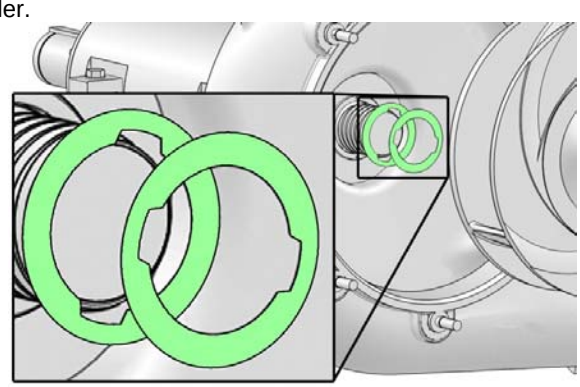
- Coat only the shaft threads with anti-seize compound.
- Two 0.5 mm (0.020”) aramid gaskets (400.10) are placed between the shaft sleeve and the impeller hub face to prevent galling and to ensure ease of impeller removal. Stagger the gaskets so they are not in alignment. The gaskets should be installed dry, without grease.
- Make sure that the hub face of the impeller is free from nicks and burrs. Check the impeller threads to ensure they are clean.
- The impeller is threaded by holding the impeller stationary while turning the shaft. Impeller lifting jigs are available to assist in this operation.
- When assembly of the pump is complete, check the impeller to suction wear plate clearance and adjust if necessary.

Mounting Impeller for Open Hub Casings

- The impeller should be lifted in a secure way so that it cannot shift. Chains should not be hooked on the vane tips or shrouds because they could cause the tips of the impeller to chip. The impeller must also be secured so as not to allow it to turn.
- Turn the shaft to thread the impeller.

Impeller Mounting for Closed Hub Casings

- Before installing the impeller, run the bearing housing completely forward.
- Install lifting jig into impeller. The impeller must hang level.
- Turn the shaft to thread the impeller.



Staggered Impeller Gasket Installation

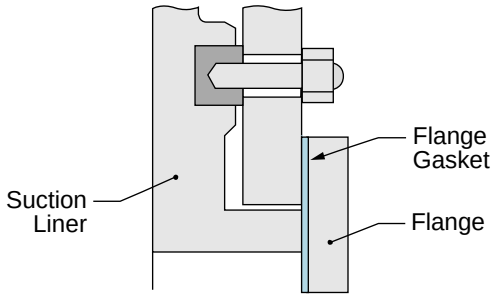
10.3.5 Mounting the Suction Plate / Liner

- Lay the suction liner on a flat level surface. Use shims to level the liner if necessary. Install studs into the liner.
- Lift the suction plate and lower onto liner. Bolt together using a cross torque bolting pattern.

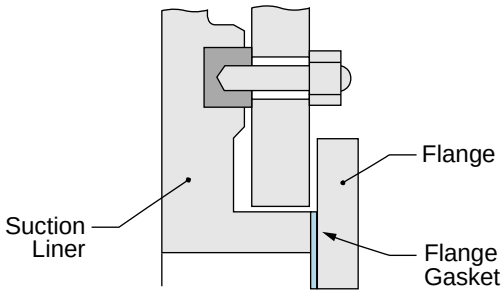




- Install studs to casing that hold the suction plate to the casing. Using the lifting eye, lift the suction plate / liner vertical.
- Inspect sealing areas for burrs. Clean, lubricate and install the o-ring or snap ring gasket.
- Mount the plate/ liner assembly to the casing using a cross torque bolting pattern.
- After mounting, if pump has liners, 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. It is important that excessive force is not placed on the liner by using a raised face flange or a gasket that covers the liner protrusion only. In general it is recommended that a full face flange and full face gasket is used to connect the suction piping.



Correct flange gasket installation



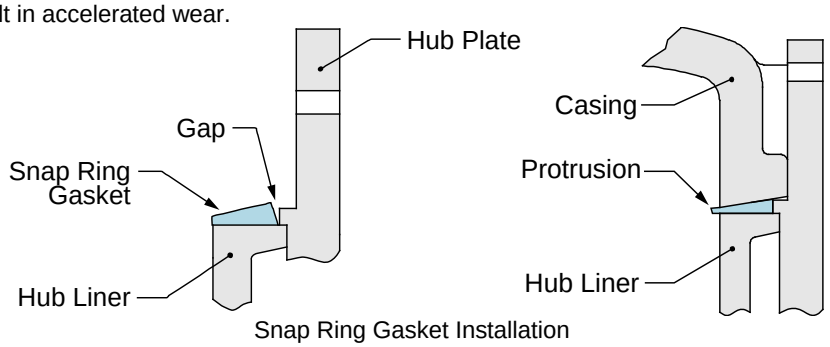
Inproper flange gasket installation

10.3.6 Snap Ring Gasket

When installing snap ring gaskets, always check to ensure 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 casing side opening is tapered at 10°. 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 ensure 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 casing. 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.



Snap Ring Gasket Installation

10.4 Setting the Nose Gap

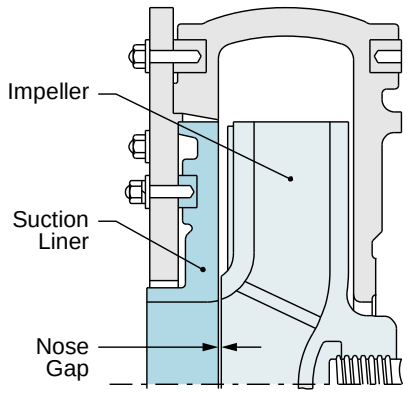
In order to maximize the performance of your pump, the clearance between the suction face of the impeller and the suction liner must be adjusted to an allowed minimum depending on the size and type of bearing assembly. This is done by moving the bearing housing assembly with the adjusting screw.

- Before adjustment may proceed, the pump wet end must be completely assembled.
  - o Stuffing Boxes may be packed before or after the adjustment procedure.
  - o Mechanical seal axial set must be left until after the adjustment is complete.
  - o Pumps with urethane or rubber lined parts should also have the suction spool or suction piping installed and torqued prior to nose gap adjustment.

- Ensure 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.
- Reverse the adjusting screw until the clearance between the impeller and the suction liner is brought to the recommended values shown in below.
- Once the clearance is correct, tighten the bearing housing hold down bolts according to the requirements of Section 8.4 “Bearing Assembly Mounting” and recheck clearance.

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.

Nominal Shaft Size	Impeller Nose Gap			
	Standard Bearing Assembly		Limited End Float Bearing Assembly	
	inch	(mm)	inch	(mm)
2 - 7/16	0.06	(1.52)	–	
2 - 15/16	0.06	(1.52)	0.012	(0.30)
3 - 15/16	0.07	(1.78)	0.012	(0.30)
4 - 7/16	0.08	(2.03)	0.012	(0.30)
5 - 7/16	0.09	(2.29)	0.012	(0.30)
6 - 7/16	0.09	(2.29)	0.012	(0.30)
7 - 3/16	0.09	(2.29)	0.012	(0.30)
9	0.11	(2.79)	0.012	(0.30)
10 - 1/4	0.12	(3.05)	0.015	(0.38)
11 - 1/2	0.13	(3.30)	–	



Example LSA cross-section shown

11 Tooling

11.1 Torque Requirements

Torque requirements listed below and in previous sections are for lubricated bolting. All bolts must be lubricated to ease in pump assembly and disassembly. Anti seize compound is preferred, but well oiled is also acceptable.

Special Torque Requirements

- Fastener torque must be accurately measured to achieve the proper clamping force as defined either on the assembly drawing or previous sections listed below. The use of a Hydraulic Torque Wrench is recommended as these tools can be calibrated to produce the necessary accuracy.
- For bearing housing hold down bolt torque refer to Section 8.4 “Bearing Assembly Mounting”.
- If the pump is equipped with an impeller release ring refer to 10.3 “Wet End Assembly” for torque requirements.
- If the pump is equipped with a mechanical seal is used refer to the Mechanical Seal Manual for torque requirements.

Non-Critical Torque Requirements

No special torque requirements exist for the remaining 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.

Recommended Fastener Torque Values for Non-Critical Fasteners

ENGLISH									METRIC								
	Anti-Sieze				Lubricated / Oiled					Anti-Sieze				Lubricated / Oiled			
Size	Pump Assembly Fasteners		Mounting Equipment to Sub Base		Pump Assembly Fasteners		Mounting Equipment to Sub Base		Size	Pump Assembly Fasteners		Mounting Equipment to Sub Base		Pump Assembly Fasteners		Mounting Equipment to Sub Base	
	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m		lb-ft	N-m	lb-ft	N-m	lb-ft	N-m	lb-ft	N-m
1/4"	3	5	5	6	5	6	7	9	M8	8	11	10	14	10	15	16	20
3/8"	12	17	17	23	19	25	25	35	M10	15	21	20	28	20	30	30	40
1/2"	30	40	40	55	45	60	60	85	M12	25	35	35	50	40	50	55	75
5/8"	60	80	85	115	90	120	125	170	M16	65	90	90	125	100	130	135	180
3/4"	105	145	150	200	160	215	220	300	M20	130	180	180	250	195	265	270	370
7/8"	175	230	240	325	250	350	360	485	M22	175	250	240	335	260	360	370	500
1"	260	350	360	490	385	520	540	730	M24	225	315	305	425	335	450	470	640
1 1/8"	320	430	445	600	470	645	660	900	M27	325	455	440	615	490	660	680	925
1 1/4"	450	610	620	850	670	910	940	1,275	M30	450	625	605	850	670	910	940	1,270
1 3/8"	590	800	825	1,115	880	1,195	1,225	1,670	M36	780	1,090	1,060	1,480	1,170	1,600	1,640	2,220
1 1/2"	780	1,060	1,090	1,480	1,170	1,585	1,635	2,220	M38	920	1,285	1,250	1,740	1,375	1,865	1,930	2,615
1 3/4"	915	1,240	1,280	1,735	1,370	1,850	1,920	2,600	M39	995	1,390	1,350	1,885	1,490	2,020	2,090	2,830
2"	1,375	1,864	1,925	2,610	2,060	2,795	2,885	3,910	M42	1,245	1,740	1,685	2,360	1,865	2,530	2,610	3,540
2 1/4"	2,010	2,726	2,815	3,815	3,015	4,085	4,220	5,725	M48	1,860	2,610	2,525	3,540	2,795	3,790	3,910	5,300
2 1/2"	2,750	3,729	3,850	5,220	4,125	5,590	5,775	7,825	M64	4,445	6,220	6,025	8,440	6,670	9,040	9,335	12,650

Values based on Grade 5 fasteners

Torque Values taken at 50% Proof Strength for Pump Assembly Fasteners
70% Proof Strength for Mounting Equipment to Sub Base
K-Factors = 0.120 for Anti Sieze
0.180 for Lubricated / Oiled

11.2 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 require the replacement of certain parts.

The following are recommended lists of parts (whenever applicable) 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.

Commissioning Spares

- Gaskets for all equipment
- Wet End fasteners
- Shaft Sleeve w/ gaskets & o-rings
- Impeller Release Ring assembly
- Impeller Release Ring hardware
- Mechanical Seal w/ adapter & fasteners

Operational Spares include Commissioning Spares plus

- Additional set of gaskets for all equipment
- Pump Casing
- Impeller
- Side Liners

Bearing Assembly

- Bearings
- Bearing Assembly Gasket Kit
- Bearing Lubricant

Shaft Seal

- Shaft Sleeve
- Shaft Seal Water Ring
- Stuffing Box Packing
- Additional mechanical Seal
- Seal Plate or Optional Throttle Seal

12 Troubleshooting

Pump delivers insufficient flow rate	Motor is overloaded	Excessive discharge pressure	Increase in bearing temperature	Leakage at the pump	Excessive leakage at the shaft seal	Vibration during pump operation	Excessive temperature rise in pump	**Cause**	**Remedy** For further information consult the GIW Tech Series at: giwindustries.com
♦		♦	♦		♦	♦	♦	Blocked discharge or suction piping. **WARNING: Pump must not be run with blocked piping. Danger of explosion due to heating of liquid and overpressure of pump.**	Remove blockage or open valve. If piping cannot be unblocked immediately, pump must be shut down without delay.
♦		♦						System head is higher than expected.	Check for unexpected clogging, collapsed line or partially closed valve. Check system calculations. Adjustment may be needed to system design and/or pump operating conditions.*
			♦			♦	♦	Low flow operation.	Increase flowrate. In general, operation below 30% of best efficiency flowrate is not recommended.
	♦					♦		System head is lower than expected, leading to excessive flowrate.	Adjustment may be needed to system design and/or pump operating conditions.*
♦						♦	♦	Pump and piping are not completely vented or primed.	Vent and / or prime.
♦						♦		Excess air entrained in liquid.	Improve sump design and venting to prevent air from reaching pump. Consider a froth pump design if air cannot be avoided.
♦					♦	♦	♦	Partial clogging of impeller.	Remove blockage. Be aware that blockage may drain back into sump after shutdown.
			♦		♦	♦		Resonance vibrations in the piping.	Check pipeline connections and pump mounting. If required, reduce the distances between, or otherwise modify pipe supports.
♦					♦	♦	♦	Insufficient suction head ($NPSH_{available}$)	Check sump level. Raise if necessary. Fully open any valves in the suction line. Check suction line friction loss calculations. Alter design if necessary.*
	♦							Density or viscosity of the fluid pumped is higher than expected.	Adjustment may be needed to system design and/or pump operating conditions.*
	♦	♦						Speed is too high.	Reduce the speed.
				♦	♦	♦		Worn parts. Loose bolts, seals or gaskets.	Check for worn parts. Replace as needed. Tighten the bolts and/or fit new seals and gaskets if needed.
					♦			Incorrect packing material or adjustment or… Incorrect seal water pressure (too high or low).	Correct adjustment. Replace parts as needed. (See GIW Tech Article on this subject.)
			♦		♦	♦		The unit is misaligned.	Check the coupling. Re-align if required.
			♦			♦		Bearing failure.	Replace bearings. Check lubricant for contamination. Inspect and repair bearing seals as needed. Contact a GIW service center for factory rebuild services.
			♦					Insufficient or excessive quantity of lubricant or unsuitable lubricant.	Correct according to maintenance manual recommendations.
			♦					Insulating or hot ambient conditions	Remove insulation and/or dirt from bearing assembly. Improve ventilation around pump.
	♦							Operating voltage is too low.	Increase the voltage.

* Contact your GIW/KSB representative for further advice.

13 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.

13.1 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 seats in the radius. Verify that the toric is not twisted by inspecting the mold flash line on the outside diameter. Eliminate any irregularity by gently pulling a section of the toric radially off the ring and letting it snap back. Twisted torics will cause nonuniform face load, resulting in leakage and bearing contamination.





Place the housing end cover and seal holder on a flat, clean surface. Verify that the grooves are clean and free from burrs or sharp edges. Using the correct Seal Installation Tool, locate the machined ridge in the tool over the toric and clamp together. Align the parts squarely with the groove and carefully snap the seal assembly into place using a rapid, 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. Lower 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 crisscross 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.

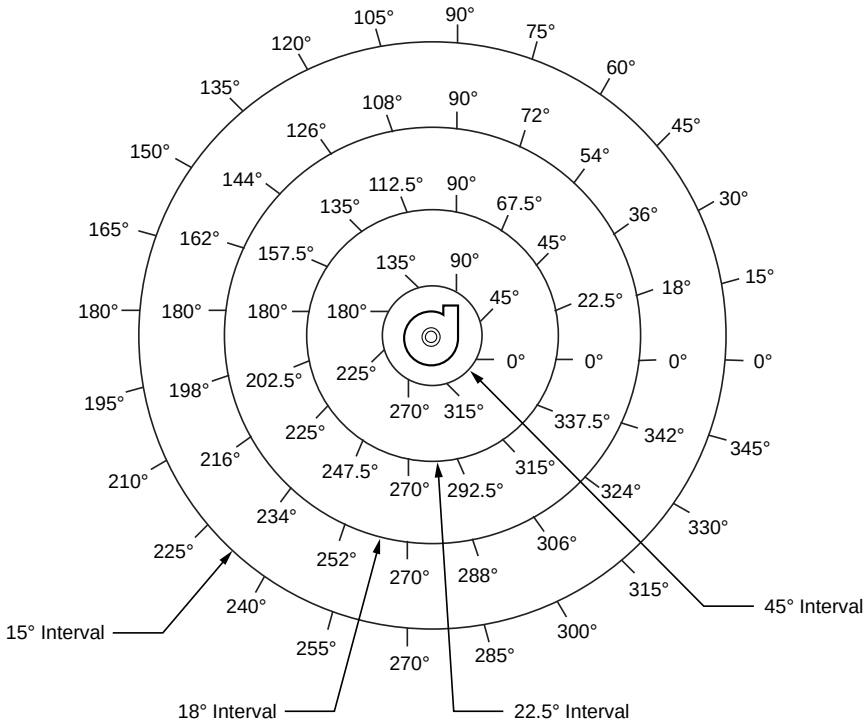
Shaft Size	**Underwater Bearing Assembly Oil Quantity**	
	liters	(quarts)
35 mm	1.5	(1.5)
50 mm	4.0	(4.0)
70 mm	9.0	(9.5)
100 mm	18	(19)
125 mm	35	(36)
4–7/16"	18	(19)
5–7/16"	41	(43)
6–7/16"	73	(77)
7–3/16"	88	(93)
9"	131	(138)
10–1/4"	170	(180)
11–1/2"	284	(300)

Approximate Values

LSA Standard (LSA-S) Pump Information Table

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	
0501x	6x8-25	150x200-635	180	12.41	3.2x3.6	81x92	22.5	4ME
0562x	8x10-32	200x250-810	172	11.86	3.9x4.6	99x117	22.5	4ME
0563x	8X10-32	200x250-810	172	11.86	4.6x4.6	117x117	22.5	3ME
0564x, 0566x	8x10-32	200x250-810	172	11.86	3.9x4.6	99x117	15	4ME
0565x, 0567x	8x10-32	200x250-810	172	11.86	4.6x4.6	117x117	15	3ME
0508x, 0510x	10x12-36	250x300-910	156	10.75	4.0x6.7	102x171	15	4ME
0509x, 0511x	10x12-36	250x300-910	156	10.75	6.3x6.7	160x171	15	3ME
0568x, 0570x	12x14-36	300x350-910	173	11.93	5.1x8.3	129x210	15	4ME
0569x, 0571x	12x14-36	300x350-910	173	11.93	6.4x8.3	162x210	15	3ME
0516x	4X6-25	100x150-635	180	12.41	1.5x1.5	39x39	22.5	4ME
0517x	2x3-21	50x75-530	220	15.17	1.0x1.0	25x25	45	4RV
0518x	3x4-21	75x100-530	220	15.17	1.0x1.0	25x25	45	4RV
0519x	4X6-21	100x150-530	220	15.17	2.5X2.8	63X71	45	4RV
0521x	8x10-25	200x250-635	163	11.24	2.4x4.9	63x125	22.5	4RV
0522x, 0525x	10x12-32	250x300-810	140	9.65	3.7x6.7	95X171	15	4RV
0527x	16x16-39	400x400-990	120	8.27	5.8x8.2	148x209	15	4ME
0530x, 0532x	16x16-39	400x400-990	126	8.68	4.4x8.7	112x222	30	4ME
0534x, 0536x	16x18-44	400x450-1115	150	10.34	5.5x7.6	141x193	18	4ME
0535x, 0537x	16x18-44	400x450-1115	150	10.34	7.6X7.6	193x193	18	3ME
0538x, 0540x	18x18-44	450x450-1115	160	11.03	6.3x11.6	161x295	18	4ME
0539x, 0541x	18x18-44	450x450-1115	160	11.03	8.9x11.6	226x295	18	3ME
0546x, 0547x	20x20-48	500x600-1220	105	7.24	9.7x13.0	247x330	9	4RV
0548x	20x20-48	500x600-1220	130	8.96	9.7x13.0	247x330	15	4RV
0549x	20x24-48	500x600-1220	113	7.79	6.1x13.0	155x330	15	4ME
0550x	22x24-54	550x600-1370	186	12.82	8.1x13.5	208x343	18	4ME
0551x	26x28-58	650x700-1470	91	6.27	8.6x11.7	218x298	15	4ME



LSA Discharge Positions

- Rotation direction is clockwise from the drive end
- A vertical discharge is standard

NOTES

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.