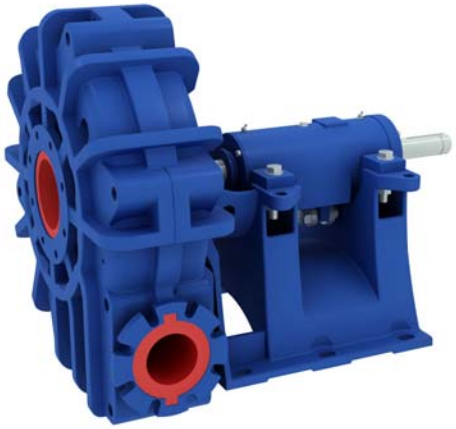
Maintenance Manual

07/2013 **LCC**

LCC – Metal



LCC – Rubber

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.

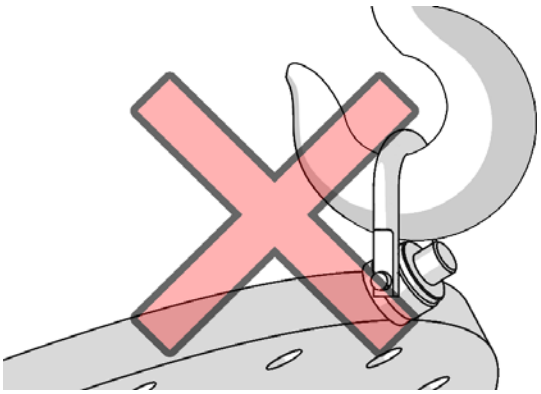
Before dismantling or reassembly, secure the pump so as to make sure it cannot be switched on accidentally. The shut-off elements in the suction and discharge nozzles must be closed. The pump must have cooled down to ambient temperature, drained, and its pressure must be released.

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

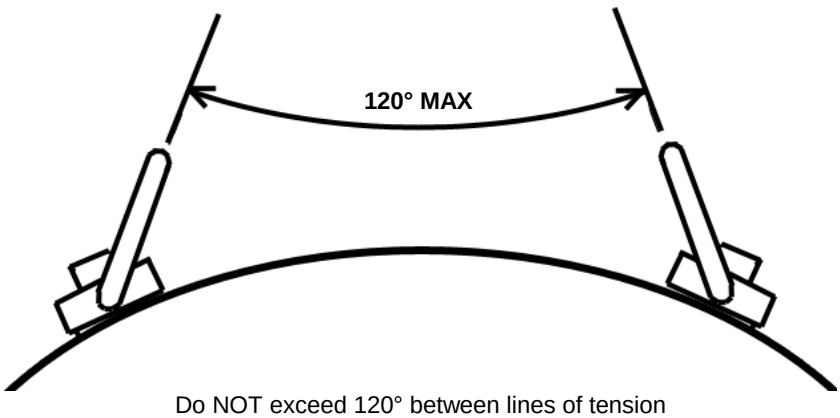
Do not apply heat to the impeller hub or nose due to the sealed cavity at the impeller nose.
DANGER OF EXPLOSION!

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.

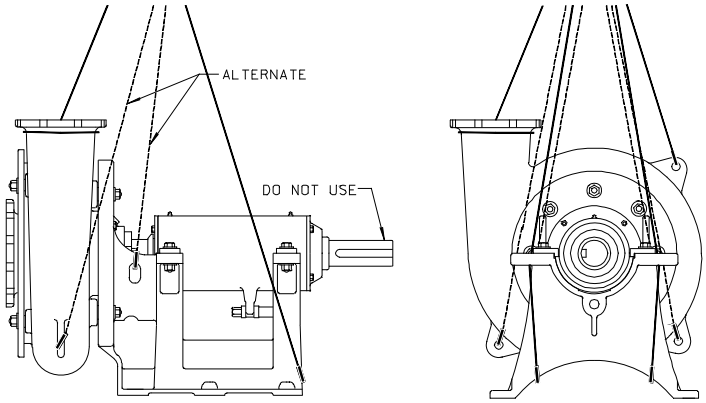
Pump Part	Storage Requirements
Pedestal, Plate, Casing, Impeller, Casing Half, Sub-base, Liner	✓ Outdoor storage with monthly inspection permitted for these parts only ✓ Lay sub-bases flat and do not stack
Rubber, Urethane, Elastomers, Neoprene	✓ Check expiration date (shelf life is 5 years) ✓ Keep dry, 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

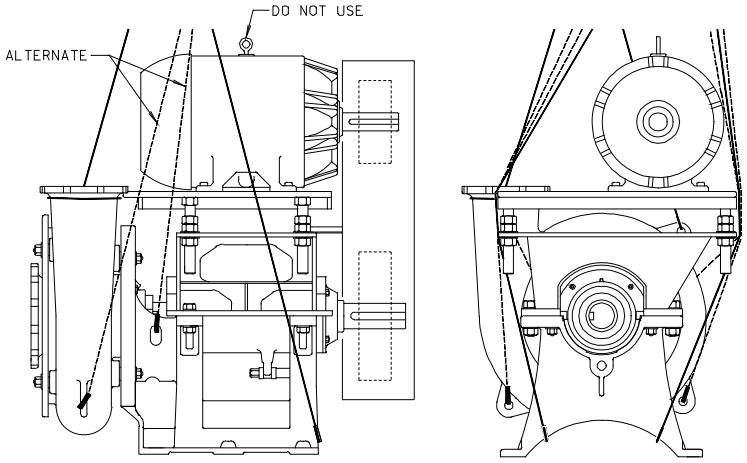
- Remove rust from machined surfaces using a wire brush.
- Remove rust inhibitor from all machined surfaces prior to installation/assembly.
- Check the painted surfaces for any signs of corrosion or breaks in the coatings and touch-up as needed.
- It is recommended that the bearing assembly be drained 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 pump



WARNING: Very top heavy

Transport of the complete pump unit

4. Description

4.1 Technical Specification

The LCC pump range is an international product and has been designed, in most respects, to the METRIC system of units using metric components. All fasteners are metric and will require metric tooling. All seals are metric including oil seals, O-rings and stuffing box packing.

Two important exceptions:
1) The suction and discharge flange bolting patterns are to the American (ANSI) standard, however, flange adapting spools are available.
2) The drive end bearing is an inch based taper roller bearing.

Centrifugal pump for handling coarse or fine particles from solids-laden waste water to aggressive slurries of an abrasive or corrosive nature. Applications include process pumping and tailings disposal for mining, dredging and other industrial operations.

4.2 Designation

LCC-M 300-710.5M C M1

- Pump Type
- Hydraulic Type
- Discharge Nozzle (mm)
- Nominal Impeller Diameter (mm)
- Mechanical Size
- Seal Type
- Options
- Material Code

Hydraulic Type
- M ——— Metal
- R ——— Rubber
- H ——— Heavy Construction

Mechanical (Frame) Size

1	2	3	4	5
35 mm	50 mm	70 mm	100 mm	125 mm

Seal Type
- K ——— KE
- B ——— Throat Bushing
- M ——— Mechanical Seal
- E ——— Expeller

Options
- O ——— Open Shroud Impeller
- AF ——— Oil Lubricated Face to Face
- AB ——— Oil Lubricated Back to Back
- UF ——— Underwater Oil Lubricated Face to Face
- UB ——— Underwater Oil Lubricated Back to Back
- GF ——— Grease Lubricated Face to Face
- GB ——— Grease Lubricated Back to Back
- T ——— Turn Down Impeller
- C ——— Elastomer Impeller

Material Code
- M1 ——— Metal
- MC2 ——— Metal / Chemical
- R1 ——— Rubber

Nominal Flange and Impeller Diameters in mm (*inches*)

Designation	Discharge	Suction	Impeller
LCC 50 - 230	50 *(2")*	80 *(3")*	225 *(8.86")*
LCC 80 - 300	80 *(3")*	100 *(4")*	310 *(12.22")*
LCC 100 - 400	100 *(4")*	150 *(6")*	395 *(15.55")*
LCC 150 - 500	150 *(6")*	200 *(8")*	500 *(19.69")*
LCC 200 - 610	200 *(8")*	250 *(10")*	610 *(24")*
LCC 250 - 660	250 *(10")*	300 *(12")*	660 *(26")*
LCC 300 - 710	300 *(12")*	350 *(14")*	710 *(27.95")*

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

4.3 Design Details

Horizontal, end suction, modified volute casing pump with three-vane impeller for large solids passage. Available in interchangeable elastomer, metal and extra-heavy designs.

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

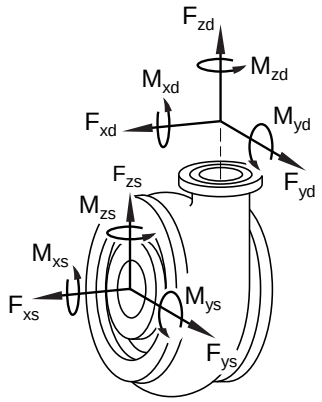
4.6 Dimensions and Weights

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.

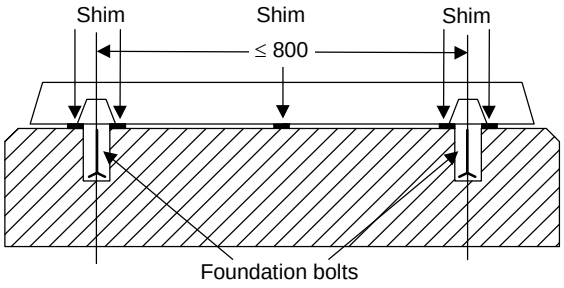
Appropriate personal protective equipment should be worn when handling concrete and grouting materials.

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.

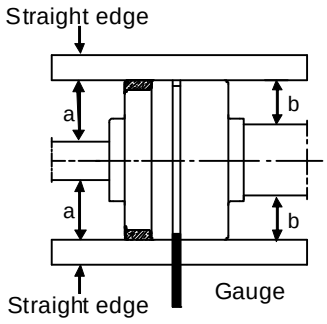
Caution Improper alignment of the unit can cause damage to both the coupling and the unit itself!

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.

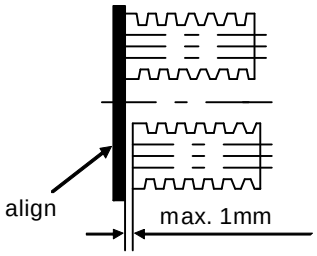
- Coupling check and realignment must be done even if pump and motor are supplied completely assembled and aligned on a common base plate. The correct distance between the coupling halves as specified in the installation plan must be observed.
- The pump set is correctly aligned if a straightedge placed 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, Startup and Shutdown

Caution Compliance with the following requirements is of paramount importance. Damage resulting from non-compliance shall not be covered by the scope of warranty. This manual applies to single stage pumps. Procedures for multistage pumps should be obtained from 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

Appropriate personal protective equipment should be worn when handling lubrication fluids.
Regular lubrication checks should also be performed to prevent excess heat buildup, possibility of fire or damage to the pump unit.

Grease Lubricated Bearings

- Grease lubricated bearings are packed with grease at the factory. They should be re-lubricated after the initial 50 hours of operation, and at regular intervals thereafter.
- If shaft speeds exceed those in the table below, the bearing housing temperature should be monitored during commissioning and additional grease added if it exceeds 100 °C (210 °F), or if bearings are noisy . In some cases where external cooling of the housing is poor, it may be necessary to stop and allow the bearings to cool several times during this break-in period.
- The bearing cavities should be fully packed with grease.
- After adding grease, some excess may be expelled from the labyrinth oil seals. This is normal and will stop once the excess grease has been purged.
- Use high-quality lithium-soap grease, free of resin and acid, not liable to crumble and with good rust-preventive characteristics.

Bearing Assembly	*Shaft Speed RPM	Approximate Grease Capacity			
		Spherical Roller Bearing		Taper Roller Bearing	
		mL	(oz)	mL	(oz)
35mm	2300	15	(0.5)	20	(0.7)
50mm	1800	20	(0.7)	40	(1.4)
70mm	1400	30	(1.0)	90	(3.0)
100mm	1000	90	(3.0)	190	(6.4)
125mm	750	140	(4.7)	280	(9.5)

*Monitor commission temperature if exceeded

Oil-lubricated bearings

Caution Pump bearing units are shipped with preservative and 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 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.

Bearing Assembly	Approximate Oil Capacity	
	liter	quart
35 mm	0.75	0.75
50 mm	1.00	1.00
70 mm	1.75	2.00
100 mm	3.00	3.25
125 mm	6.00	6.50

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

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.

If the pump is equipped with a deaeration chamber (HVF), the mechanical seal must be of the double faced type with barrier fluid. This will prevent dry running and seal face destruction.

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 Plant Piping

The cleaning operation mode and duration for flushing and pickling service must be matched to the casing and seal materials used.

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.

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

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.
- If the pump is equiped with an deaeration chamber (HVF) the following steps may be taken to reduce the amount of fluid in the vent pipe and hose:
  1. Reduce suction pressure to 10kPa / 1.5 psig by lowering the sump level
  2. Close the vent valve to stop slurry from re-entering the vent hose

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

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.

Oil Changes

- **Refer to Section 6.1.1 "Bearing Lubrication" for bearing oil change instructions, specifications & capacities.**
- The first oil change should be carried out after 300 operating hours, then every 3000 hours thereafter or when it appears or is suspected of being dirty or contaminated.
- Drain the existing oil by removing the drain plug on the bottom of the housing.
- Reinstall the drain plug and fill with fresh oil until the oil level reaches the center of the oil sight gauge.

Grease Changes

- **Refer to Section 6.1.1 "Bearing Lubrication" for bearing grease change instructions, specifications & capacities.**
- Grease lubricated bearings should be replenished after the initial 50 hours of operation, then every 1,500 hours thereafter by an injection roughly equal to one half of the amount originally used to pack the bearings.
- After 20,000 operating hours or 2.5 years the bearings should be checked, then cleaned and relubricated if required.

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 gasket / o-ring should always be used with a new suction liner or new pump casing.

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.

Expeller Maintenance

- Proper adjustment of the impeller nose clearance as covered in the Section 10.4 “Setting the Nose Gap” should result in proper expeller clearances in the new condition and no further adjustments should be necessary. In some cases adjusting the impeller after excessive suction liner wear may result in the expeller rubbing against the expeller plate. In other cases it is desired to optimize expeller performance rather than optimize the impeller clearance. Refer to Section 9.3.3 “Expeller Running Clearance” for instructions.

Caution Optimizing the expeller clearances is recommended only in cases where expeller performance is marginal and a small increment in performance is required to seal against the pump pressure. Setting of clearances for optimal expeller performance may result in excessive impeller clearance and accelerated wear. If necessary, this may be remedied by providing a custom fitted machined spacer with gaskets between the impeller and expeller.

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 sloughing 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 any conditions occur, 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.

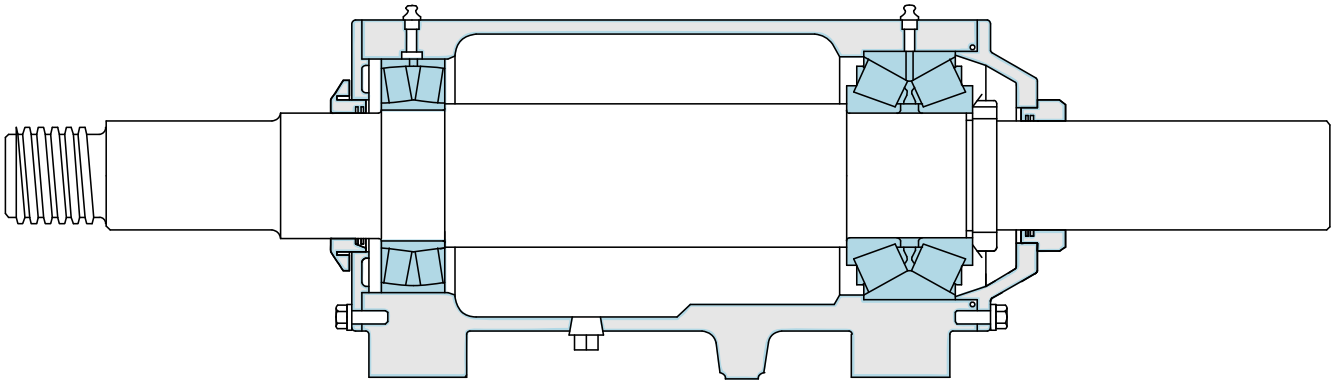
8 Mechanical End

8.1 Mechanical End Overview

- The bearing assembly is a cartridge design mounted on a concentric pedestal with an adjustment mechanism for setting the impeller axial clearance.
- Standard lubrication is grease. Oil lube is also available. See Section 6.1.1 “Bearing Lubrication” for lubrication quality and quantity.
- Basic bearing parts are listed below for reference. Note that the suffix can vary depending on configuration and vendor. Replacement bearings are available from GIW/KSB.

Bearing Assembly	Bearings Installed						
	Spherical Roller	Double Row Taper Roller - Back to Back			Double Row Taper Roller - Face to Face		
		Part number (Timken)	Bench End-Play		Part Number (SKF)	Bench End-Play	
	E Type	Cone / Cup / Spacer *	mm	(inch)		mm	(inch)
35 mm	22209E	53177 53376D X2S53176	0.15	(0.006)	31309 J2/QCL7CDF	0.10	(0.004)
50 mm	22212E	72225C 72488D X1S72225	0.15	(0.006)	31312 J2/QDF	0.12	(0.005)
70 mm	22217E	9285 9220D X4S9285	0.18	(0.007)	31316 J1/QLC7CDF	0.14	(0.006)
100 mm	22224E	HM926740 HM926710CD HM92674XA	0.25	(0.010)	31322 XJ2/DF	0.16	(0.006)
125 mm	22230E	HH932145 HH932110 H932145XA **	0.20	(0.008)	31328 XJ2/DF	0.19	(0.008)

* Koyo is also an approved supplier for the Back to Back Taper roller bearing.
** Assembled from two single row bearings.



Cartridge 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.

- Drain the oil (if applicable) by removing the drain plug on the bottom of the housing.
- Remove the flingers (if any) and bearing housing end covers. Care should be taken with the Inpro oil seals, which should not be removed from the end covers unless they have been damaged and are in need of replacement. Inspect the seals, gaskets, and o-rings, and discard any that appear worn or broken.
- The locknut and lock washer that clamp the drive side bearing should also be removed. One tab of the lock washer will be bent into a recess on the lock ring and must be bent back to allow the lock nut to be unscrewed.

- The shaft and bearings (which are pressed onto the shaft) may then be removed as a unit from the drive end of the housing. Horizontal disassembly is acceptable when proper support is given to the shaft to prevent its contacting and marring any of the finished surfaces of the shaft or bearing housing bore. Care should be taken to avoid damaging the grease retaining ring (part 63-7, grease lubricated) or spacer ring (part 45-4, oil lubricated) that will come out on the shaft between the two bearings.
- The bearings are hot when installed on the shaft, and fit tight. 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 heating, which should be done quickly to prevent heating of the shaft as well. Flame cutting of the outer race and careful grinding of the inner race may occasionally be required. Care must be taken, however, to avoid damaging the shaft, especially in the oil seal area.

8.3 Mechanical End Assembly

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

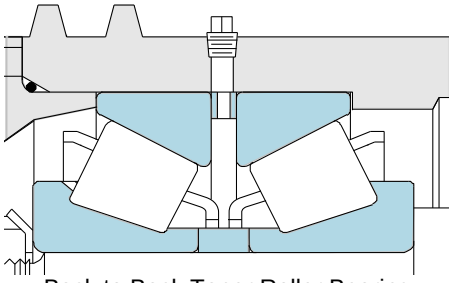
Caution Before assembly, thoroughly clean all shaft, housing bore, and end cover surfaces with a suitable solvent to remove old grease and any water, dust or grit. Clean all dismantled components and check them for signs of wear. Damaged or worn components are to be replaced by original equipment spare parts. Make sure that the seal faces are clean and the O-rings and gaskets are properly fitted.

8.3.1 Mounting the Bearings

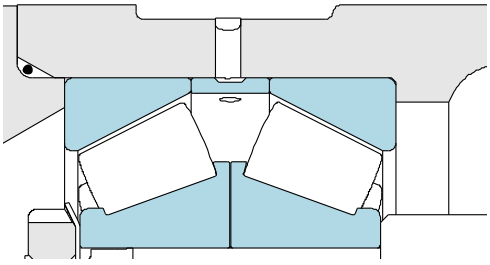
Care must be taken when handling heated components

- Heat radial bearing to 120 °C (250 °F) by a suitable bearing heater, oil bath, or other even heating device prior to mounting. Flame heating is not recommended.
- Install radial bearing onto shaft
- Press fit bearing ensuring that it is seated fully against the abutting shaft shoulder.

Caution Use the bearing assembly drawing to determine if the bearing assembly uses the face to face or back to back taper bearing arrangement.



Back to Back Taper Roller Bearing



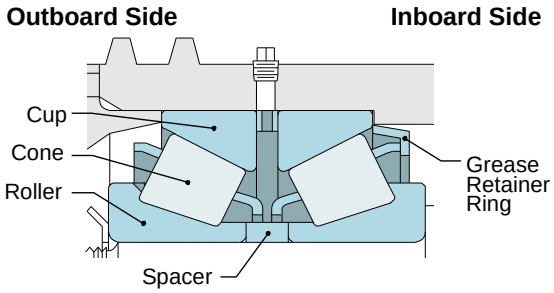
Face to Face Taper Roller Bearing

Taper Bearing Locknut Assembly Torque

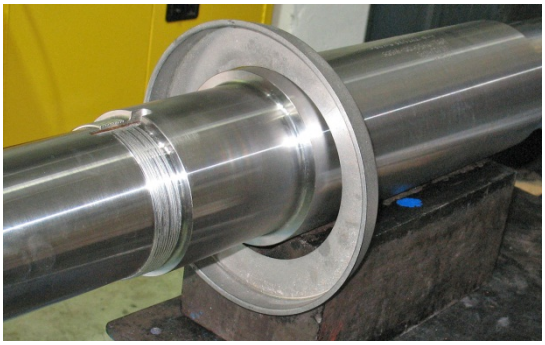
Bearing Assembly	Locknut Assembly Torque	
	N-m	ft-lbs
35 mm	100	75
50 mm	135	100
70 mm	200	150
100 mm	375	275
125 mm	680	500

8.3.2 Back to Back Thrust Bearing Installation

- For grease: Install grease retaining ring 63-7 and ensure proper orientation.
- For oil: Install spacer ring 45-4 and ensure proper orientation.

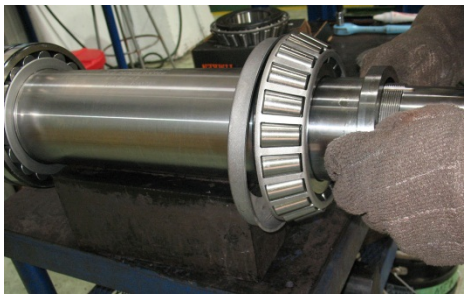
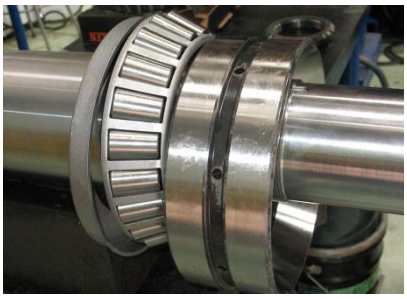


Back to Back Thrust Bearing Arrangment


Retainer Ring (Grease)

Caution The grease retaining ring (63-7, for grease lubrication) or spacer ring (45-4, for oil lubrication) must be placed on the shaft between the bearings, and in the proper orientation, before both bearings are mounted. Once the bearings are mounted, they cannot be removed without risk of damage. The grease ring is essential in protecting the taper bearing from loss of lubrication in the event of high loadings. Failure to install the ring may result in significantly reduced bearing life.

- Heat inboard cone to 120 °C (250 °F) and install. Ensure that the larger OD of the bearing is towards the center of the shaft.
- Install spacer and bearing cup

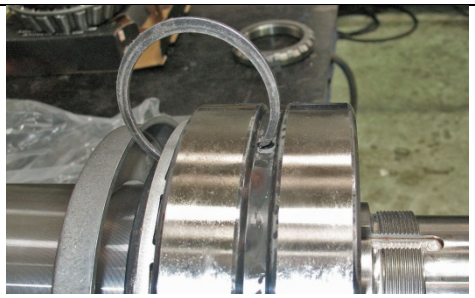
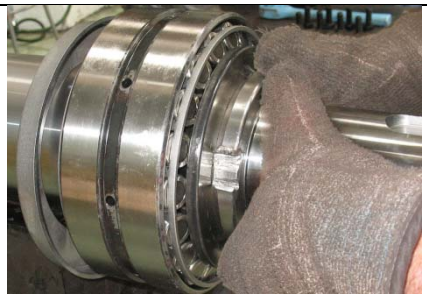
- A clip may be used to hold the cup in place.
- Heat the outboard cone to 120 °C (250 °F) and install. Ensure that the larger outer diameter of the bearing is towards the drive end of the shaft.
- Before the taper roller bearing has cooled on the shaft, use the lock nut **without** lock washer to fully seat the bearing against the shaft shoulder. (The lock washer must be left out during this step to prevent damage)
- After the bearings have cooled, remove the locknut and reinstall **with** lock washer against the taper roller bearing, tightening the nut according to the torque given in Section 8.3.1 “Mounting the Bearings”.

Caution Over-tightening can damage the lock washer and allow the locknut to back off during operation.

Caution Do not back off the locknut any amount after tightening in an attempt to set the bearing clearances. The taper bearing has an internal spacer, which automatically sets the internal bearing clearances.

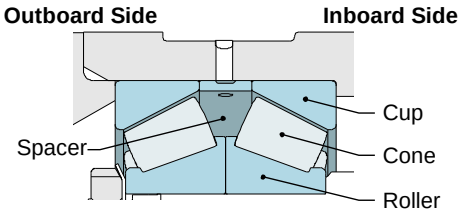
- After tightening, bend down one tab of the lock washer into one of the mating grooves on the locknut. If none of the tabs are aligned with a groove, locate the nearest one, and further tighten the locknut until the tab can be bent down.
- Failure to bend down one of the lock washer tabs may allow the locknut to back-off and lead to premature bearing failure.
- Ensure that the bearing outer diameters and housing bores are clean. Coat shaft between the bearings with GIW Blue Synthetic Bearing Lubricant.
- Lift shaft vertically and place into housing from drive end. It will be necessary to align the grease ring 63-7 or spacer 45-4 as it enters the housing since it has about 6mm (0.25”) of clearance with the shaft.

Caution The bearings should slide easily and fully into the bearing housing without excessive force that would indicate possible dust or grit between the bearings and the housing, and result in a thrust preloading on the impeller end spherical roller bearing. Preloading of the bearing will cause it to carry thrust loadings, which would normally be carried by the taper roller bearing and can result in overheating and premature failure of the spherical roller bearing.


8.3.3 Face to Face Thrust Bearing Installation

- Place the cup of the inboard bearing onto the shaft.
- Heat the inboard cone to120°C (250°F) and press fit onto the shaft.
- Heat the outboard bearing cone to 120 °C (250 °F) and press fit onto the shaft.



Face to Face Thrust Bearing Arrangment



- After both cones are installed and before the taper roller bearing has cooled on the shaft, use the lock nut **without** lock washer to fully seat the bearing against the shaft shoulder. (The lock washer must be left out during this step to prevent damage)
- After the bearings have cooled, remove the locknut and reinstall **with** lock washer against the taper roller bearing, tightening the nut according to the torque given in Section 8.3.1 “Mounting the Bearings”.

Caution Over-tightening can damage the lock washer and allow the locknut to back off during operation.

Caution Do not back off the locknut any amount after tightening in an attempt to set the bearing clearances. The taper bearing has an internal spacer, which automatically sets the internal bearing clearances.

- After tightening, bend down one tab of the lock washer into one of the mating grooves on the locknut. If none of the tabs are aligned with a groove, locate the nearest one, and further tighten the locknut until the tab can be bent down.
- Failure to bend down one of the lock washer tabs may allow the locknut to back-off and lead to premature bearing failure.
- Ensure that the bearing outer diameters and housing bores are clean. Coat shaft between the bearings with GIW Blue Synthetic Bearing Lubricant then lift shaft vertically and place into housing from drive end.
- Insert the spacer and cup for the outboard bearing using a rubber mallet.

Caution The bearings should slide easily and fully into the bearing housing without excessive force that would indicate possible dust or grit between the bearings and the housing, and result in a thrust preloading on the impeller end spherical roller bearing. Preloading of the bearing will cause it to carry thrust loadings, which would normally be carried by the taper roller bearing and can result in overheating and premature failure of the spherical roller bearing.

Bearing Assembly inserted into Housing Drive End

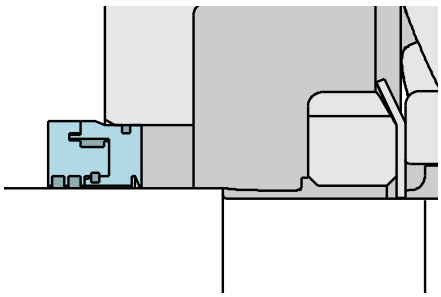
Inserting the Spacer and Cup

Use a rubber mallet to ease insertion

8.3.4 Installing End Covers and Seals

- The standard bearing housing shaft seal is the Inpro VBX type labyrinth seal. Other seal types may be available including the Caterpillar Duo-Cone seal for underwater bearing assemblies. See your arrangement drawing for specific information regarding these alternate seal types.
- Prior to installation, press the Inpro shaft seals into each end cover, ensuring that the contaminant expulsion port and lubrication return trough are located at the 6 o'clock (bottom) position. If possible, use a hand operated arbor press instead of a hydraulic press to improve control of the pressing operation. You will be overcoming a light interference fit and may shear off a portion of the outer diameter o-ring, however, this is normal and indicates a secure fit.

Install with lubrication return trough at 6 o'clock position



VBX Inpro Seal

- Slide end covers with gaskets and Inpro seals over the shaft at each end, again making certain that the contaminant expulsion port and lubrication return trough are located at the bottom. Use O-Ring lubricant, Parker O-Lube or Parker Super-O-Lube to lubricate the inner diameter o-rings against the shaft. Take special care when running the seal over the shaft keyway to avoid cutting the o-ring. If necessary, lightly file the keyway edges to avoid this problem.
- After bolting the end covers in place, rotate the shaft by hand. There should be no frictional contact between the rotating and stationary parts of the Inpro seal. Any rubbing or axial movement in the seal may indicate misalignment. If this is the case, tap lightly into alignment. Note that the drive side end cover clamps against the outer race of the taper roller bearing and may not fit flush against the housing. No shimming is necessary. A gap of up to 1 mm (0.04") is acceptable and within the tolerance of the parts. Any larger gap may indicate that the taper roller bearing is not fully seated into the housing.
- Install grease fittings or oil plugs.

8.4 Bearing Assembly Mounting

- After mounting the stuffing box (or mechanical seal adapter) loosely onto the pedestal plate, and screwing the adjusting screw (909) with nut (924) an appropriate length into the pedestal, the cartridge bearing assembly may be placed onto the pedestal saddle. Note that the slotted tab on the housing must be inserted between the adjusting screw shoulder and the adjusting nut.
- The pedestal and bearing housing saddles should be clean, dry, and free from oil or grease. If corrosion of the saddles is a problem, apply a thin film of preservative. Special care must then be taken in the axial adjustment procedure to ensure that no movement may occur. See the Section 10.4 "Setting the Impeller Nose Gap" for more details.
- The four bearing housing hold down clamps (732) may now be bolted on, but should remain slightly loose until the axial adjustment of the bearing housing is complete.

- 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.

⚠ 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.

Bearing Assembly Clamp Bolts

Bearing Assembly	Bolt Size	Clamp Bolt Torque	
		N-m	ft-lbs
35 mm	M20	340	250
50 mm			
70 mm	M24	680	500
100 mm			
125 mm			

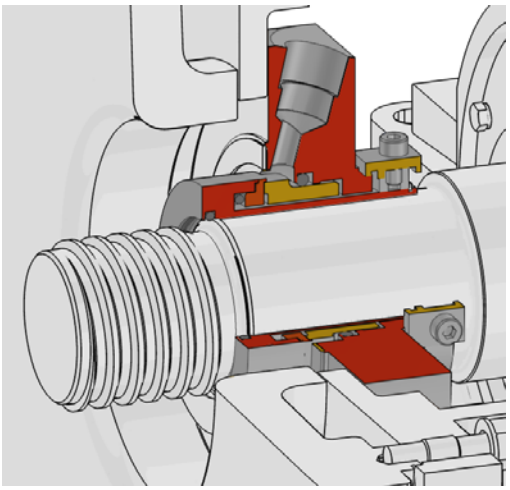
9 Shaft Seal

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

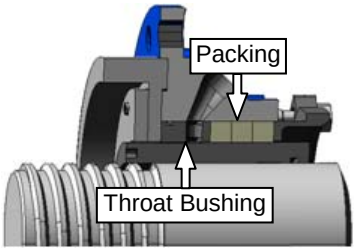
Review the mechanical seal arrangement and determine the layout of the mechanical seal assembly. Some mechanical seals have an adapter which must be placed on the shaft before the hub plate and/or casing is installed while others can be installed after the casing is installed.

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

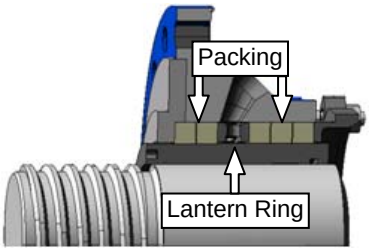
9.2 Stuffing Box

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.

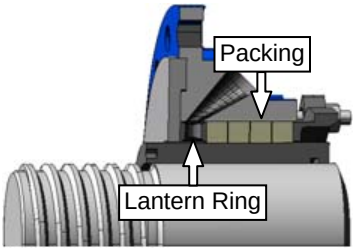
- The **Throat Bushing** design is the standard product offering in GIW's LSA style S & SC pumps. It combines the lantern ring with a longer, tight tolerance collar and provides a compromise between the Forward Flush and KE designs in difficult applications where water reduction is needed. It produces 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

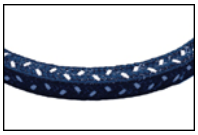
9.2.1 Stuffing Box Packing

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 0.25 mm (.010”) 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 shown in the Table.
- 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

- For hot, high pressure or otherwise severe service conditions, an optional combination lantern ring / throat bushing is recommended in place of the standard lantern ring and first ring of packing. Water requirements for this option will be about mid-way between the forward flush and KE configurations shown in the table below.
- For expeller applications, the stuffing box used must be of the ‘KE’ (low flow) type with a ring of packing between the lantern ring and pumped fluid. All rings of packing should be well coated with water resistant grease during assembly.

Shaft Size	**Stuffing Box Type**							
	Throat Bushing		KE Design		Forward Flush		*SpiralTrac	
	L/sec	(gpm)	L/sec	(gpm)	L/sec	(gpm)	L/sec	(gpm)
35mm	0.18	(2.8)	0.09	(1.4)	0.44	(7.0)	0.09	(1.4)
50mm	0.21	(3.4)	0.11	(1.7)	0.54	(8.5)	0.10	(1.7)
70mm	0.30	(4.8)	0.15	(2.4)	0.76	(12.0)	0.15	(2.4)
100mm	0.39	(6.2)	0.20	(3.1)	0.98	(15.5)	0.19	(3.1)
125mm	0.47	(7.4)	0.23	(3.7)	1.17	(18.5)	0.23	(3.7)

*Non-standard option

9.3 Expeller Seal

Expeller seals are used in pump applications where limited or no gland flush water is readily available or where it is not compatible with the process fluid. A second rotating impeller contained in a separate casing creates a lower pressure at the stuffing box seal area. This allows the shaft sleeve to be grease lubricated and run with only enough packing compression to seal the pump.

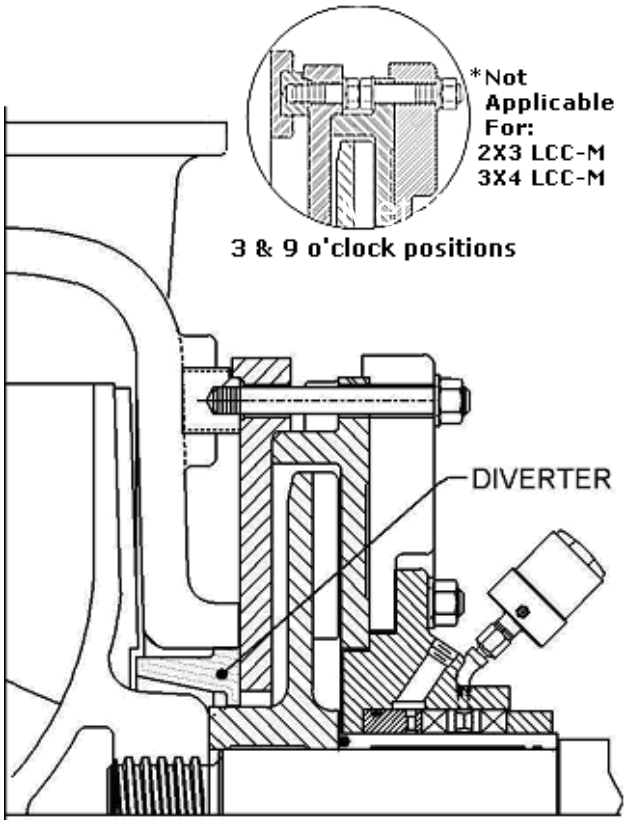
Unlike mechanical seals, expellers must be carefully selected for each application and specific operating conditions. Expellers require additional driver horsepower, which must be accounted for during motor selection. Changes to head, flow, pump speed, process solids or sump level after the pump has been installed can affect the functionality of an expeller sealing system.

Correct installation, adjustment and operating procedures are extremely critical to the proper function and life of these seals. Extensive testing has shown that the following guidelines can help keep the expeller system operating properly while prolonging the life of wear components. Further engineering review is recommended for expeller operation outside these guidelines.

Particle size – The D50 should be kept between 200 and 1500 microns.

Slurry SG – The Specific Gravity of the slurry should remain below 1.35.

Solids – Slurries that could deposit scale on pump surfaces should be avoided.



Typical Expeller Arrangement

Flow rate – Stay between 0.5 and 1.3 times the Best Efficiency Point (Q_{BEP}).

Flushing – Solids in the process flow can precipitate out when the pump stops and build up in the expeller chamber. Over time, this reduces efficiency and accelerates wear. The system should always be purged with clear water for at least 15 minutes prior to stopping the pump. Starting the system on clear water will help the expeller displace solids. For applications where precipitate buildup in the expeller chamber is unavoidable, intermittent gland water flush may be necessary.

When the stuffing box does not have flush water, the packing must be lubricated with grease or oil. Graphite packing such as Tuf-Pak 400 is recommended. Manual or automatic grease dispensers are available depending on the application. Twisting the cap in on the manual units will add a small amount of grease to the packing. These are refilled by removing the cap and packing the cup with lubricant. Automatic greasers use a spring driven piston to maintain a steady supply of grease. These are refilled by connecting a grease gun to the fitting on the side of the unit. Note that extremes in temperature can alter the amount of lubricant supplied to the packing and must be accounted for. Springs are available for the automatic greaser with three different tension levels to control the flow of grease.

New expeller pumps are equipped with a diverter ring pressed into the hub area of the pump casing. This acts as a baffle to help reduce the amount of solids entering the seal chamber. The diverter can be ordered as a service part and retrofit into earlier units. For diverter installation see supplement 11.4.

It is important to operate the expeller pump within the speed limitations and operating conditions specified in the original design parameters. Wide variations in flow rate and solids can allow particles to accumulate in the expeller chamber, which may result in a plugging or premature component failure. 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.

9.3.1 Expeller Assembly

For 2x3 and 3x4 LCC-M Pumps

- Before mounting the expeller (23-15) a 0.5 mm (0.020 inch) aramid gasket (400.31) is placed between the shaft sleeve and the expeller to prevent galling and ensure ease of removal. The gasket should be installed dry, without grease.
- Mount the expeller casing (10-7) to the pedestal using two spare bolts (not provided) at 180 degrees to each other to hold it temporarily in place.
- After mounting the expeller, which is a close sliding fit to the shaft, adjust the bearing assembly towards the drive end until the expeller just begins to rub on the expeller casing. Then move it back towards the pump end approx. 1.0 mm (0.4 inch). This is a preliminary adjustment. Final adjustment will be made after wet end assembly is complete.
- Mount the expeller plate (16-4) at the same time the shell or casing is mounted by inserting the studs into the shell or casing and allowing the expeller plate to rest on and be supported by the studs.

If attempt is made to mount the expeller plate without the support of the shell or casing studs, it will not be properly supported and may fall without warning.

For LCC-R, LCC-H, and all other LCC-M Pumps

- Before mounting the expeller (23-15) a 0.5 mm (0.020 inch) aramid gasket (400.31) is placed between the shaft sleeve and the expeller to prevent galling and ensure ease of removal. The gasket should be installed dry, without grease.
- Mount the expeller casing (10-7) to the pedestal using two hex head bolts (901.13) at the 3 & 9 o'clock positions with the bolt heads on the expeller casing side.
- After mounting the expeller, which is a close sliding fit to the shaft, adjust the bearing assembly towards the drive end until the expeller just begins to rub on the expeller casing. Then move it back towards the pump end approx. 1.0 mm (0.4 inch). This is a preliminary adjustment. Final adjustment will be made after wet end assembly is complete.
- Mount the expeller plate (16-4) to the shell using two hex head bolts (901.14) at the 3 & 9 o'clock positions. Mount the expeller plate and shell to the expeller casing and pedestal by inserting studs into the remaining stud positions. Hex head bolts at the 3 & 9 o'clock positions should not be removed or replaced with studs.

If attempt is made to mount the expeller plate without the support of the shell or casing studs, it will not be properly supported and may fall without warning.

9.3.2 Expeller Disassembly

For 2x3 and 3x4 LCC-M Pumps

- After supporting the pump shell, remove the nuts from all four of the studs (902.10) which hold the shell in place.
- Dismount the shell and the expeller plate (16-4) together, allowing the expeller casing to rest on and be supported by the 4 studs.
- Go to the "Removing the Expeller" section below.

For LCC-R, LCC-H, and all other LCC-M Pumps

- After supporting the pump shell, remove the nuts from all six of the studs (902.10), which hold the shell in place. This excludes hex head bolts at the 3 & 9 o'clock positions which mount the expeller plate to the shell (901.14) and expeller casing to the pedestal (901.13).
- Dismount the shell and the expeller plate (16-4) together.

If not removed in the above manner, the expeller plate may fall without warning after the shell is removed.

Removing the Expeller

- Before removing the expeller, ensure that the 2 bolts in the 3 & 9 o'clock positions (901.13) that secure the expeller casing (10-7) to the pump pedestal have not been removed.
- **For 2x3 and 3x4 LCC-M**, use two of the holes left open and two spare bolts (not included) to secure the expeller casing (10-7) to the pump pedestal.

If not secured in the above manner, the expeller casing may fall without warning after the expeller is removed.

- The expeller (23-15) may now be removed from the shaft. The fit of this part is similar to that of a shaft sleeve (a close sliding fit). If necessary, the expeller casing may be unfastened from the pedestal, supported as needed and used to apply pressure to the expeller in order to force it from the shaft. This pressure must be applied at several points around the expeller casing to prevent uneven loading and potential breakage of the hard iron parts.

9.3.3 Expeller Running Clearance

The following procedure is recommended for optimizing expeller performance or for setting the clearances in pumps containing any worn parts:

1. With the suction plate/liner removed, adjust the bearing assembly toward the pump end until the back surface of the expeller just begins to rub the expeller plate.
2. Mount a dial gauge to indicate cartridge bearing assembly axial movement and zero the dial gauge at this location.
3. Now adjust the bearing assembly toward the drive (or motor) end until the expeller vanes just begin to rub on the expeller casing, or the impeller begins to rub on the hub side of the pump shell, whichever comes first.
4. Adjust the bearing assembly toward the pump end again approximately 1.0 mm (0.04 in.) to provide a minimal expeller running clearance. If optimization of expeller performance is desired, lock the adjustment at this location
5. Reassemble the suction plate and check the impeller to liner clearance. If not optimizing expeller clearances set the impeller clearance as detailed in the section “Axial Adjustment of the Bearing Housing”. Do not allow the dial gauge to come closer than 1.0 mm (0.04 in.) to the original zero setting or expeller rubbing may occur. If necessary, consider the use of a spacer as mentioned in step 4.

10 Wet End

10.1 Wet End Overview

10.1.1 Pump Casing

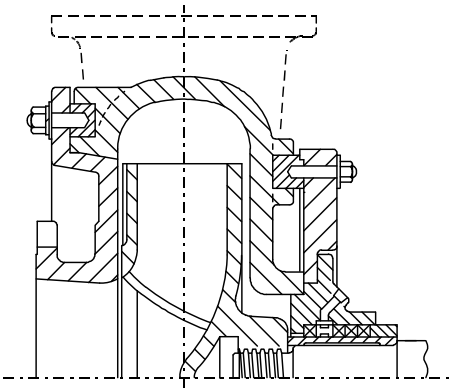
Three standard configurations are available:

1 Hard Metal. Single-wall casing, impeller and suction liner of high-chrome white iron. Suitable for high-discharge head, all particle sizes up to maximum sphere passage and mildly corrosive slurries. Custom materials available for highly corrosive slurries.

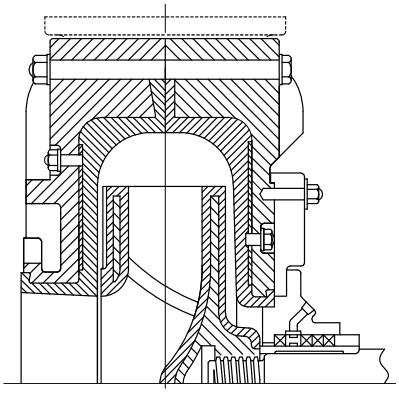
2 Elastomer Lined. Radially split construction with ductile iron outer casing and molded-elastomer inner liners. Impeller of high chrome white iron or polyurethane. For moderate discharge head, fine to medium particles and highly corrosive slurries.

3 Extra Heavy Hard Metal. Similar to hard metal version, but with heavier sections and hydraulics suited to the most severe slurry duties. Two-stage pressure capability. Available in sizes LCC 150 - 500 and above.

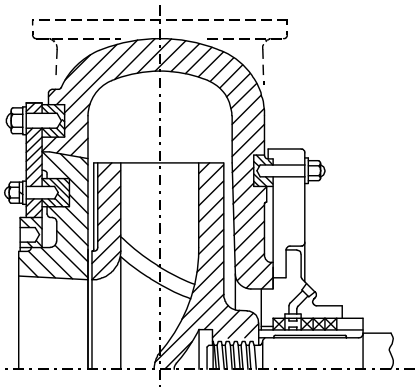
All casings carry 125 pound, ANSI flange bolting patterns. Adapters for conversion to DIN flanges are available.



Hard Metal



Elastomer-Lined



Extra Heavy Hard Metal

10.1.2 Impeller Form

All standard impellers are 3 vane, double shrouded designs. Open-shrouded and alternate vane number designs are available in some sizes.

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!

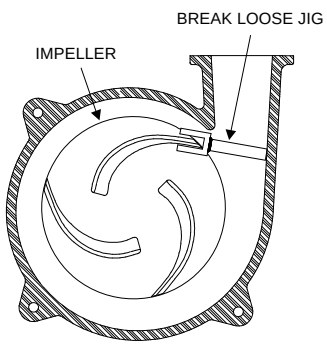
10.2.1 Impeller Removal

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

10.2.2 Impeller 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.

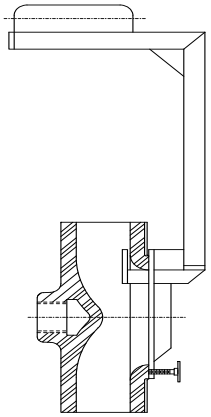


Impeller Break Loose Jig

10.2.3 Impeller Lifting Jig

- 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

10.2.4 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.

10.2.5 Elastomer-Liner Removal

Most liners fit snug into the casings. Two threaded push-off holes at 180 degrees are provided in the casings to aid in removal. If reuse of the liners is anticipated, care must be taken to push the liners out evenly to avoid bending of the steel backing plate.

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

- 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 sleeve face and shaft 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.

10.3.2 Mounting the Casing

- The alignment of the pump casing with the mechanical end is obtained through a rabbet fit machined into the pedestal. For the best wear and efficiency performance, it is essential that the casing be fully seated in this fit.
- Ensure that the proper gasket is fitted between the casing and pedestal before installing.
- In the case of the elastomer lined LCC-R pump, the liner itself forms the seal. See below for additional instructions.

10.3.3 Elastomer Lined Wet End

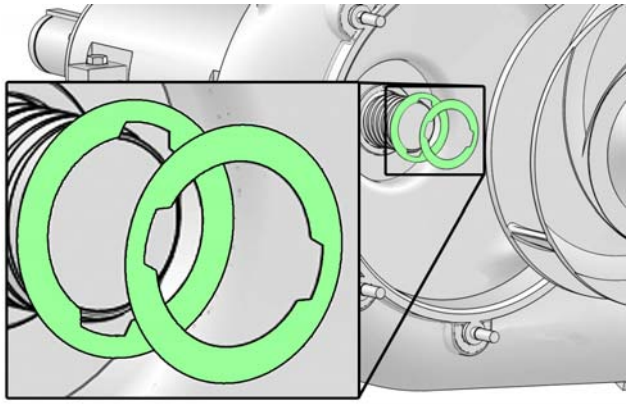
- Firmly seat the liners into the metal casings using a large rubber mallet if necessary. To seat the suction side liner, use a wooden brace and large C-clamps, or lay the liner, flange side up, on a wooden brace and lower the metal casing onto it, allowing the weight of the casing to seat the liner. Seat the elastomer flanges into their grooves using a blunt tool if necessary.
- The close fit of the liners, although requiring some effort in assembly, will ultimately ensure better liner support, and longer wear life. If desired, liquid soap may be used to lubricate the liners during assembly.

Caution Do not use petroleum-based products to lubricate the liners since they can cause degradation of the elastomer.

- Before assembling the casing halves together, check the fit of the liners in the casing to ensure that they are seated correctly, especially in the suction, hub, and discharge flange areas. Clearance allowing for limited readjustment of parts has been provided in the holes through which the liner studs protrude.
- When bolting the casings together, ensure that the liners remain well aligned with each other on their outer perimeter, especially in the discharge area. Some bulge may occur at the seam on the discharge flange. This may be removed, and the sealing surface restored to flatness by lightly buffing with a coarse grade sand paper or grinding stone. If desired, rubber gaskets may be applied at both the suction and discharge flanges, although this is typically not necessary.
- Some bulging may also occur inside the casing between liners. This is normal and does not affect performance.

10.3.4 Installing the Impeller

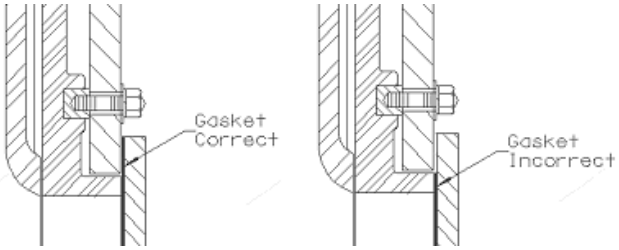
- Coat the shaft threads heavily with anti-seize compound. Do **not** coat the shaft sleeve faces which contact the impeller and the step in the shaft.
- **Two** 0.5mm (0.020 inch) aramid gaskets (400.10) are placed between the shaft sleeve and the impeller hub face to prevent galling and to ensure ease of impeller removal. Stagger the gaskets so they are not in alignment. The gaskets should be installed dry, without grease.
- Screw on the impeller tightly by hand. With larger sizes, it may be convenient to hold the impeller stationary while turning the shaft. Impeller lifting jigs are available to assist in this operation.
- When assembly of the pump is complete, check the impeller to suction wear plate clearance and adjust if necessary, (see section on Axial Adjustment of Bearing Housing).



Staggered Impeller Gasket Installation

10.3.5 Suction Plate & Liner (LCC-H only)

- Bolt the suction liner to the suction plate and install o-ring before mounting to casing.
- After mounting, the suction liner should protrude approximately 1.0 mm (0.04 inch) 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.



Proper suction flange 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.
  - Stuffing Boxes may be packed before or after the adjustment procedure.
  - Mechanical seal axial set must be left until after the adjustment is complete.
  - Pumps with urethane or rubber lined parts should also have the suction spool or suction piping installed and torqued prior to nose gap adjustment.

- Ensuring 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.
- Once the clearance is correct, lightly tighten the bolts of the four bearing housing clamps by hand, making sure that proper contact is maintained at all four locations. Next fully tighten the bolts according to the requirements of Section 8.4 “Bearing Assembly Mounting” and recheck clearance.
- Finally, firmly lock the adjusting screw and nut together against the bearing housing tab.

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.

Caution Proper tightening of the bearing housing clamps and adjusting nut is essential to prevent movement of the rotating assembly during operation. Failure to do so can result in severe vibration and damage to all pump components.

Shaft Size	Impeller Nose Gap inch	(mm)
All Sizes	0.010	(0.25)

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

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.