



Maintenance Manual

07/2013

LCV



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

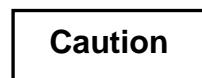
The safety instructions contained in this manual whose non-observance might cause hazards to persons are specially marked with the general hazard sign, namely



Safety sign in accordance with DIN 4844-W9



The electrical danger warning sign is the safety sign in accordance with DIN 4844-W8.



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 cyanoacrylate 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.



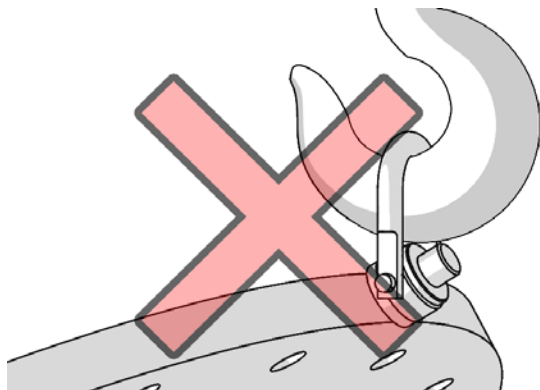
Do not apply heat to the impeller hub or nose due to the sealed cavity at the impeller nose.
DANGER OF EXPLOSION!



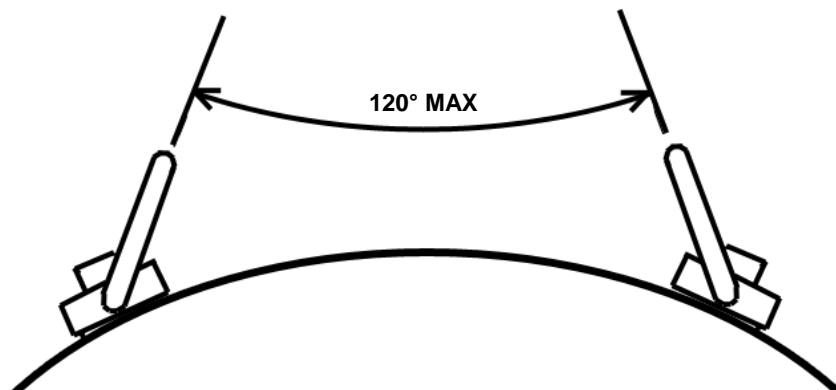
Upon completion of the work, all safety-related and protective equipment must be properly refitted and/or reactivated before starting the pump set.



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 auxiliary 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 be 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
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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 foreign 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 Casing Casing Half Liner	Plate Impeller Sub-base	<ul style="list-style-type: none"> ✓ Outdoor storage with monthly inspection permitted for these parts only ✓ Lay sub-bases flat and do not stack
Rubber Elastomers	Urethane Neoprene	<ul style="list-style-type: none"> ✓ 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 Wear Plate	Lantern Ring	<ul style="list-style-type: none"> ✓ Coat complete part with rust protector
Shaft		<ul style="list-style-type: none"> ✓ Coat complete part with rust protector and wrap with 6mil VCI plastic
O-Ring	Gasket	<ul style="list-style-type: none"> ✓ Check expiration date (shelf life is typically 5 years) ✓ Keep dry, out of direct sunlight and away from heat
Bearings Stat-o-Seals	InPro Seals	<ul style="list-style-type: none"> ✓ 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 Gear Reducer Coupling	Sheave Bushing etc...	<ul style="list-style-type: none"> ✓ Refer to manufacturer's storage guidelines

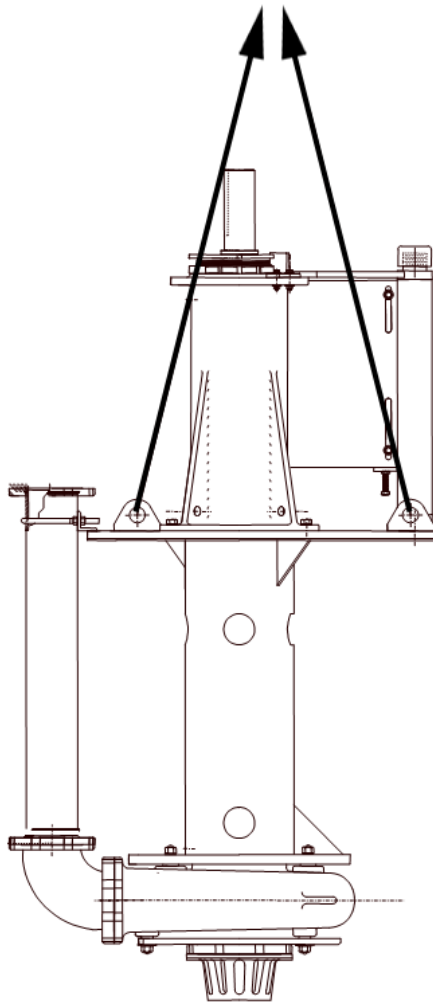
3.2.4 Removal from Storage

- 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 auxiliary 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.

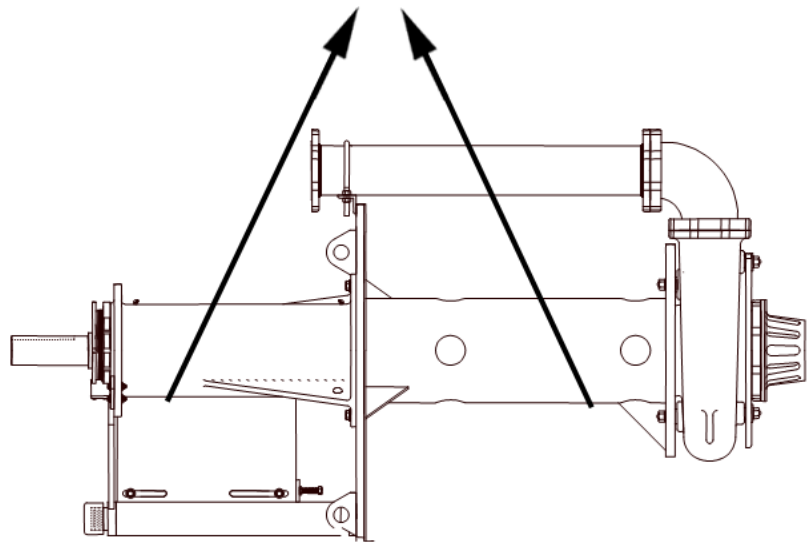
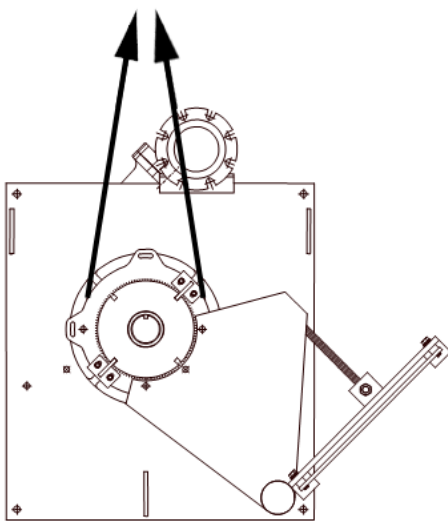
3.3 Recommended Lifting

Caution

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



Vertical Lifting



Horizontal Lifting

4 Description

4.1 Technical Specification

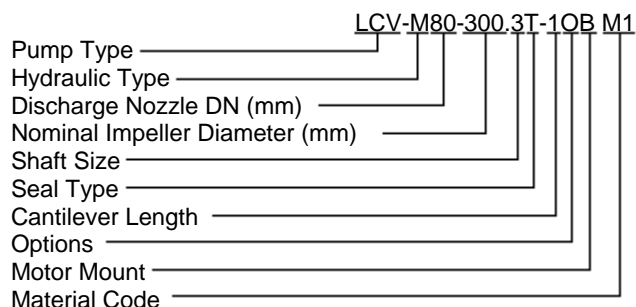
The LCV pump range is an international product and has been designed, in most respects, to the **METRIC** system of units using metric components. All fasteners are metric and will require metric tooling. All seals are metric including oil seals and O-rings.

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



Motor Mount

- A _____ Small
 B _____ Large

Options

- O _____ Open Metal Impeller
 C _____ Closed Shroud Impeller

Material Code

- M1 _____ Metal
 MC2 _____ Metal / Chemical

Hydraulic Type

- M _____ Metal

Mechanical (Shaft) Size (mm)

1	2	3	4	5	6
90	110	130	150	170	200

Seal Type

- S _____ Seal Plate
 T _____ Throttle Seal

Nominal Cantilever Lengths

1	2	3	4	5
900	1200	1500	1800	2100

Nominal Flange and Impeller Diameters in mm (inches)

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

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

4.3 Design Details

Vertical, end suction, modified volute casing pump with three-vane impeller for large solids passage.

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

Pulleys, belts, motor mounts and/or drive guards 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 the Pump Nozzles

Suction piping is normally not used in vertical pump applications. However, if a suction extension is used, the inlet end must be located a minimum of 1.5 pipe diameters above the bottom of the sump and no closer than 12" (300mm).

Discharge flange loads are limited to the weight of the discharge pipe section supplied with the pump by GIW. Any additional pipe loads or moments must be compensated for by the system pipe supports.

Contact GIW Engineering if additional information is required.

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

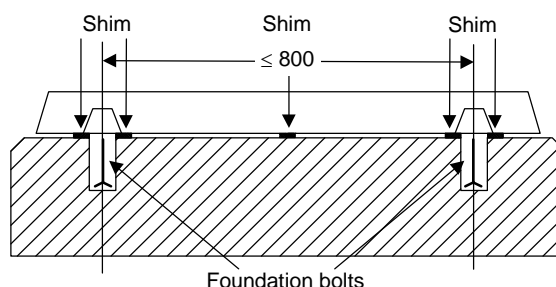
All structural work required must have been prepared in accordance with the dimensions stated in the dimension table / installation plan.

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.

5.3 Installing the Baseplate and Pump

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!

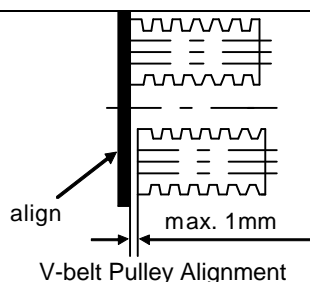


Use of the mounting bolts to close gaps between motor feet and the mounting plate (in place of shimming) is not recommended and may result in twisting of the motor frame, "soft foot" mounting and excessive vibration.



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.
- Checks and realignment must be done even if pump and motor are supplied completely assembled and aligned on a common base plate.
- 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.



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 and moments must not be exceeded (see to 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, Start-up 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.

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. Pump drive train final alignment is complete.
See Section 5.3.1 "Alignment" for details.
3. Final torquing of all bolts has been completed.
See Section 11.1 "General Torque" for details.
4. All electrical and power supply connections are in order, including fuses and overload protection devices.
See Section 5.1 "Safety Regulations" for details.
5. All required auxiliary connections, such as shaft seal water, oil coolers, etc. are made, tested and ready to function.
See Section 5.4.1 "Auxiliary Connection" for details.
6. All safety guards and equipment are in place.
See Section 5.5 "Safety Guards" for details.
7. Any required instrumentation has been properly installed.
See Section 5.6 "Oil Temperature Monitoring" for details on RTD installation.
8. Bearing assembly lubrication is completed.
See Section 6.1.1 "Bearing Lubrication" for details.
9. Shaft seal is ready for operation
See Section 6.1.2 "Shaft Seal Commissioning" for details.
10. Drive train direction of rotation at the pump is correct.
See Section 6.1.3 "Checking the Direction of Rotation" for details.
11. The pump set is primed.
See Section 6.2.1. "Priming the Pump"
12. 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

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.

Frame Size	*Shaft Speed (rpm)
LCV 1	1800
LCV 2	1400
LCV 3	1000
LCV 4	750
ZW	(monitor commission)

*Monitor commission temperature if exceeded

Grease Replenishment Intervals - Under Normal Operating Conditions							
LCV Frame	LCV Hours	Volume (mL)		ZW Pump	ZW Hours	Volume (cm³)	
		Drive End	Pump End			Drive End	Pump End
1	600	30 ml (1.01 oz)	40 ml (1.35 oz)	40-190	1000	30	40
2	1000	50 ml (1.69 oz)	90 ml (3.04 oz)	50-350	3000	80	80
3	1500	125 ml (4.23 oz)	190 ml (6.43 oz)	65-290	3000	80	80
4	1500	200 ml (6.76 oz)	280 ml (9.47 oz)	100-390	3000	80	80
				125-405	3000	80	80
				150-480	2000	90	140

6.1.2 Shaft Seal Commissioning

Ensure that the seal plate is aligned correctly with the shaft. Adjust if necessary.

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

- 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.
- Once the operating temperature has been reached and / or in the event of leakages, switch off the unit and re-tighten all bolts. Check the V-Belt alignment as described in Section 5.3.1 "Aligning the Pump / Drive Train" and re-align if necessary.



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 and the tank must be vented and primed with the liquid to be pumped. The shut-off element in the suction line must be fully open.

Pump size	Minimal Submergence for Priming	
	Axial height above centerline of the pump shell inches	mm
ZW Pump	7.90	200
LCV 50-230	8.25	210
LCV 80-300	8.50	215
LCV 100-400	9.06	230
LCV 150-500	10.00	255
LCV 200-610	11.00	280
LCV 250-660	12.25	315
LCV 300-700	13.75	350

6.3 Shutdown

- Close the shut-off element in the discharge line.
- If the discharge line is equipped with a non-return or check valve, the shut-off element may remain open.
- If shut-off is not possible, the pump may run in reverse. The reverse runaway speed must be lower than the rated speed.
- Switch off the drive, making sure that the unit runs smoothly down to a standstill.
- Where temperatures may drop below freezing, the pump and system must be drained or otherwise protected against freezing.

Caution

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

Caution

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

6.3.1 Measures to be taken for Prolonged Shutdown

1 The pump remains installed; operation check run

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

2 The pump is dismantled and stored

Before putting the pump into storage carry out all checks specified in Section 3.2 "Storage Requirements". It is advisable to close the nozzles (for example 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.

6.4.4 ZW Pump Additional Limits

- Slurry S.G. should not exceed 1.3.
- Operating temperature should not exceed 80 °C (176 °F).
- Operating pH should be kept above 6.0 pH.
- Chlorides in the slurry should not exceed 1000 ppm.

ZW Speed Limits (rpm)							
ZW 40-190		ZW 50-360 ZW 65-290		ZW 100-390		ZW125-405 ZW150-480	
min	max	min	max	min	max	min	max
1000	2560	700	1920	600	1280	500	1120

ZW Motor Mount Power Limit (kW)				
Pump	Motor Limit		Application Limit	
	Frame 1	Frame 2	Frame 1	Frame 2
ZW 40-190	7.46	14.91	5.03	9.32
ZW 65-290	11.19	22.37	7.46	17.15
ZW 50-360	11.19	44.74	12.68	35.05
ZW 100-390	29.83	74.57	20.13	55.93
ZW 125-405	55.93	111.85	41.01	91.72
ZW 150-480	55.93	111.85	41.01	91.72

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.
- Any stand-by pumps installed should be switched on and off again once a week to keep them operational. Attention should be paid to the correct functioning of the auxiliary connections.

7.2 Drainage / Disposal

Caution

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

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

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

7.3 Lubrication and Lubricant Change

- **Refer to Section 6.1.1 “Bearing Lubrication” for bearing 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.
- Under severe operating conditions, high ambient temperature, high humidity, dust laden air, aggressive industrial atmosphere, etc. the intervals for checking, replenishing and replacing the lubricant should be shortened.

7.4 Maintenance Procedures for Maximum Parts Life

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

Suction Liner

- 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.

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 "Troubleshooting" for additional information.

Sump Design

- A minimum sump capacity of one minute at the expected flow conditions should be provided. Sump design should prevent any uneven flow of the solids to the suction. Often, a flat bottom sump is best since it will allow the solids to assume a natural slope of repose. The sump should be observed during operation to ensure that solids are not building up and sluffing off.
- Sump design should prevent the formation of a vortex, or other means of introducing air into the pump. Where a submerged suction is available, the depth of water level above the pump suction is more important than the cross-sectional area of the sump. Frothing of the sump should be eliminated by the installation of baffles, a submerged inlet pipe or other methods to prevent air becoming entrained in the slurry. If unavoidable, frothing must be accounted for in the system design and operation.
- If the sump runs dry, the system will surge causing accelerated pump wear. Pump speed or impeller diameter should be decreased or make up water increased. If the flow variations are too great, a variable speed motor may be required.

Cavitation / NPSH Performance

- The NPSH available must always be greater than the NPSH required by the pump or cavitation will occur resulting in head loss (drop in discharge pressure), increased wear rate of the pump parts, and shock loading of the pump bearing assembly. If in doubt, consult your GIW / KSB representative for the NPSH requirements of your pump.
- To maximize the NPSH available to the pump, ensure that the suction line is as short and straight as possible and the sump level is as high as possible, (or the suction lift as small as possible in the case of a pump located above the water level). Minimizing the number of valves or short radius fittings and attaching a suction inlet bell will also reduce entrance losses. A larger diameter suction pipe may help, but one must be careful not to reduce the flow velocity below safe carrying levels or bedding of the slurry will occur and result in increased suction liner and impeller wear.
- In dredging applications where a free suction pipe or suction cutter head is lowered into the solids to be pumped, it is useful to have pressure gauges attached to the pump suction and discharge. An operator, by observing the gauges, will be able to maintain a maximum suction vacuum without cavitating the pump.

Piping System Design

- With coarse settling slurries, the pipelines should be vertical or horizontal. Inclined pipelines may surge due to a backward drift or build up of solids. Also, an increase in slurry friction loss may be experienced in these sloped lines, further reducing performance.
- Piping diameters must be properly sized to maintain sufficient carrying velocity. Oversized pipelines may result in the formation of a sliding bed of slurry which can greatly accelerate the wear of pumps and pipelines.

Operating Conditions of Flow and Head

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

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

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

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

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

- A. Pump serial number (from the nameplate on the pedestal), customer location, and the approximate startup date.
- B. Pumped fluid SG (specific gravity), slurry information including SG and particle size, and liquid temperature.
- C. The approximate flow rate desired and the actual minimum and maximum flow rate of the system if known.
- D. The system static head (the difference in elevation between the water level on the suction side of the pump and the point of discharge)

-
- E. The length and size of suction and discharge lines, including a description of the general arrangement including fittings, bends and valves
 - F. If the discharge point is not to atmosphere, what is the pressure, (e.g. cyclone backpressure).
 - G. If suction is taken from a sump, provide the general arrangement including size dimensions and minimum and maximum sump levels referenced to the suction centerline of the pump.
 - H. The available driver horsepower, speed of motor and pump or description of the ratio device between the pump and motor.
 - I. The impeller diameter if different from that supplied with the pump.

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

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

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

8 Mechanical End

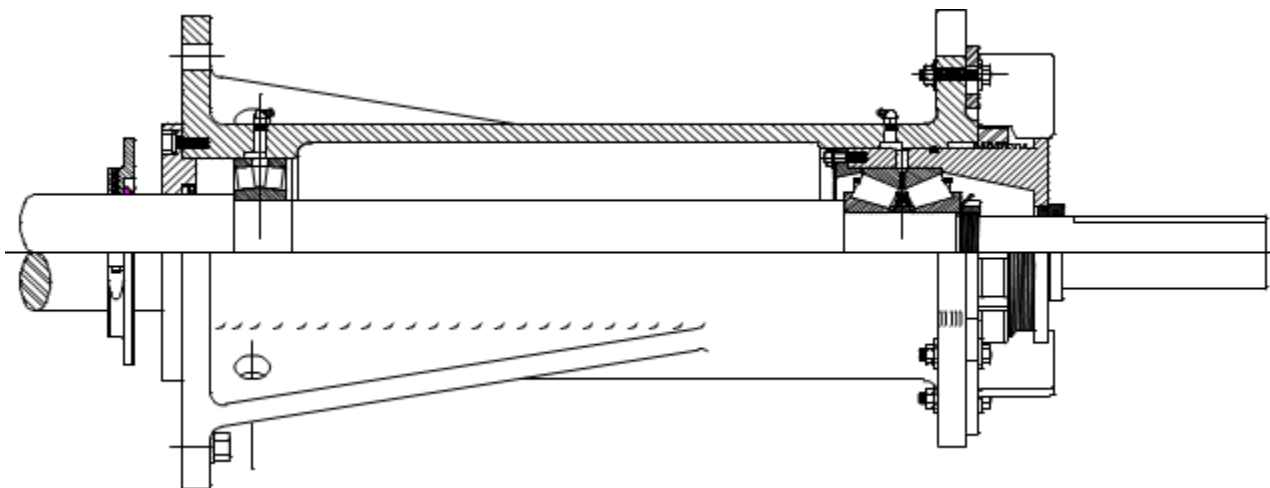
8.1 Mechanical End Overview

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

See Section 6.1.1 “Bearing Lubrication” for lubrication quality and quantity.

Frame Size	Spherical Roller (E Type)	Bearings Installed Double Row Taper Roller	
		Part Number* Cone / Cup / Spacer	Bench End-play mm (inch)
1	22216E	72225C 72488D X1S72225	0.15 (0.006)
2	22220E	9285 220D X4S9285	0.18 (0.007)
3	23028E	HM926740 HM926710CD HM92674XA	0.25 (0.010)
4	23036E	HH932145 HH932110 H932145XA	0.20 (0.008)

* Timken Co. part numbers shown, Koyo is also an approved supplier



LCV 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.

- Separate the bearing housing from the mounting plate and impeller.
- 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 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.
- Remove the drive end bearing assembly to expose the thrust bearings. 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 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; however, care must be taken 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

- The bearing configuration is such that the thrust bearing must be removed in order to change the radial bearing. An assessment should be made of the condition of the radial bearing at the time of any thrust bearing replacement since later replacement of the radial bearing could damage an acceptable thrust bearing. Once the bearings are mounted, they cannot be removed without risk of damage.
- The radial bearing is mounted first. The bearings are press fitted to the shaft and should be heated 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. When mounting, it is important that the bearings are seated fully against the abutting shaft shoulder.
- In mounting the taper roller bearing, it is important to heat the outer race (or cup) along with the inner races (or cones) to ensure proper seating against the inner spacer required by this preset clearance type bearing.
- Before the taper roller bearing has cooled on the shaft, use the lock nut without lockwasher to fully seat the bearing against the shaft shoulder. (The lockwasher must be left out during this step to prevent damage)
- After the bearings have cooled, remove the locknut and reinstall with lockwasher against the taper roller bearing, tightening the nut according to the torque listed.
- After tightening, bend down one tab of the lockwasher 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.
- See Section 6.1.1 “Bearing Lubrication” for grease lubrication requirements

Frame Size	Locknut Assembly Torque
1	55 N-m (40 ft-lbs)
2	110 N-m (80 ft-lbs)
3	270 N-m (200 ft-lbs)
4	680 N-m (500 ft-lbs)

Caution

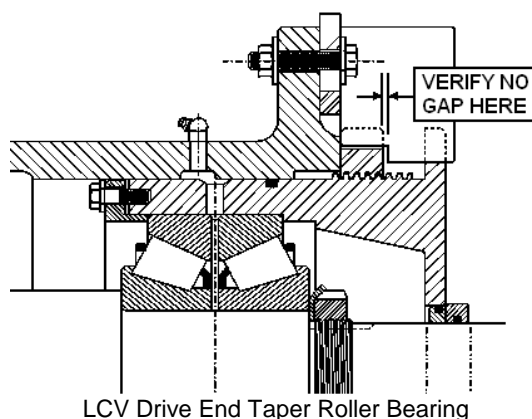
Over-tightening can damage the lockwasher and allow the locknut to back off during operation.

Caution

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

Caution

Failure to bend down one of the lockwasher tabs may allow the locknut to back-off and lead to premature bearing failure.



8.3.2 Inserting Shaft and Bearings into Housing

- To assemble in the horizontal position, lift the shaft using a sling at the approximate center of gravity.
- Insert into the housing until a second sling can be secured around the opposite end.
- Level both the housing and shaft at the precise elevation needed.
- Ensure the bearing outer diameters and housing bores are thoroughly clean then assemble the thrust end.
- Insert the shaft with bearings and thrust end assembly into the housing from the drive end.
- The radial bearing outer race must go in straight. A pipe jig may be made for this purpose.

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 Installing End Covers and Seals

- The standard drive end bearing housing shaft seal is the Inpro VBX type labyrinth seal. Impeller end sealing is accomplished by Inpro or lip seal.
- Prior to installation, press the Inpro shaft seals into each end cover. 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.
- Slide end covers with gaskets and Inpro seals, or lip seal, over the shaft at each end. Use a light coating of 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.

8.4 Bearing Assembly Mounting

- No special torque requirements exist for the mounting 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 24mm (1.0 inch) diameter.
- Place the support assembly in the horizontal position at a suitable height to facilitate pump assembly.
- Set lifting strap at the approximate center of gravity of the bearing assembly, positioning the strap to correctly orient the bearing housing assembly to the support assembly as shown in the pump assembly drawing.
- Clean the interfacing surfaces, the impeller side face of the bearing housing and the rabbit fit area of the support assembly. Do not apply oil or grease.
- Slide the bearing housing assembly through the support assembly far enough so that a second strap can be placed on the other side of the shaft. Level the bearing housing assembly and slide into position against the support assembly. The connecting bolts can now be fastened.

9 Shaft Seal

9.1 Seal Plate

Standard wet end sealing is accomplished by a urethane coated seal plate. An optional hard metal throttle seal is available for severe duty. Both seals are non-contacting with the shaft.

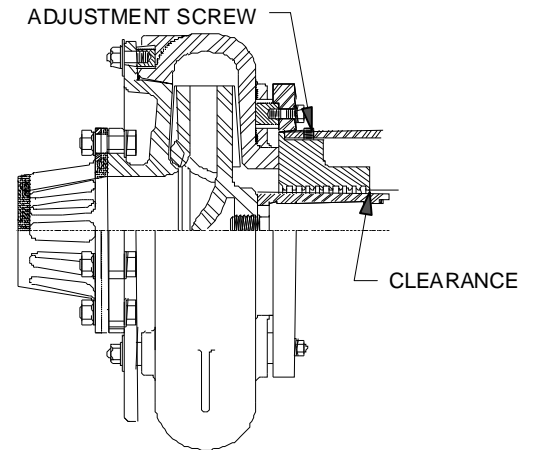
9.1.1 Seal Plate Assembly

The seal plate is self aligning but radial adjustment of the optional throttle bushing is required. Failure to correctly center the seal will lead to unnecessary shaft wear and loss of efficiency.

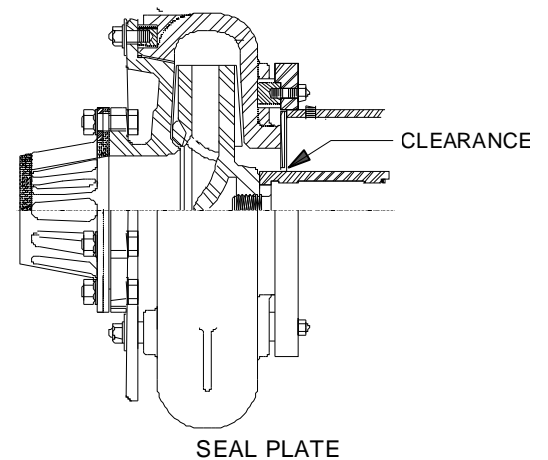
To adjust the running clearance:

- Loosen the bolts that attach the casing.
- Center the clearance between the throttle bushing inner diameter and the shaft by adjusting the throttle bushing using the set screws in the support assembly.
- The clearance can be determined by inserting a clearance gauge through the access holes. The gauge should move freely around the shaft circumference.
- Re-tighten the casing bolts.

	Frame 1	Frame 2	Frame 3	Frame 4
Seal Clearance	0.188"	0.188"	0.250"	0.250"



THROTTLE BUSHING ADJUSTMENT



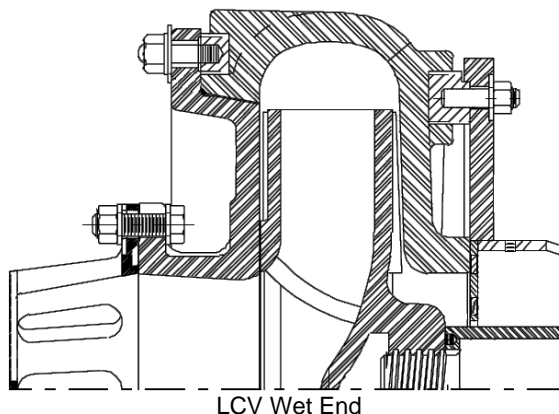
10 Wet End

10.1 Wet End Overview

10.1.1 Pump Casing

Radially split, 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 are available for highly corrosive slurries.

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



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

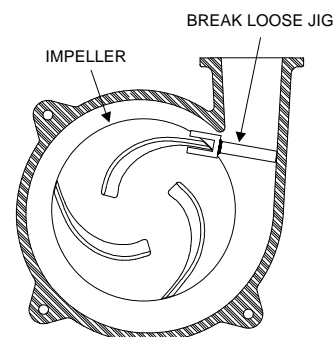
During normal operation, the impeller becomes tightly screwed onto the shaft by the running torque. A steady torque or mild, yet sudden, torsional jolt is usually required to disengage the impeller. Several methods of achieving this end are possible. One of the easiest methods is outlined below. To order 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.



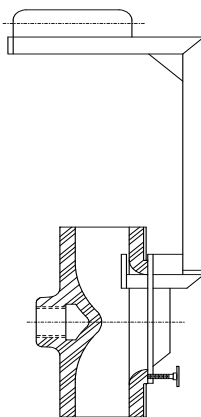
Impeller Break Loose Jig

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.

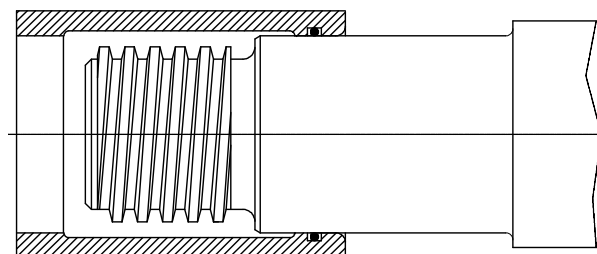
10.3 Wet End Assembly



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

10.3.1 Mounting 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 release ring face and the shaft sleeve face are approximately 1 " apart. Inspect the faces to be sure they are still clean and free from grease. If grease is present, the faces must be cleaned before the sleeve is slid into place.
- In many cases, there will be an o-ring which must be placed on the shaft first. As the shaft sleeve is pushed into position, this o-ring should be completely forced into the shaft sleeve recess.



Standard LCC Shaft Sleeve Arrangement



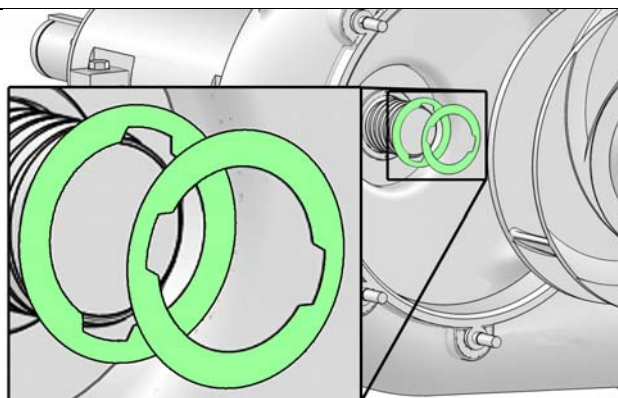
Lubrication at any of shaft sleeve, release ring, or shaft shoulder faces may result in overloading and breakage of the shaft.

10.3.2 Mounting the Casing

- Slide the seal plate (or optional throttle seal) over the shaft sleeve and into the machined groove of the bottom flange of the support assembly.
- Place the pump casing into position clamping the seal plate against the support assembly.
- Alignment of the pump casing with the mechanical end is obtained through a rabbet fit machined into the support assembly. For the best wear and efficiency performance, it is essential that the casing be fully seated in this fit.

10.3.3 Mounting the Impeller

- Coat **only** the shaft **threads** with anti-seize compound. **Two** 0.5 mm (0.020 inch) aramid gaskets (400.10) are placed between the shaft sleeve and the impeller hub face to prevent galling and to ensure ease of impeller removal. 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 liner clearance and adjust if necessary.
- 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.



Staggered Impeller Gasket Installaion

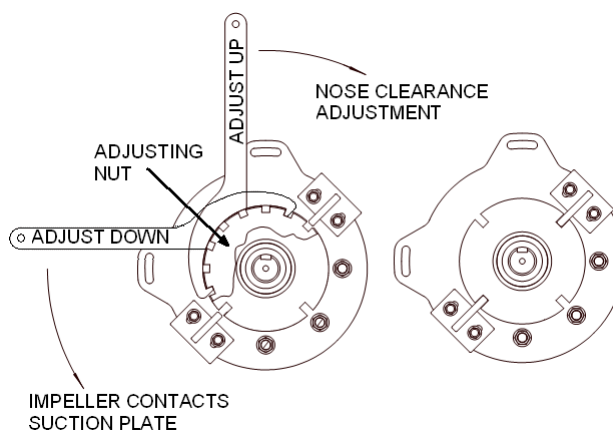
10.4 Setting the Nose Gap

In order to maximize the performance of your LCV pump, the clearance between the suction face of the impeller and the suction liner must be adjusted to a minimum clearance of 1.0 mm (0.040 in.).

- Before adjustment may proceed, the pump wetted end must be completely assembled. After supporting the pump assembly in the vertical position, axial adjustment can be made.
- Back off the two locking plates so that the bearing housing end cover can rotate freely using the spanner wrench on the adjusting nut.
- Tighten the locking plates in the backed off position.
- Turn the adjusting nut counter-clockwise until contact of the impeller is made with the suction liner. It is helpful to slowly rotate the impeller during this procedure.
- Turn the adjusting nut clockwise, while rotating the shaft until no rubbing of the impeller with the suction liner is apparent.
- Impeller clearance can now be set. Three turns of the spanner wrench (three notches per turn) between the two locking brackets will set the clearance. Once the clearance is correct, slide the locking brackets back into position and tighten the bolts.
- There should be no gap between the locking bracket and adjusting nut.

Caution

Proper locking of the bearing housing end cover 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.



Axial Impeller Adjustment

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								
Size	Anti-Seize		Lubricated / Oiled		Pump Assembly Fasteners		Mounting Equipment to Sub Base		Size	Anti-Seize		Lubricated / Oiled		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 Seize
 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
♦	♦	♦		♦	♦	♦		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.

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.