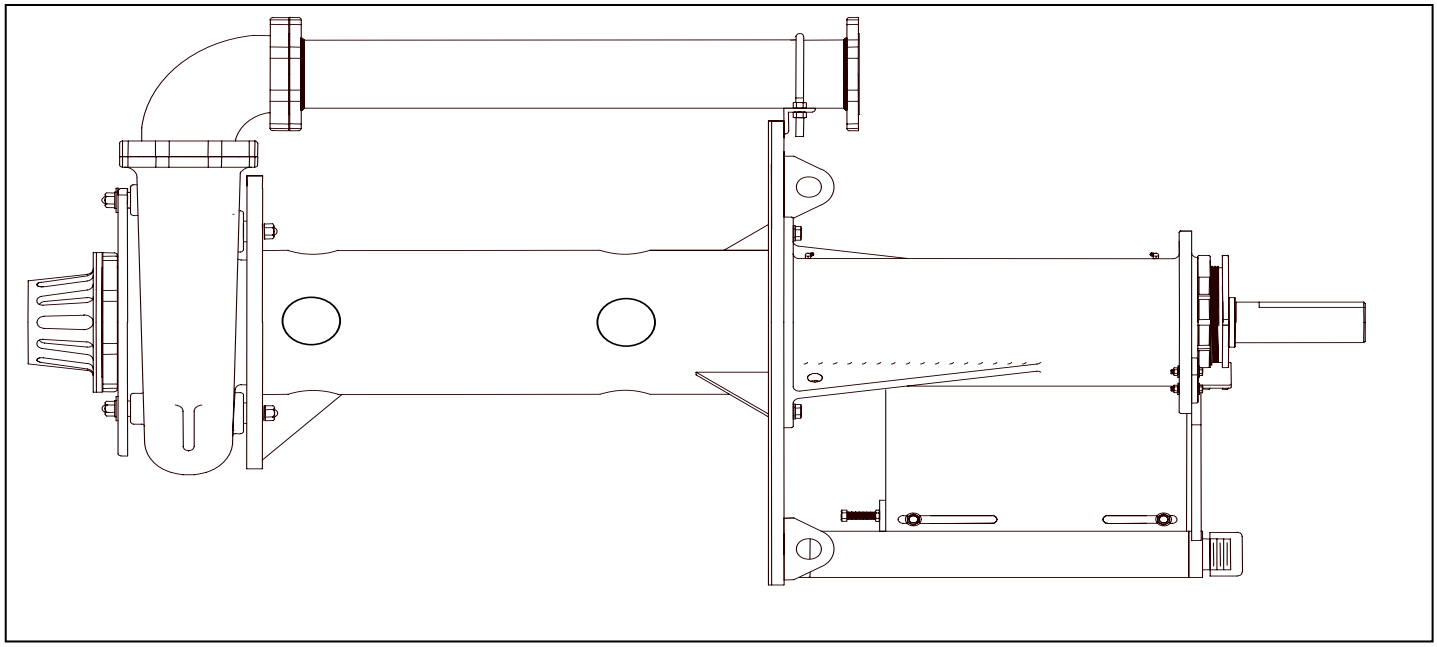
Maintenance Manual

2368.8000/-14 G2(02/02/06.0) 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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A KSB Company

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1 General

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

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

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

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

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

2 Safety

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

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

2.1 Marking of Instructions in the Manual

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

safety sign in accordance with DIN 4844-W9.

The electrical danger warning sign is

safety sign in accordance with DIN 4844-W8.The word

Caution

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

Instructions attached directly to the machine, such as:

- Arrow indicating the direction of rotation
- Marking for fluid connections must always be complied with and be kept in legible condition at all times.

2.2 Personnel Qualification and Training

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

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

2.3 Non-compliance with Safety Instructions

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

In particular, non-compliance can, for example, result in:

- Failure of important machine / unit functions
- Failure of prescribed maintenance and servicing practices
- Hazard to persons by electrical, mechanical and chemical effects
- Hazard to the environment due to leakage of hazardous substances.

2.4 Safety Awareness

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

2.5 Safety Instructions for the Operator / User

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

2.6 Safety Instructions for Maintenance, Inspection and Installation

The operator is responsible for ensuring that all maintenance, inspection and installation work is performed by

authorized and qualified personnel who are thoroughly familiar with the manual.

Work on the machine must be carried out only during standstill. The shutdown procedure described in the manual for taking the machine out of service must be adhered to without fail.
Pumps or pump units handling media injurious to health must be decontaminated.

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

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

2.7 Unauthorized Modification and Manufacture of Spare Parts

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

2.8 Unauthorized Modes of Operation

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

3 Transport and Interim Storage

3.1 Transport

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

Remove motor prior to lifting. Never lift by a single point and do not use the pump wet end or exposed shaft as a lifting point. Three welded eyes are provided on the mounting plate for shackles. For vertical lift or raising from the horizontal position, it is recommended that all three points be utilized. For horizontal transport, use at least two of the lift points and a chocker strap around the pump end of the support tube and one around the bearing housing for stability. Drain holes in the tube may be used as hook points. Follow recommended facility procedures using multiple connections as far apart as practical to stabilize the load. Always ensure that the unit remains in the correct position during transport and cannot slip out of the suspension arrangement.

At least four (4) connections are recommended to stabilize the load, and they should be as far apart as practical. Avoid excessive side loads on cast lifting eyes. Note that certain lift points on the pedestal are intended for use in handling the pedestal alone and are not necessarily optimum balance points for the pump assembly.
Always make sure that the unit remains in the horizontal position during transport and cannot slip out of the transport suspension arrangement.

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

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

⚠ Motor must not be attached to pump during lifting.

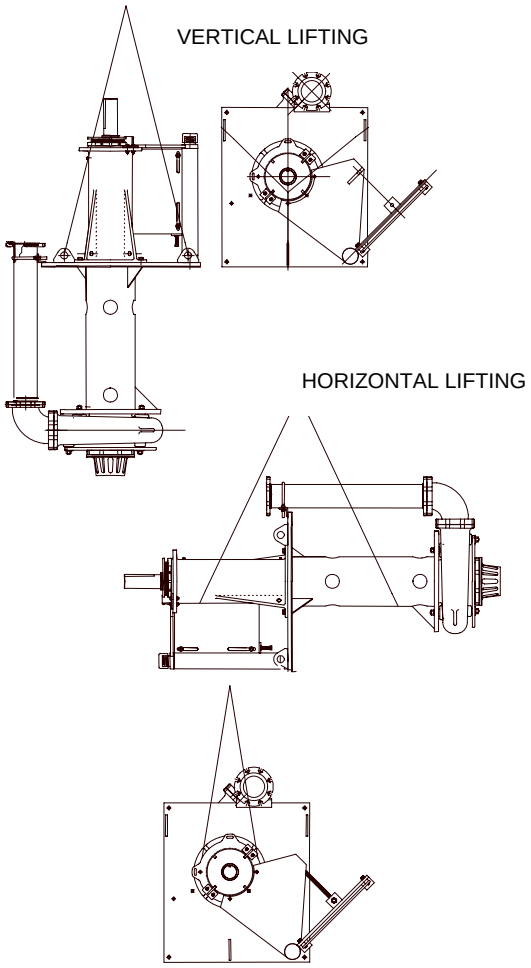


Figure 3.1-1 Transport of the Pump

3.2 Short Term Storage

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

If stored outdoors, the unit and crates must be covered by waterproof material to avoid any contact with humidity.
All openings of the assembled pump / unit components are closed and must only be opened when required during installation.

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

4 Description of the Product and Accessories

4.1 Technical Specification

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

LCV-M80-300.3T-1OB M1

Pump Type----------|
Hydraulic Type----------|
Discharge Nozzle DN in mm-----|
Nominal Impeller Diameter in mm---|
Shaft Size----------|
Seal Type----------|
Cantilever Length----------|
Options----------|
Motor Mount----------|
Material Code ----------|

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

Motor Mount
A ..... Small
B ..... Large

Options
O ....Open Metal Impeller
C……Closed Shroud Impeller

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")

4.3 Design Details

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

4.3.1 Pump Casing

Hard Metal. 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.

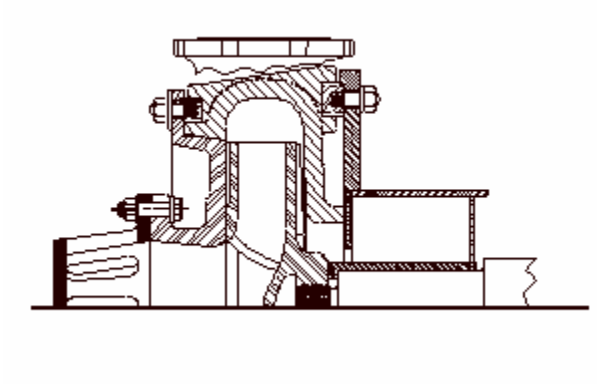


Figure 4.3-1 LCV Wet End

4.3.2 Impeller Form

All standard impellers are 3 vane, double shrouded designs as seen in figures 4.3-1 through 4.3-2. Open-shrouded and alternate vane number designs are available in some sizes.

4.3.3 Shaft Seal

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.

4.3.4 Bearings

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

Frame Size	Bearings Installed		
	Spherical Roller E Type	Double row, Taper roller Part number Cone / Cup / Spacer 1)	Bench end-play mm (inch)
1	22216E	72225C / 72488D / X1S72225	0.15 (.006)
2	22220E	9285 / 9220D / X4S9285	0.18 (.007)
3	23028E	HM926740 / HM926710CD/ HM92674XA	0.25 (.010)
4	23036E	HH932145 / HH932110 / H932145XA	0.20 (.008)

1) Timken Co. part numbers shown, Koyo is also an approved supplier.
2) 200mm taper roller bearing assembled from two single row bearings. Other sizes are TDO (one piece cup) design.

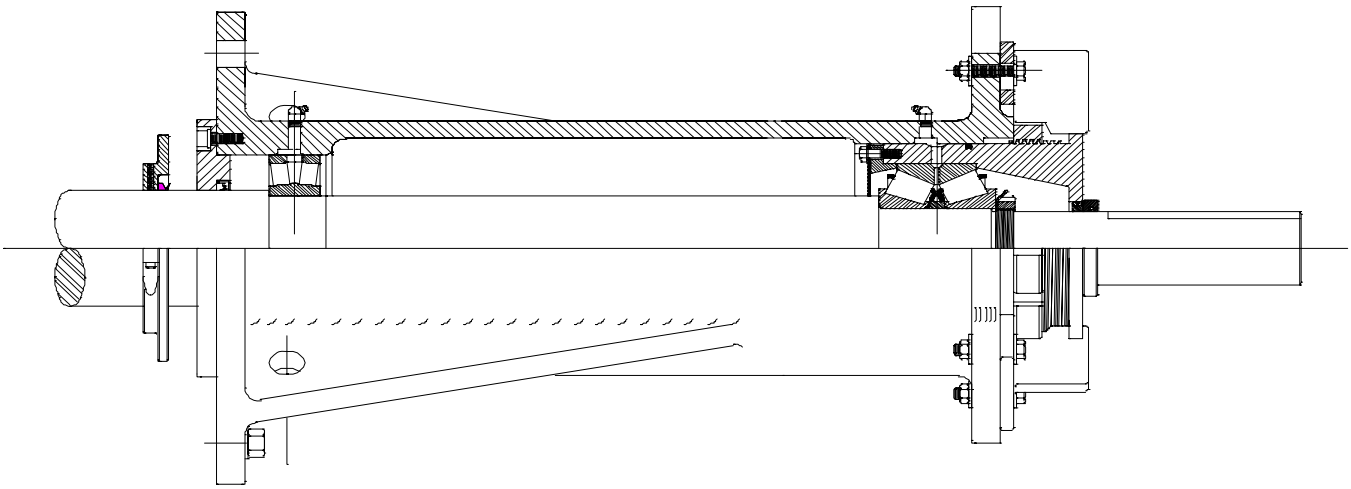


Figure 4.3-3 LCV Cartridge Bearing Assembly

4.3.5 Permissible 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.

4.3.6 Noise Characteristics

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

⚠ The addition of coarse solids, froth or cavitating conditions can significantly increase the noise levels in both the pump and piping. If accurate noise levels are required for these conditions, field testing will be required. Sound pressure levels from motor and gear reducer must be added to the above in accordance with standard acoustic formulas, taking into account the distance between units. For belt driven units, add an additional 2 dB.

4.4 Accessories

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.

4.5 Dimensions and Weights

For dimensions and weights please refer to the pump installation plan

5 Installation at Site

5.1 Safety Regulations

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

5.2 Checks to be Carried out Prior to Installation

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

The foundations shall have sufficient strength to ensure safe and functional installation. Its surface should be truly horizontal and even. The foundation bolts should be inserted in the baseplate holes.

5.3 Installing the Pump / Unit

The mounting plate must be level within one degree. After placing the mounting plate on the foundation, level by shimming. Shims should be fitted between the mounting plate and the beam or foundation, they should always be inserted to the left and right of the mounting 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.

5.3.1 Aligning the Pump / Drive Train

Caution

After fastening the baseplate on the foundation and connecting the piping, the pump and drive train must be thoroughly checked and, if necessary, realigned. ⚠ Improper alignment of the unit can cause damage to both the belts and the unit itself!

In V-belt installations, the pulleys are correctly aligned if a straight-edge placed vertically shows a deviation of no more than 1.0 mm (0.04 in.).

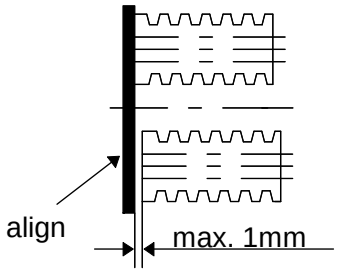


Figure 5.3-1 Aligning of V-belt pulleys

5.3.2 Place of Installation

⚠ The volute casing takes on roughly the same temperature as the medium handled. The Bearing assembly and bearing housing must not be insulated.

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

5.4 Connecting the Piping

Caution Never use the pump itself as an anchorage point for the piping. The permissible pipeline forces must not be exceeded (see Section 4.3.5).

The standard pump is configured with a suction strainer. However an extension pipe can be installed if adequately supported. Due consideration should be given to flange loadings, additional vibration and performance penalties due to entrance losses. The pipelines should be anchored in close proximity to the pump and should be connected without transmitting any stresses or strains. The nominal diameters of the pipelines should be at least equal to the nominal diameters of the pump nozzles. It is recommended to install check and shut-off elements in the system, depending on the type of plant and pump. It must be ensured, however, that the pump can still be drained and dismantled without problems.
Thermal expansions of the pipelines must be compensated by appropriate measures so as not to impose any extra loads on the pump exceeding the permissible pipeline forces and moments.

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

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

5.4.1 Safety Guards

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

5.5 Final Check

Re-check the alignment as described in Section 5.3.1
It must be easy to rotate the belts by hand.

5.6 Connection to Power Supply

Connection to the power supply must be made by a trained electrician only. Check available mains voltage against the data on the motor rating plate and select the appropriate start-up method.

We strongly recommend the use of a motor protection device.

6 Commissioning, Start-up / Shut-down

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

6.1 Commissioning

Before starting up the pump make sure that the following requirements are checked and fulfilled.
The operating data, the nose clearance, and the direction of rotation (6.1.4) must be checked. The pump set must be primed (6.1.3).

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

6.1.1 Lubricants

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. See Section 7.2.2.2 for grease lubrication instructions.

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.

Frame Size	Shaft Speed (rpm), monitor commissioning temperature if over:
1	1800
2	1400
3	1000
4	750

6.1.2 Grease Seal

An Inpro seal is installed in the drive end. Seal rings or Inpro seals prevent leakage from the impeller end of the housing.

6.1.3 Priming the Pump and Other Checks

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.

Minimal Submergence for Priming*	
Pump size	Height(in.)
LCV 50-230	8.25
LCV 80-300	8.50
LCV 100-400	9.06
LCV 150-500	10.00
LCV 200-610	11.00
LCV 250-660	12.25
LCV 300-700	13.75

* axial height above centerline of the pump shell

6.1.4 Checking the Direction of Rotation

The direction of rotation must correspond to the direction indicated by the arrow on the pump. This can be verified by switching the motor on with the coupling disconnected. If the motor runs in the wrong direction of rotation, correct and recheck before reconnecting coupling.

Caution If running in the wrong direction of rotation, even momentarily, the impeller may unscrew causing extensive damage to the entire unit.

6.1.5 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.

6.1.6 Start-up

The pump may be started up against a closed discharge-side swing check valve or shut-off element. Only after the pump has reached full rotational speed should the shut-off be opened slowly and adjusted to comply with the duty point. When starting up against an open discharge-side shut-off element, take the resulting increase in input power into account.

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

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

6.1.7 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.

In event of frost and / or prolonged shutdowns, the pump - and if applicable the cooling chambers - must be drained or otherwise protected against freezing.

6.2 Operating Limits

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

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

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

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

Bearing temperatures, as described in Section 6.1.1, must be observed. Excessive bearing temperature could indicate misalignment or other technical problem.

6.2.2 Switching Frequency

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

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

6.2.3 Density of the Medium Handled

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

6.3 Shutdown / Storage / Preservation

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

6.3.1 Storage of New Pumps

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

6.3.2 Measures to be taken for Prolonged Shutdown

1 The pump remains installed; operation check run

In order to make sure that the pump is always ready for instant start-up and to prevent the formation of deposits within the pump and the pump intake area, start up the pump set regularly once a month or once every 3

months for a short time (approx. 5 minutes) during prolonged shutdown periods. Prior to an operation check run ensure that there is sufficient liquid available for operating the pump.

2 The pump is dismantled and stored

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

6.4 Returning to Service after Storage

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

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

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

7 Maintenance /Repair

7.1 General Instructions

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.

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

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

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

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

7.2 Maintenance / Inspection

7.2.1 Supervision of Operation

Caution

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

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

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

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

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.

7.2.2 Lubrication and Lubricant Change

7.2.2.1 Lubrication

The rolling element bearings are lubricated with grease. The greasing intervals as well as the required quantity and quality are specified below.

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

7.2.2.2 Grease Quality / Grease Changes

The bearings are packed with high-quality lithium-soap grease. Under normal operating conditions the fill should be replenished as shown in the table below by an injection roughly equal to one half of the amount originally used to pack the bearings. After 20000 operating hours or 2.5 years the bearings should be checked, then cleaned and re-lubricated if required.

Frame Size	Grease Replenishment Intervals Under Normal Operating Conditions
1	600 hrs.
2	1000 hrs.
3	1500 hrs.
4	1500 hrs.

For this purpose use high-quality lithium-soap grease, free of resin and acid, not liable to crumble and with good rust-preventive characteristics. The type of grease required for temperatures above 0 degrees Fahrenheit is Chevron Ultra-Duty Grease 2 (Lithium Base) or equivalent. For temperatures below 0 degrees Fahrenheit, use Chevron Avi-Motive Grease W or equivalent. The bearing cavities should be fully packed with grease.

Frame Size	Approximate Grease Capacity	
	Spherical Roller Bearing	Taper Roller Bearing
1	30 ml (1.01 oz)	40 ml (1.35 oz)
2	50 ml (1.69 oz)	90 ml (3.04 oz)
3	125 ml (4.23 oz)	190 ml (6.43 oz)
4	200 ml (6.76 oz)	280 ml (9.47 oz)

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.

7.3 Drainage / Disposal

Caution

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

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

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

7.4 Dismantling

⚠ Before dismantling, remove the motor and pull the assembly out of the sump. The shut-off elements in the discharge nozzles must be closed. The pump must have cooled down to ambient temperature. Observe the safety regulations of Section 7.1.

Repair and maintenance work to the pump must only be carried out by specially trained personnel, using original equipment spare parts (see 2.7)

7.4.1 Sectional Drawings and Bills of Material

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

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

Pump should be placed in a horizontal position with the outer assembly locked down to prevent shifting during disassembly.

7.4.2 Dismantling Procedures

Impeller

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

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

Impeller Break-Loose Jig

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

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

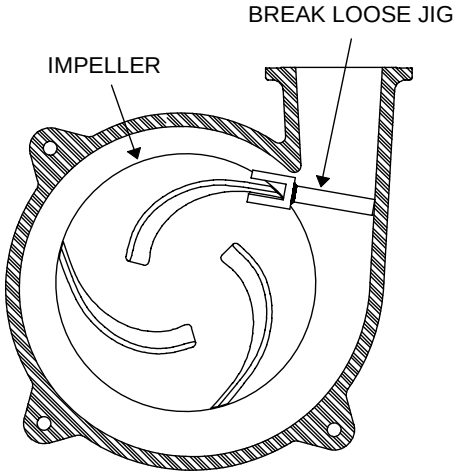


Figure 7.4-1 Impeller Break-Loose Jig

Impeller Lifting Jig

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

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

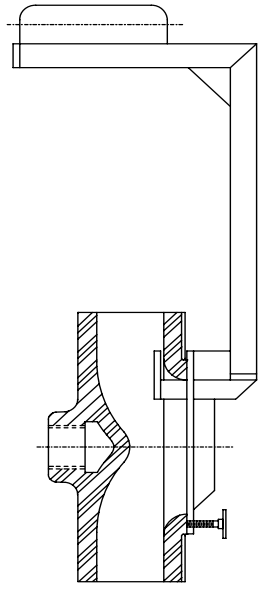


Figure 7.4-2 Impeller Lifting Jig

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

Cartridge Bearing Assembly

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 endcovers 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.

7.5 Reassembly

7.5.1 General Instructions

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

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

It is recommended that new seal elements (O-rings/ gaskets) be used whenever the pump is reassembled. Make sure that new gaskets have the same thickness as the old ones. Avoid the use of mounting aids as much as possible. Should a mounting aid be required, use a commercially available contact adhesive. The adhesive should only be applied at selected points (three to four spots) and in thin layers. Do not use cyanoacryiate adhesives (quick-setting adhesives). If in certain cases mounting aids or anti-adhesives other than those described are required, please contact the sealing material manufacturer.

7.5.2 Mounting of Bearings

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 ^{o}C (250 ^{o}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 given in Section 7.5.15.

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.

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.

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

Assemble the drive end bearing package as shown in Figure 7.5-1.

See Section 7.2.2.2 for grease lubrication requirements.

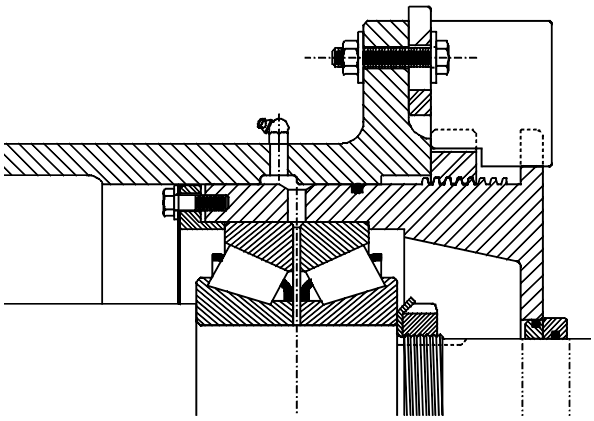


Figure 7.5-1 LCV Drive End Taper Roller Bearing

7.5.3 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. Insure the bearing outer diameters and housing bores are thoroughly clean then assemble the thrust end. After again insuring that the bearing outer diameters and housing bores are thoroughly clean, 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.

7.5.4 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 endcover. 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 endcovers 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.

7.5.5 Mounting Shaft Sleeve

In mounting the shaft sleeve, (see figure 7.5-2) 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 or the face in contact with the shaft shoulder. If necessary for ease of removal, only a light coating of anti-seize compound should be applied to the inner diameter of the shaft sleeve.

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

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

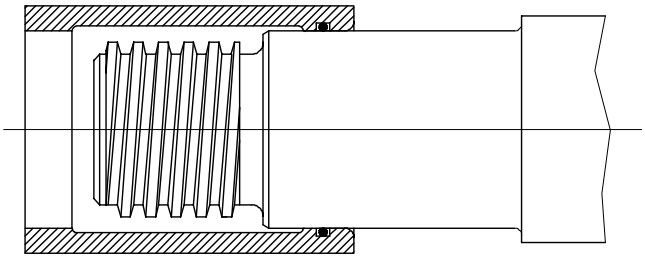


Figure 7.5-2 Standard LCV Shaft Sleeve Arrangement

7.5.7 Mounting the Bearing Assembly to the Support Assembly

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 four connecting bolts can now be fastened.

7.5.9 Mounting Shell

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 shell into position clamping the seal plate against the support assembly. Alignment of the pump shell 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 shell be fully seated in this fit.

7.5.11 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.

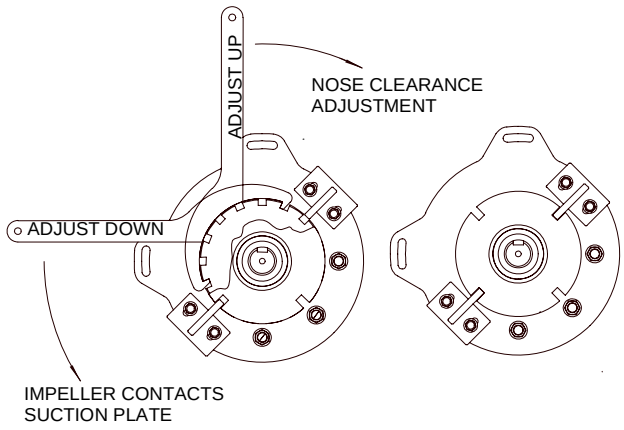
Two 0.5mm (0.020 inch) aramid gaskets (400.10) are placed between the shaft sleeve and the impeller hub face to prevent galling and to ensure ease of impeller removal. The gaskets should be installed dry, without grease.

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

When assembly of the pump is complete, check the impeller to suction wear plate clearance and adjust if necessary, (see section on Axial Adjustment of Bearing Housing (7.5.13).

7.5.13 Axial Adjustment of the Bearing Housing

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.).



AXIAL IMPELLER ADJUSTMENT

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. Tighten the locking plates in the backed off position. Turn the bearing housing end cover clockwise until contact of the impeller is made with the suction liner. It is helpful to slowly rotate the impeller during this procedure. Then turn the bearing housing end cover counter-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.

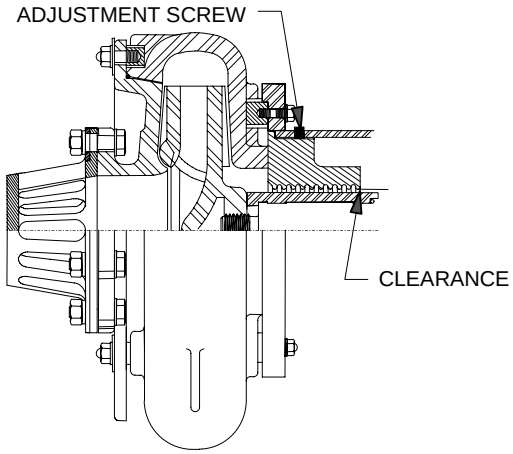
Caution Proper locking of the bearing housing end cover is essential to prevent movement of the rotating assembly during operation. Failure to do so can result in severe vibration and damage to all pump components.

7.5.14 Seal Plate and Throttle Bushing Running Clearance

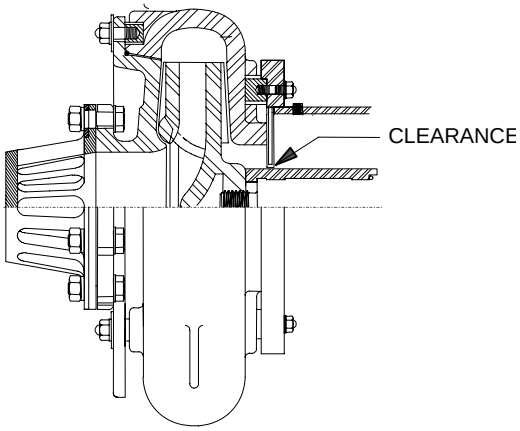
The seal plate is self aligning but radial adjustment of the optional throttle bushing is required. After loosening the bolts that attached the shell. Center the clearance between the throttle bushing inner diameter and the shaft by adjusting the throttle bushing using the set screws in the support assembly. 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 shell bolts.

	Frame 1	Frame 2	Frame 3	Frame 4
Seal Clearance	.188”	.188”	.250”	.250”

Caution Failure to correctly center the seal will lead to unnecessary shaft wear and loss of efficiency.



THROTTLE BUSHING ADJUSTMENT



SEAL PLATE

7.5.15 Tightening Torques

Taper Bearing Locknut Assembly Torque

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)

Mounting Assembly Clamp Bolts

Frame Size	Bolt size	Clamp Bolt Torque [1)]
1	**M 20**	**340 N-m (250 ft-lbs)**
2		
3	**M 24**	**680 N-m (500 ft-lbs)**
4		

Other Bolts

No special torque requirements exist for the remaining LCV 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.

7.6 Spare Parts Stock

Due to the erosive action of the slurry, many of the wetted components of the pump may require replacement in the course of normal maintenance. Inspection or overhaul of the mechanical components may also lead to the replacement of certain parts.

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

Wet End
- Casing
- Impeller
- Side Liner
- Gasket Kit
- Cast Elbow

Wet End Sealing
- Shaft Sleeve
- Seal Plate or Optional Throttle Seal
- Gasket Kit

Bearing Assembly
- Bearings
- Gasket Kit

7.6.1 Maintenance Procedures for Maximum Parts Life

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

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

Suction Liner

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

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

Impeller

The impeller to suction liner clearance should be adjusted forward several times during its life cycle for maximum impeller and suction liner life. See section 7.5.13.

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

The impeller should never be repaired by welding.

Shell

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

7.7 Operational Problems and Solutions

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

Sump Design

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

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

If the sump is pulled 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.

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.

Piping diameters must be properly sized to insure 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 being drawn. 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 (this will result in reduced flow and power being drawn).

If actual flowrates are lower than predicted, the sump may be pulled 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 flowrate 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 flowrates.

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. The approximate flow rate desired, and the actual minimum and maximum flowrate if known.

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

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

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

E. 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.

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

G. 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.

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

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

NOTES

9 General Drawing with List of Components

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