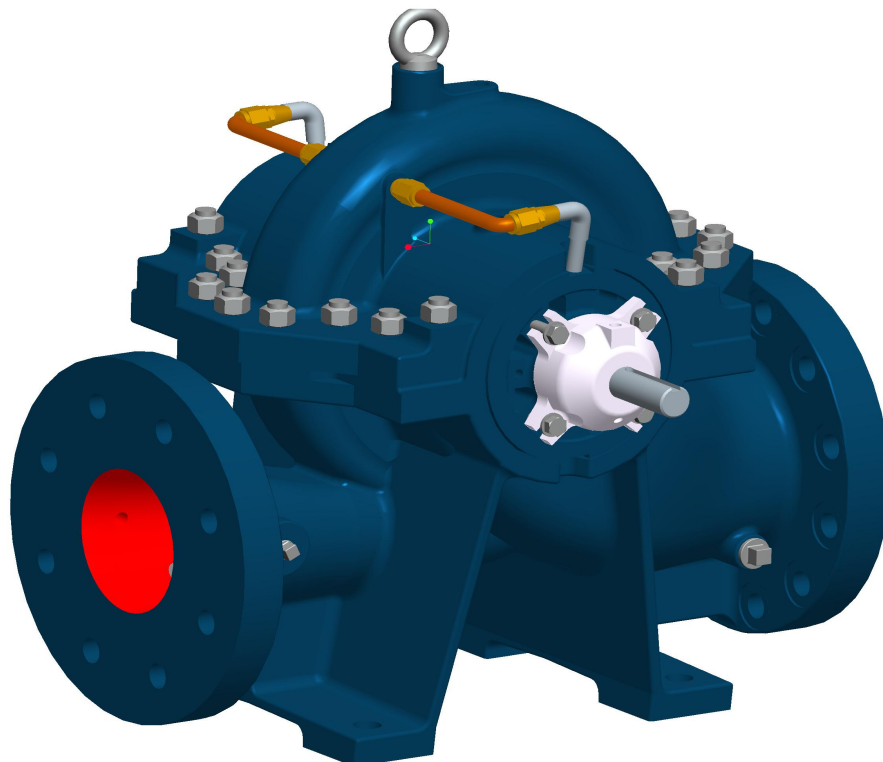




Enriching Lives

INSTRUCTION ON INSTALLTION, OPERATION & MAINTENANCE FOR KIRLOSKAR PUMP TYPE i-HT





Enriching Lives

KIRLOSKAR BROTHERS LIMITED
Udyog Bhavan, Tilak Road, Pune 411 002 (India)

WARRANTY

We warrant that the pump supplied by us is free from defective material and faulty workmanship. This warranty holds good for a period of 12 months from the date of commissioning of the equipment or 18 months from the date of despatch from our factory, whichever is earlier. Our liability in respect of any complaint is limited to replacing part/parts free of charge ex-works or repairs of the defective part/parts only to the extent that such replacement / repairs are attributable to or arise solely from faulty workmanship or defective material.

The warranty holds good only for the products manufactured by us.

KIRLOSKAR BROTHERS LIMITED



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Please ensure these instructions are read fully before installation and operation of the pump.

Please furnish complete nameplate details, part description, part nos., material construction and quantity while ordering spare parts.



1. GENERAL:

1.1 The booklet covers instructions for following types of i-HT pumps.

Following models are available in *i*-HT series.

SINGLE STAGE

Size Code	Model
01	<i>i</i> -HT06BA
02	<i>i</i> -HT08BA
03	<i>i</i> -HT08BD
04	<i>i</i> -HT08BE
05	<i>i</i> -HT10BA
06	<i>i</i> -HT10BD
07	<i>i</i> -HT10BE
08	<i>i</i> -HT10DE
09	<i>i</i> -HT10ED
10	<i>i</i> -HT12BA
11	<i>i</i> -HT12BD
12	<i>i</i> -HT12BE
13	<i>i</i> -HT12BF

Size Code	Model
14	<i>i</i> -HT12CA
15	<i>i</i> -HT12CF
16	<i>i</i> -HT12CG
17	<i>i</i> -HT12DA
18	<i>i</i> -HT12DF
19	<i>i</i> -HT12EA
20	<i>i</i> -HT15BA
21	<i>i</i> -HT15BE
22	<i>i</i> -HT15DA
23	<i>i</i> -HT15DF
24	<i>i</i> -HT20DD
25	<i>i</i> -HT20DE
26	<i>i</i> -HT20ED

DOUBLE STAGE

Size Code	Model
27	<i>i</i> -HT12XD
28	<i>i</i> -HT15XE
29	<i>i</i> -HT15XF
30	<i>i</i> -HT05AA
31	<i>i</i> -HT06AA



1.2 These are horizontal split casing type pumps with suction and discharge nozzles and their supporting feet integrally cast in the lower half casing. This construction enables to remove the rotating unit for inspection and repairs by just removing upper half casing, and without disturbing alignment, pipe connection or prime mover.

1.3 Pumps when properly installed and given due care in operation and maintenance should operate satisfactorily for a long period.

1.4 When the pump is received, sometime before the actual use of pump, it should be inspected and located in dry place. The coupling should be rotated periodically (once in a month) to prevent pitting of bearing surfaces.

1.5 Generally all the i-HT pumps mentioned above are similar in construction with minor changes of some parts.

1.6 Pump identification: All pumps are designated by serial number, model number, size and type. This information is stamped on an identification plate which is fixed on the pump.



2. SAFETY INSTRUCTIONS:

2.1 General Information

Before performing any actions detailed within this instruction, the Site Health and Safety instructions must be read and fully understood. The instructions in this document also must be read and fully understood.

Whenever the equipment is operated, maintained or used in any way, the procedures detailed within the Health and Safety Dossier (DHS) and any procedures detailed within these instructions shall be followed. The pump supplied by Kirloskar Brothers Limited (KBL) has been designed with safety in mind, where hazards cannot be eliminated; the risk has been minimized by the use of guards and other design features. Some hazards cannot be guarded against and the instructions below **MUST BE COMPLIED WITH** for safe operation. These instructions cannot cover all circumstances. It is the responsibility of the user of the equipment for maintaining safe working practices at all times.

2.1.1 KBL products are designed for installation in designated areas, which are to be kept clean and free of obstructions that may restrict safe access to the controls and maintenance access points.

2.1.2 Pump nameplate is fitted to each unit and must not be removed. Loss of this plate could make identification impossible. This in turn could affect safety and cause difficulty in obtaining spare parts. Should accidental loss or damage occur, contact KBL immediately.

2.1.3 Access to the equipment should be restricted to the personnel responsible for installation, operation and maintenance and they must be trained, adequately qualified and supplied with the appropriate tools for their respective tasks.

2.1.4 KBL firmly insists that all personnel responsible for installation, operation and maintenance of the equipment must read safety instructions mentioned in the manual before any work is done.

2.1.5 Ear defenders should be worn where the specified equipment noise level exceeds locally defined safe levels. Safety glasses or goggles should be worn where working with pressurized systems and hazardous substances. Other personal protection equipment must be worn where local rules apply.

2.2 DO NOT wear loose or frayed clothing or jewellery, which could catch on the controls or become trapped in the equipment.

2.3 Operation of the equipment for the application other than for which it is supplied can increase the risk from hazards. Please consult KBL before making such change in the application of the equipment.

2.4 Improper installation, operation and maintenance of the product supplied by KBL could result in injury or death.

2.5 Within the manual, safety instructions are marked with safety symbols.

Hazard



This symbol refers to general mechanical aspects of safety.

Hazard



This symbol refers to electrical safety.

2.6 Transport, Handling and Storage Instructions:

2.6.1 Transport.

Pumps are dispatched in duly assembled condition. Pumps are protected against corrosion and packed for transport by normal road, rail and sea carriers.

2.6.2 Handling.

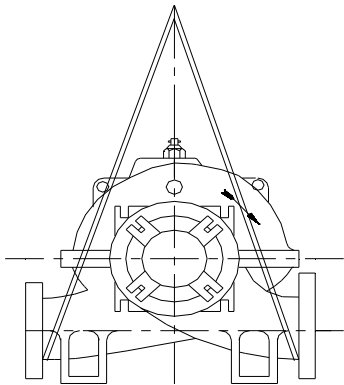


Crushing Hazard.

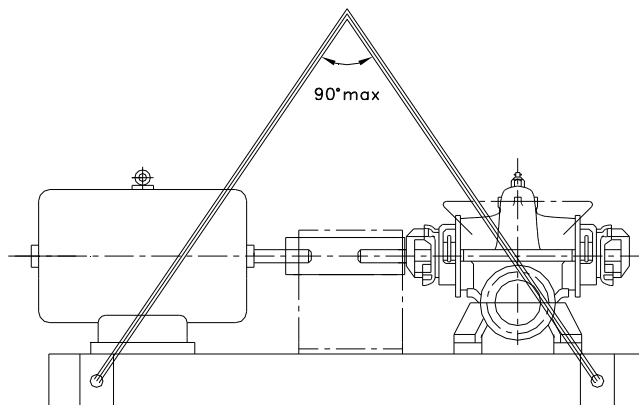
When lifting the pump or pump set, use lifting equipment having a safe working load rating suitable for the weight specified. Use suitable slings for lifting any pump not provided with lifting points.

The use of suitable forklift truck and four chain crane sling equipment is recommended but locally approved equipment rating may be used.

Pump should be slung as shown.



Pump set must be lifted from the lifting holes provided on the pump by using suitable four chain lifting equipment.



2.6.3 Storage.

2.6.3.1 Temporary Storage for up to Six Weeks.

If the pump unit is not **to** be used immediately it should be stored carefully in a horizontal position, in a sheltered, dry location. Additional rust preventive should be applied to all unpainted carbon steel or cast iron parts and should not be removed until final installation.

2.6.3.2 Long Term Storage.

If the pump is not to be installed and operated soon after arrival, store it in a clean, dry place, having slow, moderate changes in ambient temperature. Step should be taken to protect the pump from moisture, dust, dirt, and foreign bodies. It is recommended that the following procedure is taken:

- a) Ensure that the bearings are packed with the recommended grease, to prevent moisture from entering around the shaft.
- b) Remove the glands, packings and lantern rings from the stuffing box if the pump is equipped in this manner. If the pump is equipped with mechanical seal, dismantle and coat the seal with light oil.
- c) Ensure that suction and discharge branches of the pump and all other openings are covered with cardboard, wood or masking tape to prevent foreign objects entering the pump.
- d) If the pump is to be stored where there is no protective covering, it is advisable to cover the unit with a tarpaulin or other suitable covering.
- e) The shaft should be manually rotated periodically to prevent pitting of the bearing surfaces by moisture.



Shearing Hazard.

Do NOT place fingers or hands, etc., into the suction or discharge pipe outlets and do NOT touch the impeller, if rotated this may cause severe injury. To prevent ingress of any objects, retain the protection covers or packaging in place until removal is necessary for



installation. If the packaging or suction and discharge covers are removed for inspection purposes, replace afterwards to protect the pump and maintain the safety.

Fill the bearing housing with recommended grease to ensure that the shaft and bearings remain rust free.

2.6.3.3 Exposed or Extreme Conditions Storage.

For exposed storage or extreme variants in atmospheric or environmental conditions, please refer to KBL for special storage instructions to suit the conditions acceptable.

3. INSTALLATIONS:

3.1 Receiving pump

Upon receipt of the pump, a visual check should be made to determine if any damage occurred during transit or handling. The main items to look for are: -

- a) Broken or cracked equipment, including base, motor or pump feet and flanges.
- b) Bent shaft.
- c) Broken motor end bells, bent eyebolts or damaged boxes of motor.
- d) Missing parts.
- e) Pump shaft rotates freely.

Parts or accessories are sometimes wrapped individually or fastened to the equipment. If any damage or losses have been incurred; promptly notify your KBL representative, KBL Dealer and the transport company who delivered the pump.

When unloading pump units, lift equally at four or more points from the base. DO NOT LIFT ONLY THE DRIVER OR PUMP.

3.2 Preparation

Before installing the pump, clean the suction and discharge flanges thoroughly.

Remove the protective coating from the pump shaft.



If the pump has been in storage and prepared for storage in the manner outlined previously, remove all the grease from the bearings. The bearings should then be flushed with carbon tetrachloride or kerosene and re-lubricated.

3.3 Location

The pump should be installed as near the liquid source as possible, with the shortest and most direct suction pipe practically.

The pump should be installed with sufficient accessibility for inspection and maintenance. Ample space and head room should be allowed for the use of an overhead crane or hoist sufficiently strong to lift the unit.

Make sure there is a suitable power source available for the pump driver. If motor driven, electrical characteristics should be identical to those shown on motor data / nameplate.

3.4 Foundation

The foundation should be strong enough to reduce vibrations and rigid enough to avoid any twisting or misalignment.

The foundation should be poured without interruptions to within 20 to 40 mm of the finished height. The top surface of the foundation should be well scored and glued before the concrete sets. This provides a bonding surface for the grout. Foundation bolts should be set in concrete as shown in Fig. 1. Allow enough bolt length for grout, shims, lower baseplate flange, nuts and washers. The foundation should be allowed to cure for several days before the baseplate is shimmed and grouted.

3.5 Baseplate setting

Use blocks and shims under base for support at foundation bolts and midway between bolts, to position base approximately 25 mm above the concrete foundation with studs extending through hole in the baseplate.

By adding or removing shims under the base, level the pump shaft and flanges. The baseplate does not have to be leveled. Draw foundation bolt nuts tight against baseplate and observe pump and motor shafts or coupling hubs for alignment.

Check to make sure the piping can be aligned to pump flanges without placing pipe strain on either flange.

Grout baseplate in completely and allow grout to dry thoroughly before attaching piping to pump (24 hours is sufficient time with approved grouting procedure).

3.6 Grouting procedure

Grout compensates for uneven foundation, distributes weight of unit and prevents shifting. Use an approved, non-shrinking grout as follows, after setting and leveling unit (Refer Fig. 2).

- a) Build strong form around foundation to contain grout.
- b) Soak top of concrete foundation thoroughly, then remove surface water.
- c) Baseplate should be completely filled with grout and, if necessary, drill vent holes to remove trapped air.
- d) After grout has thoroughly hardened, check the foundation bolts and tighten if necessary.
- e) Check the alignment after the foundation bolts are tightened.
- f) Approximately 14 days after the grout has been poured or when the grout has thoroughly dried, apply an oil base paint to the exposed edges of the grout to prevent air and moisture from coming in contact with the grout.

3.7 Alignment procedure

The pump driver, if supplied, is correctly aligned on its baseplate at the factory. A certain amount of deformation of the baseplate is possible during transit and it is therefore essential to check alignment, prior to final grouting.

A flexible coupling will only compensate for small amount of misalignment and should not be used to compensate for excessive misalignment of the pump and driver shafts.

Inaccurate alignment results in vibration and excessive wear on the bearings, sleeve or shaft and wear rings.

Coupling alignment can be checked with dial gauge Indicator also. Alignment should be performed after the baseplate has been properly set and grout has dried thoroughly according to instructions. Final alignment should be made by shimming driver only.

Alignment should be made at operating temperatures.

After final alignment, it is necessary to dowel pump and driver feet to the baseplate.



FACTORS THAT MAY DISTURB ALIGNMENT

The unit should be periodically checked for alignment. If the unit does not stay in line after being properly installed, the following are possible reasons: -

- a) Setting, seasoning of the foundation.
- b) Pipe strains, distorting or shifting of the machines.
- c) Wear of the bearings.

3.8 Suction and Discharge Piping

When installing the pump piping, make sure to observe the following precautions: -

Piping should always run to the pump. Do not move pump to pipe. This could make final alignment impossible.

Both suction and discharge piping should be supported independently and close to pump so that no strain is transmitted to the pump when the flange bolts are tightened.

Use pipe hangers or other supports at necessary intervals to provide support. When expansion joints are used in the piping system, they must be installed beyond the piping supports close to the pump.

It is advisable to increase the size of both suction and discharge pipes at the pump connection to decrease the loss of head from friction.

Install piping as straight as possible, avoiding unnecessary bends. Where necessary, use 45 degrees or long sweep 90 degrees fitting to decrease friction losses.

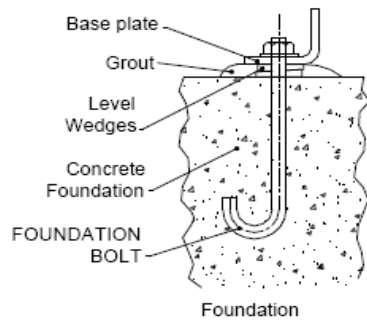
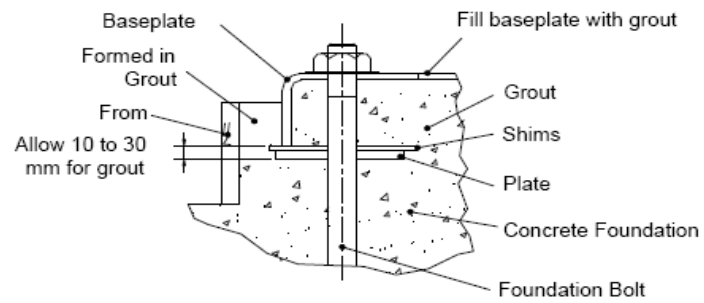
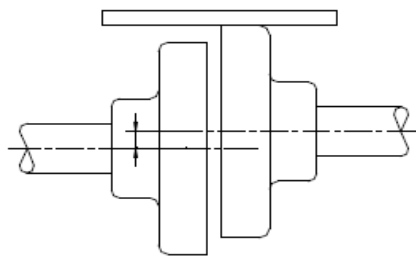


FIG. 1



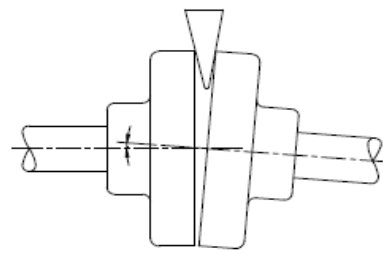
Setting Baseplate & Grouting

FIG. 2



Parallel Alignment

FIG. 4



Angular Alignment

FIG. 3

COUPLING ALIGNMENT



Make sure that all piping joints are air tight. Provide pipe expansion bellows when hot fluids are to be pumped. Where reducers are used, eccentric reducers are to be fitted in suction lines and straight taper reducers in discharge and vertical lines (Refer Fig. 5).

Misuse of reducers may cause the formation of air pockets in the pipe and thus preventing the correct operation of the pump.

The suction pipe should be as short and direct as possible. Where suction lift is not very high, it is advisable to use a foot valve. Horizontal suction line must have a gradual rise to the pump.

The discharge pipe is usually preceded by a non-return valve or check valve and a discharge gate valve (Refer Fig. 5). The check valve is to protect the pump from excessive back pressure and reverse rotation of the unit and to prevent back flow into the pump in case of stoppage or failure of the driver. The discharge valve is used in priming, starting and when shutting down the pump.

4. OPERATION:

4.1 Before Starting

Before initial starting of the pump, make the following inspection:

4.1.1 The unit baseplate is grouted and bolted to the foundation.

4.1.2 Alignment between pump and motor.

4.1.3 Motor is correctly wired to starting device, check voltage, phase and frequency on motor nameplate with line circuit.

Ensure correct direction of rotation prior to coupling to pump. Check by starting motor and switching off immediately. Observe rotation is the same as the arrow direction on the pump casing.

4.1.4 Bearing lubrication is provided (refer lubrication section), also check driver lubrication.

4.1.5 Mechanical seal has been fitted or stuffing box has been packed.

4.1.6 All rotating parts are found to be free when turned by hand.



4.1.7 Pump is primed. Never run the unit dry. The liquid in the pump serves as a lubricant for close running fits within the pump and the pump may be damaged if operated dry. The pump may be primed by using an ejector, exhauster or vacuum pump. If a foot valve is used in the suction line, the pump may be primed by venting and filling the casing with liquid.

4.2 Starting

4.2.1 Close valve in discharge line.

4.2.2 Open fully all valves in the suction line.

4.2.3 Turn on seal water to the stuffing box where external pipe supplied.

4.2.4 Prime the pump.

4.2.5 Start the pump driver.

4.2.6 When the pump is operating at full speed, open the discharge valve slowly.

Do not operate pump for prolonged periods with closed discharge valve, so as to avoid overheating.

The pump should be shut down at once and the trouble corrected if the pump is running at its rated speed and found to have any of the following defects:

- a) No liquid delivered.
- b) Not enough liquid delivered.
- c) Not enough pressure.
- d) Loss of liquid after starting.
- e) Excess vibration.
- f) Motor runs hot.
- g) Pump bearing overheating.

4.3 Running

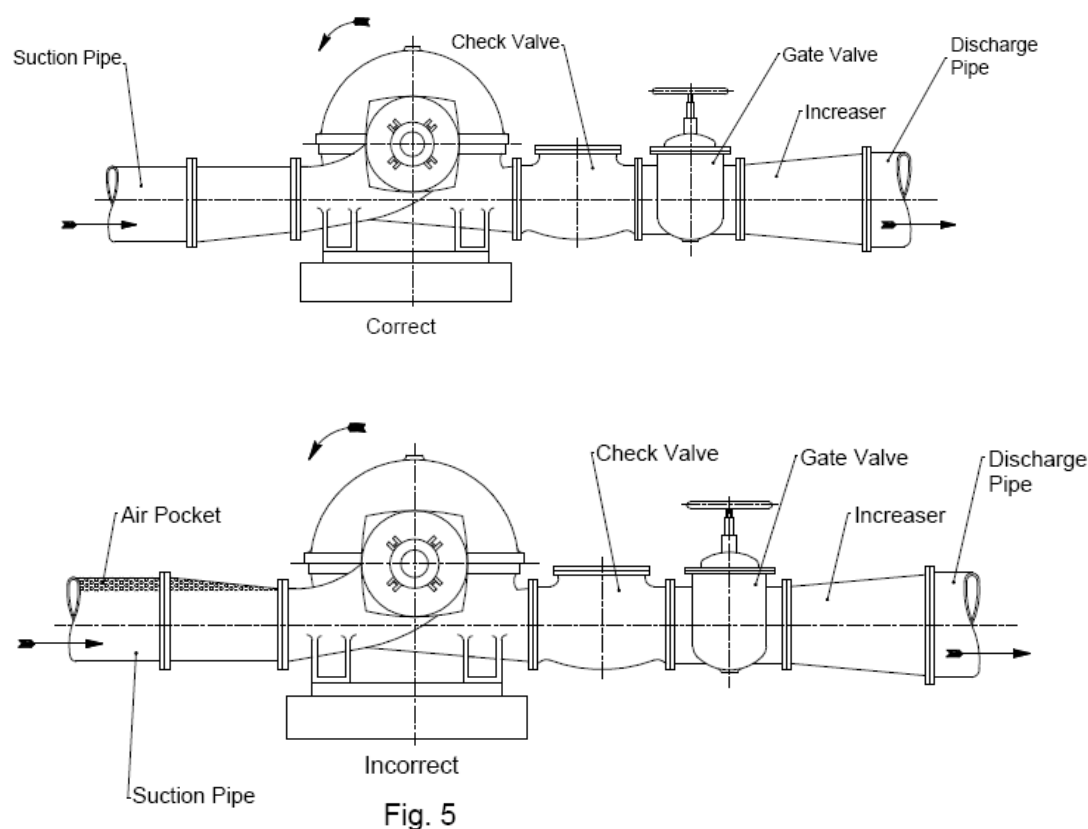
While the pump is running, a periodic inspection should be made of:

- a) Stuffing box (soft packed pumps only). Ensure there is sufficient leakage to lubricate the packing.

- b) Bearings. Check the bearings for temperature, which should not exceed pumped liquid temperature or 800 C whichever is the lower.
- c) With mechanical seal fitted pumps, check that there is no leakage from the stuffing box.
- d) Suction and discharge gauge readings.

4.4 Stopping

- a) Slowly close delivery valve and shut down driving unit in accordance with manufacturer's instructions.
- b) Shut off external sealing liquid supply, if supplied, to relieve stuffing box pressure.
- c) Successful operation of the pump depends on accurate alignment. It is recommended to re-check the alignment after preliminary run.





5. TECHNICAL DATA:

5.1 Direction of Rotation

Pumps are supplied with clockwise direction of rotation when viewed from coupling end. The direction of rotation can be reversed easily without changing any part.

5.2 BEARING DETAILS:

Pump Model	Bearing Module	Bearing DE Deep Groove Ball Bearing	Bearing NDE Angular Contact Paired Bearing (Face to Face)
i-HT 06 BA	1	6306	7306(BECB)
i-HT 08 BA			
i-HT 12 CA			
i-HT 08 BD			
i-HT 08 BE			
i-HT 10 DE			
i-HT 12 CF			
i-HT 12 CG	2	6309	7309(BECB)
i-HT 12 DA			
i-HT 12 BA			
i-HT 15 BA			
i-HT 12 EA			
i-HT 15 DA			
i-HT 10 BA			
i-HT 10 BD			
i-HT 10 BE			
i-HT 12 BD			
i-HT 12 BE			
i-HT 12 BF			
i-HT 12 DF			
i-HT 15 BE			
i-HT 15 DF			
i-HT 10 ED			
i-HT 20 DD	3	6312	7312(BECB)
i-HT 20 DE			
i-HT 20 ED			

Note: Thrust bearing is at non-driving end and radial bearing is at driving end.



Two Stage

Pump Model	Bearing Module	Bearing DE Deep Groove Ball Bearing	Bearing NDE Deep Groove Ball Bearing
i-HT 12 XD	3T	6411	6411
i-HT 15 XE			
i-HT 15 XF			
i-HT 05 AA	1T	6307	6307
i-HT 06 AA	2T	6309	6408

5.3 Special care for Bearings

These instructions do not supersede any information issued by the bearing manufacturers, to whom application should be made for more comprehensive literature by personnel responsible for bearing care, who with it to make a detailed study.

Care and maintenance of bearings is a matter of ensuring that they are:

- a) Correctly lubricated at intervals as laid down in routine maintenance chart.
- b) Removed, cleaned and refitted with care.
- c) Tools used and work areas should be cleaned.

To remove a bearing, use correctly suited withdrawal equipment.

CAUTION: Damage can be caused by exerting force against the outer ring of a ball bearing.

Ball bearings should not be dismantled.

Clean bearings thoroughly with an approved fluid.

Dry the bearings by spinning with dry compressed air or by hand. Do not spin a clean dry bearing.

Inspect the bearing for wear, fractures, cracks, corrosion or other damage which may necessitate bearing replacement.

Pack both sides of bearing with grease.

Check that the bearing, shaft and housing are cleaned and undamaged.



Recharge with grease to a maximum of two thirds full.

Refit the bearing onto the shaft and press or tap into position.

5.4 Lubrication Details

Initially bearings are lubricated during assembly. In the regreasing period these bearings should be repacked with a high quality, lithium soap base, ball and roller bearing grease free from resin and acid, not liable to harden or crumble and possessing rust preventive properties. Regreasing interval depends upon the operating speed of the unit.

Operating speed	Regreasing Interval
1450 rpm	4000 hours
2900 rpm	3000 hours

To recharge the bearings with fresh grease, use a grease gun and feed through the two grease nipples provided.

DO NOT APPLY LUBRICANT WHEN PUMP IS RUNNING.

After 10,000 hours or two years whichever is earlier remove bearings from pumps, degrease, thoroughly clean, recharge with fresh grease and refit in accordance with reassembly instructions.

Recommended Grease Specifications

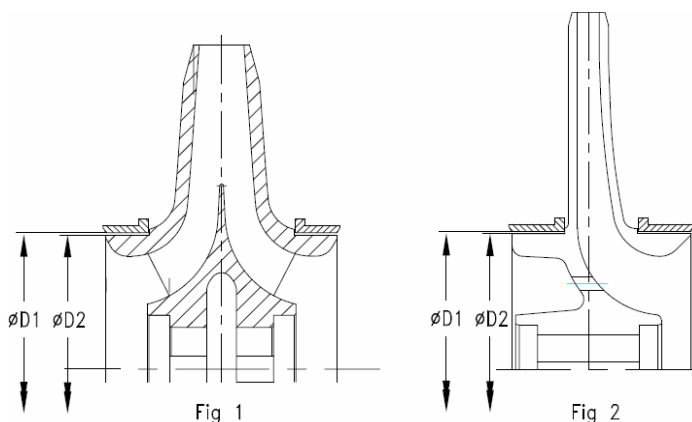
Speed	Lubricant recommended
1450 rpm	IOCL SERVOGEM-3 or equivalent
2900 rpm	IOCL SERVOGEM-2 or equivalent

Drop point: 180° C min.

5.5 Wearing Ring Details

Pumps are supplied with casing wear rings. The Diametrical clearances between

Impeller and casing rings should be minimum 0.18 mm and maximum 0.6 mm depending upon pump model.



Pump Type	Fig. No.	D1 Tol. H7		D2 Tol. c9		DiametralClearances	
		Min.	Max.	Min.	Max.	Min.	Max.
i-HT06BA	1	115.000	115.035	114.733	114.820	0.180	0.302
i-HT08BA	1	115.000	115.035	114.733	114.820	0.180	0.302
i-HT08BD	1	120.000	120.035	119.733	119.820	0.180	0.302
i-HT08BE	1	120.000	120.035	119.733	119.820	0.180	0.302
i-HT10BA	1	150.000	150.040	149.690	149.790	0.210	0.350
i-HT10BD	1	150.000	150.040	149.690	149.790	0.210	0.350
i-HT10BE	1	150.000	150.040	149.690	149.790	0.210	0.350
i-HT10DE	1	145.000	145.040	144.690	144.790	0.210	0.350
i-HT10ED	1	150.000	150.040	149.690	149.790	0.210	0.350
i-HT12BA	1	175.000	175.040	174.670	174.770	0.230	0.370
i-HT12BD	1	175.000	175.040	174.670	174.770	0.230	0.370
i-HT12BE	1	175.000	175.040	174.670	174.770	0.230	0.370
i-HT12BF	1	175.000	175.040	174.670	174.770	0.230	0.370
i-HT12CA	1	145.000	145.040	144.690	144.790	0.210	0.350
i-HT12CF	1	145.000	145.040	144.690	144.790	0.210	0.350
i-HT12CG	1	145.000	145.040	144.690	144.790	0.210	0.350
i-HT12DA	1	175.000	175.040	174.670	174.770	0.230	0.370
i-HT12DF	1	175.000	175.040	174.670	174.770	0.230	0.370
i-HT12EA	1	185.000	185.046	184.645	184.760	0.240	0.401
i-HT15BA	1	175.000	175.040	174.670	174.770	0.230	0.370
i-HT15BE	1	180.000	180.040	179.670	179.770	0.230	0.370
i-HT15DA	1	185.000	185.046	184.645	184.760	0.240	0.401
i-HT15DF	1	185.000	185.046	184.645	184.760	0.240	0.401
i-HT20DD	1	224.000	224.046	223.625	223.740	0.260	0.421
i-HT20DE	1	224.000	224.046	223.625	223.740	0.260	0.421
i-HT20ED	1	245.000	245.046	244.605	244.720	0.280	0.441
TWO STAGE							
i-HT12XD	2	240.000	240.072	239.465	239.580	0.420	0.607
i-HT15XE	2	240.000	240.072	239.465	239.580	0.420	0.607
i-HT15XF	2	240.000	240.072	239.465	239.580	0.420	0.607
i-HT05AA	2	115.035	115.000	114.630	114.543	0.492	0.370
i-HT06AA	2	150.040	150.000	149.605	149.505	0.535	0.395

- For i-HT12XD, i-HT15XE, i-HT15XF Tolerance is H8/b9

**5.6 Impeller Details**

Sr. No.	Pump Type	Full Impeller Dia. in mm.	Min. Impeller Dia. in mm.	Impeller Type
1	i-HT06BA	240	180	Double Entry
2	i-HT08BA	235	175	Double Entry
3	i-HT08BD	235	190	Double Entry
4	i-HT08BE	210	160	Double Entry
5	i-HT10BA	245	190	Double Entry
6	i-HT10BD	245	210	Double Entry
7	i-HT10BE	210	184	Double Entry
8	i-HT10DE	303	225	Double Entry
9	i-HT10ED	370	270	Double Entry
10	i-HT12BA	245	185	Double Entry
11	i-HT12BD	245	210	Double Entry
12	i-HT12BE	210	180	Double Entry
13	i-HT12BF	245	205	Double Entry
14	i-HT12CA	286	210	Double Entry
15	i-HT12CF	286	210	Double Entry
16	i-HT12CG	286	255	Double Entry
17	i-HT12DA	303	230	Double Entry
18	i-HT12DF	308	230	Double Entry
19	i-HT12EA	348	280	Double Entry
20	i-HT15BA	252	205	Double Entry
21	i-HT15BE	252	215	Double Entry
22	i-HT15DA	325	240	Double Entry
23	i-HT15DF	325	240	Double Entry
24	i-HT20DD	340	240	Double Entry
25	i-HT20DE	340	240	Double Entry
26	i-HT20ED	378	320	Double Entry
TWO STAGE				
27	i-HT12XD	310	275	Single Entry
28	i-HT15XE	326	295	Single Entry
29	i-HT15XF	326	295	Single Entry
30	i-HT05AA	220	195	Single Entry
31	i-HT06AA	240	180	Single Entry



5.7 Stuffing Box Details

Sr.No.	i-HT Model	Mech. Seal
1	i-HT06BA, i-HT08BA, i-HT12CA, i-HT08BD, i-HT08BE, i-HT10DE, i-HT12CF, i-HT12CG	35 mm
2	i-HT12BA, i-HT12DA, i-HT15BA, i-HT12EA, i-HT15DA, i-HT10BA, i-HT10BD, i-HT10BE, i-HT12BD, i-HT12BE, i-HT12BF, i-HT12DF, i-HT15BE, i-HT15DF, i-HT10ED	50 mm
3	i-HT20DE, i-HT20DD, i-HT20ED	65 mm

Two stage pumps are Gland packed.

5.9 Interchangeability of Components

NAME OF PART	i-HT06BA	i-HT08BA	i-HT08BD	i-HT08BE	i-HT10DE	i-HT12CA	i-HT12CF	i-HT12CG	i-HT10BA	i-HT10BD	i-HT10BE	i-HT10ED	i-HT12BA	i-HT12BD	i-HT12BE	i-HT12BF	i-HT12DA	i-HT12DF	i-HT12EA	i-HT15BA	i-HT15BE	i-HT15DA	i-HT15DF	i-HT20DD	i-HT20DE	i-HT20ED
UPPER HALF CASING	1	2	2	2	3	4	4	4	5	5	5	6	7	7	7	7	8	8	9	10	10	11	11	12	12	13
LOWER HALF CASING	1	2	2	2	3	4	4	4	5	5	5	6	7	7	7	7	8	8	9	10	10	11	11	12	12	13
IMPELLER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
PUMP SHAFT	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
CASING RING	1	1	2	2	3	3	3	3	4	4	4	4	5	5	5	5	5	5	6	5	7	6	6	8	8	9
MECH. SEAL	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
SHOULDER RING	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
BEARING HOUSING DE	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
BEARING HOUSING NDE	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
BEARING	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
EYE BOLT	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
IMPELLER NUT	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
COUPLING KEY	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
IMPELLER KEY	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
VENT VALVE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
GASKET TOP-BOTTOM	1	2	2	2	3	4	4	4	5	5	5	6	7	7	7	7	8	8	9	10	10	11	11	12	12	13
INSERT	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	5	5	6

Two Stage

NAME OF PART	i-HT12XD	i-HT15XE	i-HT15XF	i-HT05AA	i-HT06AA
UPPER HALF CASING	1	2	2	3	4
LOWER HALF CASING	1	2	2	3	4
IMPELLER-I STAGE	1	3	5	7	9
IMPELLER-II STAGE	2	4	6	8	10
PUMP SHAFT	1	2	2	3	4
CASING RING	1	2	2	3	4
SHOULDER RING	1	2	2	3	4
ST BOX COVER	1	2	2	3	4
GLAND	1	2	2	3	4
LANTERN RING	1	2	2	3	4
BEARING HOUSING DE	1	2	2	3	4
BEARING HOUSING NDE	1	2	2	3	4
BEARING	1	2	2	3	4
EYE BOLT	1	1	1	2	3
SHAFT SLEEVE	1	2	2	3	4
COUPLING KEY	1	2	2	3	4
GLAND PACKING	1	2	2	3	4
VENT VALVE	1	1	1	2	3
GASKET TOP-BOTTOM	1	2	2	3	4
ST.ST.FLEXIBLE PIPE	1	1	1	2	3
INSERT	1	2	2	3	4

6. MAINTENANCE:

6.1 Maintenance EHS (Environmental Hazard Safety) Instructions

Following hazards may arise during maintenance work.



Fluid Pressure Jet Hazards.

Check and ensure that the pump operates at below the maximum Working Pressure specified.



Hazardous Materials.

Wear a suitable mask or respirator when working with chemical material handling.



Hazardous Gases, Mists, Sprays and Leaks.

Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation from noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.

Before attempting any maintenance on a pump, particularly if it has been handling any form of hazardous liquid; ensure that the unit is safe to work on. The pump must be flushed thoroughly with suitable cleanser to purge away any of the product left in the pump components. The plant operator should carry this out and a certificate of cleanliness obtained before starting work. To avoid any risk to health it is also advisable to wear protective clothing as recommended by the site safety officer, especially when removing old packing that may be contaminated.



Electric Shock and Accidental Starting Hazard.

Isolate the equipment before any maintenance work is done. Switch off the mains supply, remove fuses, apply lockouts where applicable and affix suitable isolation warning signs to prevent inadvertent re-connection.

In order to avoid the possibility of maintenance personnel inhaling dangerous fumes or vapours, it is recommended that maintenance work be carried out away from the pump location by removal of the rotating unit assembly to a suitable maintenance area.

6.2 Routine Maintenance Chart

Preventive maintenance schedule is a periodical checks and precautions by which possibilities of failure and breakdown will be rare.

EVERY WEEK	Visually check for leaks. Check for vibration. Adjust gland as necessary to maintain slight leakage. Hand test bearing housing for any sign of temperature. Voltage and current.
EVERY MONTH	Check bearing temperature with thermometer.
EVERY 3 MONTHS	Check grease lubricated bearings for saponification.
EVERY 6 MONTHS	Check the packing and replace if necessary. Check shaft or shaft sleeve for scoring. Check alignment of pump and motor. Check holding down bolts for tightness. Check coupling bush/rubber star.
EVERY YEAR	Check rotating element for wear. Check wear ring clearances. Clean and regrease bearings. Measure total suction and discharge Head as a test of pipe connection.

7. OVERHAULING:

With normal daily operating spell, the pump will be due for overhaul after about 5000 working hours. This work should be done by skilled personnel. Please refer to the cross-sectional drawing while dismantling and reassembling the pump. Please also refer to chart given at end of this booklet.

Single Stage Pump



7.1 Dismantling Procedure.

1. Remove drain plug (60100) and drain the pump by opening air vent valve (45000).
2. Remove all casing main joint nuts (58001) and dowel pins (61100). Remove flushing piping.
3. Insert a screw driver or peg bar into the slots between the Upper and Lower half casing and separate the halves, lifting off the upper half casing.
4. Tap the stuffing box inserts (97900) with a soft headed hammer to break the seal between the stuffing box insert and lower half casing and lift the rotating element out of the lower half.
5. Remove four hex. head screws (57100) from each bearing housing (24001 and 24002) and remove the bearing housings from the bearings.
6. Remove bearing retaining nut (33600) and lock washer (41500) from the outboard end of the shaft and using a puller remove the bearing [260] from the shaft. Remove the drive end bearing [260] in the same manner.
NOTE: Retaining nut and lock washer are not used on the drive end bearing.
7. Remove shoulder rings [19900] from the shaft. Remove oil seals [50000] from the supporting frame [22000].
8. Slide stuffing box inserts [97900] off the shaft. Mark the mechanical seal position correctly before removing mechanical seal. It is very important to assemble the pump. Remove mechanical seal from each stuffing box insert.
9. Remove casing rings [19000] from the impeller [15900].
10. a. Clockwise rotation:
Unscrew impeller nut [33000] from the non-drive end and slide it off the shaft.
b. Anti-clockwise rotation:
Unscrew impeller nut [33000] from the drive end and slide it off the shaft.
11. Remove impeller [15900], slide back impeller key [32000] and remove the other impeller nut. Remove impeller key.

NOTE: For the overhauling of bearings, bearing housing can be removed without removing top casing. Pull the bearing housing by means of grip



provided on the bearing housing. There is slot on the insert face. By locating the puller in that slot bearing can be easily removed.

7.2 Assembly Procedure.

For clockwise rotation

1. Wipe shaft [18000] with clean light oil. Screw impeller nut [33000] onto shaft at drive end as per dimension "A" given on page 34.
2. Place impeller key [32000] into key way and tap milled-down end right home under sleeve. Not clear?
3. Check the impeller for correct rotation [page 31] and slide onto shaft from non-drive end.
4. Screw second impeller nut [33000] onto shaft at non-drive end and lock up tight against impeller hub and first impeller nut.
5. Slide the casing rings [19000] onto the impeller.
6. Fix the mechanical seal to the correct location where the marking is done before dismantling.
7. Check "O" rings for cuts or flaws, discard if faulty. Lubricate and roll "O" ring into the groove in each insert [97900].
8. Slide insert [97900] over shaft with guide vane at top position.
9. Fit shoulder ring [19900] onto shaft, then press oil seal [50000] into insert.
10. Heat the ball bearing [26000] to approximately 100°C [212°F] using bearing hot plate or oil and water solution [10 to 15% soluble]. NOTE: Do not exceed temperature 120°C [250°F].
11. Slide the heated bearing onto the shaft up to shoulder ring [19900] [non-drive end]. Place locking washer [41500] onto shaft and screw bearing retaining nut [36000] using hook spanner. Lock up tight against bearings.
12. Cool the bearing to room temperature and coat both sides with recommended grease.



13. Coat the inside of the bearing housing [24002] with grease and slide into place over bearing. Secure bearing housing [24002] to the support frame [22000] with four hex. head screws [57100].
14. At coupling end: heat the bearing [26000] to approximately 100° C [212° F] using bearing hot plate or oil and water solution. NOTE: Do not exceed 120° C [250° F].
15. Slide the heated bearing onto the shaft to about shoulder ring [19900] [coupling end].
16. Cool the bearing to room temperature and coat both sides with recommended grease.
17. Coat the inside of the bearing housing [24001] with grease and slide into place over bearing. Secure bearing housing [24001] to the support frame [22000] with four hex. head screws [57100].
18. Set the rotating element in the pump casing bottom half [12300]. Locate both insert tongues in their respective casing grooves. Locate pin (61002) and (61003) in their respective horizontal slots on the face of bottom casing. Correct any excessive "O" ring buckling. Check that the impeller is centralized in the casing ± 2.5 mm and that there is no rubbing.
19. Install casing gasket [51900] with a light coat of commercial cup grease on both gasket surfaces. Carefully align the inner edge of the gasket with the insert "O" rings.
20. Lower the upper half casing [12200] into place and install casing joint nuts. NOTE: When installing upper half casing make sure that the "O" rings are not cut or pinched and that the gasket is hard against the "O" rings.
21. Insert casing joint dowels [61100] and drive them home. Tighten the joint nuts [500.1] as per instructions on page 33.
22. Install stuffing box flushing piping [56000].
23. Rotate the shaft by hand to assure smooth turning and that it is free from rubbing or binding.



7.3 REVERSING ROTATION OF PUMPS.

Reversing rotation of pumps puts suction and discharge opening on opposite sides with respect to the coupling end.

Changes in assembly procedure –

1. Screw impeller locking nut [33000] onto shaft [18000] at non-drive end as per dimension “Z” given on page 34.
2. Place impeller key [32000] into key way and tap milled-down end right home under non-drive end impeller locking nut [mechanical seal] or shaft sleeve [soft packed].
3. Check impeller for correct rotation (refer page 31) and slide onto shaft from drive end.
4. Screw second impeller locking nut [33000] or shaft sleeve onto shaft at drive end and using hook spanner, lock up tight against the impeller hub. From step 5 the assembly procedure is the same as for clockwise rotation pumps.

Two Stage Pump

7.4 Dismantling Procedure.

1. Drain the pump by opening air vent valve.
2. Remove all the screws of bearing housing (240) tightened with casing, insert (979) and bearing cover (271) and dismantle the bearing cartridge.
3. Remove all the nuts and bolts (577, 581) and locating pin (611) of the upper and lower casing flange.
4. Insert a screw driver or peg bar into the slot between the two halves and separate two halves, lifting of the upper half casing.
5. Tap the inserts (979) with a soft hammer to break the seat between the insert and lower half casing and lift the rotating unit out of the lower half casing.
6. Remove the bearing lock nut (336) and lock washer (415) from the NDE side of the shaft. By using bearing puller remove the bearings from the shaft. Remove the driving end bearing in the same manner.
7. Remove bearing cover (271) in the same manner. Remove the liquid deflectors (236).



8. While removing cartridge mechanical seal.
9. Lock the seal with 4 clamps provided with on seal.
10. Release the allen screws provided to clamp the seal with shaft sleeve.
11. Remove fasteners used for tightening gland plate with insert.
12. Remove the impeller nut and insert from DE.
13. Remove impellers with impeller ring from shaft. Impellers at DE and NDE are with different bores 70 and 72 respectively. So they cannot be interchanged with their positions.
14. Remove the impeller key (320). Take out interstage ring (204) along with the interstage bush (313).

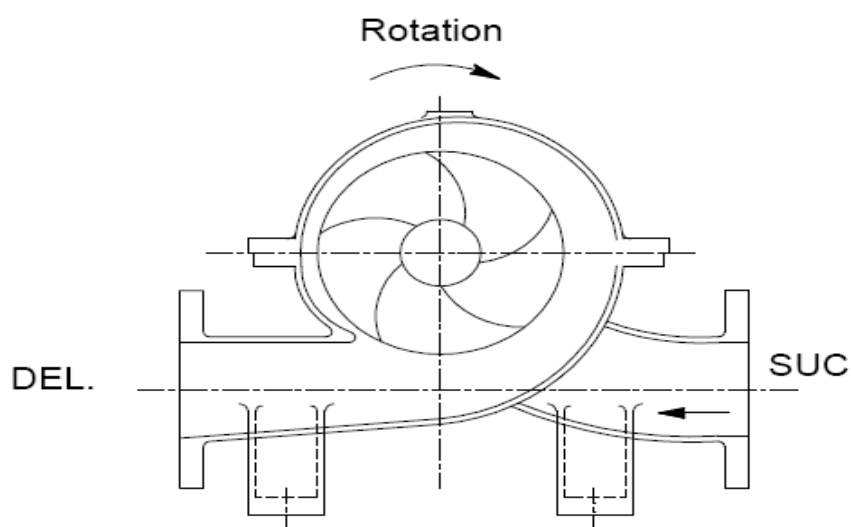
7.5 Assembly Procedure.

1. Check the "O" rings (522) for cut or flows, discard if faulty, lubricate and roll the "O" ring in groove.
2. Wipe over the shaft (180) with clean light oil.
3. Place the impeller key (320) into the keyway and interstage ring (204) along with interstage bush (313).
4. Check the 1st and 2nd stage impeller for correct rotation and slide onto the shaft from DE and NDE.
5. Place the impeller nut (330) onto the shaft DE and NDE and the DE impeller nut against the impeller hub. After fixing the DE impeller nut at a distance "A" 509mm (refer page 34) locate the NDE impeller nut. Slide the casing rings (190) onto the impellers.
6. Check the "O" rings (522) for cuts or flaws, discard if faulty. Lubricate and roll the "O" ring (522) into the groove in each insert (979.1 and 979.2).
7. Slide insert (979) tightened with cartridge mechanical seal with gland nuts, liquid deflectors (236) and bearing cover (271) simultaneously over the shaft.
8. Ensure that no foreign particle enters in bearing assembly. Refer the cross-sectional drawing.
9. Heat the bearing (260) to approximately 100° C (212° F) using bearing oil bath.

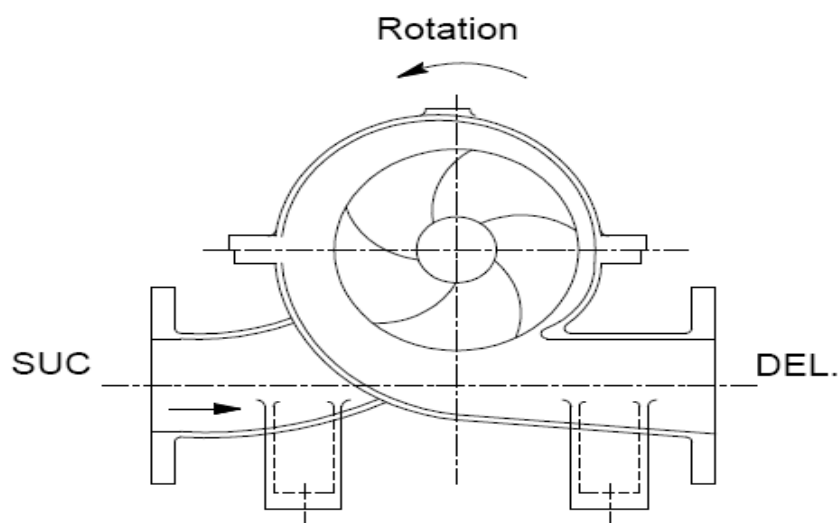


10. Slide the heated bearing onto the shaft. Place the locking washer (415) onto the shaft and screw the bearing lock nut (336) using spanner. Lock up tightly against the bearing. Bend the washer in slot of bearing lock nut.
 11. Cool the bearing to room temperature and coat both the slides with 200 grams of recommended grease.
 12. Place the bearing cartridge over the bearings and tighten up with the insert.
 13. Tighten the bearing cover (271) with bearing cartridge.
 14. Apply same procedure to the DE end side.
 15. Lift the rotating unit by means of crane. Place it in lower half casing such that DE insert takes guide on lower half casing, casing rings should take guide in groove provided in lower half casing.
 16. Check whether both Impellers are centrally placed in volute. If it did not, adjust NDE sleeve.
 17. Place the cylindrical pins (used to locate the wear ring) in their respective holes. Install casing gasket (519) with a light coat grease on both gasket surfaces. Carefully align the inner edge of the gasket with the insert "O" rings. Lower the casing half upper (122) onto place and engage casing joint nuts loosely.
- NOTE- WHEN INSTALLING CASING HALF UPPER MAKE SURE THAT THE "O" RINGS (522.1) ARE NOT CUT OR PUNCHED AND THE GASKET IS HARD AGAINST THE "O" RINGS.**
18. Insert the locating pin (611) and drive them home.
 19. Tighten the bearing cartridge with both upper and lower half casings.
 20. Loose the cartridge seal clamps and tighten the cartridge seal allen screws with the shaft.
 21. Install the stuffing box flushing piping.
 22. Rotate the shaft by hand to ensure smooth turning and that is free from rubbing or binding.

With normal daily operating spell, the pump will be due for overhaul after about 5000 working hours. This work should be done by skilled personnel.



CLOCKWISE ROTATION VIEWED
FROM THE COUPLING END



COUNTER CLOCKWISE ROTATION
VIEWED FROM THE COUPLING END

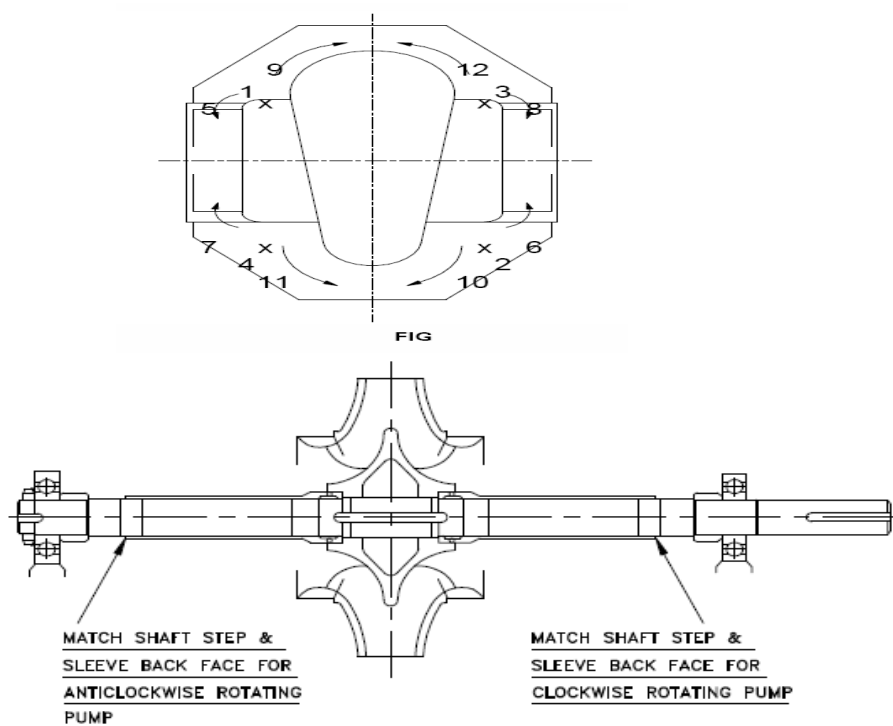
JOINT FLANGE

TIGHTENING TORQUES AND SEQUENCE

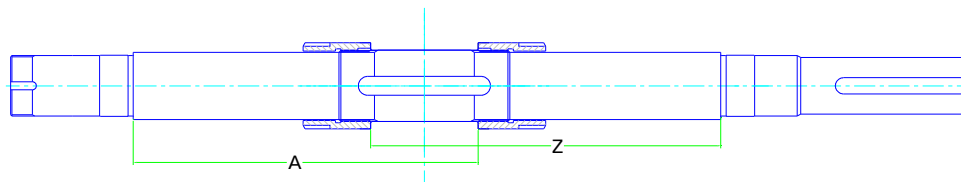
Stud and nut used in this main joint flange of pumps should be tightened to the torques stated in Table 1 and in the sequence stated in below Figure.

STUD SIZE	TIGHTENING TORQUES kg-cm
M12	250
M16	650
M20	1270
M24	2200

2. Tightening sequence.
 - 2.1 Tighten the four corner studs marked 'X' 1, 2, 3, and 4.
 - 2.2 Work outward along shaft axis towards the stuffing boxes in opposite quarters tightening nut in regions 5, 6, 7 and 8.
 - 2.3 Work outwards along the branch and in opposite quarters tightening nuts in regions 9, 10, 11, and 12.
 - 2.4 Repeat the whole sequence.



7.6 SLEEVE LOCKING DISTANCE

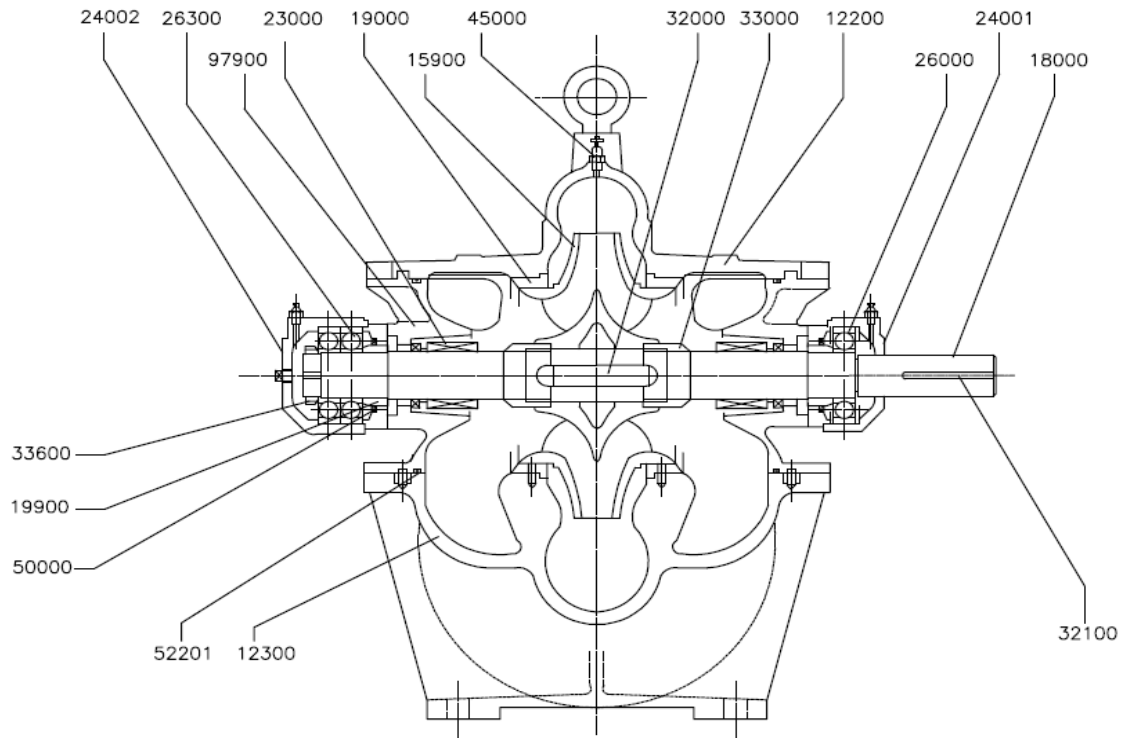


Sr. No.	Pump Type	Clockwise Pump "A"	CCW Pump "Z"
1	i-HT06BA	198	202
2	i-HT08BA		
3	i-HT08BD		
4	i-HT08BE		
5	i-HT10BA	256	260
6	i-HT10BD		
7	i-HT10BE		
8	i-HT10DE	198	202
9	i-HT10ED	256	260
10	i-HT12BA	256	260
11	i-HT12BD		
12	i-HT12BE		
13	i-HT12BF		
14	i-HT12CA	198	202
15	i-HT12CF		
16	i-HT12CG		
17	i-HT12DA	256	260
18	i-HT12DF	256	260
19	i-HT12EA		
20	i-HT15BA		
21	i-HT15BE	256	260
22	i-HT15DA		
23	i-HT15DF		
24	i-HT20DD	330	334
25	i-HT20DE	330	334
26	i-HT20ED		
27	i-HT12XD		
28	i-HT15XE	509	513
29	i-HT15XF		
30	i-HT05AA	313	317
31	i-HT06AA	338	342

**8. SPARE PARTS LIST AND CROSS-SECTIONAL DRAWINGS:**

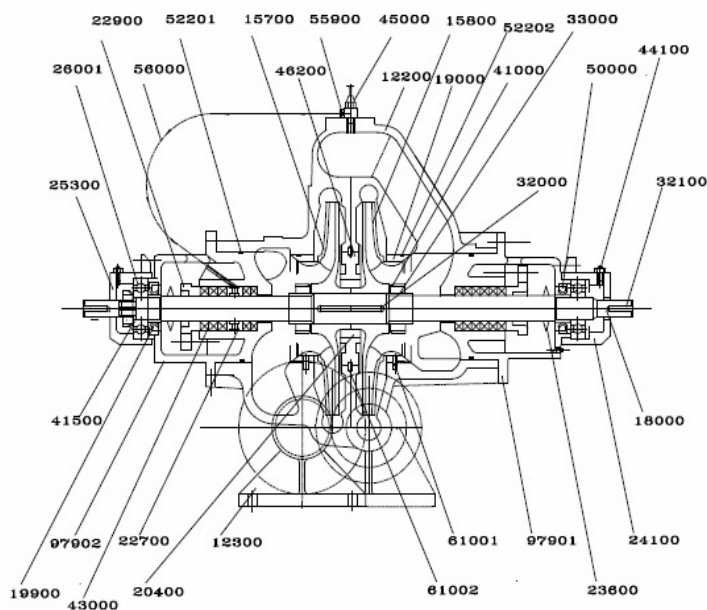
Part code no.	Part description
12200	CASING HALF UPPER
12300	CASING HALF LOWER
15900*	IMPELLER
19000*	WEARING RING
19900	SHOULDER RING
24001	BEARING HOUSING DE
24002	BEARING HOUSING NDE
26000*	BALL BEARING
27000	BEARING COVER DE
27101	BEARING COVER NDE
27102	BEARING COVER DE & NDE
32000*	KEY (IMPELLER)
32100	KEY (COUPLING)
33600	LOCK NUT (BEARING)
41500	LOCK WASHER (BEARING)
44101	GREASE NIPPLE
45000	VENT VALVE
47101	PROTECTION COVER (SUC)
47102	PROTECTION COVER (DEL)
50000	OIL SEAL
51900	GASKET (CASING)
52200*	O RING (INSERT)
52202*	ORING (SLEEVE)
57100	SCREW (BEARING HOUSING)
57101	SCREW (BEARING HOUSING & CASING)
57102	SCREW (BEARING HOUSING & INSERT)
58001	NUT (CASING)
58002	NUT (INSERT)
59001	STUD (CASING)
59002	STUD (INSERT)
60500	PIPE PLUG (BEARING HOUSING NDE)
60600	PIPE PLUG (PRIMING)
61000	LOCKING PIN (CASING RING)
61100	LOCATING PIN (CASING)
64000	RIVET (NAMEPLATE)
67000	DUTY NAMEPLATE
69100	NUT (LOCATING PIN)
84901	WASHER (LOCATING PIN)
84902	WASHER (INSERT)
84903	WASHER (BEARING HOUSING)
60000	GAUGE PLUG
60100	DRAIN PLUG

CROSS SECTIONAL OF i-HT PUMPS SINGLE STAGE (MECHANICAL SEAL)



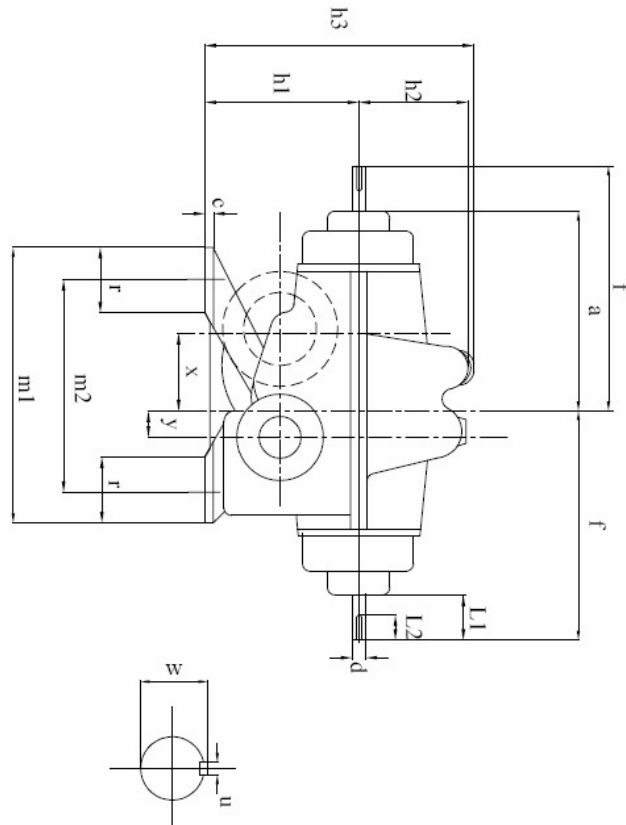
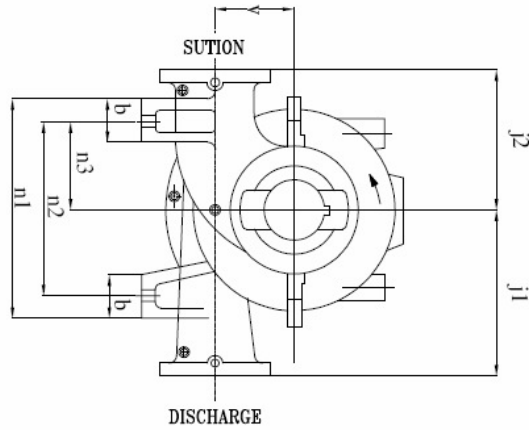
PART NO.	DESCRIPTION	QTY
12200	UPPER HALF CASING	01
12300	LOWER HALF CASING	01
15900*	IMPELLER	01
18000*	SHAFT	01
19000*	WEAR RING	02
19900	SHOULDER RING	02
23000	MECHANICAL SEAL	02
24001	BEARING HOUSING DE	01
24002	BEARING HOUSING NDE	01
26000	BEARING	02
26200	ANGULAR CONTACT PAIRED BRG.	02
32000*	IMPELLER KEY	01
32100*	KEY FOR COUPLING	01
33000*	IMPELLER NUT	02
33600*	LOCK NUT FOR BEARING	01
45000	VENT VALVE	01
50000*	OIL SEAL	02
52201*	"O" RING FOR INSERT	02
97900	INSERT	02

CROSS SECTIONAL ASSEMBLY OF TWO STAGE PUMPS (i-HT05AA,i-HT06AA)



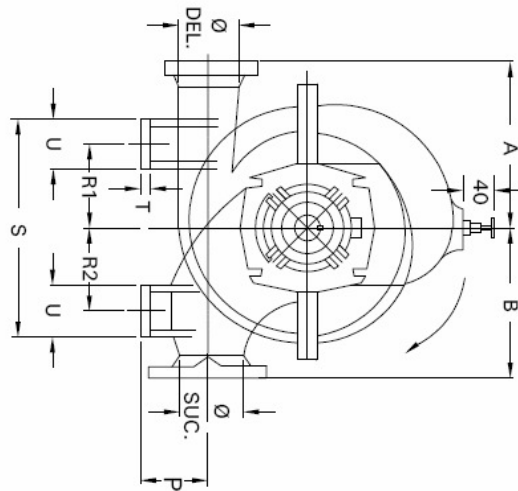
CODE NO.	DESCRIPTION	QTY
12200	CASING HALF UPPER	01
12300	CASING HALF LOWER	01
15700*	IMPELLER I STAGE	01
15800*	IMPELLER II STAGE	01
18000*	PUMP SHAFT	01
19000*	WEAR RING	02
19900	SHOULDER RING	02
20400*	INTERSTAGE RING	01
22700*	LANTERN RING	01
22900	GLAND	02
23600*	LIQUID DEFLECTOR	02
24100	BRG. CARTRIDGE DE	01
25300	BRG. CARTRIDGE NDE	01
26000*	DEEP GROVE BALL BEARING	01
32000*	KEY FOR IMPELLER	02
32100*	KEY FOR COUPLING	01
33000*	IMPELLER NUT	02
41000	LOCK WASHER	01
41500	LOCK WASHER	01
43000*	GLAND PACKING	01
44100	GREASE NIPPLE	02
45000	VENT VALVE	02
46200	INTERSTAGE DIAPHRAGM	01
50000	OIL SEAL	02
51900*	GASKET BETN. HALVES	02
52201	"O" RING	02
52202	"O" RING	02
55900	STUD COUPLING	02
56000	SEALING TUBE	01
61001	PIN FIR CASING RING	02
61002	PIN FOR INTERST. DIAPHRAM	01
97901	INSERT DE	01
97902	INSERT NDE	01

TWO STAGE(/-HT12XD,/HT15XE,/HT15XF)

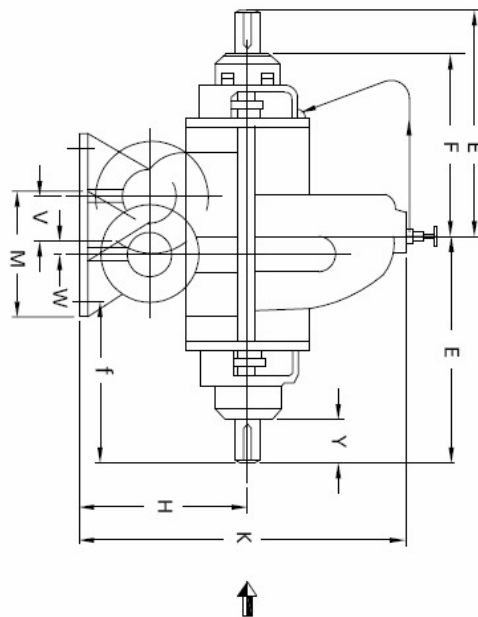
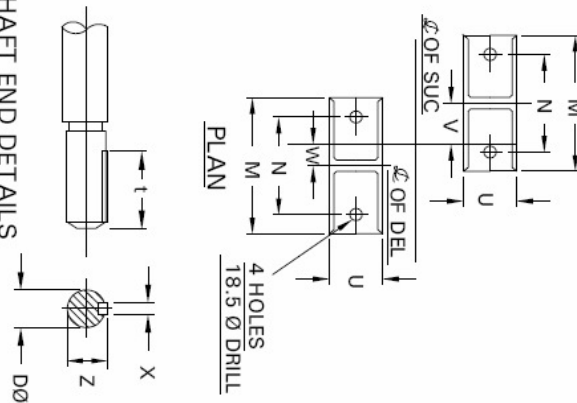


PUMP	a	f	h1	h2	h3	j1	j2	v	m1	m2	n1	n2	n3	x	y	b	c	r	d	w	u	L1	L2	mass (kg)
i-HT12XD	535	650	400	265	695	350	450	180	480	420	540	430	265	135	50	110	24	110	50	53.5	14	100	80	590
i-HT15XE	535	650	400	290	730	400	500	180	480	420	620	510	300	110	50	110	24	110	50	53.5	14	100	80	640

TWO STAGE(i-HT05AA,i-HT06AA)



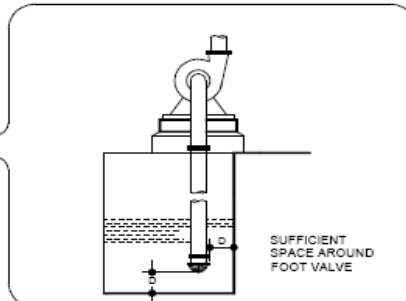
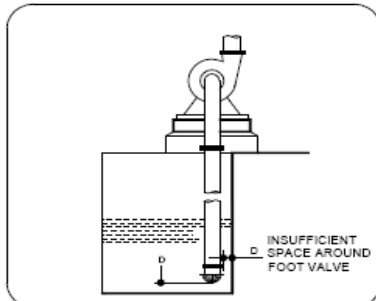
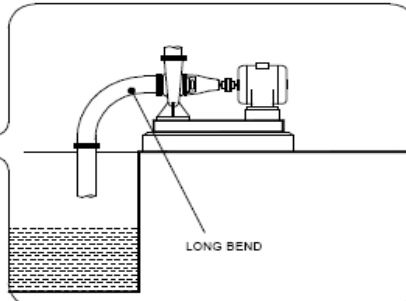
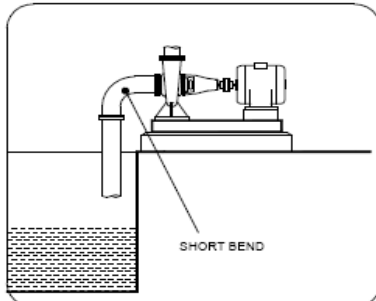
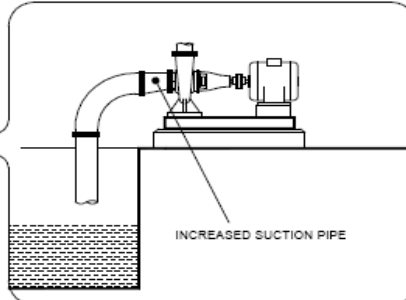
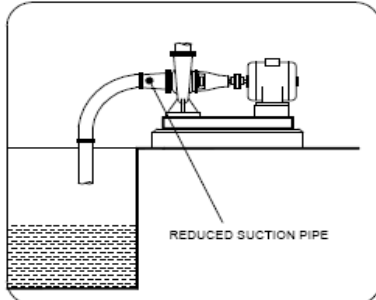
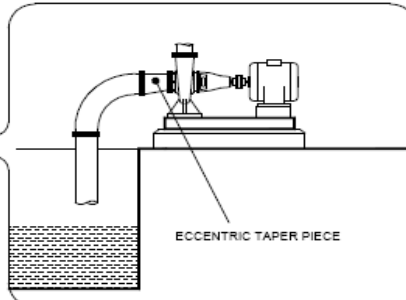
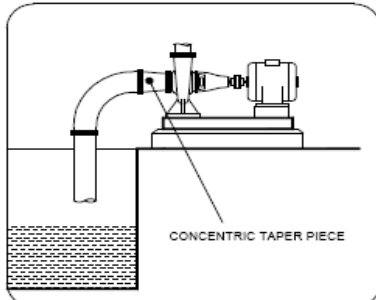
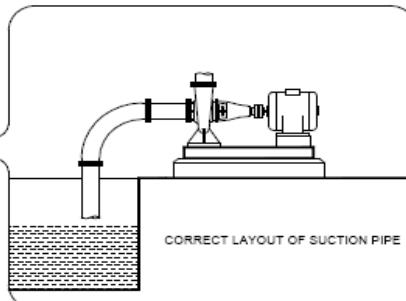
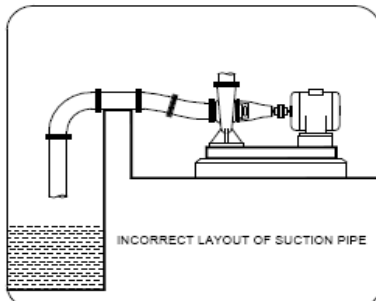
SHAFT END DETAILS



PUMP	SUC Ø	DEL Ø	A	B	E	F	H	K	M	N	T	P	R1	R2	S	U	V	W	X	Y	DØ	f	Z	t	Wt. IN kg
i-HT05AA	80	50	225	225	400	332	230	430	160	120	16	105	122.5	122.5	325	80	65	30	8	70	30	310	33	67	118
i-HT06AA	100	65	250	250	435	367	260	500	200	150	20	115	135	135	350	80	65	33	10	72	38	327	41	65	164

INCORRECT

CORRECT



FOR RECOMMENDATIONS OF SUITABLE SUCTION AND DELIVERY PIPE SIZE PLEASE CONTACT OUR AUTHORISED DEALER OR NEAREST REGIONAL OFFICE

GENERAL INSTRUCTIONS FOR INSTALLATION OPERATION & MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS

GENERAL INSTRUCTIONS FOR INSTALLATION, OPERATION & MAINTENANCE OF

KIRLOSKAR CENTRIFUGAL PUMPS

WARNING

The equipment supplied is designed for specific capacity, speed, pressure and temperature. Do not use the equipment beyond the capacities for which it is manufactured. The equipment manufactured is also shop tested for the satisfactory performance and if it is operated in excess of the conditions for which it is manufactured, the equipment will be subject to excessive stresses and strains.

LOCATION

The pump should be located as near the liquid source as possible. This will minimise the suction lift and pump will give better performance.

Ample space should be provided on all sides so that the pump can be inspected while in operation and can be serviced conveniently whenever required.

FOUNDATION

The foundation should be sufficiently substantial to absorb any vibration and to form a permanent rigid support for the base plate. This is important in maintaining the alignment of a direct connected unit. A concrete foundation on a solid base is advisable. Foundation bolts of the proper size should be embedded in the concrete located by a drawing or template. A pipe sleeve about two and one-half diameter larger than the bolt should be used to allow movement for the final position of the foundation bolts.

ALIGNMENT

Pumps and drivers that are supplied by the manufacturers, mounted on a common base plate are accurately aligned before despatch. However as the alignments are likely to be disturbed during transit to some extent and therefore must not be relied upon to maintain the factory alignment. Re-alignment is necessary after the complete unit has been levelled on the foundation and again after the grout has been set and foundation bolts have been tightened. The alignment must be checked after the unit is piped up and re-checked periodically.

FLEXIBLE COUPLING

A flexible coupling will not compensate for misalignment of the pump and driver shafts. The purpose of the flexible coupling is to compensate for temperature changes and to permit the movement of the shafts without interference with each other while transmitting power from the driver to the pump.

TYPE OF MISALIGNMENT (SEE FIGURE 1)

There are two types of misalignment between the pump shaft and the driver shaft.

- Angular misalignment : Shafts with axis concentric but not parallel.
- Parallel misalignment : Shafts with axis Parallel but not concentric.

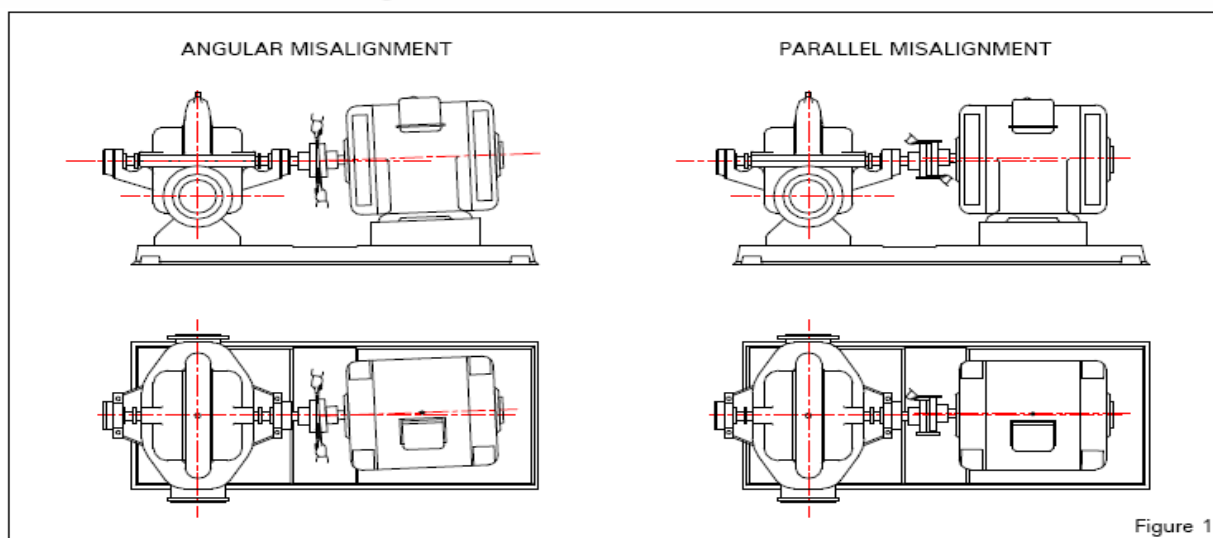


Figure 1

LEVELLING THE UNIT

When the unit is received with the pump and driver mounted on the base plate, it should be placed on the foundation and the coupling halves disconnected. The coupling should not be reconnected until all alignment operations have been completed. The base plate must be supported evenly on wedges inserted under the four corners so that it will not be distorted or sprung by the uneven distribution of the weight. Adjust the wedges until the shafts of the pump and driver are in level. Check the coupling faces, suction and discharge flanges for the horizontal or vertical position by means of spirit level.

FLEXIBLE COUPLING ALIGNMENT (SEE FIGURE 2)

The two halves of the coupling should be at least 4 mm apart so that they cannot touch each other when the driver shaft is rotated. Necessary tools for approximately checking are straight-edge and an outside caliper.

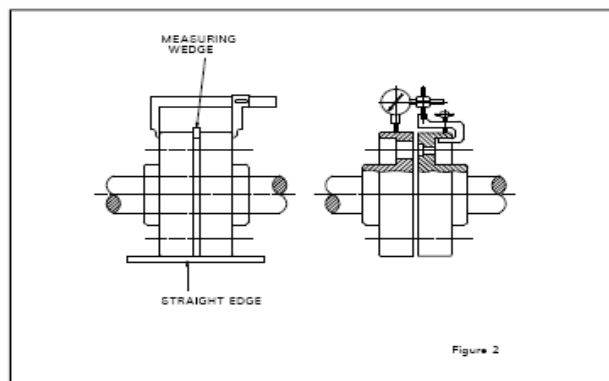
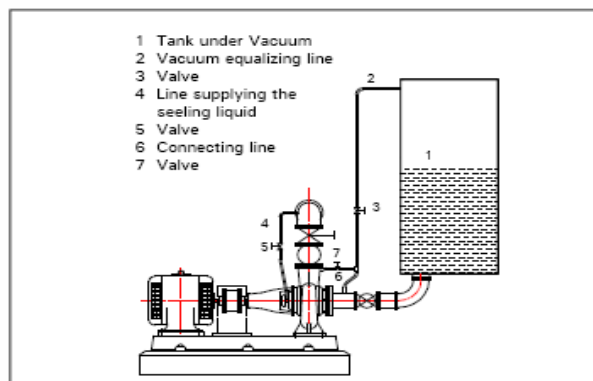


Figure 2



A check for parallel alignment is made by placing a straight-edge across both coupling periphery at the top, bottom and both the sides. The unit will be in parallel alignment when the straight-edge rests evenly on the coupling periphery at all positions. Care must be taken to have the straight-edge parallel to the axis of the shafts.

A check for angular alignment is made by using an outside caliper across the width of the coupling faces at various points.

Coupling alignment can be checked with dial gauge indicator as shown in Fig. 2.

GROUTING

When the alignment is correct, the foundation bolts should be tightened evenly but not too firmly. The unit can then be grouted by working soft concrete under the edges. Foundation bolts should not be fully tightened until the grout is hardened, usually 48 hours after pouring.

FACTORS THAT MAY DISTURB ALIGNMENT

The unit should be periodically checked for alignment. If the unit does not stay in line after being properly installed, the following are possible causes:

- Setting, seasoning of the foundation
- Pipe strains distorting or shifting the machines
- Wear of the bearings

PIPING

Both suction and delivery pipes and accessories should be independently supported near the pump so that when the flanges bolts are tightened no strain will be transmitted to the pump casing. It is usually advisable to increase the size of both suction and delivery pipes at the pump nozzles in order to decrease the loss of head from friction and for the same reason piping should be arranged with as minimum bends as possible, as these should be made with along radius wherever possible. The pipe lines should be free from scales, welding residuals etc., and have to be mounted in such a way that they can be connected to suction and delivery flanges without any stress on the pump. Adequate supports should be given to pipe lines to that weight of the pipe lines does not fall on the pump. The use of minimum number of the bends and other fittings will minimise the frictional losses.

SUCTION PIPE

The suction pipe should be as short as possible. This can be achieved by placing the pump near the liquid to be pumped. The suction pipe must be kept free from air leaks. This is particularly important when the suction lift is high. A horizontal suction line must have a gradual rise to the pump. Any high point in the pipe will be filled with air and thus prevent proper operation of the pump. A concentric taper piece should not be used in a horizontal suction line as it forms an air pocket in the top of the reducer and the pipe. Use an eccentric piece instead.

The end of the suction pipe must be well submerged to avoid whirlpools and ingress of air but must be kept clear of any deposits of mud, silt, grit etc. The pipe must be clear from any side of wall by at least 450 mm. The end of the suction pipe should be provided with a strainer of sufficient open area.

DELIVERY PIPE

A check (non-return) valve and a gate or sluice valve (regulating valve) should be installed in the discharge line. The check valve placed between the pump and the gate valve is to protect the pump from excessive pressure and to prevent water running back through the pump in case of failure of the driving machine.

Discharge piping should be provided with a sluice valve adjacent to the delivery flange to control the discharge, if required.

VACUUM EQUALISING LINE (AND LIQUID LINE) (SEE FIGURE 3)

If the pump draws from a system under vacuum an equalising pipe must be carried from the highest point of the suction line, however, as close to the suction flange of the pump as possible, to the top of the feed tank to keep gas bubbles that might have been entrapped in the flow from entering the pump. The line should be fitted with an isolating valve which should be closed only for maintenance work on the pumpset.

Apply sealing liquid (external sealing) to the shaft seal cage to prevent entry of air in the case of pumps with packed stuffing box. It is convenient to tap the sealing liquid from the delivery line above the non-return valve.

FOOT VALVE

It is advisable to install a foot valve to facilitate priming. The foot valve should have sufficient clear passage for water. Care must be taken to prevent foreign matter from being drawn into the pump or choking the foot valve and for this purpose an efficient strainer should be provided.

STUFFING BOXES AND PACKING

Stuffing boxes should be carefully cleaned and the packing placed in them. Be sure that sufficient packing is placed at the back of the water seal cage. If the water to be pumped is dirty or gritty, sealing water should be piped to the stuffing boxes from clean outside source of supply in order to prevent damage to the packing and shaft. In placing the packing, each packing ring should be cut to the proper length so that ends come together but do not overlap. The succeeding rings of packing should not be pressed too tight as it may result in burning the packing and cutting the shaft. If stuffing box is not properly packed, friction in stuffing box prevents turning the rotor by hand. On starting the pump it is well to have the packing slightly loose without causing an air leak, and if it seems to leak, instead of putting too much pressure on the gland, put some heavy oil in the stuffing box until the pump works properly and then gradually tighten up the gland. The packing should be occasionally changed.

BALL BEARINGS

Correct maintenance of ball bearings is essential. The bearing manufacturers give the following as a guide to relubrication periods under normal conditions.

Three monthly when on continuous duty.

Six monthly when on eight-hour per duty.

The bearings and housings should be completely cleaned and recharged with fresh grease after 2500 hours or the nearest pump overhaul time.

PRIMING

No pumping action occurs unless the pump casing is filled with liquid. Pump casing and suction pipe must therefore be completely filled with the liquid and thus all air removed before the pump is started. Several different priming methods can be used depending on the kind of installation and service involved.

(1) Liquid level above pump level

Pump is set below liquid level of source of supply so that liquid always flows to pump under positive head.

(2) Priming with foot valve

(a) When pump is installed on suction lift with foot valve at the end of suction line, fill pump with water from some outside source till all air is expelled and water flows through air vent.

(b) When there is liquid under some pressure in the discharge pipe, priming can be effected by bypassing the pressure liquid around the check and gate valve. Of course, the initial priming must be effected from some outside source.

NOTE: in this case, the foot valve must be capable of withstanding pump pressure and possible surge.

(3) Priming by ejector: An ejector operated by steam, compressed air or water under pressure and connected to air vent on top of casing can be used to remove air from and prime the pump on suction lift installations.

(4) Priming by dry vacuum pump : a hand or power pump sucks in all the air from the casing and the suction pipe, and thus primes the system.

STARTING

The pump must not be started without being primed. Be sure that the driver rotates in the proper direction as indicated by a direction arrow on the pump casing.

RUNNING

On account of its simple construction, the centrifugal pump requires practically no attention while running. Lubrication of the bearings and manipulation of the glands are the only things that need attention from the operator.

STOPPING

Before stopping the pump, close the gate valve. This will prevent water hammer on check valve.

STUFFING BOXES

Do not tighten the glands excessively. A slight dripping of water from the stuffing boxes when pump is running keeps packing in good condition.

CASING RINGS

Casing rings are fitted in the casing to reduce the quantity of water leaking back from the high pressure side to the suction side. These casing rings are fitted to maintain a small clearance and depend on the water in the pump for lubrication. When they are worn out, the clearance becomes greater and more water passes back into the suction. They must be replaced from time to time to restore the pump efficiency to its normal value.



SPARE PARTS

A set of ball bearings, a set of casing rings, and a set of gland packing rings must always be kept at hand to ensure uninterrupted service from the pump. While ordering for spare parts, always give type, size and serial number of the pumps as stamped on the name plate.

PUMP TROUBLE

When investigating trouble with Kirloskar pumps, always remember that pumps have been tested at the factory and are mechanically correct when sent out. Discounting the possibility of damage during transit, most of the trouble in the field is due to faulty installation. Investigation shows that the majority of troubles with centrifugal pumps result from faulty conditions on the suction side.

BREAK DOWN-CAUSE-CHECK POINTS

In case of breakdown we recommend the location of the fault by using the following table.

BREAKDOWN	CHECK POINTS									
Pump does not deliver	1 18	7 19	8 23	9 25	10 26	11 56	12 57	14 58	15	17
Pump delivers at reduced capacity	1 11 22	2 12 56	3 13 57	4 14 58	5 15	6 17	7 18	8 19	9 20	10 21
Delivery performance deteriorates	1 20	3 21	7 22	9 23	10 24	11 53	12 57	13 62	14	19
Pump delivers too much	16	56	57	58						
Delivery is interrupted	1 14 58	3 15 62	6 16	7 19	8 22	9 23	10 25	11 26	12 56	13 57
After stopping pump runs in reverse direction	52									
Very noisy	1 19	2 20	5 22	6 54	7 55	8 56	11 57	12 62	13	15
Unsteady running of pump	19 39 55	20 40 58	22 43	31 44	32 47	33 48	35 49	36 50	37 51	38 54
Stuffing box leaks excessively	24	27	28	29	30	31	47	48	49	53
Fumes from stuffing box	22 42	23 43	24	25	26	27	28	29	30	41
Pump rotor locked in standstill position	22	45	46	50						
Pump is heating up and seizing	23 42	24 45	25 47	26 48	27 49	28 50	29 54	30	40	41
Bearing temperature increases	19 37 47	20 38 48	21 39 49	22 40 51	31 41 54	32 42 55	33 43 58	34 44	35 45	36 46
Motor will not start	14	22	60							
Motor gets hot or burns out	14 58	22 59	27 60	28 61	40	43	50	55	56	57
Motor is difficult to start	14	22	27	28	45	46	50	58	59	60

CHECK POINTS

1. Suction pipe, foot valve choked.
2. Nominal diameter of suction line too small.
3. Suction pipe not sufficiently submerged.
4. Too many bends in the suction line.
5. Clearance around suction inlet not sufficient.
6. Shut off valve in the suction line in unfavourable position.
7. Incorrect layout of suction line (formation of air pockets).
8. Valve in the suction line not fully open.
9. Joints in the suction line not leak-proof.
10. Air leaking through the suction line and stuffing box etc.
11. Suction lift too high.
12. Suction head too low (difference between pressure at suction connection and vapour pressure too low).
13. Delivery liquid contains too much gas and/or air.
14. Delivery liquid too viscous.
15. Insufficient venting.
16. Number of revolutions too high.
17. Number of revolutions too low.
18. Incorrect direction of rotation (electric motor incorrectly connected, leads of phases on the terminal block interchanged).
19. Impeller clogged.
20. Impeller damaged.
21. Casing rings worn out.
22. Separation of crystals from the flow of pumping liquid (falling below the temperature limit/equilibrium temp).
23. Sealing liquid line obstructed.
24. Sealing liquid contaminated.
25. Lantern ring in the stuffing box is not positioned below the sealing liquid inlet.
26. Sealing liquid omitted.
27. Packing incorrectly fitted.
28. Gland tightened too much/slanted.
29. Packing not suitable for operating conditions.
30. Shaft sleeve worn in the region of the packing.
31. Bearing worn out.
32. Specified oil level not maintained.
33. Insufficient lubrication of bearings.
34. Ball bearings over-lubricated.
35. Oil/Grease quality unsuitable.
36. Ball bearing incorrectly fitted.
37. Axial stress on ball bearings (no axial clearance for rotor).
38. Bearings dirty.
39. Bearings rusty (corroded).
40. Axial thrust too great because of worn casing rings, relief holes obstructed.
41. Insufficient cooling water supply to stuffing box cooling.
42. Sediment in the cooling water chamber of the stuffing box cooling.
43. Alignment of coupling faulty or coupling loose.
44. Elastic element of coupling worn.
45. Pump casing under stress.
46. Pipeline under stress.
47. Shaft runs untrue.
48. Shaft bent.
49. Rotor parts insufficiently balanced.
50. Rotor parts touching the casing.
51. Vibration of pipe work.
52. Non-return valve gets caught.
53. Contaminated delivery liquid.
54. Obstruction in delivery line.
55. Delivery flow too great.
56. Pump unsuitable for parallel operation.
57. Type of pump unsuitable.
58. Incorrect choice of pump for existing operating conditions.
59. Voltage too low/power supply overloaded.
60. Short circuit in the motor.
61. Setting of starter of motor too high.
62. Temperature delivery liquid too high.



GENERAL INFORMATION & SAFETY INSTRUCTIONS

1. The products supplied by KBL have been designed with safety in mind. Where hazards cannot be eliminated, the risk has been minimized by the use of guards and other design features. Some hazards cannot be guarded against and the instructions below **MUST BE COMPLIED WITH** for safe operation. These instructions cannot cover all circumstances. Installation, operation and maintenance personnel must use safe working practices at all the times.

- 1.1 KBL products are designed for installation in designated areas, which are to be kept clean and free of obstructions that may restrict safe access to the controls and maintenance access points.

A pump duty nameplate is fitted to each unit and must not be removed. Loss of this plate could make identification impossible. This in turn could affect safety and cause difficulty in obtaining spare parts. If accidental loss or damage occur, contact KBL immediately.

- 1.2 Access to the equipment should be restricted to the personnel responsible for installation, operation and maintenance and they must be trained, adequately qualified and supplied with appropriate tools for their respective tasks.
- 1.3 Most accidents involving product operation, maintenance and repair are caused by failure to observe safety rules or precautions. An accident can often be avoided by recognizing potentially situations before an accident occurs. A person must be aware of potential hazard associated in activities of installation, operation and maintenance of equipment.
- 1.4 KBL requires that, all personnel who are responsible for installation, operation or maintenance of the equipment, have access to and study the product instruction manual **BEFORE** any work is done and that they will comply with all local and industry based safety instructions and regulations.
- 1.5 Ear defenders should be worn where the specified equipment noise level exceeds locally defined safe levels. Safety glasses or goggles or face shield should be worn where working with pressurized systems and hazardous substances. Other personal protection equipment must be worn where local rules apply. Wear safety shoes, helmets and cotton overall [Apron] when you enter pump house. Noise level should not exceed 90 dbA and 110 dbA for motor driven and engine driven pumps, respectively.
- 1.6 Do not wear loose clothing or jewellery, which could catch on the controls or become trapped in the equipment.
- 1.7 Read the instruction manual before installation, operation or maintenance of the equipment. Check and confirm that you are referring relevant copy of the manual by comparing pump type on the nameplate and with that on the manual.
- 1.8 Note the "Limits of product application permissible use" specified in the manual. Operation of the equipment beyond these limits will increase the risk from hazards noted below and may lead to premature and hazardous pump failure.
- 1.9 Clear and easy access to all controls, gauges and dials, etc., must be maintained at all times. Hazardous or flammable materials must not be stored in pump rooms unless safe areas or racking and suitable container have been provided.
- 1.10 Use suitable earthing and tripping devices for electrical equipment.

2. **IMPROPER INSTALLATION, OPERATION, MAINTENANCE, LUBRICATION, REPAIR OF THIS KBL PRODUCT COULD RESULT IN INJURY OR DEATH.**

If any tool, procedure, work method and operation technique is not recommended by KIRLOSKAR BROTHERS LIMITED is used or followed, it should be ensured that it is a safe for personnel around and others. It should also be ensured that the product will not be damaged or made unsafe by the operation, lubrication and maintenance or repair procedures you choose.



3. SAFETY INSTRUCTIONS WHILE HANDLING AND STORAGE

When lifting the pump, use the lifting points specified on general arrangement drawing, if provided. Use lifting equipment having a safe working load rating suitable for the weight specified. Use suitable slings for lifting pump, which is not provided, with lifting points. The use of forklift truck and chain crane sling equipment is recommended but locally approved equipment of suitable rating may be used. While lifting, the equipment adjusts the center of gravity, so that it is balanced properly.

Do not place fingers or hands, etc., into the suction or discharge pipe outlets and do not touch the impeller, if rotated this may cause severe injury. To prevent ingress of any objects, retain the protection covers or packaging in place until removal is necessary for installation. If the packaging or suction and discharge covers are removed for inspection purposes, replace afterwards to protect the pump and maintain safety.

4. SAFETY INSTRUCTIONS WHILE ASSEMBLY & INSTALLATION

Shaft alignment must be checked again after the final positioning of the pump unit and connection to pipework as this may have disturbed the pump or motor mounting positions. If hot liquids [above 80°C] are being pumped, alignment should be checked and reset with the pump and motor at their normal operating temperature. If this is not possible, KBL can supply estimated initial offset figures to suit extreme operating temperatures. Failure to support suction and delivery pipework may result in distortion of the pump casing, with the possibility of early pump failure.

5. SAFETY INSTRUCTIONS WHILE COMMISSIONING & OPERATION

Never attempt adjustments while the pump is running, unless otherwise specified in the operation, maintenance manual.

Do not touch any moving or rotating parts. Guards are provided to prevent access to these parts, where they have been removed for maintenance they must be replaced before operating the equipment.

Check that pump is primed. Pump should never be run dry as the pumped liquid acts as lubricant for the close running fits surrounding impeller and damage will be incurred.

Failure to supply the stuffing box or mechanical seal with cooling of flush water may result in damage and premature failure of the pump.

Do not touch surfaces, which during normal running will be sufficiently hot to cause injury. Note that these surfaces remain hot after the pump has stopped, allow sufficient time for cooling before maintenance. Be cautious and note that other parts of the pump may become hot if a fault is developing.

Do not operate water pumps in temperatures below freezing point, without first checking that the pumped fluid is not frozen and the pump is free to turn. Pumps in these environments should be drained down during inactivity and re-primed before starting.

In addition to local or site regulations for noise protection, KBL recommend the use of personal ear protection equipment in all enclosed pump rooms and particularly those containing diesel engines. Care must be taken to ensure that any audible alarm or warning signal can be heard with ear defenders worn.

Be aware of the hazards relating to the pump fluid, especially the danger from inhalation of noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.



6. SAFETY INSTRUCTIONS WHILE MAINTENANCE & SERVICING

Do not attempt repairs of the pump or its accessories which you do not know. Use proper tools.

Before attempting any maintenance on a pump particularly if it has been handling any form of hazardous liquid, it should be ensured that the unit is safe to work on. The pump must be flushed thoroughly with suitable cleaner to purge away any of the product left in the pump components.

This should be carried out by the plant operator and a certificate of cleanliness obtained before starting work. To avoid any risk to health it is also advisable to wear protective clothing as recommended by the site safety officer especially when removing old packing, which may be contaminated.

Isolate the equipment before any maintenance work is done. Switch off the main supply, remove fuses, apply lockouts where applicable and affix suitable isolation warning signs to prevent inadvertent reconnection. In order to avoid the possibility of maintenance personnel inhaling dangerous fumes or vapours, it is recommended that maintenance work be carried out away from the pump location by removal of the rotating unit assembly to a suitable maintenance area.

Check and ensure that the pump operates at below the maximum working pressure specified in the manual or on the pump nameplate and before maintenance, ensure that the pump is drained down.

Wear a suitable mask or respirator when working with packing and gasket containing fibrous material, as these can be hazardous when the fibrous dust is inhaled. Be cautious, if other supplier's components have been substituted for genuine KBL parts, these may then contain hazardous materials.

Store all oily rags or other flammable material in a protective container in a safe place. Do not weld or flame cut on pipes/tubes that contain flammable fluids. Clean them thoroughly with nonflammable solvent before welding or flame cutting on them. Use solvent/chemical resistant gloves for hand protection.

Dispose of all wastes like gaskets, gland packing, oil, batteries, packing material, etc., in accordance with local regulation.

Adequacy of suitable crane should be checked before lifting the pump/pump components. Also condition of pulleys, chain and lifting shackles should be checked before use.