



Enriching Lives

INSTRUCTIONS ON INSTALLATION, OPERATION AND MAINTENANCE FOR KIRLOSKAR PUMP TYPE - KPDS - KPDSQF



KIRLOSKAR BROTHERS LIMITED

REGISTERED OFFICE "Yamuna", Survey No. 98 (3 to 7), Baner, Pune 411 045
GLOBAL HEADQUARTERS, "Yamuna", Survey No. 98 (3 to 7), Baner, Pune 411 045

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WARRANTY

We warrant that the pump supplied from us is free from defective material and faulty workmanship. This warranty holds good for a period of 12 months from the date of commissioning the equipment or 18 months from the date of dispatch 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 or arise solely from faulty workmanship or defective material.

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

KIRLOSKAR BROTHERS LIMITED

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Note: A copy of **General instructions for maintenance, operation & maintenance of 'Kirloskar pumps'** is attached at the end of this manual.

1. INTRODUCTION:

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



CAUTION:

- Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

- Save this manual for future reference, and keep it readily available at the location of the unit.

➤ Product Description: -

1.1 'KIRLOSKAR' make **KPDS - KPDSQF** pumps are used for handling various types of chemical liquids like acids, alkalis, hazardous liquids, hydrocarbons and water. These pumps are manufactured to close tolerance and are of rigid construction, However, proper installation, operation and maintenance are equally important to ensure trouble free service. This booklet covers important guidelines and instructions for installation, operation and maintenance. These instructions should be followed carefully for satisfactory performance of the pumping unit. Only mechanical aspects are dealt within this booklet.

1.2 This booklet covers instructions for following types of KPDS and KPDSQF series.

Unit 80C25	Unit 100C25	Unit 150C38	Unit 150C45 (1450RPM only)
20/13QF	25/16QF	25/26A#	65/32 *
20/16QF	32/13*	32/26 *	80/32 *
20/20QF	32/16*	40/26 *	80/40*/80/40N#
	32/16A#	40/32 *	100/26#
	32/20*	50/26 *	100/32 *
	32/20A#	50/32 *	100/40 *
	40/13*	65/16 *	125/26 *
	40/16*	65/20 *	125/32 *
	40/20*,40/20A#	65/26 *	125/40#,125/45#
	50/13*	65/26N#	125/40N#
	50/16*	80/16 *	150/32*,150/32N#
	50/16A#	80/20 *	150/40#
	50/20*	80/26 *	65/43#
	65/13*	100/20 *	

NOTES:

- a) *Marked pumps are also supplied with semi-open (QF) type impeller as an option.

- b) # Marked pumps are supplied with "Enclosed" type impeller only.
- c) KPDS40/32QF & 50/32QF supplied in 1450 RPM only.

1.3 Description of KPDS pumps.

KPDS - KPDS pumps with enclosed impeller

KPDS-QF - KPDS pumps with semi open impeller.

KPDS - KIRLOSKAR PROCESS DEVELOPMENT SUMP

KPDS 32/13

32 INDICATES DELIVERY SIZE OF PUMP IN mm

13 INDICATES NOMINAL IMPELLER DIAMETER IN cm

Maximum column length & pump will be supplied in assembled condition up to 6.0 meters.

1.4 The complete range of 'KPDS' pump is covered by four driving units thereby reducing inventory and achieving interchangeability.

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

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

2. SAFETY INSTRUCTIONS:

2.1. General Information:

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

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.

2.1.2 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 the appropriate tools for their respective tasks.

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

2.1.4 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.

2.1.5 *DO NOT* wear loose or frayed clothing or jewelry, which could catch on the controls or becomes trapped in the equipment.

2.1.6 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.

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

2.1.8 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.

2.2 Environmental safety:

Always keep the station clean to avoid and/or discover emissions.

Waste and emissions regulations:

Observe these safety regulations regarding waste and emissions:

- Appropriately dispose of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.

Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

Recycling guidelines

Always follow local laws and regulations regarding recycling.

2.3 Transport handling and storage instructions:

2.3.1 Transport-

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

2.3.2 Handling-



WARNING:

- Make sure that the pump cannot roll or fall over and injure people or damage property.
- These pumps might use carbon or ceramic silicon carbide components. Do not drop the pump or subject it to shock loads as this can damage the internal ceramic components.

NOTICE:

Use a forklift truck or an overhead crane with sufficient capacity to move the pallet with the pump unit on top. Failure to do so can result in equipment damage.

2.3.3 Lifting methods-



WARNING:

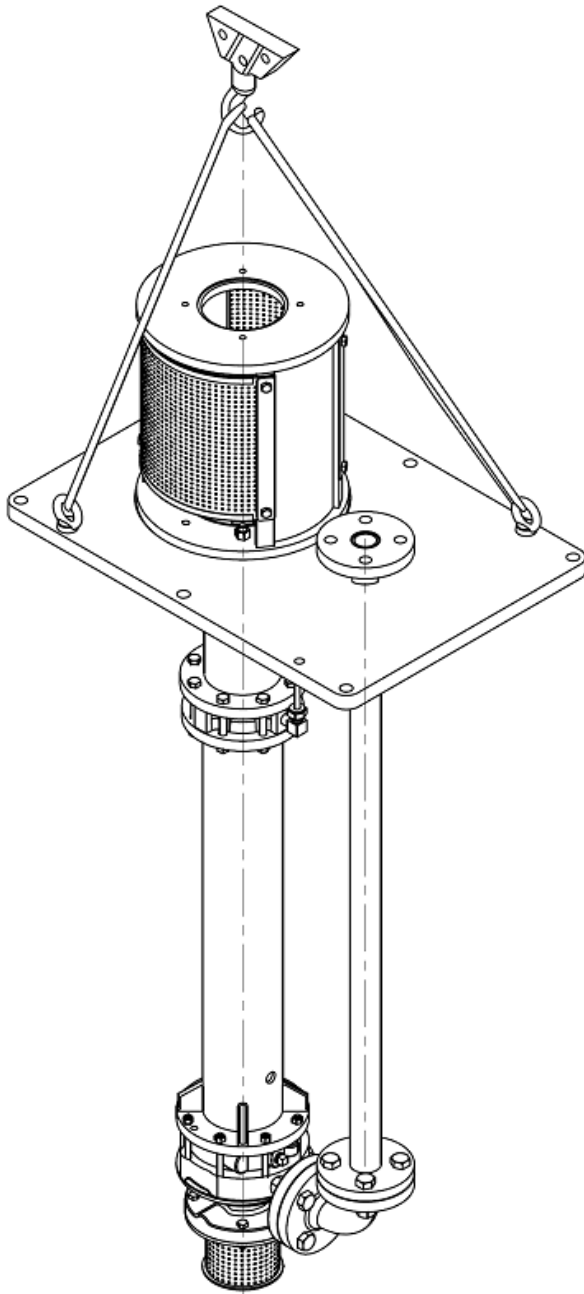
- Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.
- Do not attach sling ropes to shaft ends.

Use the supplied lifting lugs and suitable slings in order to lift the entire pump to a vertical position and lower the unit into the sump. Then use the lifting lugs on the motor and a suitable sling in order to hoist the motor into position. Use a tag line attached to the casing end in order to prevent the pump from swinging. Refer Figure 1.

Pump set must be lifted from the lifting eye bolts provided on the support plate by using suitable four chain lifting equipment.

LIFTING ARRANGEMENT

A) With Rectangular Support plate



B) With Round Support plate

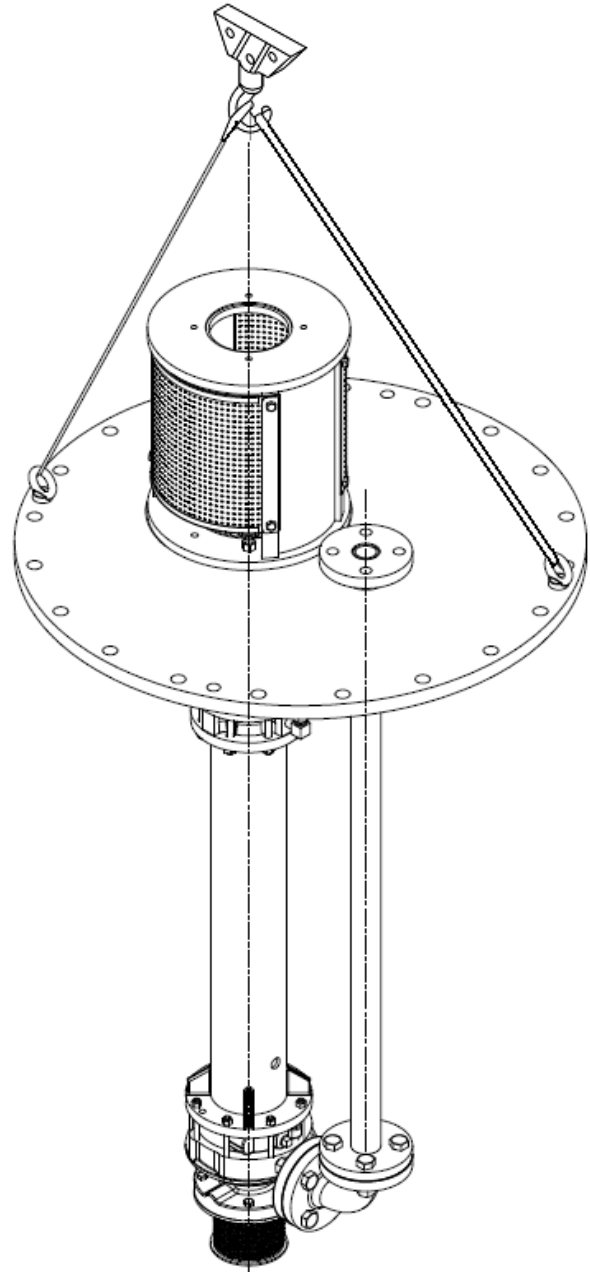


Figure 1

NOTE: It is recommended to dismantle the motor from pump along with electrical connections and then lift the pump assembly. This is recommended to avoid damage to the motor, proper alignment and levelling while commissioning the pump.

2.3.4 Storage.

2.3.4.1 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.

2.3.4.2 Long storage instructions above 6 months & up to 2 Years-

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. Care should be taken to protect the pump from moisture, dust, dirt and foreign bodies. It is recommended that following has to be followed-

- a) Ensure that the bearings are packed with the recommended grease, to prevent moisture entry.
- b) 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.
- c) 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.
- d) The shaft should be manually rotated periodically preferably once in a month to prevent pitting of the bearing surfaces by moisture.

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. PRE-REQUISITES FOR SATISFACTORY OPERATION:

For satisfactory working of the pump insure that the following preliminary conditions are maintained.

- a) Pump handles the liquid as specified in the order.
- b) The liquid is free of solid particles since the P.T.F.E (Teflon) bearing life is greatly affected by solids in the liquid.
- c) Minimum submergence is kept as shown in the outline dimension drawing supplied against the order.
- d) Operation & maintenance instructions are followed as given in this booklet.
- e) Load of delivery pipe & other accessories such as sluice valve, reflux valve, etc. is not coming directly on support plate.

Prior confirmation must be taken from the manufacturer/supplier, if the pump is to be used for the conditions other than those specified in the order.

4. PUMP HOUSE / TANK LAYOUT:

The layout should be done after considering following-

4.1 Liquid inlet to the tank:

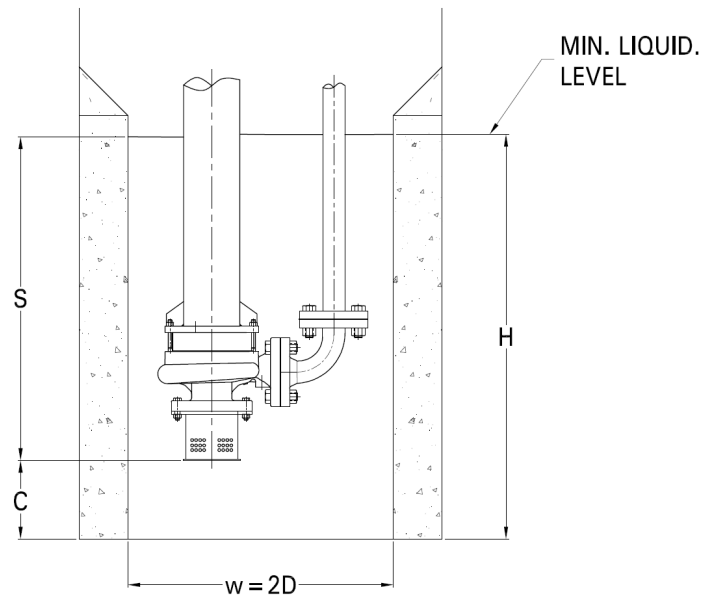
The liquid should enter in the tank such that turbulence, high velocity and air entrainment are avoided at the suction of the pump.

4.2 Suction tank:

The tank should be designed to be so as to provide-

- 4.2.1 Enough storage capacity to avoid sudden fluctuations in the liquid level, kinematics disturbances at the suction of the pump such as turbulences, eddies, vortices, air entrainment.
- 4.2.2 Low velocity:
Maximum liquid velocity of the liquid entering the tank should not exceed 1 m/sec.
- 4.2.3 Individual flow pattern:
Where one tank houses more than one pumping sets, care must be taken to provide appropriate distances from walls, floor & adjacent pipes. It is advised that such layouts should be referred to pump manufacturer. This is necessary to ensure individual flow pattern of each pump undisturbed by other pumps.
- 4.2.4 Pump Submergence:
The lowest liquid level should be as recommended in the outline drawing supplied against the order. Highest liquid level also be below specified level on the same drawing. The liquid level in the tank should be positively controlled by liquid level controller/ float switch.

Below is the reference from HI pump intake design.



Dimension Variable	Description	Recommended value
C	Distance between the inlet bell & floor	$C = 0.3 D$ to $0.5 D$
D	Inlet bell design outside diameter	Suction size of pump
H	Minimum liquid depth	$H = S + C$
S	Minimum pump inlet bell submergence	$S = D(1.0 + 2.3F_D)$
w	Constricted bay width near pump inlet bell	$w = 2D$

Where, $F_D = \text{Froude Number} = V / \sqrt{(gD)}$
 $V = \text{Velocity at inlet face} = \text{Flow} / \text{Area}$

5. PUMP HOUSE REQUIREMENTS:

These should cover mainly the following aspects.

5.1 The floor of tank should be sturdy enough to take total weight of the machine including that of liquid column in the rising pipe/ column pipe, axial thrust of impeller, etc.

5.2 Sufficient floor area for working & overhauling. In this following factors are to be considered.

5.2.1 Proper spacing of the pump to avoid transmission of vibrations from one machine to another.

5.2.2 Easy & safe accessibility to the electrical switch box.

5.2.3 Space for dismantled pump parts during overhauling.

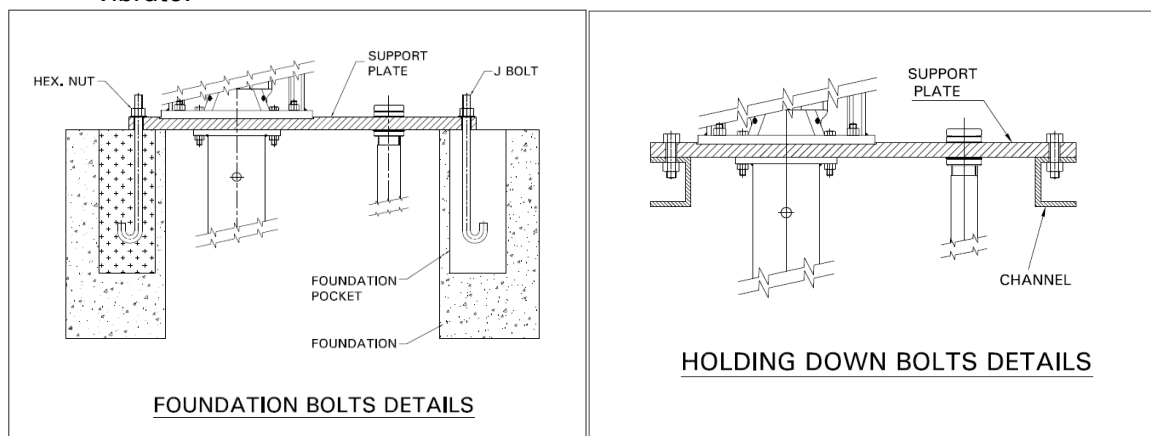
5.3 Sufficient height of the room for erection. Provision for overhead traveling crane or chain pulley block.

5.3.1 The pump house should provide adequate height of the room between the foundation and upper most position of the crane hook. The minimum required height is shown on outline drawing against order.

5.3.2 The pump house should provide sufficient cross travel of the trolley so that the pump assembly can be moved without any hindrance or receiving any undue stress during movement.

6. FOUNDATION:

6.1 The location of foundation bolts should be marked out as per the outline drawing supplied in advance. The supporting frame should be strong enough to take the load of complete unit, axial thrust, etc. and should be rigid enough not to vibrate.



6.2 Leveling

For smooth working of the pumps, it is necessary that the motor stool keeps up its horizontal level perfectly and the assembly keeps up its vertical position. The rotating unit should be aligned with the vertical axis.

The whole foundation frame plane position on which the support plate is to be mounted should be checked with straight edge and spirit level (0.05 mm accuracy) for its horizontal level. The plane portion should be made horizontal by scraping operation, if necessary. Use gasket in between support plate & foundation plane portion so that the joints become leak tight for gases and air coming out of the

tank. After tightening the foundation bolts, ensure that the top portion of the motor stool is exactly horizontal.

6.3 Ensure that the holes on the delivery flange above support plate and that of delivery pipe to be connected to it, exactly match, with proper uniform clearance in between pipe flanges. That clearance will not give any rise to horizontal displacement of the pumping unit. Due care should be taken to see that load of the delivery pipes & accessories such as sluice valve, reflux valve, etc. should not come on support plate. Separate firm supports should be given to the delivery pipe and its accessories.

7. TOOLS AND EQUIPMENT'S:

Essential equipments required for erection are as follows.

- 7.1 The chain pulley block/crane should be of ample capacity to take the load of the complete unit. The pulley block should have lift of three-meter minimum and the hand chains provided should be long enough to operate it conveniently from the floor. The chain pulley block of 3 tons capacity is more suitable.
- 7.2 Chain and lifting hook.
- 7.3 Jute ropes, crow bars & small pipes for leverage.
- 7.4 Light but accurate straight edge.
- 7.5 Kerosene or thinner for cleaning of parts.
- 7.6 Spirit level having the accuracy of 0.02 mm per meter.
- 7.7 Small wire brush for cleaning threads at shaft.
- 7.8 Threading compounds for shaft and pipe threads.
- 7.9 'V' blocks, dial gauge with magnetic stands to check run out of shafts.
- 7.10 Two sturdy wooden logs or mild steel girders to rest the clams during erection process.
- 7.11 Besides following standard tools and equipments should be available for smooth erection.
 - 7.11.1 Files triangular, half round and flat of different cuts and sizes.
 - 7.11.2 Triangular scraper, filler gauge.
 - 7.11.3 Two sets of standard/ring spanners.
 - 7.11.4 Set of wrenches and chain tang.
 - 7.11.5 Adjustable spanners, screw drivers of 12" & 6".
 - 7.11.6 Allen keys.
 - 7.11.7 Steel rule and steel tape.
 - 7.11.8 Set of taps and dies up to M16.
 - 7.11.9 Chisel, hammer, hacksaw, vice, etc.
 - 7.11.10 Emery paper, cloth.

8. EQUIPMENT SCHEDULE:

8.1 Installation:

For location, preparing foundation, installation, alignment, piping, general maintenance, trouble shooting, etc. the instructions given in our publication - 'GENERAL INSTRUCTIONS FOR INSTALLATION OPERATION AND MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS' which is also printed along with this booklet must be followed very carefully. The external sealing connection to the pump, if applicable, must be made after installing and before commissioning the pump. Pump on hot service must have final coupling alignment made with the unit at its operating temperature.

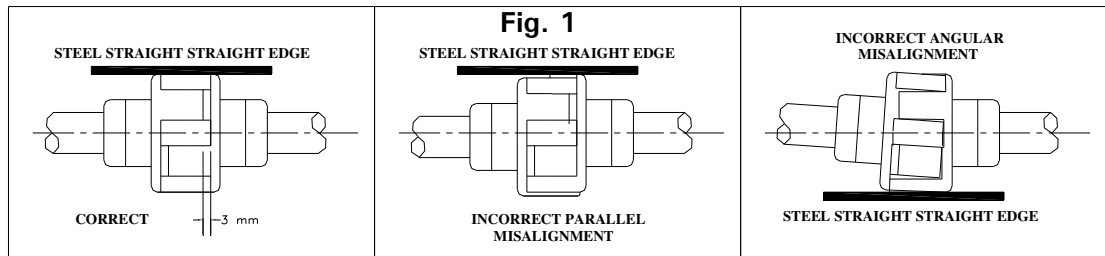
8.2 Mounting and alignment:

A flexible coupling is used to connect pump shaft to the driver. However other types of coupling can be supplied against request.

8.2.1 Alignment-

ALWAYS REMEMBER "A FLEXIBLE COUPLING IS NOT A UNIVERSAL JOINT". Correct alignment is essential for the smooth operation of the pump. There are two types of misalignment between the pump shaft and the drive shaft, which are:

- 1) Angular misalignment – shaft with axis concentric, but not parallel.
- 2) Parallel misalignment – shaft with axis parallel, but not concentric.



This misalignment is checked by using a straight edge as shown in Fig. 1 given above.

Following points should be checked before alignment.

- i) Check the direction of rotation of prime mover before mounting.
- ii) Fix the motor on motor stool.
- iii) Check the float adjustment and start aligning the coupling.
- iv) Check free rotation of shaft after alignment.

Before commissioning the pump set, please ensure:

- A. The pipe connections are flushed and tightened properly.
- B. Alignment is proper.
- C. Auxiliary piping connections such as external lubrication connections, cooling connections, etc. are made.

9. EQUIPMENT OPERATION:

9.1 Before starting the pump check the following:

- 1) The pump rotates freely by hand.
- 2) The cooling water connections are properly tightened and adjusted.
- 3) The direction of rotation of driver. It should correspond to the direction of rotation of pump.

- 4) Valve on delivery side is closed.
- 5) The cock for pressure gauge connection is closed.

9.2 Starting the pump

- 1) Start the pump.
- 2) Open the valve on delivery line gradually.
- 3) Regulate the required flow by adjusting the delivery valve.
- 4) Open the cock for pressure gauge connection.

9.3 During running the pump check the following things and regulate if needed -

- 1) The pump is running smooth.
- 2) The flow of cooling water is uninterrupted.
- 3) The bearings are not getting abnormally hot.
- 4) Head and capacity developed by the pump is as specified.
- 5) Power consumption is within limit.
- 6) Ensure that there is no mechanical friction in the pipe.
- 7) Stop the pump immediately, if any, defects are detected. Do not start the pump unless the defects are rectified. Report immediately to the supplier, if it is not possible to rectify the defects.

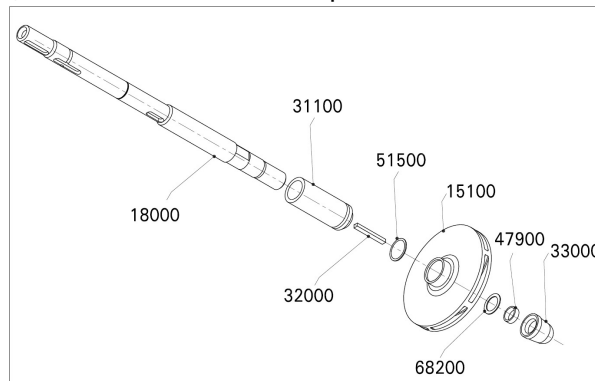
9.4 During stopping the pump

- 1) Close the valve on the delivery line.
- 2) Stop the motor.
- 3) Close the cooling water liquid connections.
- 4) It has always recommended that use of NRV (Non return valve) in delivery pipe to avoid back flow during stopping the pump.

10. ERECTION/ASSEMBLING PROCEDURE:

Follow the procedure given below in case of pumps to be erected for the first time or pumps to be assembled after dismantling for overhauling. Clean all the parts thoroughly in Kerosene, Petrol or Benzene to remove dust, dirt, etc. Replace the parts with a new one if found damaged. Use new gaskets and "O" rings at the time of reassembly of pump.

10.1 Insert shaft sleeve for pump side (31100) on pump shaft/impeller shaft (18000/18600) with key for impeller (32000) in proper position. Mount impeller (enclosed 15100 /semi open15300) on the shaft with gasket (51500) in position. Fit the helicoil screw (47900) in the impeller nut (33000) by using special tool, tighten the impeller nut (33000) with gasket (68200) in between the impeller and Impeller nut. For KPDS 20/13, 20/16 and 20/20QF impeller nut is inbuilt in impeller.



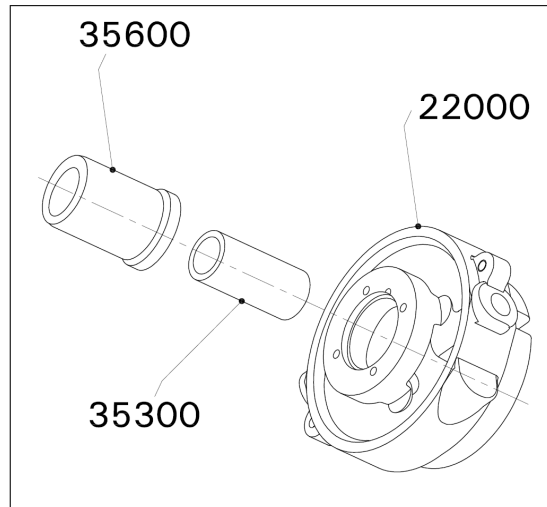
10.1.1 Procedure for fitting bearing bush:

Applicable for 80C25 and 100C25 unit pumps-

Press the bearing bush (35300) in casing cover (22000) and drill and tap (M6x10L), bush and casing cover together at the junction of bush and casing cover (for 80C25 and 100C25 unit pumps). Fit a grub screw in the tapped hole to avoid rotation of bush (this is necessary in case of replacement of bush only).

10.1.2 Applicable for 150C38 and 150C45 unit pumps-

Press the bearing bush (35300) in bearing shell (35600) and drill and tap (M6x10L), bush and bearing shell together at the junction of bush and bearing shell. Fit a grub screw in the tapped hole to avoid rotation of bush. Now fit the bearing shell along with bush in casing cover and fix the hex. socketed cap screws (66601). Mount the cover (27801) on bearing shell and fix 4 nos. non metallic screws.

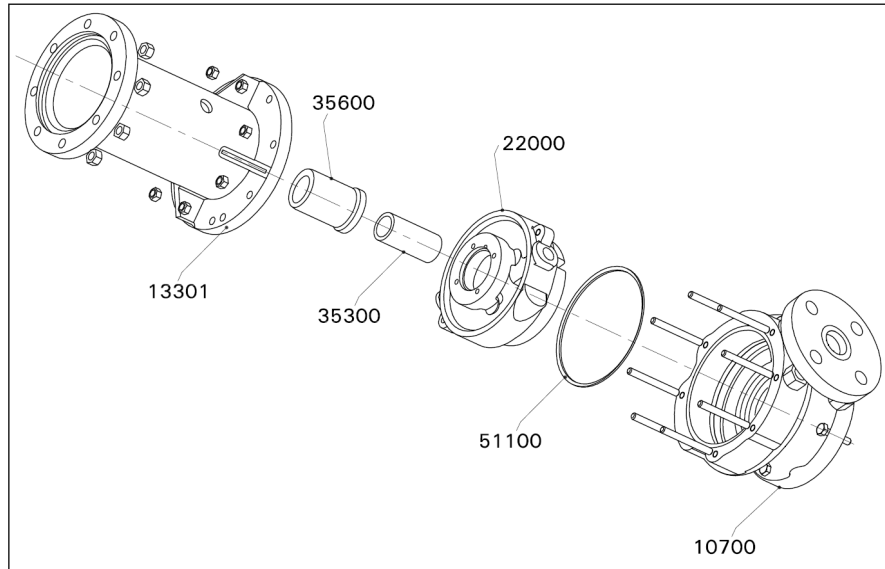


10.2 Insert casing cover (22000) on to the pump shaft/impeller shaft (18000/18600) and shaft sleeve (31100). Insert the assembly so far completed in to pump casing (10700) with gasket (51100) in proper position. Tighten the hex. nuts on pump casing studs diametrically opposite evenly.

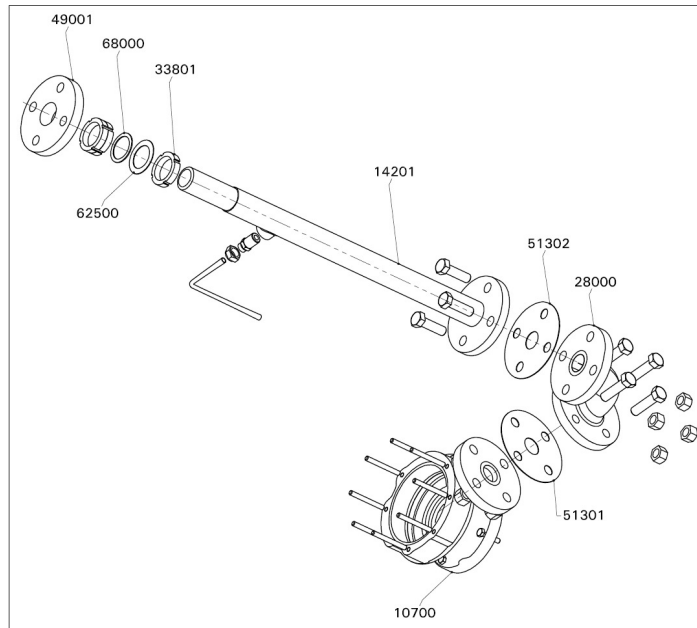
Mount bottom column pipe (13301) on casing cover and tighten nuts on pump casing studs. In short casing cover is sand-witched between pump casing and bottom column pipe.

NOTE: For pumps with impeller diameters 32 & 40 cm (e.g. KPDS 40/32, 80/40, etc.) and KPDS 20/16QF casing cover is double flanged, hence first nuts on casing cover to be tightened and then bottom column pipe (13301) to be mounted on casing cover (22000).

10.3 Mount bottom column pipe (13301) on casing cover (22000), tighten the nuts on casing cover studs diametrically opposite evenly.



10.4 Connect bend (28000) to the pump casing (10700) with gaskets (51301) in between the flanges. Also connect the first rising pipe (14201) (if the rising pipes are in two pieces) to the bend with gasket (51302) in between the flanges and tighten the nuts and bolts.

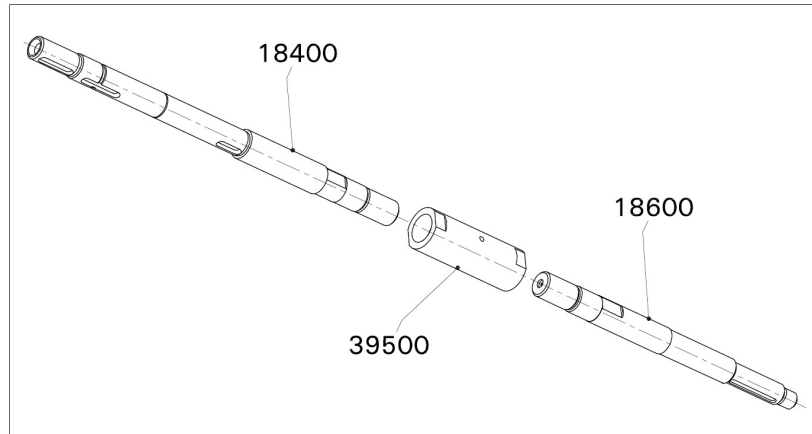


10.5 Apply thread compound liberally inside the screwed coupling (39500). Fit the screwed coupling on impeller shaft (18600) and then fit intermediate shaft (18400). While fitting screwed coupling, note that-

10.5.1 Use of thread compound is a must to prevent rust seizing.

10.5.2 Half of the screwed coupling length should come on each shaft.

10.5.3 Ends of shafts should rest on each other perfectly. Ensure this by taking Colour seat.



- 10.6 Fit adapter to casing cover and tee joint to bearing spider (if applicable). Connect the transmission bearing flushing pipe to adapter with the help of nuts. (Applicable if transmission bearing lubrication is external clear compatible liquid, otherwise fix plug to the casing cover).
- 10.7 Fix the clamp to the bottom column pipe (13301).
- 10.8 Lift the unit vertically with the help of slings and chain pulley block. While lifting take care that no part of the pump is being dragged against the floor.
- 10.9 Put two girders or strong wooden logs across the opening of the tank in which pump is to be fitted. Rest the clamp while erecting the pump. Lower the unit till the clamp rests on the girders.
- 10.10 Press the intermediate bearing bush (35100) in bearing spiders (24500) then drill and tap (M6x10L) one hole at the junction of bush and bearing spider. Fit one grub screw in the tapped hole to avoid the rotation of bush (This is required in case of replacement of bush only). Mount cover (27801) on bearing spider with the help of screws. Fix non-metallic screw on bearing spider to avoid the rotation of bush.
- 10.11 Mount bearing spider (24500) on the bottom column pipe (13301).
- 10.12 Mount standard column pipe (13302) on bearing spider (24500). Fix it with the help of screw and nuts. Tighten the diametrically opposite nuts one by one. Fix three way pieces to the bearing spider (24500) and connect the flushing pipe coming from casing cover (22000). Also fix one more flushing pipe to another end of three way piece with the help of sealing nut.
- 10.13 Apply thread compound liberally inside the screwed coupling (39500) fitted on the pump shaft and threaded portion of intermediated shaft (18400). Fit the successive screwed coupling in to intermediate shaft (18400) and intermediate shaft in to the screwed coupling already fitted on the pump shaft (18600).
- 10.14 Lift the column pipe (13302) with the help of another clamp.
- 10.15 Lower the standard column pipe (13302) and fix to the lower column pipe (13301) with the bearing spider in between. Tighten the diametrically opposite nuts one by one.

Fix another clamp to the standard column pipe (13302). Now fix the slings to the upper clamp.

10.16 Fit a T joint on bearing spider and connect the end of first flushing pipe. Also connect the successive bearing flushing pipe to the T joint with the help of nut.

Remove clamp fixed on bottom column pipe. Lower the unit till the clamp rests on girder.

10.17 Lift the complete unit slightly and remove the clamp of bottom column pipe (13301). Lower the complete unit till the clamp fixed to the standard column pipe (13302) rest on girder.

10.18 Mount bearing spider along with intermediate bush on standard column pipe (13302). Mount top column pipe (13200) and fix it with the help of screws and nuts. Tighten the diametrically opposite screws one by one.

10.19 Repeat procedure given in 10.13, 10.14, 10.15, 10.16 and 10.17 till head shaft (18500), top column pipe (13200) and bearing flushing pipes are fitted. Let the whole unit rest on the clamp fixed on the top column pipe.

10.20 While fitting the column pipes, rising pipes are also to be fitted if rising pipes are in more than one piece.

10.21 Mount the shaft sleeve (31000) with O-Ring (52300) and key (32300). Mount circlip (48600) to locate the shaft sleeve.

10.22 Fit the pipe nut (33801) with gasket (68000) and washer (62500) on rising pipe (14201).

10.23 Fit the adapter plate (46100) to the stuffing box housing (23800) with gasket (51200) in between.

10.24 Lift the support plate (46700) with the help of eye bolts (30000) and mount on top column pipe (13200). Also mount the stuffing box housing (23800) on the support plate (46700) with gasket at the joint and clamp the stuffing box housing, support plate and top column pipe together with the help of bolts. Tighten diametrically opposite bolts evenly.

10.25 Adjust the pipe nut (33801) till it touches the support plate. Tighten the pipe nut (33802) above support plate till it touches the support plate. Mount delivery flange (49001) on rising pipe (14201) above support plate (46700).

Fix the flushing pipe to the support plate by using adapter and sealing nut.

10.26 Lift the unit slightly and remove the clamp fixed to the standard column pipe (13302). Remove the girders used for erection and lower the unit till support plate rests on the top of the tank.

Caution

: USE SUITABLE GASKET IN BETWEEN TANK FLANGE AND SUPPORT PLATE (IF APPLICABLE)

10.27 With the hanging support to the support plate, adjust the holes of support plate with that of the tank holes.

10.28 Insert the gland packing (43000) and lantern ring (22700) into the stuffing box housing (23800) with 3 + L + 2 sequence.

10.29 Mount gland (22900) on stuffing box housing. Do not tight the nuts.

10.30 Replace the oil seal (50002) if it is damaged. Mount bearing holder (25400) on to the stuffing box housing (23800) (For 80C25 and 100C25 unit pumps).

Fit the oil seal (50001) in bearing cover (27001) and another oil seal (50002) in bearing holder (25400).

10.31 Mount angular contact ball bearings (26300) with exact position on thrust bearing carrier (24700). [Bearing should be fitted in such a way that axial thrust in downward direction is taken by the bearing].

Mount the above assembly in bearing holder (25400) and mount the bearing holder on stuffing box. Fix it with the help of screws. Insert the spacer for thrust bearing carrier (19800) with key (32400). This is for 150C38 and 150C45 unit pumps.

10.32 Insert the thrust bearing carrier (24700) in to the head shaft (18500). Insert the spacer for thrust bearing carrier (19800) with key (32400). Insert the key (32400) on the head shaft. This is for 80C25 and 100C25 unit pumps.

Fit the bearing cover after replacing oil seal if found damaged.

10.33 Insert the lock washer (41501) on head shaft (18500) and then fit bearing nut (33500) and lock nut (33600) on the head shaft (18500). Do not tighten the lock nut till the final stage of assembly.

10.34 Mount the motor stool (29000) on support plate (46700) and tighten the nuts.

10.35 Tighten the holding down bolts of the support plate (46700). Check the level on the machined surface of the upper motor stool (29000). It should be levelled accurately to the limit of 0.05 mm. Use gasket places underneath the support plate to adjust the level.

10.35 Float adjustment –

10.35.1 For Semi-open type impeller pumps - Lift the rotating unit by 0.5-1.00 mm so that impeller rotates freely. Tighten the lock nut (33600) to lock the bearing nut. Fold one arm of lock washer (41500) in the bearing cover slot and fold remaining arms on bearing nut (33500).

10.35.2 For enclosed impeller pumps - Mount the magnetic stand of dial indicator on the motor stool (29000) and pop up the dial gauge on the top portion of the head shaft (18500). Adjust the zero of dial gauge. Loose the bearing nut (33500) so that the impeller will touch casing ring. Note the reading on dial gauge. Now tight the bearing nut so that impeller will touch the casing cover. Note the reading on dial gauge. Calculate the difference between two readings. Now adjust the bearing nut so that the difference is half of the reading. Tighten the lock nut (33600) to lock the bearing nut. Fold one arm of the lock washer (41501) in the bearing cover slot and fold remaining arms on bearing nut (33500).

Caution

ENSURE THAT THE SHAFT ROTATES ABSOLUTELY FREE.

- 10.36 Mount the pump half coupling (39000) and tighten the set screw. Put coupling star (40300) in between (in case of coupling without spacer).
- 10.37 Make all the connections of valves and delivery pipe above support plate (46700).
- 10.38 Once again check the level on the machined surface of the motor stool (29000). If level is disturbed once again it should be reset up in the range of 0.05 mm.
- 10.39 Make the motor electric connections. Mount the motor half coupling (39100) and tighten the set screw of the coupling. **Check the direction of rotation before mounting the motor on the motor stool.** The direction of rotation of motor should be **CLOCKWISE** when viewed from top i.e. non-driving end of the motor.
- 10.40 Mount the motor on the motor stool. Check the angular alignment with the help of filler gauge and parallel alignment with the help of straight edge and filler gauge. Alignment should be within 0.05 mm.
- 10.41 Grease the bearing (26300) with the help of grease gun.
- 10.42 Ensure that liquid level controller is fitted and is working properly.
- 10.43 Clearance between impeller vanes and wear plate should be 0.3 to 0.5 mm in case of pumps with semi-open impeller.
- 10.44 Interchangeability:
Parts standardization is optimized utilizing interchangeable components to cover a very wide performance. This unique feature enables the customer to have a very low spare parts inventory even though he may have many sizes of these pumps.

11. OPERATION:

11.1 Prior to starting:

- 11.1.1 Rotate the coupling by hand. It should rotate freely.
- 11.1.2 Ensure that submergence is more than the recommended minimum on outline drawing. Use of liquid level controller is recommended.
- 11.1.3 Ensure direction of rotation of Motor is CLOCKWISE (when viewed from non-driving end) before connecting motor coupling to pump coupling.
Incorrect rotation even for small duration will quickly damage the pump.

11.1.4 Ensure that external clear compatible liquid connection for lubricating the bearing bushes is given as per details mentioned on outline drawing (in case of external lubrication).

11.2 Putting the pump in operation:

11.2.1 Start the pump. Let the motor pickup full speed.

11.2.2 Open the delivery sluice valve gradually till the current taken by motor reaches the full load / current stated on the motor name plate.

11.2.3 See that motor is not getting over loaded.

11.3 Check during running:

11.3.1 The pump is running smooth. Check noise and vibrations. Vibrations should be checked at the top of motor (not on fan cover) or NDE side bearing of motor. Stop the pump if abnormal noise or vibrations are observed. Detect the reasons for vibrations and restart the pump after eliminating the reasons for the same.

11.3.2 Take the temperature of bearing holder (25400). For this keep a small lump of grease on maximum heated surface of bearing holder and insert thermometer in to the lump of grease and measure the temperature. Maximum temperature should not be more than 80° C.

11.3.3 Head and capacity developed by the pump is as specified in the name plate of the pump.

11.3.4 Motor bearings are not getting heated up excessively.

11.4 Stopping the pump:

Pump should be switched off only after closing the delivery sluice valve.

12. MAINTENANCE:

12.1 Daily checks:

12.1.1 Pressure gauge reading.

12.1.2 Voltage and current.

12.1.3 Pump and motor bearing temperature.

12.1.4 Vibration and Noise.

12.2 Periodical checks:

12.2.1 Replenishing of the grease to the pump bearing and motor bearing after proper intervals.

12.2.2 Check the vibrations.

12.2.3 Check the liquid level controller for its functioning.

12.2.4 Calibration of measuring instruments.

12.2.5 Check the level of motor stool as described in assembly procedure after taking out motor at regular intervals of 6 months.

12.2.6 Clean the tank, if there are chances of deposition of the contents of the liquid handled.

12.3 Overhauling:

12.3.1 With continuous daily operations spell, the pump will be due for overhaul after 10,000 working hours. This work should be carried out by specialized and experienced fitters.

12.3.2 While ordering spare parts, the details of the name plate must be quoted in full. Particularly the name of the pump, order number, name of the part and quantity required.

12.3.3 Keep sufficient stock of the spare parts in order to meet the emergency requirement. The recommended parts are shown with Asterisk (*) mark in the cross section drawing.

12.4 Use following procedure while dismantling the pump:

12.4.1 Disconnect the delivery pipe connections above support plate (46700). Unscrew the fasteners holding support plate on the flange of tank.

12.4.2 Disconnect the motor power connections. Unscrew the bolts and nuts of motor stool (29000) and take out motor along with motor stool.

12.4.3 Remove coupling star (40300) / coupling spacer and take out pump half coupling (39000) after loosening the set screw. Use suitable puller. Remove coupling key (32100).

12.4.4 Unscrew the two bearing nuts (33500 and 33600) and take out from the head shaft (18500).

12.4.5 Remove the bearing cover (27000) along with oil seal (50001). Use release bolts if necessary.

12.4.6 Remove spacer for thrust bearing carrier (19800). Remove key (32400).

12.4.7 Unscrew nuts holding bearing holder (25400) on stuffing box housing (23800) and take out bearing holder along with thrust bearing carrier (24700), bearings (26300). Also take out spacer for bearing (19801). Remove bearing cover with oil seal (50001).

12.4.8 Lift entire unit vertically upward with the help of crane having slings supported on eye bolts screwed on support plate.

- 12.4.9 Fit clamp to the top column pipe (13200) and keep two girders or strong wooden logs across the opening of the tank.
- 12.4.10 Rest the clamps on these two girders or wooden log.
- 12.4.11 Unscrew delivery flange (49002) and pipe nut (33800).
- 12.4.12 Unscrew the nuts holding stuffing box housing (23800), support plate (46700) and top column pipe (13200) together. Disconnect the flushing connections above and below support plate. Take out stuffing box (23800) and support plate (46700).
- 12.4.13 Remove key for thrust bearing carrier (32400). Take out bearing holder (25700) along with bearings (26300) and thrust bearing carrier (24700). Use release bolts.
- 12.4.14 Push thrust bearing carrier so that it will come out of bearing holder (25400) along with angular contact bearing. Remove bearing from thrust bearing carrier (24700) only if damaged.
- 12.4.15 Lift the unit vertically up after engaging the shelling on the arms of the pump.
- 12.4.16 Fit another pair of clamp on standard column pipe (13302) next below the top column pipe.
- 12.4.17 Allow the unit to lower down so as to rest the clamps on the girders or wooden logs.
- 12.4.18 Unscrew the bolts holding top column pipe (13200), bearing spider (24500) and bottom column pipe (13301) together.
- 12.4.19 Take out top column pipe (13200).
- 12.4.20 Disconnect the head shaft (18500) using suitable spanner.
- 12.4.21 Disconnect the flushing piping for bearing spider (24500) by unscrewing sealing nut.
- 12.4.22 Take out bearing spider (24500).
- 12.4.23 Unscrew grub screw at the junction of intermediate bearing bush (35100) and bearing spider (24500). Remove the bearing bush (35100) out of bearing spider (24500) only if it is found damaged.
- 12.4.24 Unscrew the screwed coupling (39500) from intermediate shaft (18400) or impeller shaft (18600).
- 12.4.25 Follow the procedure given in 12.4.15 to 12.4.24 till you remove last intermediate shaft (18400), last bearing spider (24500) and last screwed coupling (39500).
- 12.4.26 Disconnect the rising pipe (14201) at support plate while dismantling the column pipes if rising pipe is in two or more pieces.

12.4.27 Lift the remaining unit and take it out of the tank for further dismantling.

12.4.28 Rest the unit on suction flange of pump casing (10700).

Remove the strainer and rest the unit on suction flange of pump casing.

12.4.29 Remove the rising pipe (14201) and bend (28000).

12.4.30 Remove bottom column pipe (13301).

12.4.31 Disconnect the lubricating piping and its accessories.

12.4.32 Remove casing cover (22000) along with the bearing shell (35601).

12.4.33 Take out shaft along with impeller (15100), shaft sleeve (31100) and impeller nut (33000).

12.4.34 Remove impeller nut (33000) and take out impeller (15100) and shaft sleeve with the help of suitable puller.

12.4.35 After dismantling the parts as indicated above, clean them and inspect them for wear, tear and damage. Especially following parts should be specifically inspected.

- a. Angular contact ball bearings - Wear.
- b. Bearing bushes - For wear and surface condition.
- c. Shaft for run out (within 0.05 mm).
- d. Shaft sleeves and screwed couplings - For wear and surface condition.

12.4.36 Replace all the damaged parts with new one. Impeller wear ring and case wear ring should be locked in position by grub screws (M6x6L) at least at two points.

12.5 MAINTENANCE MANUAL:

MAINTENANCE ENVIRONMENTAL HEALTH AND 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 vapors, 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.

13. TECHNICAL DATA:

13.1 Direction of rotation:

Direction of rotation shall be clockwise when viewed from motor top.

13.2 The bearing is provided in thrust bearing carrier (26300). This bearing is antifriction angular contact ball bearing SKF or Equivalent. This bearing is grease lubricated and the bearing sizes are as under.

Bearing size	Applicable for
SKF 7206B or EQ,	20/13QF,20/16QF,20/20QF,32/13,32/16,32/16A 32/20,32/20A,40/13,40/16/40/20,40/20A,50/13,50/16,50/16A,50/20,65/13
SKF 7309B	25/16QF,32/13QF,32/16QF,32/20QF,40/13QF,40/16QF,40/20QF,50/13QF, 50/16QF,50/20QF,65/13QF 32/26,40/26,50/26,65/16,65/20,65/26,65/32,65/43,80/16 80/20,80/26,80/32,80/40,80/40N,100/20,100/26,100/32,100/40, 125/26,125/32,125/40,125/40N,125/45,150/32,150/32N,150/40,32/26QF,40 /26QF,50/26QF,65/16QF,65/20QF,65/26QF,80/16QF,80/20QF, 100/20QF,25/26A,65/26N,80/26QF
SKF 7310B	40/32, 50/32, 40/32QF, 50/32QF
SKF 7311BG	65/32QF,80/32QF,80/40QF,100/32QF,100/40QF,125/26QF,150/32QF, 125/32QF

13.3 Quantity and refilling of grease: For 1000 running hours.

SKF 7206B or EQ 10 to 15 gm
 SKF 7309B or EQ 15 to 20 gm
 SKF 7310B or EQ 25 to 30 gm
 SKF 7311BG or EQ 40 gm

Recommended grease:

Speed (RPM)	Indian Grade			International Grade		
	Indian oil	Hindustan Petroleum	Bharat Petroleum	Castrol	Gulf	Veedol
1450	Servogem-3	Lithon-3	MP Grease-3	Ball Bearing AP3	Gulf-MP Grease-3	Alitho 30
2900	Servogem-2	Lithon-2	MP Grease-2	Ball Bearing AP1	Gulf-MP Grease-2	Alitho 20

a) Bearing details:

Bearings of SKF make and with C3 clearance are used. Bearings are grease lubricated.

Notes:

1. Bearing of SKF make or equivalent are used.
2. C3 clearances are used.
3. Axial running clearance shall be less than 0.45 mm for all above bearing arrangements.
4. Maximum allowable temperature of bearing shall be 80° C.

13.4 Bearing temperature of antifriction angular contact ball bearing - Grease lubricated bearings can be operated up to 80° C. Measure the bearing temperature with thermometer placed over bearing holder (25400).

A sudden increase in temperature is an indication of danger and signal to investigate. Occasionally when pumps are first started the bearing seems to run extremely hot. This high temperature is frequently caused by oil seals and not because of bearing. As soon as oil seal lips get seasoned, the temperature drops to normal.

13.5 Line shaft bearings:

Line shaft bearings (35100 and 35300). These bearings are made out of 25% Glass filled Teflon or 25% Carbon filled Teflon. Clearances between bearing and shaft sleeve/screwed coupling are as follows.

Minimum clearance = 0.5 mm dia.

Maximum clearance = 0.6 mm dia.

13.6 Line shaft bearings shall be lubricated by the liquid handled by the pump and need no external lubrication unless otherwise specified.

13.7 Gaskets and oil seals data

PART NO.	DESCRIPTION	SIZE (in mm)
51100	Gasket for pump casing and casing cover	
	20/13QF, 32/13, 40/13, 50/13,65/13	141D x 152D x 1T
	20/16QF,25/16QF,32/16,40/16,50/16 65/16,80/16	176D x 188D x 1T
	20/20QF,32/20,40/20*,50/20,65/20, 80/20,100/20	216D x 230D x 1T
	32/26,40/26,50/26,65/26,80/26, 100/26,125/26	266D x 282D x 1T
	40/32,50/32,65/32,80/32,100/32,125/32, 150/32,150/32N	331D x 348D x 1T
	80/40,100/40,125/40,125/40N,150/40	411D x 432D x 1T

	125/45	470D x 490D x 1T
51301	Gasket for pump casing and bend	
	20/13QF, 20/16QF, 20/20QF, 25/16QF	27D x 115D x 1T
	32/13, 32/16, 32/16A, 32/20, 32/20A, 32/26	32D x 140D x 1T
PART NO.	DESCRIPTION	SIZE (in mm)
	40/13,40/16,40/20,40/20A,40/26,40/32	40D x 156D x 1T
	50/13,50/16,50/16A,50/20,50/26,50/32	50D x 165D x 1T
	65/13,65/16,65/20,65/26,65/32	65D x 200D x 1T
	80/16,80/20,80/26,80/32,80/40	80D x 200D x 1T
	100/20,100/26,100/32,100/40	105D x 220D x 1T
	125/26,125/32,125/40,125/40N,125/45	127D x 254D x 1T
	150/32,150/32N,150/40	150D x 285D x 1T
51302	Gasket for bend and rising pipe. 1 For rising pipe size same as delivery size of pump casing. 2 For rising pipe size one size higher than delivery size of pump casing. 3 For rising pipe size two size higher than delivery size of pump casing.	
	KPDS 20/13QF, 20/16QF, 20/20QF	1 20D x 120D x 1T 2 25D x 125D x 1T
	KPDS 25/16QF	1 25D x 125D x 1T 2 32D x 140D x 1T 3 40D x 156D x 1T
	KPDS 32/13-26	1 32D x 140D x 1T 2 40D x 156D x 1T 3 50D x 166D x 1T
	KPDS 40/13-32	1 40D x 156D x 1T 2 50D x 166D x 1T 3 65D x 185D x 1T
	KPDS 50/13-32	1 50D x 166D x 1T 2 65D x 185D x 1T 3 80D x 200D x 1T
	KPDS 65/13-32	1 65D x 185D x 1T 2 80D x 200D x 1T 3 105D x 220D x 1T
	KPDS 80/16-40	1 80D x 200D x 1T 2 105D x 220D x 1T 3 127D x 245D x 1T
	KPDS 100/20-40	1 105D x 220D x 1T 2 127D x 245D x 1T 3 150D x 280D x 1T
	KPDS 125/26-45	1 127D x 245D x 1T 2 150D x 280D x 1T 3 200D x 340D x 1T
	KPDS 150/32-40	1 150D x 200D x 1T 2 200D x 340D x 1T
68000	Gasket for pipe nut. 1 For rising pipe size same as delivery size of pump casing. 2 For rising pipe size one size higher than	

	delivery size of pump casing. 3 For rising pipe size two size higher than delivery size of pump casing.	
PART NO.	DESCRIPTION	SIZE (in mm)
	KPDS 20/13 QF, 20/16 QF, 20/20 QF	1 26.5D x 38D x 1T
	KPDS 25/16 QF	1 39D x 67D x 1T 2 42D x 54D x 1T 3 48D x 63D x 1T
	KPDS 32/13-26	1 42D x 54D x 1T 2 48D x 63D x 1T 3 60D x 72D x 1T
	KPDS 40/13-32	1 48D x 63D x 1T 2 60D x 72D x 1T 3 75D x 95D x 1T
	KPDS 50/13-32	1 60D x 72D x 1T 2 75D x 95D x 1T 3 89D x 121D x 1T
	KPDS 65/13-32	1 75D x 95D x 1T 2 89D x 121D x 1T 3 115D x 130D x 1T
	KPDS 80/16-40	1 89D x 121D x 1T 2 115D x 130D x 1T 3 138D x 165D x 1T
	KPDS 100/20-40	1 115D x 130D x 1T 2 138D x 165D x 1T 3 163D x 200D x 1T
	KPDS 125/26-45	1 138D x 165D x 1T 2 163D x 200D x 1T 3 213D x 270D x 1T
	KPDS 150/32-40	1 163D x 200D x 1T 2 213D x 270D x 1T
51500	Gasket for impeller and shaft sleeve.	
	KPDS 20/13QF, 20/16QF, 20/20QF	17D x 23D x 1T
	KPDS 25/16QF, 32/13-20, 40/13-20, 50/13-20, 65/13	25D x 30D x 1T
	KPDS 40/26-32, 50/26-32, 65/16-26, 80/16-26, 100/20	35D x 40D x 1T
	KPDS 80/32-40, 100/26-40, 125/26-45, 150/32	44D x 50D x 1T
68200	Gasket for impeller and impeller nut.	
	KPDS 20/13QF, 20/16QF, 20/20 QF	Not applicable
	KPDS 25/16QF, 32/13-20, 40/13-20, 50/13-20, 65/13	20D x 28D x 1T
	KPDS 40/26-32, 50/26-32, 65/16-26, 80/16-26, 100/20	28D x 38D x 1T
	KPDS 80/32-40, 100/26-40, 125/26-45, 150/32	38D x 48D x 1T
51400	Gasket for bearing cover.	
	KPDS 20/13, 16, 20QF, 25/16QF, 32/13- 20, 40/13-20, 50/13-20, 65/13	62D x 94D x 1T
	KPDS 40/26-32, 50/26-32, 65/16-32, 80/16-40, 100/20-40, 125/26-45, 150/32	100D x 150D x 1T
80400	Gasket for stuffing box housing.	

	KPDS 20/13, 16, 20QF, 25/16QF, 32/13-20, 40/13-20, 50/13-20, 65/13	180D x 130D x 1T
	KPDS 32/26, 40/26-32, 50/26-32, 65/16-32, 80/16-40, 100/20-40, 125/26-45, 150/32	171D x 270D x 1T
51200	Gasket for adapter plate.	
	KPDS 20/13, 16, 20QF, 25/16QF, 32/13-20, 40/13-20, 50/13-20, 65/13	51D x 128D x 1T
	KPDS 32/26, 40/26-32, 50/26-32, 65/16-32, 80/16-40, 100/20-40, 125/26-45, 150/32	75D x 170D x 1T
50001	Oil seal (DE).	
	KPDS 20/13, 16, 20QF, 32/13-20, 40/13-20, 50/13-20, 65/13	40D x 55D x 7T
	KPDS 25/16QF, 32/16-20QF, 40/16-20 QF, 50/16-20QF, 32/26, 40/26, 50/26, 65/16-32, 80/16-40, 100/20-40, 125/26-45, 150/32	55D x 80D x 13T
	KPDS 40/32, 50/32, 40/32QF, 50/32QF	50D x 68D x 10T
50002	Oil seal (NDE).	
	KPDS 20/13, 16, 20QF, 32/13-20, 40/13-20, 50/13-20, 65/13	30D x 42D x 7T
	KPDS 25/16QF, 32/16-20QF, 40/16-20 QF, 50/16-20QF, 32/26, 40/26, 50/26, 65/16-32, 80/16-40, 100/20-40, 125/26-45, 150/32	45D x 65D x 12T
	KPDS 40/32, 50/32, 40/32QF, 50/32QF	60D x 80D x 12T

13.8 If transmission bearing lubrication is EXTERNAL clear water or compatible liquid, the pressure and quantity required to be calculated as given under.

$$\text{Pressure} = 1/30 \times (\text{Total head in meters}) \times \text{sp.gr.} + 1.0 \text{ kg.}$$

$$\text{Quantity} = 0.2 \text{ m}^3/\text{hr} \times (\text{N} + 1)$$

Where N = No of bearing spiders.

13.9 Mechanical seal disassembly procedure for EBIPL make seal. Refer Fig. A.

- ❖ Decouple the coupling; keep motor side coupling on motor shaft. Do not remove motor from motor stool.
- ❖ Remove the motor stool (29000) along with motor from support plate (46700).
- ❖ Remove pump half coupling from pump shaft.
- ❖ Remove the socket head cap screw (943.14). Then rotate the locking strip and keep in a position as shown in drawing so that it will get fitted in a groove provided on mating ring-composite (301.00). Again, tight the socket head cap screw so that operating length will be maintained. (Refer Fig. 1-EBIPL mechanical seal drawing).
- ❖ Unscrew the grub screw of mechanical seal (944.17) so that seal becomes free for movement on shaft. (Refer Fig. 1-EBIPL mechanical seal drawing).
- ❖ Remove hex. lock nut (33600), bearing lock nut (33500) from pump shaft.
- ❖ Remove the bearing cover (27000) and then remove spacer. Then remove key for thrust bearing carrier (32400).

- ❖ Remove the bearing holder (25400) from stuffing box housing (23800). Note that removal of bearing housing cover and bearing from housing is not needed.
- ❖ Remove mechanical seal assembly from stuffing box housing (23800) along with the gasket.

Mechanical seal assembly procedure-For EBIPL make seal. Refer Fig. A.

- ❖ Apply grease on sleeve-O ring-mating ring (111.30), apply grease and put the gasket-gland (444.05)-(Refer Fig. 1-EBIPL mechanical seal drawing).
- ❖ Apply grease on shaft for easy movement of seal on shaft. Mount the seal assembly on the shaft. Tight the head cap screw of seal to fix the seal on stuffing box. (Refer Fig. 1-EBIPL mechanical seal drawing).
- ❖ Assemble the bearing holder (25400) along with bearing on the stuffing box (23800). Put the key for thrust bearing carrier (32400). Put the bearing spacer. Then tighten the bearing lock nut (33500) and hex. lock nut (33600).
- ❖ Now adjust the float as per requirement.
- ❖ Then tight the grub screw of mechanical seal (944.17) so that seal position and operating length get maintained. (Refer Fig. 1-EBIPL mechanical seal drawing).
- ❖ Remove the socket head cap screw (943.14). Then rotate the locking strip and keep in opposite position so that it will not get fitted in a groove provided on mating ring-composite (301.00). Again, tighten the socket head cap screw (Refer Fig. 1-EBIPL mechanical seal drawing).
- ❖ Put the pump side hub of the coupling on pump shaft. Then assemble the motor stool along with motor on the support plate.

Mechanical seal disassembly procedure for Flowserve make seal. Refer Fig. A.

- ❖ Decouple the coupling, keep motor side coupling on motor shaft. Do not remove motor from motor stool.
- ❖ Remove the motor stool (29000) along with motor from support plate (46700).
- ❖ Remove pump half coupling from pump shaft.
- ❖ Rotate retainer plates of mech. seal and lock it with seal, with cap screws (K) available on the collar (5) to maintain operating length. (Refer Fig. 2-Flowserve mechanical seal drawing).
- ❖ Loose the set screws so that seal assembly gets free from sleeve (10) (Refer Fig. 2-Flowserve mechanical seal drawing).
- ❖ Remove hex. lock nut (33600), bearing lock nut (33500) from pump shaft.
- ❖ Remove the bearing cover (27000) and then remove spacer. Then remove key for thrust bearing carrier (32400).
- ❖ Remove the bearing holder (25400) from stuffing box housing (23800). Note that removal of bearing housing cover and bearing from housing is not needed.
- ❖ Remove the circlip, and then remove seal assembly from the stuffing box housing along with gasket.
- ❖ Remove sleeve (10) along with key. (Refer Fig. 2-Flowserve mechanical seal drawing).

Mechanical seal assembly procedure for Flowserve make seal. Refer Fig. A.

- ❖ Apply grease on O-ring area of sleeve. Also apply on the area for gasket. Put the gasket.
- ❖ Put the key on the shaft.
- ❖ Apply grease on shaft for easy movement of seal on shaft.

- ❖ Mount the sleeve on the shaft. Mount the seal assembly on the sleeve and care has to be taken that key on sleeve and shaft get properly fitted. Tighten the seal on stuffing box.
- ❖ Insert the circlip on shaft and set properly in the groove above mech. seal assembly.
- ❖ Assemble the bearing holder (25400) along with bearing on the stuffing box (23800). Put the key for thrust bearing carrier (32400). Put the bearing spacer. Then tighten the bearing lock nut (33500) and hex. lock nut (33600).
- ❖ Now adjust the float as per requirement.
- ❖ Tight the set screws so that seal assembly gets free from sleeve (10) (Refer Fig. 2-Flowserve mechanical seal drawing).
- ❖ Rotate retainer plates of mech. seal and unlock it with seal, with cap screws (K) available on the collar (5). Fit the cap screw again in collar. (Refer Fig. 2-Flowserve mechanical seal drawing).
- ❖ Put the pump side hub of the coupling on pump shaft. Then assemble the motor stool along with motor on the support plate.

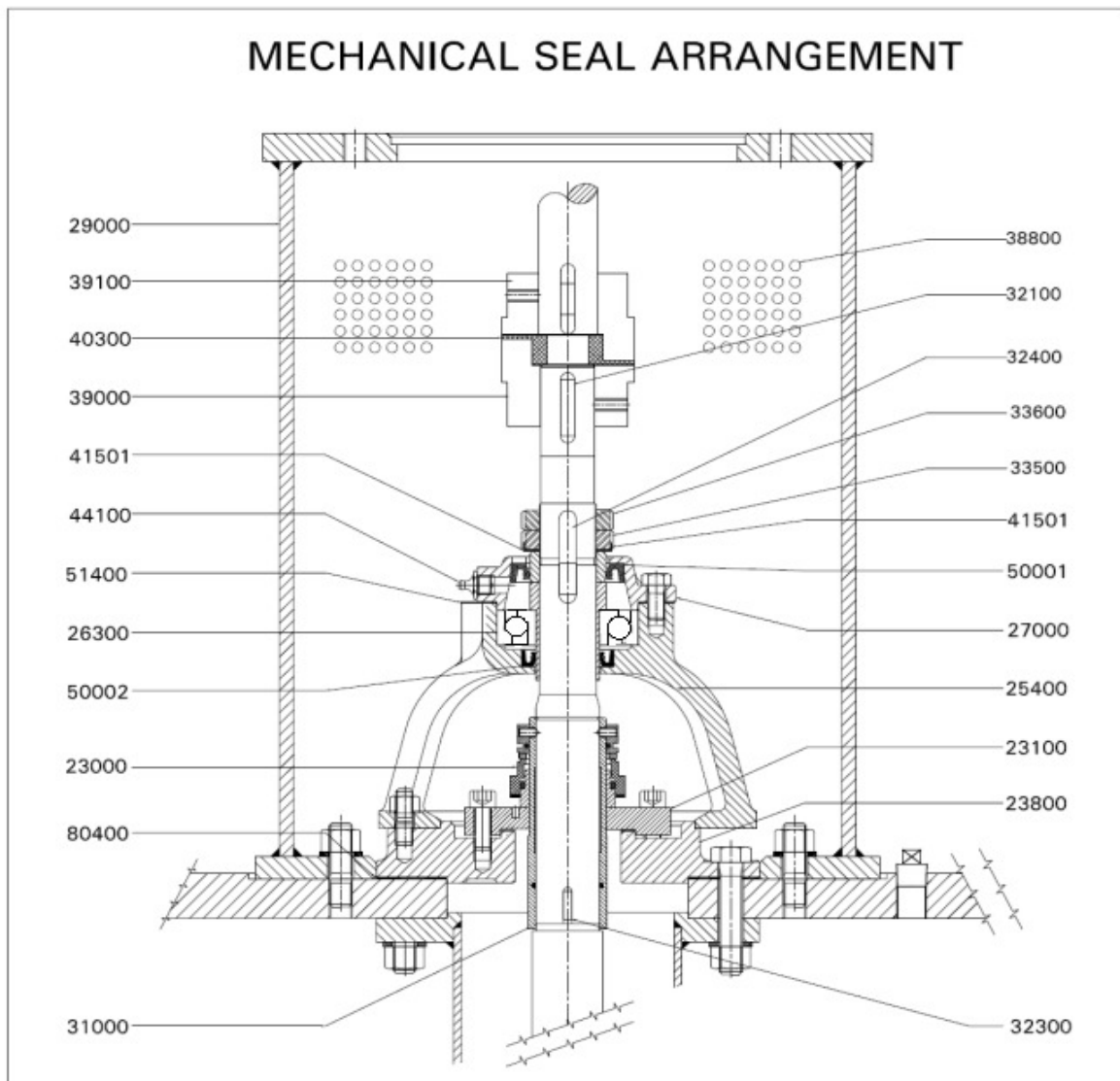


FIGURE - A

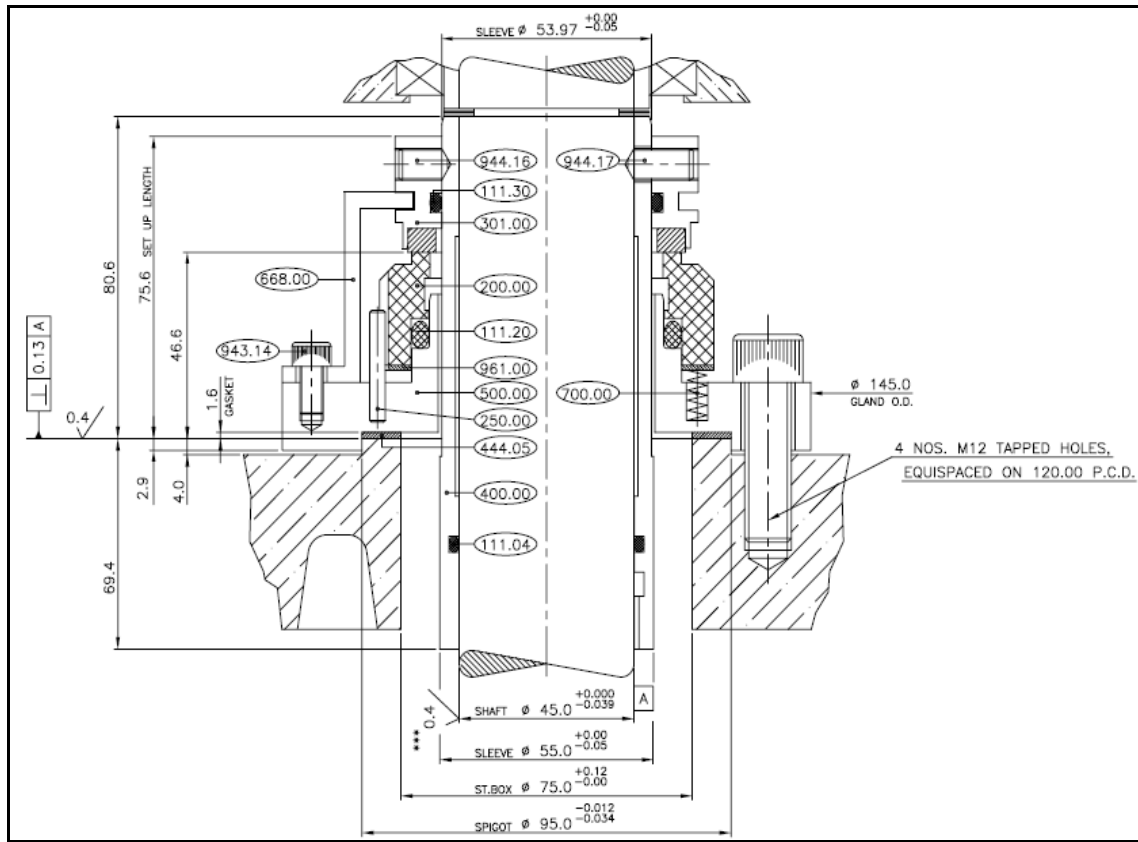


FIGURE - 1

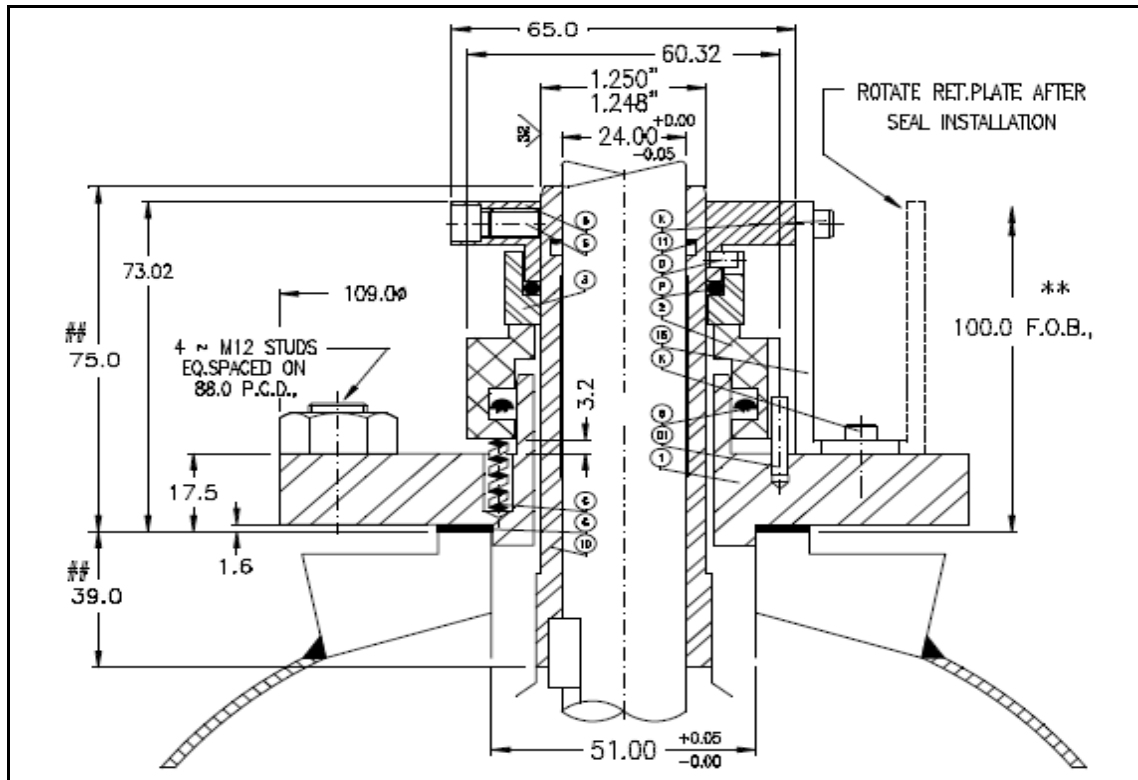


FIGURE - 2

14. CROSS SECTIONAL ASSEMBLY DRAWINGS & SPECIFICATIONS LIST:

PARTCD	PART DESCRIPTION
10700	PUMP CASING
13202	TOP COLUMN PIPE
13301	BOTTOM COLUMN PIPE
13302	STD COLUMN PIPE
14201	TOP RISING PIPE
14202	STD RISING PIPE
14300	TAPER COLUMN PIPE
15100	ENCLOSED IMPELLER
15300	SEMI-OPEN IMPELLER
18000	PUMP SHAFT
18400	INTERMEDIATE SHAFT
18500	HEAD SHAFT
18600	IMPELLER SHAFT
19000	CASING RING SUCTION SIDE
19100	CASING RING DELIVERY SIDE
19200	IMPELLER RING SUCTION SIDE
19300	IMPELLER RING DELIVERY SIDE
21600	STRAINER
22000	CASING COVER
22700	LANTERN RING
22900	SPLIT GLAND
23800	STUFFING BOX HOUSING
24500	BEARING SPIDER
24700	THRUST BEARING CARRIER
25400	BEARING HOLDER
26300	BALL BEARING
27000	BEARING COVER
28000	BEND
29000	MOTOR STOOL
31000	SHAFT SLEEVE D.S.
31100	SHAFT SLEEVE PUMP SIDE
32100	KEY FOR COUPLING
32300	KEY FOR SHAFT SLEEVE
32400	KEY FOR THRUST BEARING CARRIER
33000	IMPELLER NUT
33500	HEX LOCK NUT
33600	HEX LOCK NUT
33801	PIPE NUT
35100	INTERMEDIATE BEARING BUSH
35300	BEARING BUSH FOR IMPELLER SHAFT
35601	BEARING SHELL FOR BEARING BUSH
38800	COUPLING GUARD
39000	PUMP COUPLING
39100	MOTOR COUPLING
39500	SCREWED COUPLING

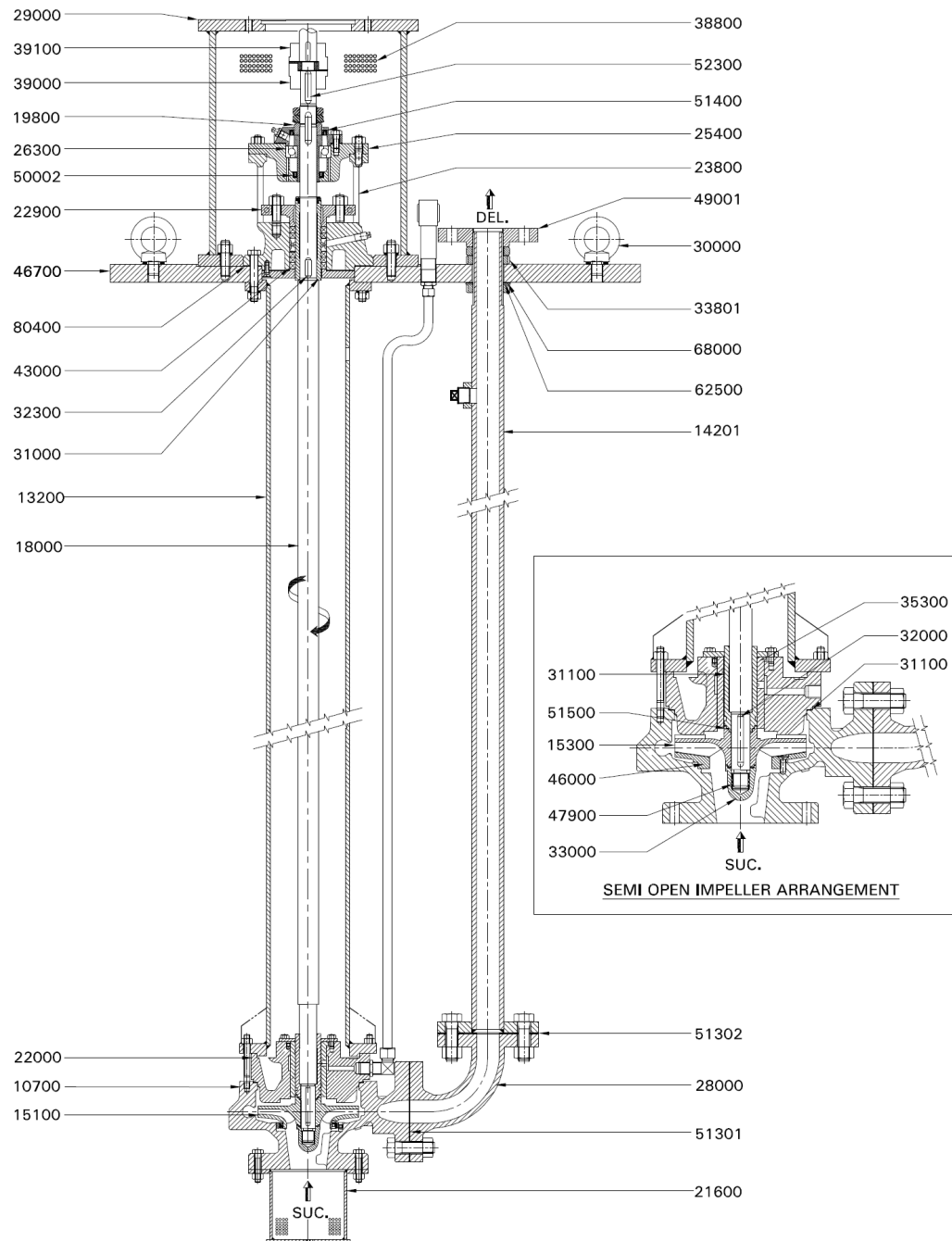
40300	RUBBER STAR
PARTCD	PART DESCRIPTION
41501	LOCK WASHER FOR NDE BEARING
43000	GLAND PACKING
44100	GREASE NIPPLE
46000	WEAR PLATE
46100	ADAPTOR PLATE
46700	SUPPORT PLATE
47900	HELICOIL LOCK INSERT
48600	EXTERNAL CIRCLIP
49001	DELIVERY FLANGE ABOVE SUPPORT PLATE
50001	OIL SEAL DE
50002	OIL SEAL NDE
51100	GASKET FOR CASING COVER
51200	GASKET FOR ADAPTOR PLATE
51301	GASKET FOR CASING AND BEND
51302	GASKET FOR BEND AND RISING PIPE
51400	GASKET FOR BEARING COVER DS
51500	GASKET FOR IMPELLER AND SHAFT SLEEVE
52300	O-RING FOR SHAFT SLEEVE
62500	WASHER FOR RISING PIPE NUT
66600	SCREW FOR SHELL FOR BUSH UNDER BEARING. SPIDER
68001	GASKET FOR RISING PIPE NUT
68201	GASKET FOR IMPELLER AND IMPELLER NUT

KIRLOSKAR BROTHERS LIMITED

DRG. NO.

CROSS SECTIONAL DRAWING OF KPDS PUMP
KPDS 6 UNIT 25

KPD-S 167-017-0



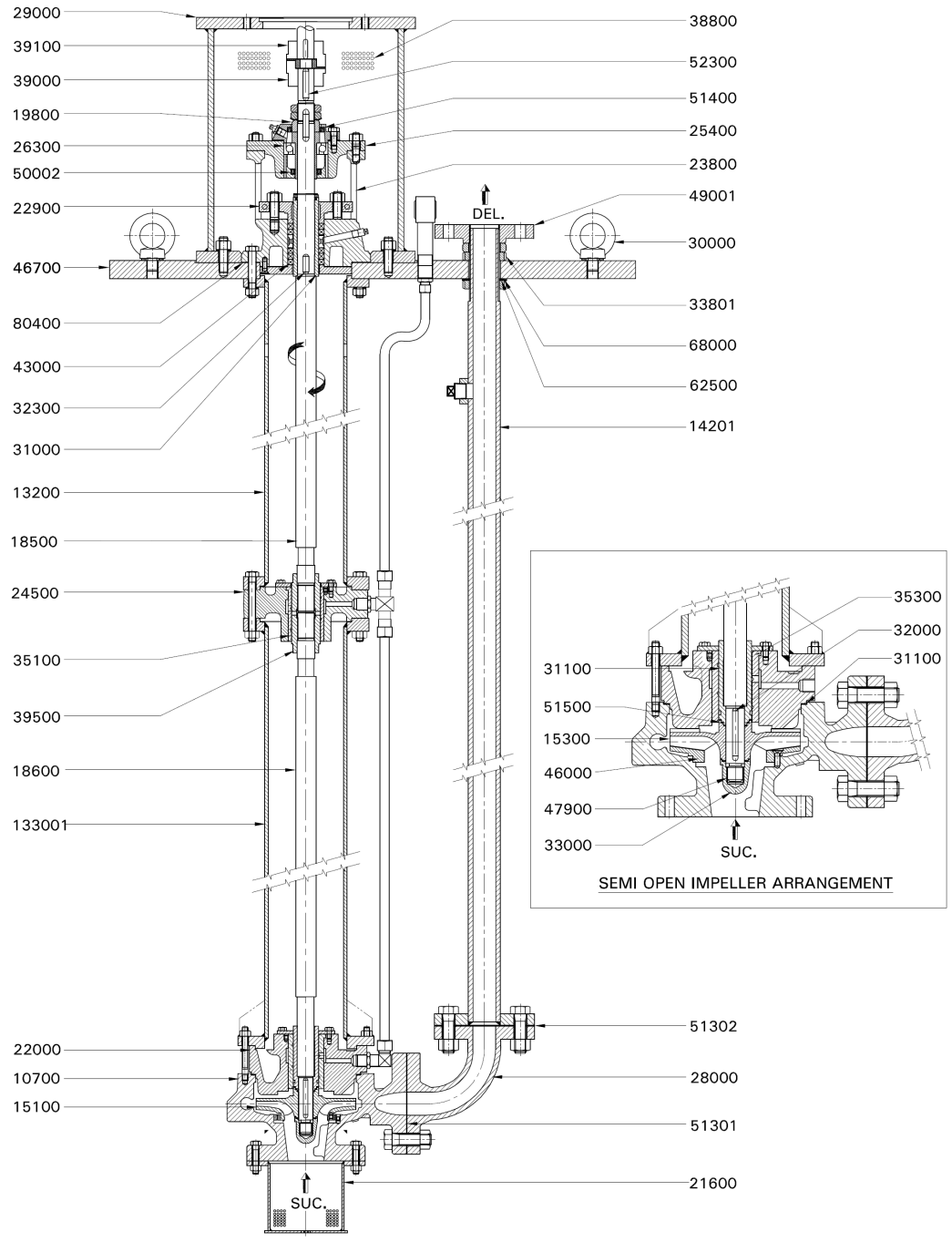
NOTE- FOR PART LIST REFER DRG. NO. KPD-S 167-017, SHEET 2 OF 2

DESCRIPTION- GENERAL FOR KPD-S UNIT-I PUMP WITH SINGLE PIECE SHAFT DESIGN UP TO COLUMN LENGTH OF 800 mm.

KIRLOSKAR BROTHERS LIMITED
 CROSS SECTIONAL DRAWING OF KPDS PUMP
 KPDS 6 UNIT 25

DRG. NO.

KPD-S 167-018-0

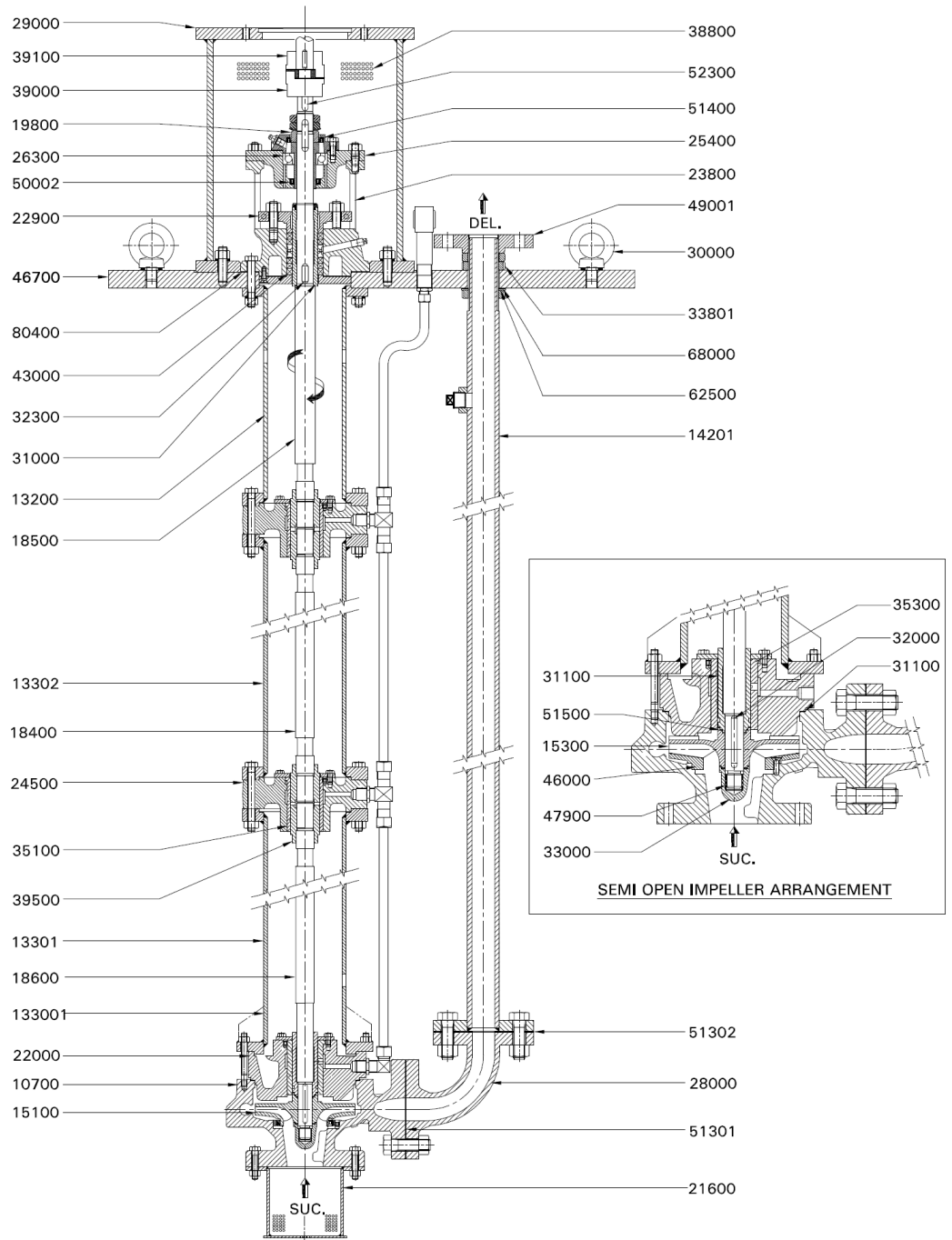


NOTE- FOR PART LIST REFER DRG. NO. KPD-S 167-018, SHEET 2 OF 2

DESCRIPTION- GENERAL FOR KPD-S UNIT-I PUMP WITH ONLY 1 NO INTERMEDIATE COUPLING APPLICABLE UP TO COLUMN LENGTH OF 850 TO 1650 mm.

KIRLOSKAR BROTHERS LIMITED
 CROSS SECTIONAL DRAWING OF KPDS PUMP
 KPDS 6 UNIT 25

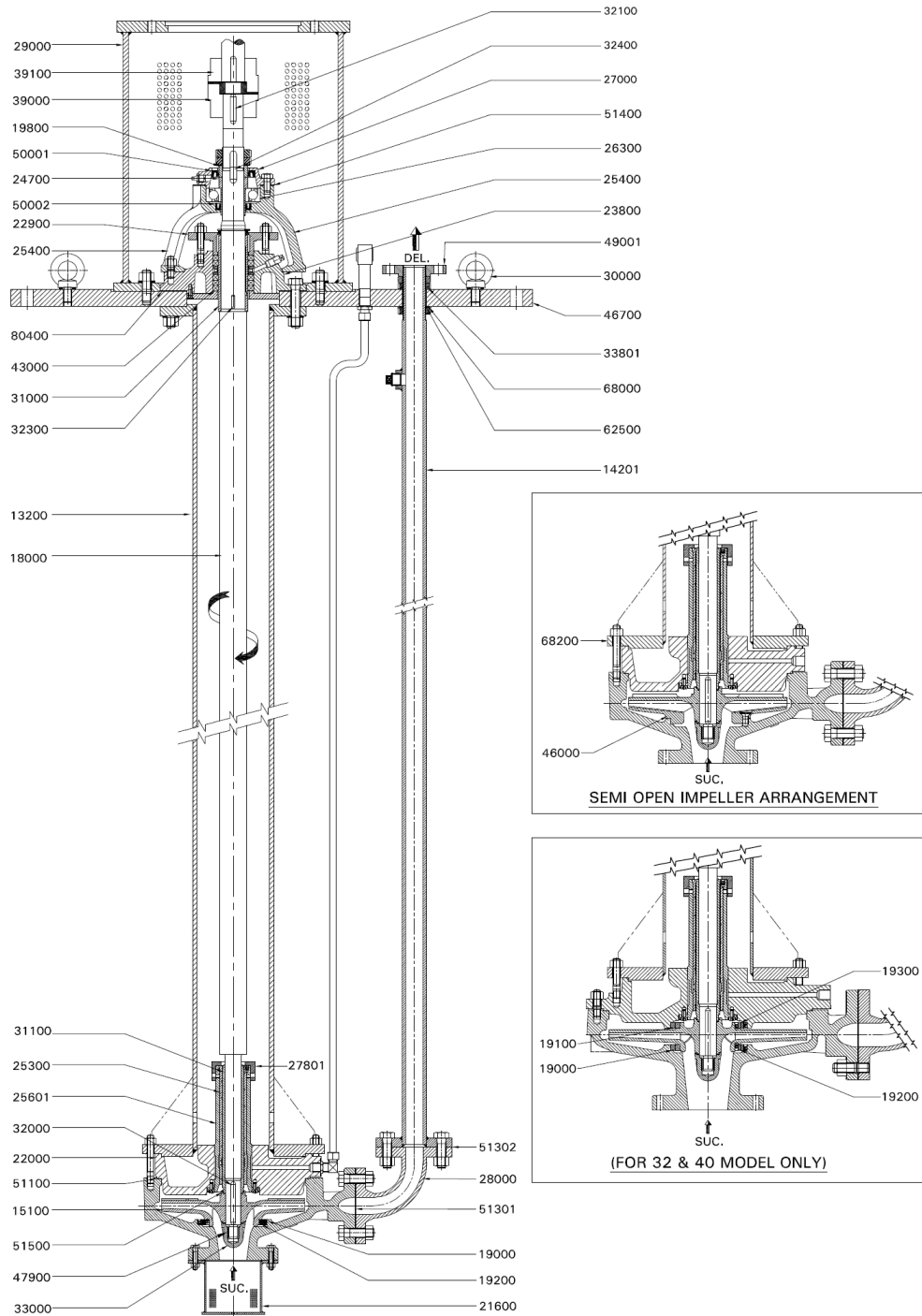
DRG. NO.
 KPD-S 167-019-0



NOTE- FOR PART LIST REFER DRG. NO. KPD-S 167-019, SHEET 2 OF 2
 DESCRIPTION- GENERAL FOR KPD-S UNIT-I PUMP FOR COLUMN LENGTH ABOVE 1650mm.

KIRLOSKAR BROTHERS LIMITED
CROSS SECTIONAL DRAWING OF KPDS PUMP
KPDS 6 UNIT 25

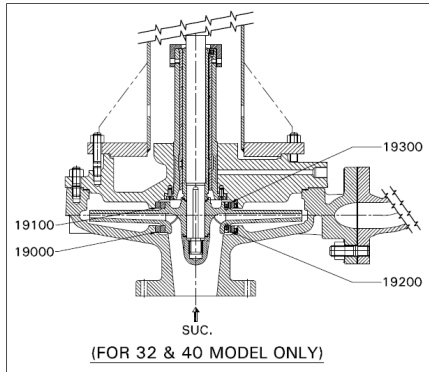
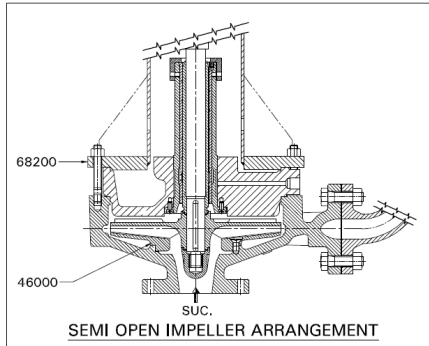
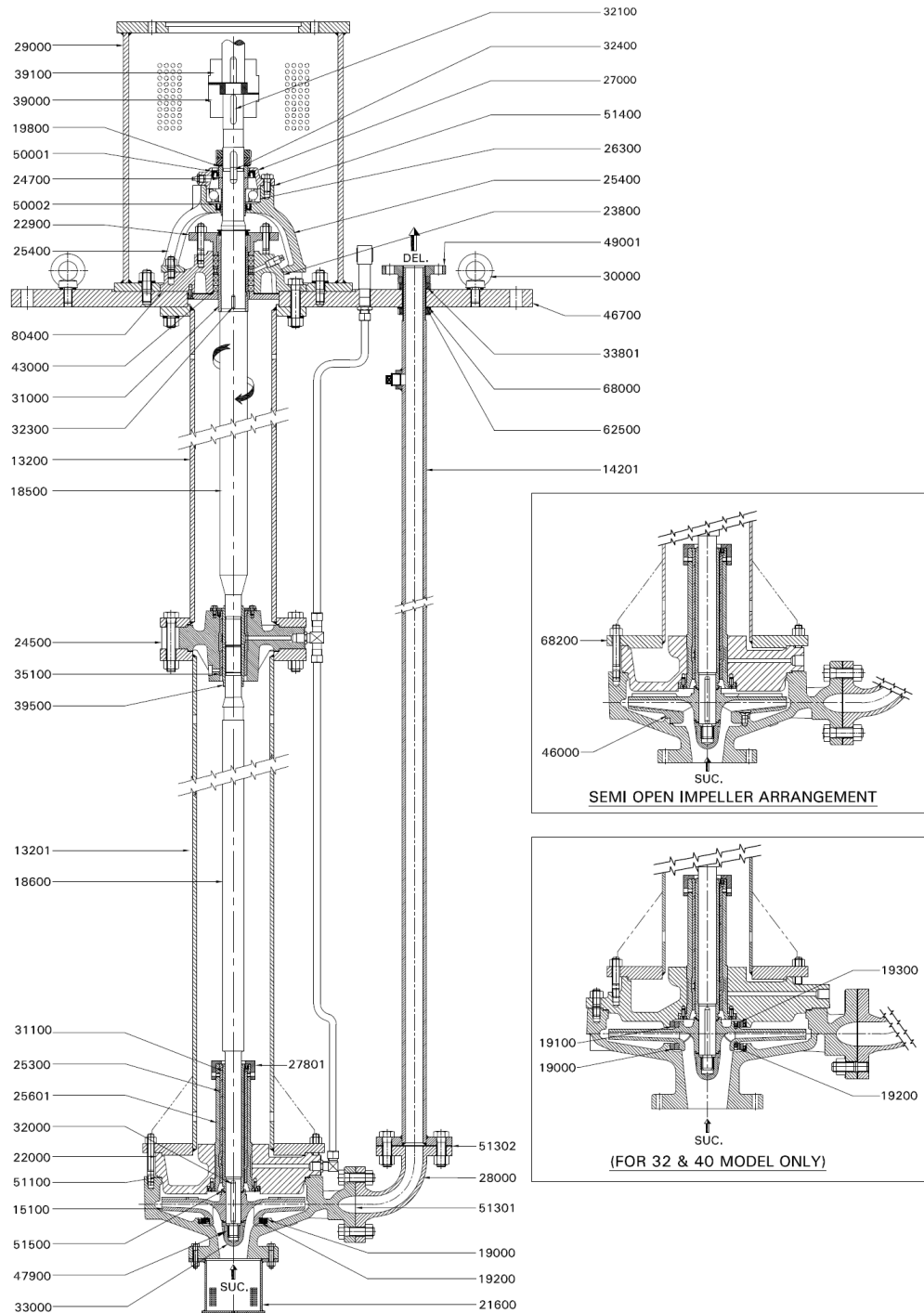
DRG. NO.
 KPD-S 167-020-0



NOTE- FOR PART LIST REFER DRG. NO. KPD-S 167-020, SHEET 2 OF 2.
DESCRIPTION- GENERAL FOR KPD-S UNIT-II & III FOR COLUMN LENGTH UP TO 950 mm.

KIRLOSKAR BROTHERS LIMITED
CROSS SECTIONAL DRAWING OF KPDS PUMP
KPDS 6 UNIT 25

DRG. NO.
 KPD-S 167-021-0

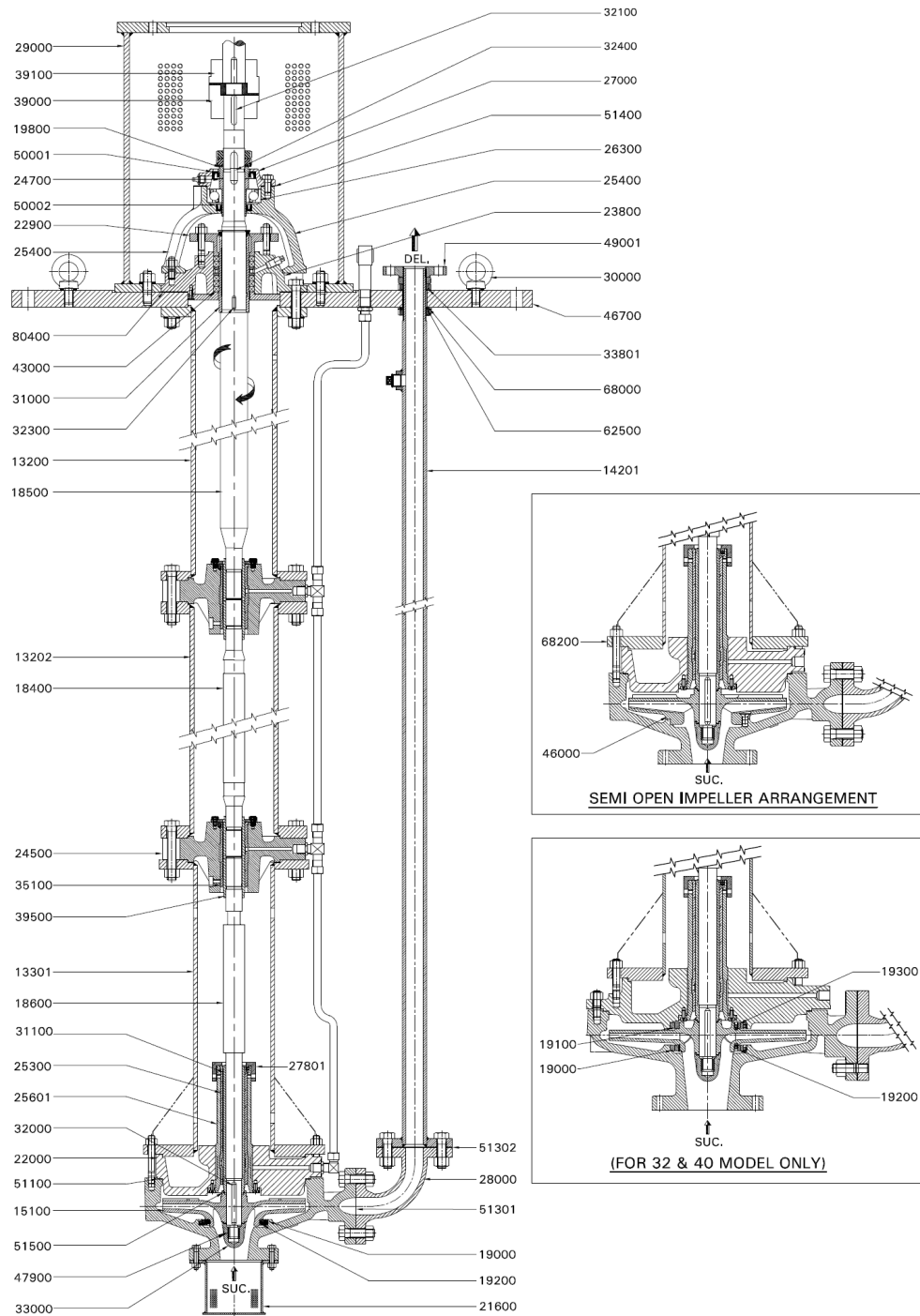


NOTE- FOR PART LIST REFER DRG. NO. KPD-S 167-021, SHEET 2 OF 2.
DESCRIPTION- GENERAL FOR KPD-S UNIT-II & III PUMP FOR COLUMN LENGTH UNIT-II-1000 TO 1950/UNIT III-1000 TO 2450mm.

KIRLOSKAR BROTHERS LIMITED
CROSS SECTIONAL DRAWING OF KPDS PUMP
KPDS 6 UNIT 25

DRG. NO.

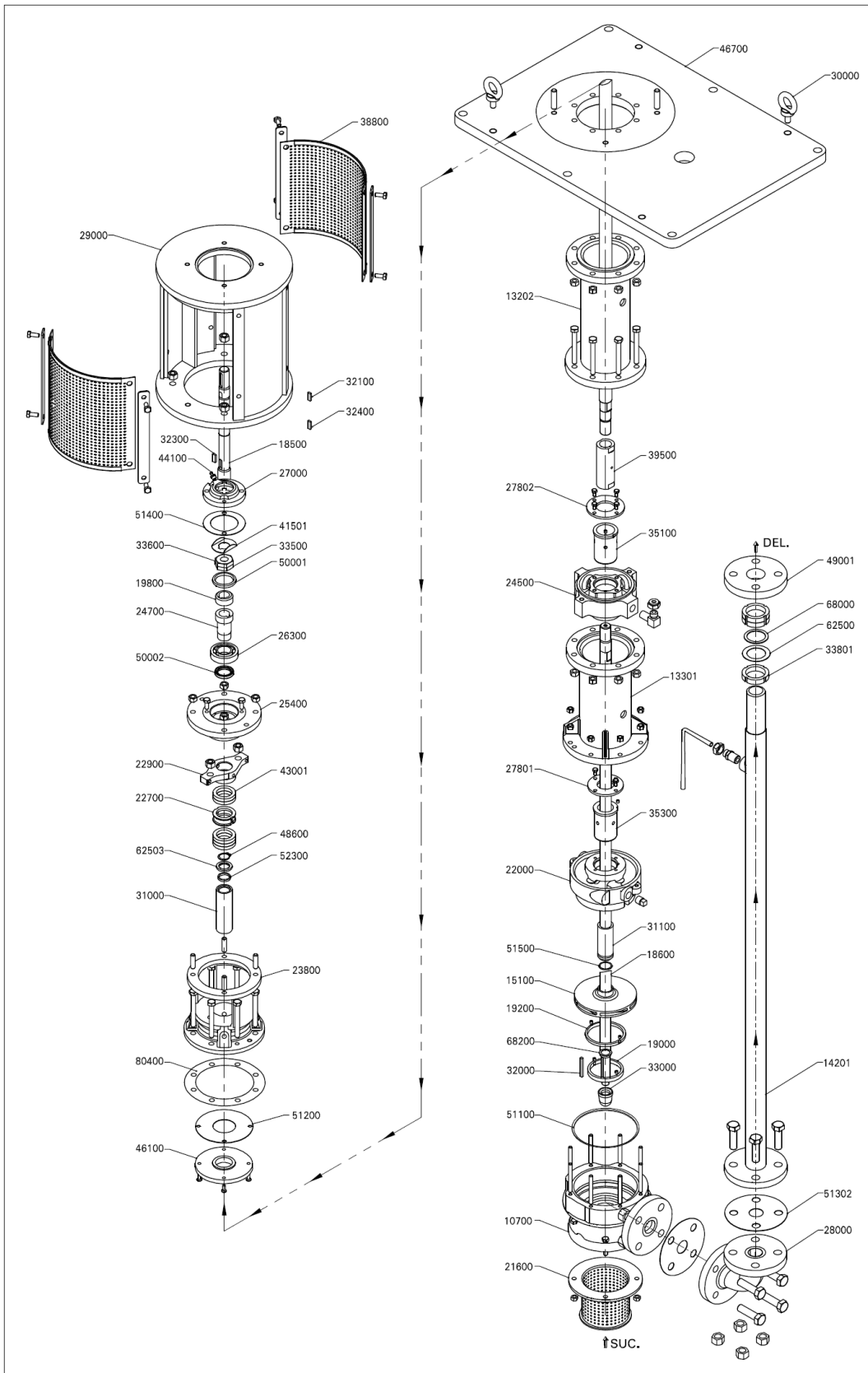
KPD-S 167-022-0



NOTE- FOR PART LIST REFER DRG. NO. KPD-S 167-022, SHEET 2 OF 2.

DESCRIPTION- GENERAL FOR KPD-S UNIT-II & III PUMP FOR COLUMN LENGTH UNIT-II-2000 TO 6500/UNIT III-2500 TO 5500mm.

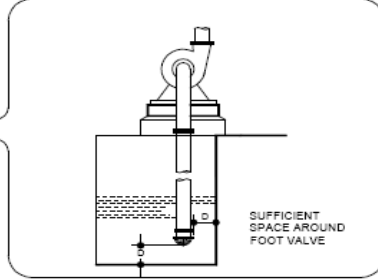
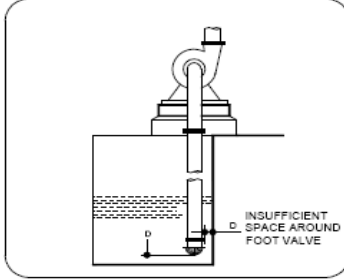
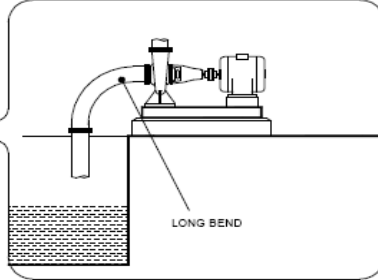
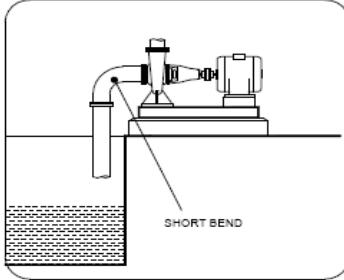
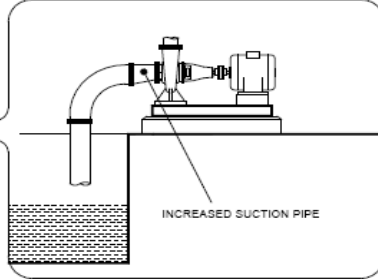
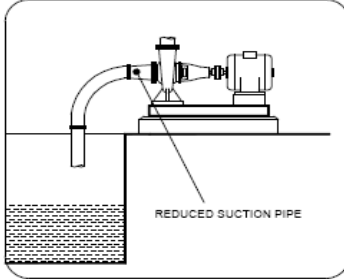
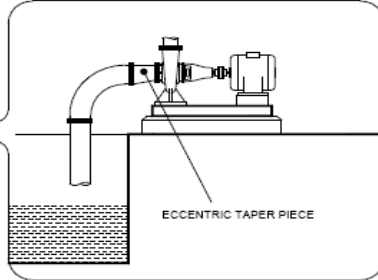
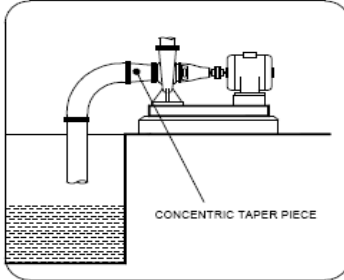
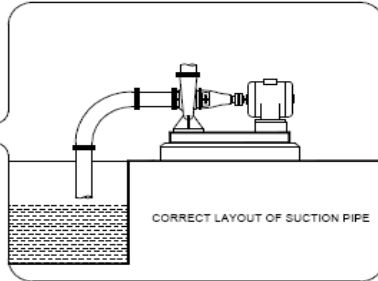
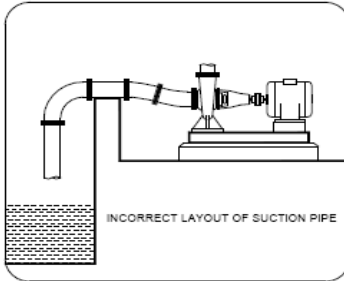
15. EXPLODED VIEW:





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

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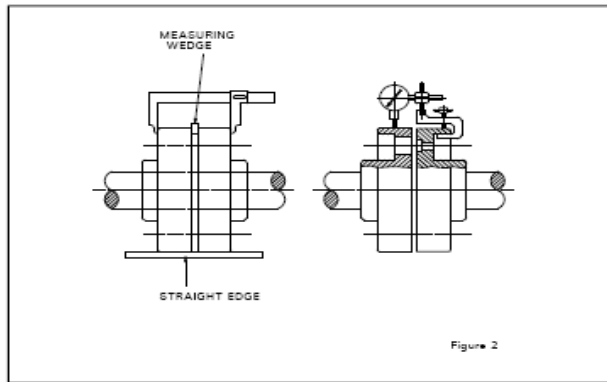
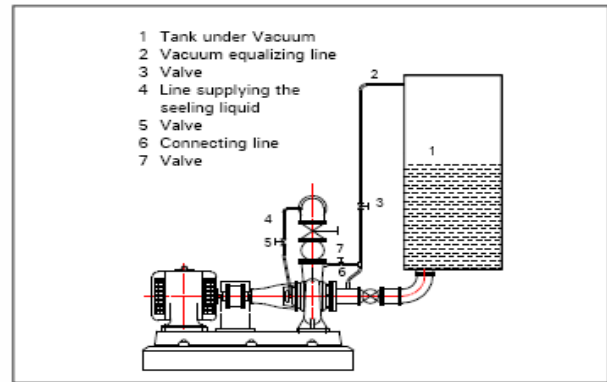


Figure 2



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:

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

**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.

- (a) Angular misalignment : Shafts with axis concentric but not parallel.
- (b) Parallel misalignment : Shafts with axis Parallel but not concentric.

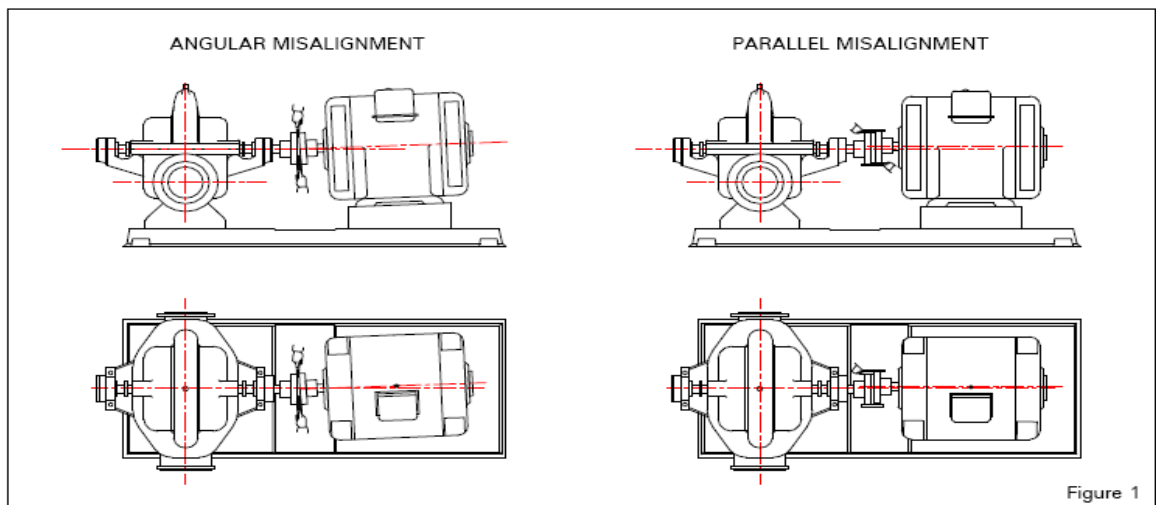


Figure 1

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.

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

1.1 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.

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.

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 potential situations before an accident occurs. A person must be aware of potential hazard associated in activities of installation, operation and maintenance of equipments.

1.3 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.

1.4 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.

1.5 Do not wear loose clothing or jewellery, which could catch on the controls or become trapped in the equipment.

1.6 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.

1.7 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.

1.8 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. Use suitable earthing and tripping devices for electrical equipments.

1.9 **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.

2.0 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.

3.0 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.

4.0 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.

5.0 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 vapors locations by removal of bearing housing and shaft 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. Does not weld or flame cut on pipes/tubes that contains flammable fluids. Clean them thoroughly with nonflammable solvent before welding or flame cutting on them. Use solvent/chemical resistant gloves for hand protection.

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.

CUSTOMERS ARE ADVISED TO DISPOSE OF ALL UNUSABLE WASTE LIKE GASKETS, GLAND PACKING, OIL, BATTERIES, PACKING MATERIAL, ETC. THROUGH APPROPRIATE DISPOSAL AGENCIES AND IN ACCORDANCE WITH LOCAL REGULATION TO AVOID HARMFUL IMPACT (IF ANY) ON ENVIRONMENT.