Enriching Lives

INSTRUCTIONS ON INSTALLATION OPERATION AND MAINTENANCE FOR

KIRLOSKAR MULTISTAGE PUMP
TYPE "KPDS ALL MODELS"

KIRLOSKAR BROTHERS LIMITED
UDYOG BHAVAN, TILAK ROAD, PUNE - 411 002

KIRLOSKAR BROTHERS LIMITED

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WARRANTY

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

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

KIRLOSKAR BROTHERS LIMITED

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CAUTION:

THIS INSTRUCTION MANUAL COVERS THE GENERAL REQUIREMENTS OF INSTALLATION, OPERATION AND MAINTENANCE. HOWEVER THE END USER SHOULD REFER TO THE DRAWINGS AND DOCUMENTS IF SUPPLIED AGAINST SPECIFIC ORDER.

1. INTRODUCTION

KPD-S type sump pumps are manufactured to close tolerances and as per rigid specifications. However proper erection and maintenance is equally important to ensure proper service.

The pump types are designated as KPD-S (delivery size in mm x nominal full diameter of impeller in cm). - e.g. KPDS 40/32 pump where 40 mm is delivery nozzle size of pump casing and 32 cm is nominal full diameter impeller.

This booklet covers important guidelines and instructions on erection, operation and maintenance. These instructions should be followed carefully and failing to this may result in unsatisfactory performance and damage to the pump parts.

Only mechanical aspects in connection with erection and maintenance of the pumps are covered in this booklet. Civil and electrical engineering aspects are to be considered and taken care of at customers end only. The customers are requested to report the problems arising at the site to the supplier without fail. The name plate details should be mentioned while making correspondence with the supplier/ manufacturer.

KPDS pumps are divided into following 3 units.

UNIT I	UNIT II	UNIT III
20/13Q, 20/16Q, 20/20Q	32/26*, 40/26, 40/32	65/32, 80/32, 80/40
25/26Q, 32/13, 32/16*	50/26, 50/32, 65/16,	100/26, 100/32
32/20*, 40/13, 40/16*	65/20*, 65/26, 80/16	100/40, 125/26
40/20*, 50/13, 50/16*	80/20, 80/26, 100/20	125/32, 125/40, 150/32
50/20*, 65/13		

*** Denotes pump with semi-open impeller (KPDS-Q)**

2. PRE-REQUISITES FOR SATISFACTORY OPERATION

For satisfactory working of the pump ensure 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 and maintenance instructions are followed as given in this booklet.

e. Load of delivery pipe and other accessories such as sluice valve, reflux valve etc. is not coming directly on support plate of the pump.

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.

3. PUMP HOUSE/ TANK LAYOUT

The layout should be done after considering following.

3.1 **Liquid Inlet to the tank:**

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

3.2 **Suction tank:**

The tank should be designed so as to provide-

3.2.1 Enough storage capacity to avoid sudden fluctuations in liquid levels, kinematic disturbances at the suction of the pump such as turbulence, eddies, vortices, air entrainment etc.

3.2.2 **Low velocity:**

The maximum liquid velocity of the liquid entering in the tank should not exceed 1 m/sec.

3.2.3 **Individual flow pattern:**

Where one tank houses more than one pumping sets, care must be taken to provide appropriate distances from walls, floor and adjacent pipes. It is advised that such layouts should be referred to the pump manufacturer. This is necessary to ensure individual flow pattern of each pump undisturbed by other pumps.

3.2.4 **Pump submergence:**

The lowest liquid level should be as recommended in the outline drawing supplied against 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.

4. PUMP HOUSE REQUIREMENTS

These should cover mainly the following aspects.

4.1 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.

4.2 Sufficient floor area for working and overhauling. In this, the following factors are to be considered.

4.2.1 Proper spacing of the pumps to avoid transmission of vibrations from one machine to another.

4.2.2 Easy and safe accessibility to the electrical switch box.

4.2.3 Space for dismantled pump parts during overhauling.

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

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

4.3.2 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.

5. STORAGE AND HANDLING

5.1 KPDS pumps up to 3 M suspension length are despatched in completely assembled condition. The pump with more than 3 m suspension length are despatched in partially assembled form.

5.1.1 Check that all packages are in tact and open parts are not damaged in transit.

5.1.2 Open the packages and check contents of each package against delivery notes.

5.1.3 Check specifically intermediate shafts and verify that these are not bent and are in good condition. (when shafts are supplied in separate packages)

5.1.4 Report immediately discrepancies, if any to the supplier.

5.1.5 Unless the pump is to be installed immediately, repack the material in respective cases after the contents have been verified against delivery notes.

5.1.6 Do not open the packages again, unless site is completely ready for erection.

5.2 Storage

5.2.1 Storing place should be free from dust, heat, moisture etc. The floor of the store room should be hard and plane.

5.2.2 Do not place packages one over the other inconveniently. Keep the parts on wooden logs and properly leveled.

5.3 Handling

5.3.1 All machined surfaces are coated with a special antirust compound. If any surface is found exposed, clean it and apply a thick coating of grease or antirust compound and wrap it with paper to prevent further rusting.

5.3.2 Never drag any components or package of parts for any reason. Dragging sets in intrinsic vibration which may distort the accuracies, parallelism etc. of machined surfaces. Distortion of accuracies might cause serious functional and operational troubles.

5.3.3 Over hanging should be avoided as far as possible. While lifting the parts by ropes, they should be properly balanced.

5.3.4 Transportation should be free from jerks. Long parts should not be handled without due supports.

5.3.5 Open parts must be transported on soft and well supported beaming to prevent scratches.

CAUTION

CARE MUST BE TAKEN IN HANDLING OF ALL PARTS ESPECIALLY THE SHAFTS. THEY ARE MACHINED TO CLOSE TOLERANCES AND CAREFULLY INSPECTED AT FACTORY AND IF BENT, THEY CAN CAUSE A SERIOUS TROUBLE. A BENT SHAFT SHOULD NEVER BE USED. (RUNOUT MORE THAN 0.05 MM IS NOT PERMISSIBLE).

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) fir its horizontal level. The plain portion should be made horizontal by scrapping operation, if necessary. Use gasket in between support plate and foundation plane portion so that the joint becomes leak tight for gases and air coming out of the tank. After tightening the foundation bolts ensure that the top portion of motor stool is exactly horizontal.

6.3 Ensure that the holes on flange of delivery pipe above support plate and that of delivery pipe to be connected to it exactly match and there is proper uniform clearance in between two pipes flanges and the clearance will not give rise to any horizontal displacement of the pumping unit. Due care should be taken to see that load of the delivery pipes and 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 EQUIPMENTS

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 3 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 most suitable.

7.2 Chain and lifting hook.

7.3 Jute ropes, crow bars and 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 accuracy of 0.02 mm/meter.

7.7 Small wire brush for cleaning threads at shafts.

7.8 Threading compounds for shafts and pipe threads.

7.9 ‘V’ blocks, dial gauge with magnetic stand to check run out of shafts.

7.10 Two sturdy wooden logs or Mild Steel girders to rest the clamps during erection process.

7.11 Besides above 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 scrapper, filler gauge.

7.11.3 Two sets of standard/ring spanners.

7.11.4 Set of wrenches and chain tang.

7.11.5 Adjustable spanner, screw drivers and 12"and 6".

7.11.6 Allen keys.

7.11.7 Steel rule and steel tape.

7.11.8 Sets of taps and dies upto M16.

7.11.9 Chisel, hammer, hack saw, vice etc.

7.11.10 Emery paper, cloth.

8. ERECTION/ ASSEMBLING PROCEDURE

Follow the procedure given below in case of pumps to be erected for the first time or the 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.

8.1 Insert shaft sleeve (311) on pump shaft (180/185) with key (320) in proper position. Mount impeller (151/153) on the shaft with gasket (515) in position. Fit the helicoil screw lock nut (479) in the impeller nut (330). Tighten the impeller nut (330) with gasket (682). In case of 20/13-20Q pumps impeller nut is inbuilt in impeller.

Press the bearing bush (353) in casing cover (220) and drill and tap (M6 x 10L) bush and casing cover together at the junction of bush and casing cover (**FOR UNIT I PUMP SIZES)**. Fit a grub screw in the tapped hole to avoid rotation of bush (This is necessary in case of replacement of bush only). Press the bearing bush (353) in bearing shell (356.1) and drill and tap (M6 x 10L) 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 (220) and fix the hex. socketed cap screws (666.1) (**FOR UNIT II AND UNIT III PUMP SIZES).**

8.2 Insert casing cover (220) on to the shaft with shaft sleeve. Insert the assembly so far completed into pump casing (170) with gasket (511) in proper position. Tighten the hex. nuts on pump casing studs diametrically opposite evenly.

8.3 Mount bottom column pipe (133.1) on casing cover (220), tighten the nuts on casing cover studs diametrically opposite evenly.

8.4 Connect bend (280) to the pump casing (107) with gasket (513.1) in between the flanges. Also connect the first rising pipe (142.1) (if the rising pipe is in two or more pieces) to the bend (280) with gasket (513.2) in between the flanges and tighten the bolts and nuts. In case of KPDS 20/13Q, 20/16Q, and 20/20Q pumps bend (280) is both end threaded. One end is to be fitted to pump casing and it other end flange to be fitted.

8.5 Apply thread compound liberally inside the screwed coupling (395). Fit the screwed coupling on impeller shaft (186) and then fit head shaft (185). While fitting screwed coupling, note that.

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

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

8.5.3 Ends of the shafts should rest on each other perfectly. Ensure this by taking colour seat.

8.6 Fit adapter to casing cover and tee joint to pump casing. Connect the bearing flushing pipe to adapter and tee joint with the help of nuts.

8.7 Mount the taper column pipe (143) on casing cover (220) and tighten the nuts on pump casing studs/casing cover studs diametrically opposite evenly. (for sizes 32 and 40 cm impeller diameters e.g. 40/32, 80/40 etc. taper column pipe will be mounted on casing cover flange). In case of KPDS 20/13Q, 2016Q and 20/20Q pumps taper column pipe (143) is not applicable.

8.8 Fix the clamp to the bottom column pipe (133.1)

8.9 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.

8.10 Put two girders or strong wooden logs across the opening of the tank in which pump is to be fitted, to rest the clamp while erecting the pump. Lower the unit in the tank till the clamp rests on the girder.

8.11 Press the intermediate bearing bush (351) into the bearing spider (245) then frill and tap (M6 x 10L) one hole at the junction of bush and spider. Fit one grub screws in the tapped holes to avoid the rotation of bush.(This is required in case of replacement of bush only)

8.12 Mount bearing spider (245) on the bottom column pipe (133.1).

8.13 Apply thread compound liberally inside the screwed coupling (395) fitted on the pump shaft and threaded portion of intermediate shaft (184). Fit the successive screwed coupling in to intermediate shaft (184) and intermediate shaft in to the screwed coupling already fitted on pump shaft.

8.14 Lift the column pipe (133.2) with the help of another clamp.

8.15 Lower the standard column pipe (133.2) and fix to the lower column pipe (133.1) with the bearing spider (245) in between. Tighten the diametrically opposite bolts one by one.

8.16 Fix 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.

8.17 Lift the complete unit slightly and remove the clamp of bottom column pipe (133.1). lower the complete unit till the clamp fixed to the standard column pipe (133.2) rests on the girders.

8.18 Mount the bearing spider (245) on the standard column pipe (133.2).

8.19 Repeat the procedure given in 8.13, 8.14, 8.15, 8.16 & 8.17 till head shaft (185), top column pipe (132) and bearing flushing pipes are fitted. Let the whole unit rests on the clamp fixed on the top column pipe.

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

8.21 Mount the shaft sleeve (D.S.) with O-ring(523) and key (323). Mount circlip (486) to locate the shaft sleeve.

8.22 Fit the pipe nut for rising pipe (338) along with gasket for pipe nut(680).

8.23 Fix the adapter plate (461) to the stuffing box housing (238) with gasket in between.

8.24 Lift the support plate (467) with the help of eye bolts screwed on it and mount it on top column pipe(132). Also mount stuffing box housing (233) on the support plate 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.

8.25 Adjust the pipe nut (338) till it touches the support plate. Tighten one more pipe nut from the upper side of support plate.

8.26 Lift the unit slightly and remove the clamp fixed to the top column pipe (132). Remove the girders used for erection and lower the whole unit till support plate rests on the top of tank.

CAUTION:

USE PERMANITE OR SUITABLE GASKET IN BETWEEN THE UPPER SURFACE TANK AND SUPPORT PLATE IF IT IS DESIRED THAT NO GAGES SHOULD ESCAPE OUT OF THE TANK. THIS IS ALSO NECESSARY IN CASE OF CLADDED SUPPORT PLATE TO PROTECT THE STEEL SUPPORT PLATE.

8.27 With the hanging support to the support plate, adjust the holes of support plate with that of the foundation holes.

8.28 Insert the gland packings (430) and lantern ring (227) into the stuffing box housing with 3 + L + 2 sequence.

8.29 Mount gland (225) on stuffing box housing. Do not tight the nuts.

8.30 Replace the oil seals (500.2) if it is damaged. Mount the bearing holder (254) (In case pumps of KPDS 6 units), on to the stuffing box housing (238).

8.31 Mount the angular contact ball bearing (263) with exact position on thrust bearing carrier (247) (**Bearing should be fitted in such a way that axial thrust in downward direction is taken by the bearing).**

8.32 Insert the thrust bearing carrier (247) in to the head shaft (185). Insert the spacer for thrust bearing carrier (198) with key (324) (FOR KPDS 6 UNIT PUMPS ONLY). Insert the key (324) on the head shaft.

8.33 Fit the bearing cover (270) after replacing oil seal (500.1) if found damaged.

8.34 Insert the lock washer (415.1) and then fit bearing nut (335) and lock nut (336) on the head shaft. Do not tighten the lock nut till the final stage of assembly.

8.35 Mount the motor stool (290) on the support plate (467) and tighten the nuts.

8.36 Tighten the foundation bolts of the support plate (467). Check the level on the machined surface of the motor stool (290). It should be leveled accurately to the limit of 0.05 mm. if necessary use gasket pieces underneath the support plate to adjust the level.

8.37 Mount the magnetic stand of dial indicator on the upper motor stool (290.1) and prop up the dial gauge on the top portion of the head shaft (185). Adjust the zero of dial gauge and tight the bearing nut (335) with the spanner in such a way that rotating unit is lifted by 1.0 to 1.5 mm. Tighten the lock nut (336) to lock the bearing nut. Fold one arm of lock washer (415.1) in the bearing cover slot and fold remaining arms on bearing nut (335).

CAUTION:
ENSURE THAT THE SHAFT ROTATES ABSOLUTELY FREE.

8.38 Mount the pump half coupling (390) and tighten the set screw. Put coupling star (403) in between (in case of coupling without spacer).

8.39 Make all the connections of valves and delivery pipe above support plate (467).

8.40 Once again check the level on the machined surface of the upper motor stool (290.1). If level is disturbed once again it should be reset up in the range of 0.05 mm.

8.41 Make the motor electric connections. Mount the motor half coupling (391) and tighten the set screw of the coupling. Check the direction of rotation before mounting the motor on the upper motor stool. The direction of rotation if motor should be clockwise when viewed from top i.e. Non driving end of the motor.

8.42 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.

8.43 Grease the bearing (263) with the help of grease gun.

8.44 Ensure that liquid level controller is fitted and is working properly.

9. OPERATION

9.1 Prior to starting:

9.1.1 Rotate the coupling by hand. It should rotate freely.

9.1.2 Ensure that submergence is more than the recommended minimum on outline drawing. Use of liquid level controller is recommended.

9.1.3 Ensure direction of rotation by giving the driver a short run. Incorrect rotation will quickly damage the pump.

9.1.4 Ensure that the liquid connection for lubricating the bearing bushes is given in case of external supply is recommended.

9.2 Putting the pump in operation:

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

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

9.2.3 See that motor is not getting over loaded.

9.3 Check during running

9.3.1 The pump is running smooth. Check noise and vibrations. Vibrations should be checked at the top 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.

9.3.2 Take the temperature of bearing holder (254). For this keep a small lump of grease on the 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.

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

9.3.4 Motor bearings are not getting heated up excessively.

9.3.5 Stopping the pump: Pump should be switched off only after closing the delivery sluice valve.

10. MAINTENANCE

10.1 Daily checks

10.1.1 Pressure gauge reading.

10.1.2 Voltage and current.

10.1.3 Pump and motor bearing temperature.

10.1.4 Vibration and noise.

10.2 Periodical checks

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

10.2.2 Check the vibrations.

10.2.3 Check the liquid level controller for its functioning.

10.2.4 Calibration of measuring instruments.

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

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

10.3 Overhauling

10.3.1 With continuous daily operations spell, the pump will be due for overhaul after 10000 working hours. This work should be carried out by specialised and experienced fitters.

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

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

10.4 Follow the following procedure while dismantling the pump.

10.4.1 Disconnect the delivery pipe connections above support plate (467). Unscrew the fasteners holding support plate on the flange of tank.

10.4.2 Disconnect the motor power connections. Unscrew the nuts of motor stool (290) and take out motor stool alongwith motor.

10.4.3 Remove coupling star (403) and take out pump half coupling (390) after loosening the set screw. Use suitable puller. Remove coupling key (321).

10.4.4 Unscrew the two bearing nuts (335 and 336).

10.4.5 Remove the bearing cover (270) alongwith oil seal (500.1). Use release bolts if necessary.

10.4.6 Remove spacer for thrust bearing adapter (198) and split key for (324). (for KPDS 100C25 unit pumps).

10.4.7 Unscrew nuts holding bearing holder (254) on stuffing box housing (238) and remove bearing holder.

10.4.8 Lift entire pump unit vertically upwards with the help of crane having slings supported on eye bolts screwed on support plate.

10.4.9 Fit clamp to the top column pipe (132) and keep two girders or strong wooden logs across the opening of the tank.

10.4.10 Rest the clamps on these two girders of wooden log.

10.4.11 Unscrew flange (490.2) and pipe nut (338).

10.4.12 Unscrew bolts holding bearing carrier (254), support plate (467) and top column pipe (132) together.

10.4.13 Remove key for thrust bearing carrier (324). Take out bearing holder (257) alongwith oil seal (500.2), angular contact ball bearing (263) and thrust bearing carrier (247). Use release bolts.

10.4.14 Push thrust bearing carrier so that it will come out of bearing holder (254) alongwith angular contact ball bearing. Remove angular contact ball bearing from thrust bearing carrier (247) only if found to be damaged.

10.4.15 Lift the unit vertically up after engaging the shellings on the arms of the pump.

10.4.16 Fit the another pair of clamps on column pipe (133.2) next below the top column pipe.

10.4.17 Allow the unit to lower down so as to rest the clamps o the girders or wooden logs.

10.4.18 Unscrew the bolts holding top column pipe (132), bearing spider (245) and column pipe (133.2) together.

10.4.19 Take out top column pipe (132).

10.4.20 Disconnect the head shaft (185) using suitable spanner.

10.4.21 Disconnect the lubricating pipe for bearing spider (245) by unscrewing nut.

10.4.22 Take out the bearing spider (245).

10.4.23 Unscrew grub screw at the junction of intermediate bearing bush (351) and bearing spider (245). Remove the bearing bush (351) out of bearing spider (245) only if it is found damaged.

10.4.24 Unscrew the screwed coupling (395) from intermediate shaft (184) or impeller shaft (186).

10.4.25 Follow the procedure given in 10.4.5 to 10.4.24 till you remove last intermediate shaft (184), last bearing spider (245) and last screwed coupling (395).

10.4.26 Disconnect the rising pipe (142.1) at support plate while dismantling the column pipes if rising pipe is in two or more pieces.

10.4.27 Lift the remaining unit and take it out of the tank for further disassembly.

10.4.28 Rest the unit on suction flange of pump casing (107).

10.4.29 Remove rising pipe (142.1) and bend(280).

10.4.30 Remove bottom column pipe (133.1).

10.4.31 Disconnect lubricating piping and its accessories.

10.4.32 Remove casing cover (220) along with bearing shell (356.1).

10.4.33 Take out shaft along with impeller (151), shaft sleeve (311) and impeller nut(330).

10.4.34 Remove impeller nut (330) and take out impeller and shaft sleeve ith the help of suitable puller.

10.4.35 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 bearing: Wear

b. Bearing bushes- For wear and surface condition.

c. Shaft for runout (within 0.05 mm).

d. Shaft sleeves and screwed couplings- For wear and surface condition.

e. *Wear rings – For wear

Wear rings should be replaced if drop in hydraulic performance is more than allowable limit of the application.

10.4.36 Replace all the damaged parts with new one. Impeller wear ring and case wear ring should be locked in position by grub screws (M6 x 6L) at least at two points.

11. TECHNICAL DATA

11.1 Direction of rotation

Direction of rotation is clockwise when viewed from motor top.

11.2 Bearing is provided in thrust bearing carrier (263). This bearing is antifriction angular contact ball bearing SKF or equivalent. This bearing is grease lubricated. Following grease is recommended.

BEARING SIZE	APPLICABLE FOR
SKF 7206B OR EQ.	20/20Q, 25/16Q, 32/13,32/16, 32/20, 40/13, 40/16, 40/20, 50/13, 50/16, 50/20, 65/13
SKF 7309B OR EQ.	32/26, 40/26, 40/32, 50/26, 50/32, 65/16, 65/20, 65/26, 80/16, 80/20, 80/26, 100/20, 80/32, 65/32, 80/40, 100/26, 100/32, 100/40, 125/26, 125/3, 125/40, 150/32, 32/16Q, 32/20Q, 40/16Q, 40/20Q, 50/16Q, 50/20Q, 32/26Q, 65/20Q

SPEED	INDIAN OIL MAKE	HINDUSTAN PETROLEUM MAKE	CALTEX MAKE
1450	SERVOGEM	LITHON-3	STARFAK-3
2900	SERVOGEM-2	LITHON-2	STARFAK-2

11.3 Quantity of grease – For SKF 7206B or equivalent 5 to 10 gms and for SKF 7309B or equivalent 15 to 18 gms per 1000 running hours.

11.4 Bearing temperature of antifriction angular contact ball bearing – Grease lubricated bearings can be operated upto 80°C. Measure the bearing temperature with thermometer placed over bearing holder (254).

A sudden increase in temperature is an indication of danger and signal to investigate.

11.5 **Line shaft bearings:-**

Line shaft bearings (351 & 353). These bearings shall be 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.

11.6 Line shaft supporting bearing shall be lubricated by the liquid handled by the pump and need no external lubrication, unless otherwise specified.

11.7 Compressed asbestos gaskets:-

PART NO.	PUMP TYPE	SIZE IN mm
511.0	(Basket for casing cover and pump casing) 20/13Q, 32/13, 40/13, 50/13, 65/13.	141D x 152D x 1T
	20/16Q,25/16Q, 32/16*, 40/16*, 50/16*, 65/16, 80/16	176D x 188D x 1T
	20/20Q, 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	331D x 348D x 1T
	80/40, 100/40, 125/40	411D x 432D x 1T

* Denotes pump with semi-open impeller (KPDS-Q).

PART NO.	PUMP TYPE	SIZE IN mm
513.1	(Gasket for pump casing and bend)	
	20/13Q, 20/16Q, 20/20Q	NOT APPLICABLE
	25/16Q	27D x 115D x 1T
	32/13, 32/16*, 32/20*, 32/26*	32D x 140D x 1T
	40/13, 40/16*, 40/20*, 40/26, 40/32	40D x 156D x 1T
	50/13, 50/16*, 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	127D x 254D x 1T
	150/32	150D x 285D x 1T

* Denotes pump with semi-open impeller (KPDS-Q).

513.2 (Gasket for bend and rising pipe)

1. For rising pipe size same as delivery size of pump casing.
2. For rising pipe one size higher than delivery size of pump casing.
3. For rising pipe two size higher than delivery size of pump casing.

KPDS 20/13Q, 20/16Q, 20/20Q	1. 20D x 102D x 1T
KPDS 25/16Q	1. 25D x 124D x 1T 2. 32D x 140D x 1T 3. 40D x 156D x 1T
KPDS 32/13 TO 26 (also for 'Q' models)	1. 32D x 140D x 1T 2. 40D x 156D x 1T 3. 50D x 165D x 1T
KPDS 40/13 TO 32 (also for 'Q' models)	1. 40D x 156D x 1T 2. 50D x 165D x 1T 3. 65D x 185D x 1T
KPDS 50/13 TO 26 (also for 'Q' models)	1. 50D x 165D x 1T 2. 65D x 185D x 1T 3. 80D x 200D x 1T
KPDS 65/13 TO 32 (also for 'Q' models)	1. 65D x 185D x 1T 2. 80D x 200D x 1T 3. 105D x 220D x 1T
KPDS 80/16 TO 40	1. 80D x 200D x 1T 2. 105D x 220D x 1T 3. 127D x 245D x 1T
KPDS 100/20 TO 40	1. 105D x 220D x 1T 2. 127D x 245D x 1T 3. 150D x 200D x 1T

PART NO.	PUMP TYPE	SIZE IN mm
	KPDS 125/26 TO 40	1. 127D x 245D x 1T 2. 150D x 200D x 1T 3. 213D x 270D x 1T
	KPDS 150/32	1. 150D x 200D x 1T 2. 213D x 270D x 1T
680.0	(Gasket for pipe nut).	
	1. For rising pipe size same as delivery size of pump casing. 2. For rising pipe one size higher than delivery size of pump casing. 3. For rising pipe two size higher than delivery size of pump casing.	
	KPDS 20/13Q, 20/16Q, 20/20Q	1. 26.6D x 38D x 1T
	KPDS 25/16Q	1. 39D x 67D x 1T 2. 42D x 54D x 1T 3. 48D x 63D x 1T
	KPDS 32/13 TO 26 (also for 'Q' models)	1. 42D x 54D x 1T 2. 48D x 63D x 1T 3. 60D x 72D x 1T
	KPDS 40/13 TO 32 (also for 'Q' models)	1. 48D x 63D x 1T 2. 60D x 72D x 1T 3. 75D x 95D x 1T
	KPDS 50/13 TO 26 (also for 'Q' models)	1. 60D x 72D x 1T 2. 75D x 95D x 1T 3. 89D x 121D x 1T
	KPDS 65/13 TO 32 (also for 'Q' models)	1. 75D x 95D x 1T 2. 89D x 121D x 1T 3. 115D x 130D x 1T
	KPDS 80/16 TO 40	1. 89D x 121D x 1T 2. 115D x 130D x 1T 3. 138D x 165D x 1T
	KPDS 100/20 TO 40	1. 115D x 130D x 1T 2. 138D x 165D x 1T 3. 163D x 200D x 1T
	KPDS 125/26 TO 40	1. 138D x 165D x 1T 2. 163D x 200D x 1T 3. 213D x 270D x 1T
	KPDS 150/32	1. 163D x 200D x 1T 2. 213D x 270D x 1T

PART NO.	PUMP TYPE	SIZE IN mm
515.0	(Gasket for impeller and shaft sleeve)	
	KPDS 20/13Q, 20/16Q, 20/20Q	17D x 23D x 1T
	KPDS 25/16Q, 32/13, 32/16, 32/20, 40/13, 40/16, 40/20, 50/13, 50/16, 50/20, 65/13. (also for 'Q' models)	25D x 30D x 1T
	KPDS 32/26, 40/26, 40/32, 50/26, 50/32, 65/16, 65/20, 65/26, 80/16, 80/20, 80/26, 100/20 (also for 'Q' models)	35D x 40D x 1T
	KPDS 80/32, 65/32, 80/40, 100/26, 100/32, 100/40, 125/26, 125/32, 125/40, 150/32	44D x 50D x 1T
682.0	(Gasket for impeller and impeller nut)	
	KPDS 20/13Q, 20/16Q, 20/20Q	NOT APPLICABLE
	KPDS 25/16Q, 32/13, 32/16, 32/20, 40/13, 40/16, 40/20, 50/13, 50/16, 50/20, 65/13. (also for 'Q' models)	20D x 28D x 1T
	KPDS 32/26, 40/26, 40/32, 50/26, 50/32, 65/16, 65/20, 65/26, 80/16, 80/20, 80/26, 100/20 (also for 'Q' models)	28D x 28D x 1T
	KPDS 80/32, 65/32, 80/40, 100/26, 100/32, 100/40, 125/26, 125/32, 125/40, 150/32	38D x 48D x 1T
514.0	(Gasket for bearing cover)	
	KPDS 20/13Q, 20/16Q, 20/20Q, 25/16Q, 32/13, 32/16, 32/20, 40/13, 40/16, 40/20, 50/13, 50/16, 50/20, 65/13.	62D x 94D x 1T
	KPDS 32/16Q, 32/20Q, 40/16Q, 40/20Q, 50/16Q, 50/20Q, 32/26, 32/26Q, 40/26, 40/32, 50/26, 50/32, 65/16, 65/20, 65/20Q, 65/26, 80/16, 80/20, 80/26, 100/20, 80/32, 65/32, 80/40, 100/26, 100/32, 100/40, 125/26, 125/32, 125/40, 150/32	100D x 150D x 1T

PART NO.	PUMP TYPE	SIZE IN mm
804.0	(Gasket for stuffing box housing)	
	KPDS 20/13Q, 20/16Q, 20/20Q, 25/16Q, 32/13, 32/16, 32/20, 40/13, 40/16, 40/20, 50/13, 50/16, 50/20, 65/13.	180D x 130D x 1T
	KPDS 32/26, 40/26, 40/32, 50/26, 50/32, 65/16, 65/20, 65/26, 80/16, 80/20, 80/26, 100/20, 80/32, 65/32, 80/40, 100/26, 100/32, 100/40, 125/26, 125/32, 125/40, 150/32. (also for 'Q' models)	171D x 270D x 1T
512.0	(Gasket for adapter plate)	
	KPDS 20/13Q, 20/16Q, 20/20Q, 25/16Q, 32/13, 32/16, 32/20, 40/13, 40/16, 40/20, 50/13, 50/16, 50/20, 65/13. (also for 'Q' models)	51D x 128D x 1T
	KPDS 32/26, 40/26, 40/32, 50/26, 50/32, 65/16, 65/20, 65/26, 80/16, 80/20, 80/26, 100/20, 80/32, 65/32, 80/40, 100/26, 100/32, 100/40, 125/26, 125/32, 125/40, 150/32. (also for 'Q' models)	75D x 170D x 1T

PART NO.	PUMP TYPE	SIZE IN mm
500.1	(oil Seal)	
	Material – Synthetic rubber with steel spring	
	KPDS 20/13Q, 20/16Q, 20/20Q, 25/16Q, 32/13, 32/16, 32/20, 40/13, 40/16, 40/20, 50/13, 50/16, 50/20, 65/13.	40D x 55D x 7T
	KPDS 32/16Q, 32/20Q, 32/26, 32/26Q, 40/16Q, 40/20Q, 40/26, 40/32, 50/16Q, 50/20Q, 50/26, 50/32, 65/16, 65/20, 65/20Q, 65/26, 65/32, 80/16, 80/20, 80/26, 80/32, 80/40, 100/20, 100/26, 100/32, 100/40, 125/26, 125/32, 125/40, 150/32.	55D x 80D x 13T

PART NO.	PUMP TYPE	SIZE IN mm
500.2	(oil Seal)	
	KPDS 20/13Q, 20/16Q, 20/20Q, 32/13, 32/16, 32/20, 40/13, 40/16, 40/20, 50/13, 50/16, 50/20, 65/13.	30D x 42D x 7T
	KPDS 32/16Q, 32/20Q, 32/26, 32/26Q, 40/16Q, 40/20Q, 40/26, 40/32, 50/16Q, 50/20Q, 50/26, 50/32, 65/16, 65/20, 65/20Q, 65/26, 65/32, 80/16, 80/20, 80/26, 80/32, 80/40, 100/20, 100/26, 100/32, 100/40, 125/26, 125/32, 125/40, 150/32.	45D x 65D x 12T

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

Pressure = 1/30 x (Total head in meters) + 1.0 kg

Quantity = 0.2 m^3/hr x (N + 1)
Where, N = No. of bearing spiders.

12. TROUBLE SHOOTING

A) No liquid delivered
B) Not enough liquid delivered
C) Not enough pressure
D) Loss of liquid after starting
E) Vibration
F) Motor runs hot
G) Cavitation, noise
H) Pump bearing over heated.

SR. NO.	CAUSES	A	B	C	D	E	F	G	H
1.	PUMP NOT PRIMED	★							
2.	SPEED TOO LOW	★	★	★					
3.	SPEED TOO HIGH						★	★	
4.	AIR LEAKAGE ON SUCTION	★	★		★	★		★	
5.	AIR OR GAS IN LIQUID		★		★				
6.	DISCHARGE HEAD TOO HIGH (ABOVE RATING)	★	★	★			★		
7.	SUCTION LIFT TOO HIGH				★				
8.	NOT ENOUGH SUCTION HEAD FOR HOT LIQUID							★	

SR. NO.	CAUSES	A	B	C	D	E	F	G	H
9.	INLET PIPE NOT SUBMERGED	★	★		★				
10.	VISCOSITY OF LIQUID GREATER THAN RATING		★	★					
11.	LIQUID HEAVIER THAN RATING						★		
12.	INSUFFICIENT NET INLET HEAD	★	★		★	★		★	
13.	IMPELLER PLUGGED UP	★	★			★			
14.	WRONG DIRECTION OF ROTATION	★	★	★					
15.	EXCESSIVE WEAR RING CLEARANCE		★	★					
16.	DAMAGED IMPELLER		★	★		★			
17.	ROTOR WINDING						★		
18.	DEFECTS IN MOTOR						★		
19.	VOLTAGE OR FREQUENCY LOWER THAN RATING						★		
20.	LUBRICANT DIRTY, CONTAMINATED								★
21.	FOUNDATION NOT RIGID					★			
22.	MISALIGNMENT OF PUMP &MOTOR					★			
23.	BEARING WORN OUT					★	★		
24.	ROTOR OUT OF BALANCE					★			
25.	SHAFT BENT					★	★		★
26.	IMPELLER TOO SMALL				★				

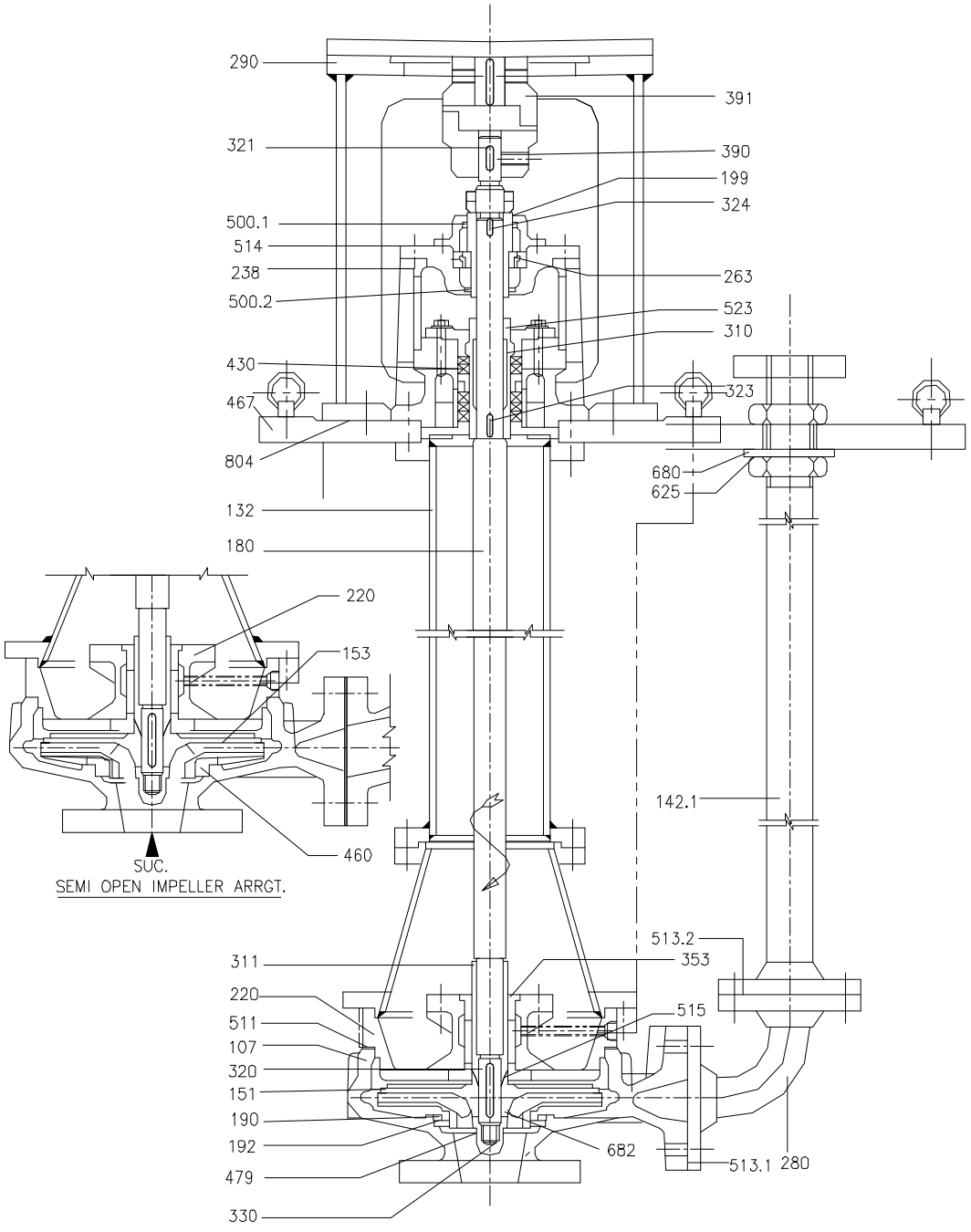
SPECIFICATION LIST OF KPDS PUMP PARTS

PART NO.	DESCRIPTION	QTY.
107.0	PUMP CASING	01
132.0	TOP COLUMN PIPE	01
133.1	BOTTOM COLUMN PIPE	01
133.2	STANDARD COLUMN PIPE	$
142.1	RISING PIPE	01
142.2	STANDARD RISING PIPE	01
143.0	TAPER COLUMN PIPE	01
151.0*	ENCLOSED IMPELLER	01
153.0*	SEMI OPEN IMPELLER	01
180.0*	PUMP SHAFT	01
184.0*	INTERMEDIATE SHAFT	$
185.0*	HEAD SHAFT	01
186.0*	IMPELLER SHAFT	01
190.0*	CASING WEAR RING SUC. SIDE	01
191.0*	CASING WEAR RING DEL. SIDE	01
192.0*	IMPELLER WEAR RING SUC. SIDE	01
193.0*	IMPELLER WEAR RING DEL. SIDE	01
198.0	COUPLING SPACER	01
216.0	STRAINER (IF ORDERED)	01
220.0	CASING COVER	01
225.0	SPLIT GLAND	01
227.0	LANTERN RING	01
238.0	STUFFING BOX HOUSING	01
245.0	BEARING SPIDER	$
247.0	THRUST BEARING CARRIER	01
254.0	BEARING HOLDER	01
263.0*	ANGULAR CONTACT BALL BEARING SKF 7206B/7309B OR EQUIVALENT	01

PART NO.	DESCRIPTION	QTY.
270.0	BEARING COVER	01
280.0	BEND	01
290.0	MOTOR STOOL	01
300.0	EYE BOLTS	$
310.0*	SHAFT SLEEVE (D.S.)	01
311.0*	SHAFT SLEEVE (P.S.)	01
320.0*	KEY FOR IMPELLER	01
321.0	KEY FOR COUPLING	01
323.0*	KEY FOR SHAFT SLEEVE	01
324.0*	KEY FOR THRUST BEARING CARRIER	01
330.0*	IMPELLER NUT	01
335.0	BEARING NUT	01
336.0	LOCK NUT	01
338.1 & 2	PIPE NUT	02
351.0*	INTERMEDIATE BEARING BUSH	$
353.0*	BEARING BUSH UNDER IMPELLER	01
356.1	BEARING SHELL FOR BUSH UNDER IMPELLER	01
390.0	PUMP SIDE COUPLING-FLEXIBLE	01
391.0	MOTOR SIDE COUPLING- FLEXIBLE	01
395.0*	SCREWED COUPLING	$
403.0*	COUPLING STAR	01
415.1	LOCK WASHER FOR BEARING NUT	01
430.0*	GLAND PACKING	01
441.0	GREASE NIPPLE	01
460.0*	WEAR PLATE	01
461.0	ADAPETR PLATE	01
467.0	SUPPORT PLATE	01

PART NO.	DESCRIPTION	QTY.
479.0*	HELICOIL SPRING INSERT	01
490.1	FLANGE FOR RISING PIPE	01
490.2	DELIVERY FLANGE ABOVE SUPPORT PLATE	01
500.1*	OIL SEAL (DRIVING SIDE)	01
500.2*	OIL SEAL (PUMP SIDE)	01
511.0*	GASKET FOR CASING COVER	01
512.0*	GASKET FOR ADAPTER PLATE	01
513.1*	GASKET FOR BEND	01
513.2*	GASKET FOR RISING PIPE	01
514.0*	GASKET FOR BEARING COVER	01
515.0*	GASKET FOR SHAFT SLEEVE	01
523.0*	O-RING FOR SHAFT SLEEVE (D.S)	01
625.0*	WASHER FOR PIPE NUT	01
666.1	HEX. SOCKETED CAP SCREW FOR BEARING SHELL	04
680.0*	GASKET FOR PIPE NUT	01
682.0*	GASKET FOR IMPELLER AND IMPELLER NUT	01
804.0*	GASKET FOR ST. BOX AND SUPPORT PLATE	01

NOTE: * RECOMMENDED SPARES
$ QUNATITY DEPENDS ON COLUMN LENGTH OF PUMP.



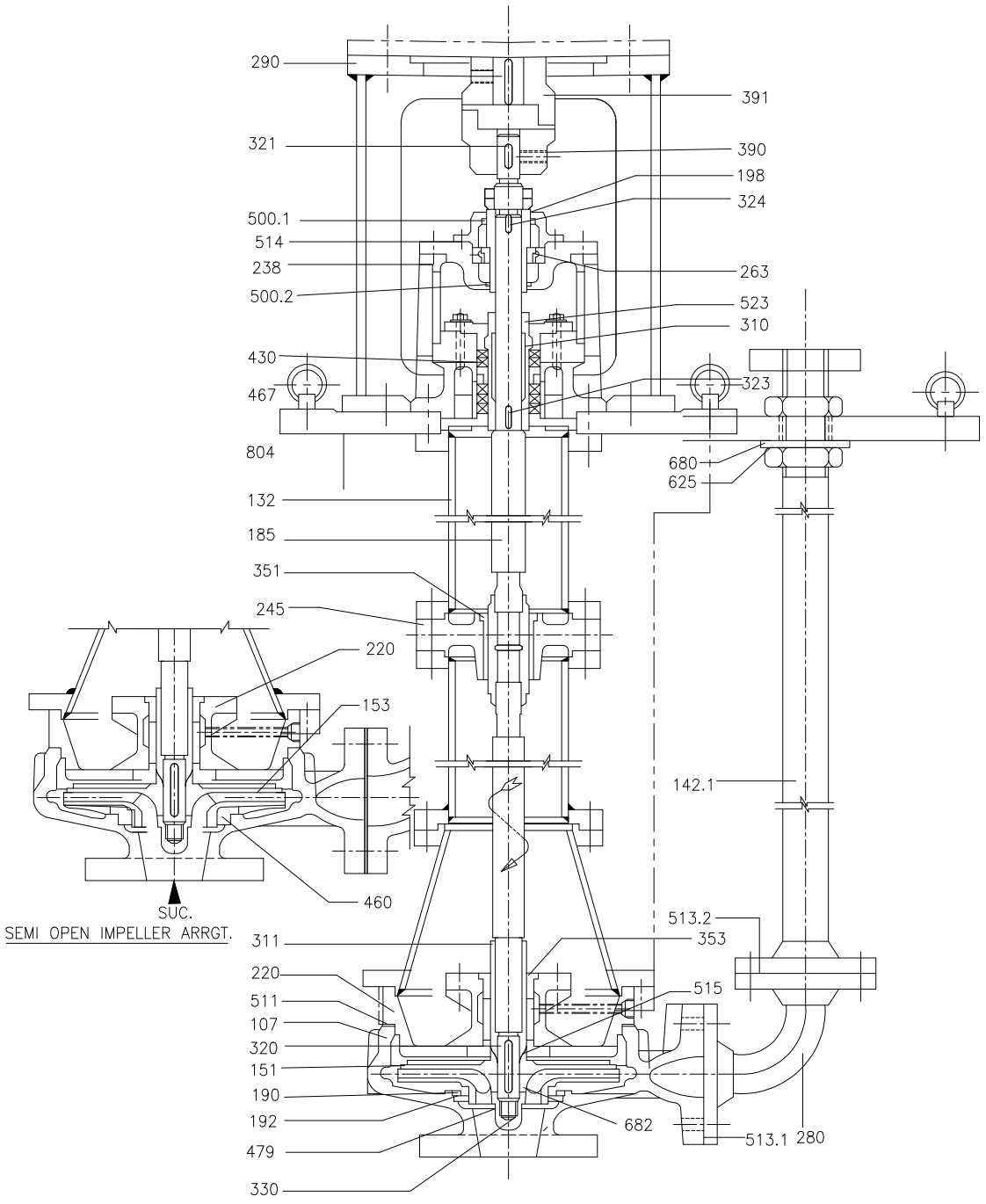
NOTE:– FOR PART LIST REFER DRG. NO.– KPD–S 167–017–0 SHEET 2 OF 2

CROSS SECTIONAL ASSEMBLY OF KPD–S PUMP

DESCRIPTION – GENERAL FOR KPD–S (UNIT–1 PUMP WITH SINGLE PIECE SHAFT DESIGN UP TO COLUMN LENGTH OF 800 mm

O/A NO.		P.O. NO.	
INDENTOR'S NAME		CUSTOMER	
CONSULTANT		SERVICE	
PROJECT			

	JOB NO.		P.O. ITEM NO.	EQUIPMENT NO.	
	DRAWN		KIRLOSKAR BROTHERS LTD. PUNE 411 002		DRAWING NO.
	CHD.				KPD–S 167–017–0
	APPRED				SHEET 1 OF 2



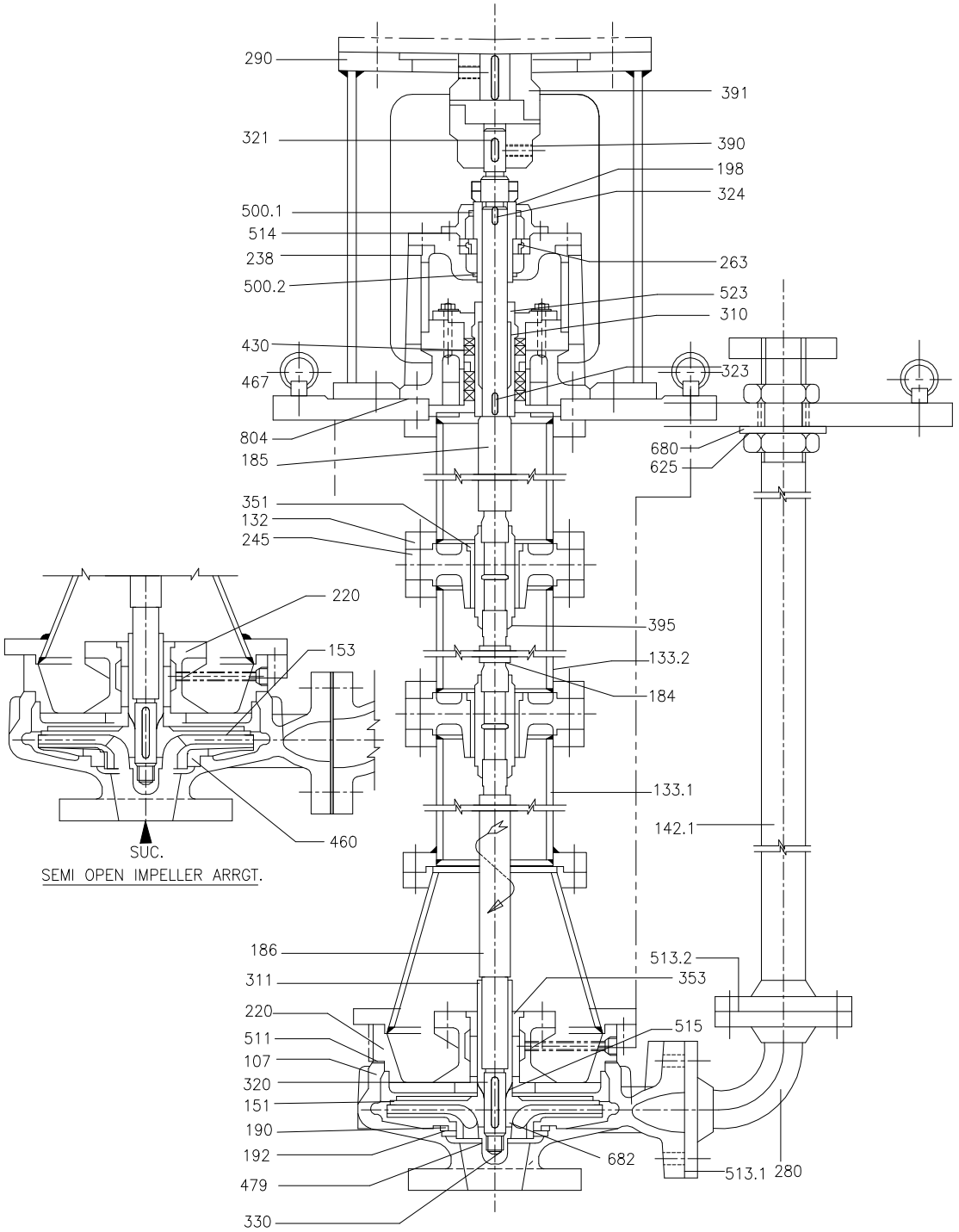
NOTE:- FOR PART LIST REFER DRG. NO.- KPD-S 167-018-0 SHEET 2 OF 2

CROSS SECTIONAL ASSEMBLY OF KPD-S PUMP

DESCRIPTION - GENERAL FOR KPD-S (UNIT-1 PUMP WITH SINGLE PIECE SHAFT DESIGN UP TO COLUMN LENGTH OF 850 TO 1650 mm

O/A NO.		P.O. NO.	
INDENTOR'S NAME		CUSTOMER	
CONSULTANT		SERVICE	
PROJECT			

JOB NO.		P.O. ITEM NO.	EQUIPMENT NO.	
DRAWN		KIRLOSKAR BROTHERS LTD. PUNE 411 002		DRAWING NO. KPD-S 167-018-0
CHD.				
APPRED				SHEET 1 OF 2



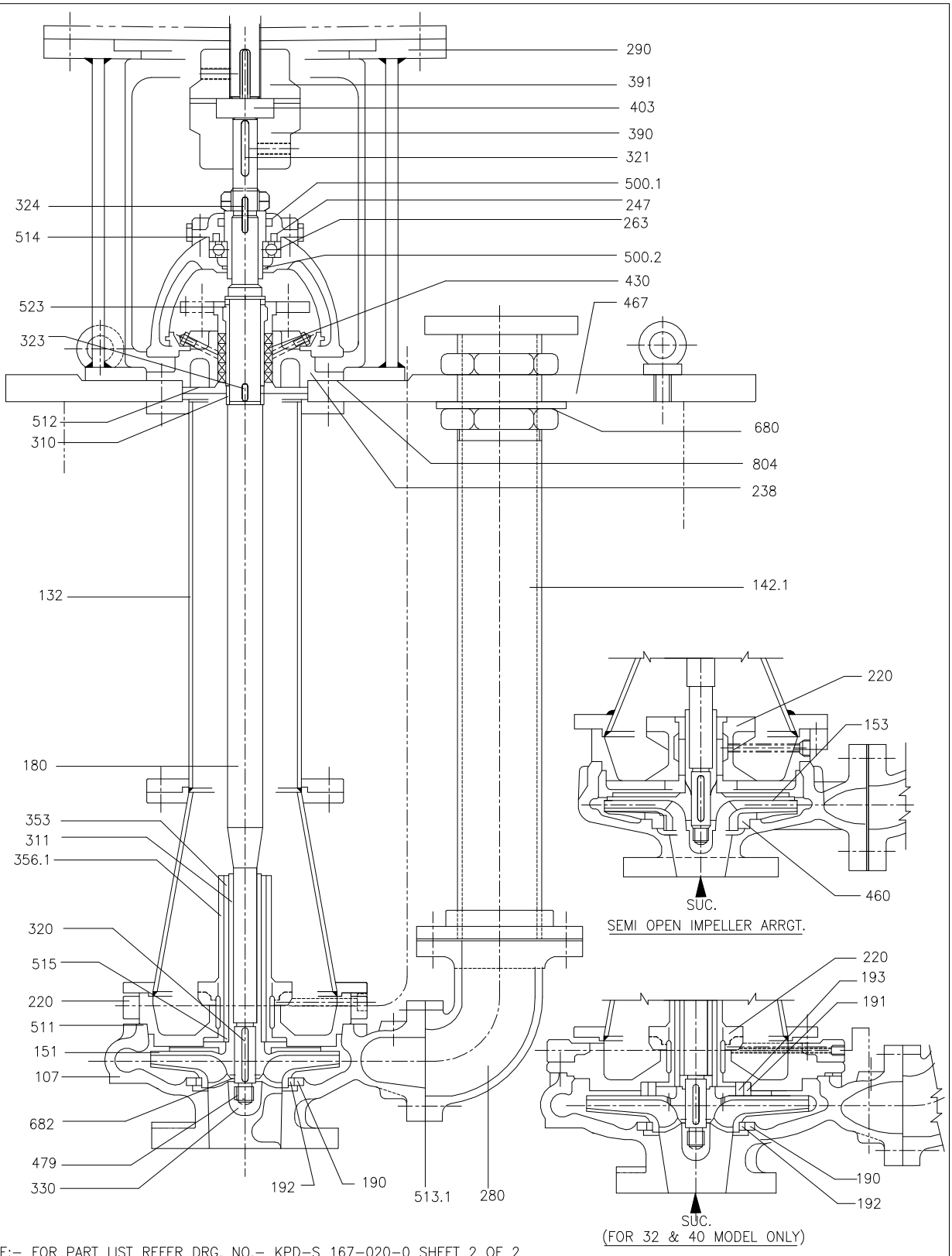
NOTE:– FOR PART LIST REFER DRG. NO.– KPD–S 167–019–0 SHEET 2 OF 2

CROSS SECTIONAL ASSEMBLY OF KPD–S PUMP

DESCRIPTION – GENERAL FOR KPD–S (UNIT–1 PUMP WITH SINGLE PIECE SHAFT DESIGN UP TO COLUMN LENGTH OF 850 TO 1650 mm

O/A NO.		P.O. NO.	
INDENTOR'S NAME		CUSTOMER	
CONSULTANT		SERVICE	
PROJECT			

	JOB NO.		P.O. ITEM NO.	EQUIPMENT NO.	
	DRAWN		KIRLOSKAR BROTHERS LTD. PUNE 411 002		DRAWING NO. KPD–S 167–019–0
	CHD.				
	APPRED				SHEET 1 OF 2



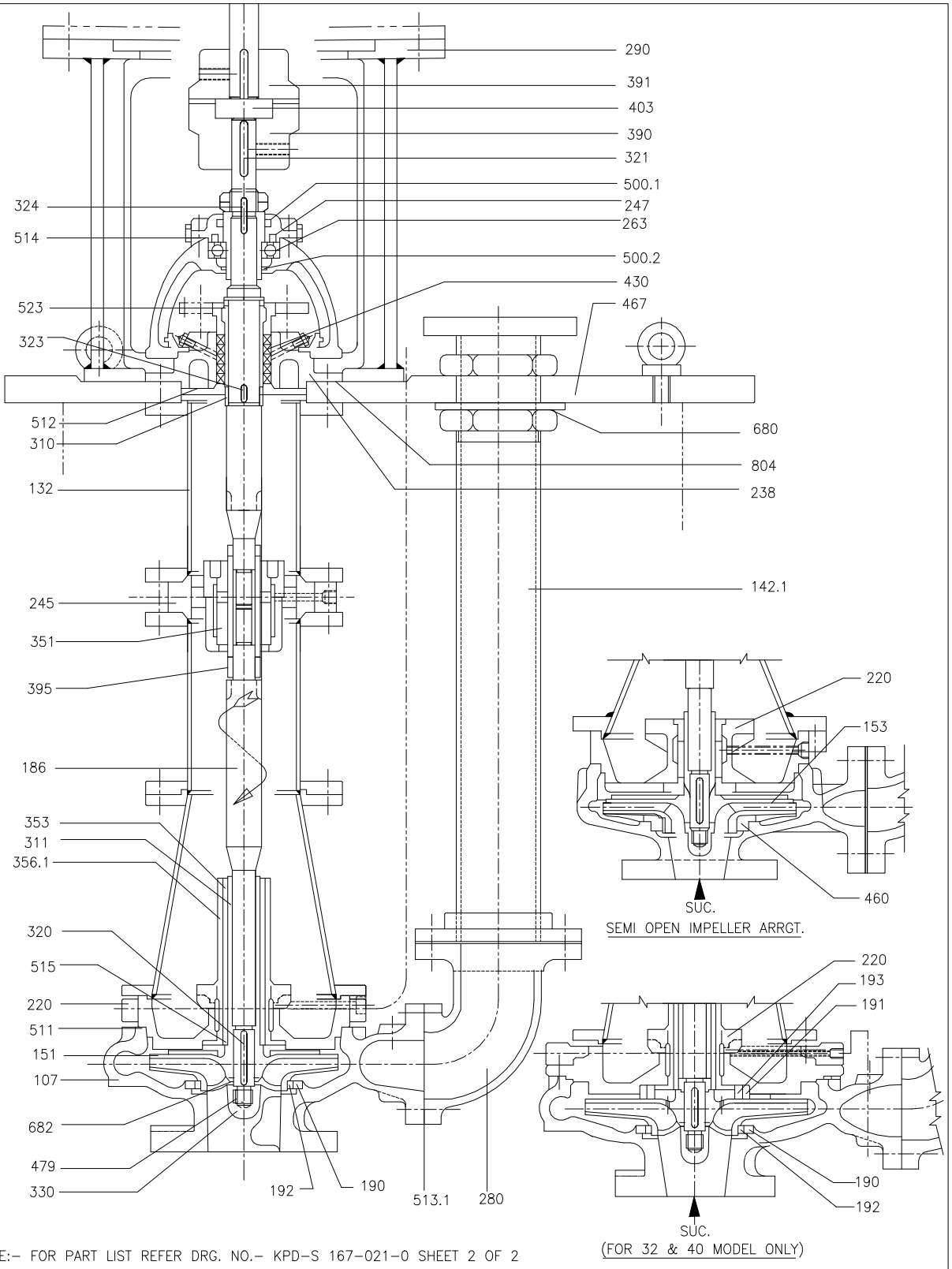
NOTE:– FOR PART LIST REFER DRG. NO.– KPD–S 167–020–0 SHEET 2 OF 2

CROSS SECTIONAL ASSEMBLY OF KPD–S PUMP

DESCRIPTION – GENERAL FOR KPD–S (UNIT–II & III PUMP FOR COLUMN LENGTH UP TO 950 mm

O/A NO.		P.O. NO.	
INDENTOR'S NAME		CUSTOMER	
CONSULTANT		SERVICE	
PROJECT			

	JOB NO.		P.O. ITEM NO.	EQUIPMENT NO.	
	DRAWN		KIRLOSKAR BROTHERS LTD. PUNE 411 002		DRAWING NO. KPD–S 167–020–0
	CHD.				
	APPRED				SHEET 1 OF 2



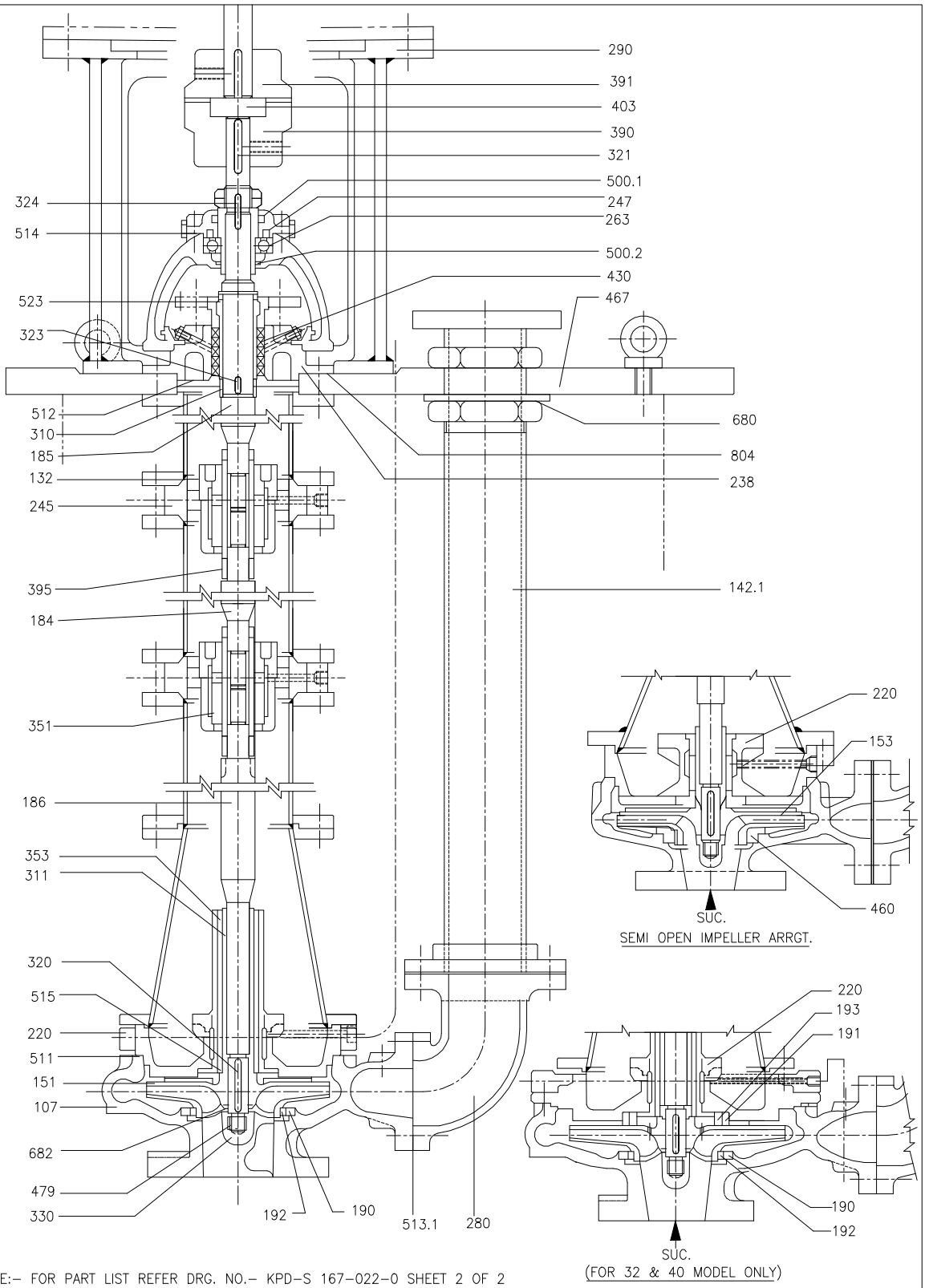
NOTE:– FOR PART LIST REFER DRG. NO.– KPD–S 167–021–0 SHEET 2 OF 2

CROSS SECTIONAL ASSEMBLY OF KPD–S PUMP

DESCRIPTION – GENERAL FOR KPD–S UNIT–II & III PUMP FOR COLUMN LENGTH UNIT–II 1000 TO 1950/UNIT–III 1000 TO 2450 mm

O/A NO.		P.O. NO.	
INDENTOR'S NAME		CUSTOMER	
CONSULTANT		SERVICE	
PROJECT			

	JOB NO.		P.O. ITEM NO.	EQUIPMENT NO.	
	DRAWN		KIRLOSKAR BROTHERS LTD.		DRAWING NO.
	CHD.		PUNE 411 002		KPD–S 167–021–0
	APPRED				SHEET 1 OF 2



NOTE:– FOR PART LIST REFER DRG. NO.– KPD–S 167–022–0 SHEET 2 OF 2

CROSS SECTIONAL ASSEMBLY OF KPD–S PUMP

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

O/A NO.		P.O. NO.	
INDENTOR'S NAME		CUSTOMER	
CONSULTANT		SERVICE	
PROJECT			

	JOB NO.		P.O. ITEM NO.	EQUIPMENT NO.	
	DRAWN		KIRLOSKAR BROTHERS LTD.		DRAWING NO.
	CHD.		PUNE 411 002		KPD–S 167–022–0
	APPRED				SHEET 1 OF 2

GENERAL INFORMATION & SAFETY REQUIREMENTS

1.0 The products supplied by KBL have been designed with safety in mind. Where hazards cannot be eliminated, the risk has been minimised 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; YOU are responsible for using safe working practices at all times.

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

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

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

1.3 KBL requires that, all personnel that 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 should be worn where working with pressurised systems and hazardous substances. Other personnel protection equipment must be worn where local rules apply.

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 and maintenance of the equipment. Check and confirm that the manual is relevant copy 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 containers have been provided.

1.9 IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF THIS KBL PRODUCT COULD RESULT IN INJURY OR DEATH.

2.0 SAFETY INSTRUCTIONS WHILE HANDLING AND STORAGE

When lifting the pump, use the lifting points specified on general arrangement drawing. 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 fork-lift truck and chain crane sling equipment is recommended but locally approved equipment of suitable rating may be used.

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

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.

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.

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.

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 the 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 will 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 pumped 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

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.

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 components which contain 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.

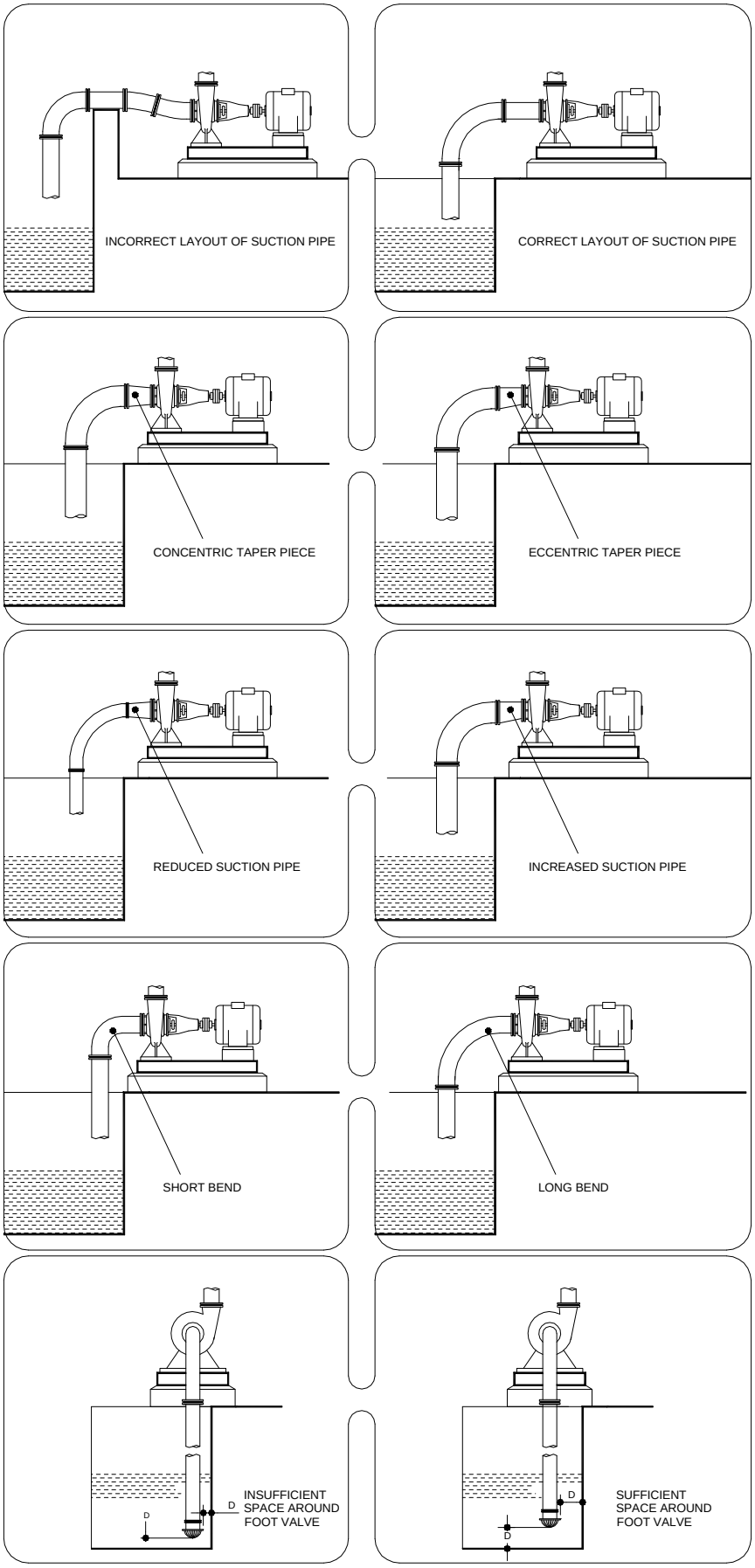
Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation of noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.

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

Ref: Proposed draft standard prEN 800:
Pumps and pump units for liquids;
General safety requirements

INCORRECT

CORRECT



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

GENERAL INSTRUCTIONS FOR INSTALLATION OPERATION & MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS

GENERAL INSTRUCTIONS FOR INSTALLATION, OPERATION & MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS

WARNING

The equipment supplied is designed for specific capacity, speed, pressure and temperature. Do not use the equipment beyond the capacities for which it is manufactured. The equipment manufactured is also shop tested for the satisfactory performance and if it is operated is 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 that 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.

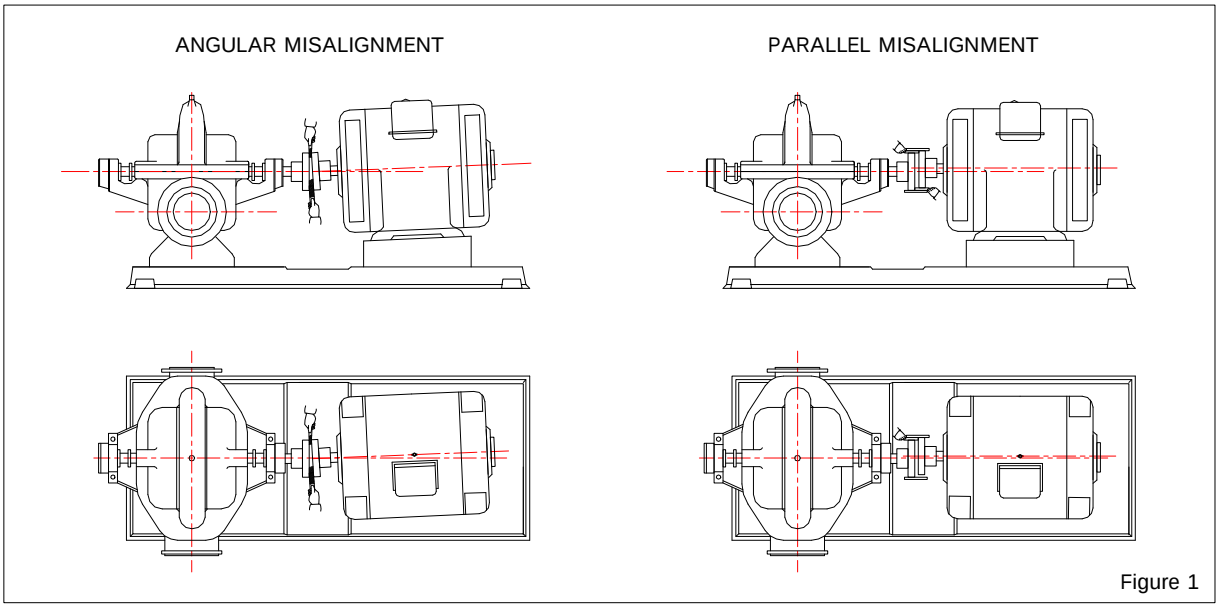


Figure 1

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 FIGURE2)

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 on an outside caliper.

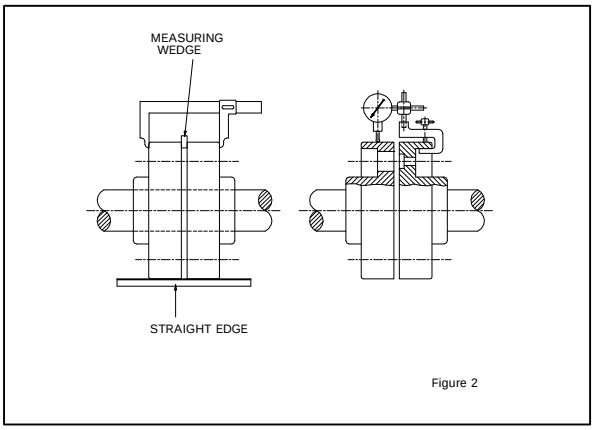
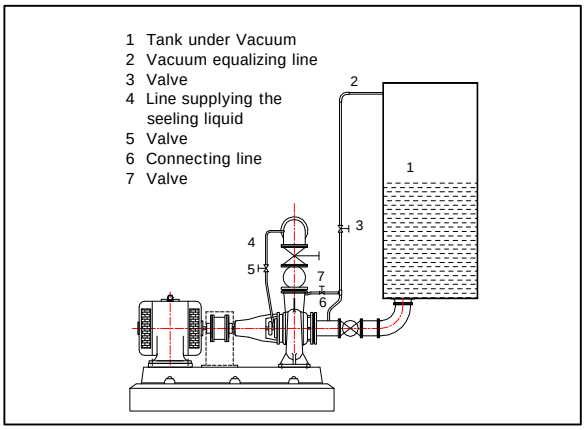


Figure 2



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

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

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

GROUTING

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

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 of 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 to that weight of the pipe lines does not fall on the pump. The use of minimum number of the bends and other fittings will minimise the frictional losses.

SUCTION PIPE

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

The end of the suction pipe must be well submerged to avoid whirlpools and ingress of air but must be kept clear of nay 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 of sluice valve (regulating valve) should be installed in the discharge line. The check valve placed between the pump and the gate valve is to protect the pump from excessive pressure and to prevent water running back through the pump in case of failure of the driving machine.

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

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

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

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

FOOT VALVE

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

STUFFING BOXES AND PACKING

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

BALL BEARINGS

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

Three monthly when on continuous duty.

Six monthly when on eight-hour per duty.

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

PRIMING

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

(1) Liquid level above pump level

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

(2) Priming with foot valve

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

   (b) When there is liquid under some pressure in the discharge pipe, priming can be effected by byepassing 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 22 56 57 58
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 58 62
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 55 58
Stuffing box leaks excessively	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 47 48 49 51 54 55 58
Motor will not start	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.

Enriching Lives

INSTRUCTIONS ON INSTALLATION OPERATION AND MAINTENANCE FOR

KIRLOSKAR PUMP
TYPE KPDS-LGT

KIRLOSKAR BROTHERS LIMITED
UDYOG BHAVAN, TILAK ROAD, PUNE - 411 002

KIRLOSKAR BROTHERS LIMITED

Udyog Bhavan, Tilak Road, Pune 411 002 (India)

WARRANTY

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

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

KIRLOSKAR BROTHERS LIMITED

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11. TECHNICAL DATA
12. TROUBLE SHOOTING
13. CROSS SECTIONAL DRAWING
14. OUTLINE DRAWING

CAUTION:

THIS INSTRUCTION MANUAL COVERS THE GENERAL REQUIREMENTS OF INSTALLATION, OPERATION AND MAINTENANCE. HOWEVER THE END USER SHOULD REFER TO THE DRAWINGS AND DOCUMENTS IF SUPPLIED AGAINST SPECIFIC ORDER.

1. INTRODUCTION

KPDS-LGT Pumps are specially developed for handling oil for gas turbines. These pumps shall be used as AOP (Auxiliary Oil Pump) or EOP (Emergency Oil Pump) to lubricate the turbine bearings at the time of starting.

The pump types are designated as KPD-S (delivery size in mm x nominal full dia. Of impeller in cm). LGT e.g. KPDS 80x26 LGT Pump where 80mm is delivery nozzle size of pump casing and 26 cm is nominal full dia. Impeller. It should be noted that the rising pipe sizes are higher than the delivery nozzle size of pump casing in order to reduce the frictional losses. e.g. for KPDS 80x26 LGT Pump, rising pipe size is 100 mm where the delivery nozzle size of the pump casing is 80mm.

This booklet covers important guidelines and instructions on erection, operation and maintenance. These instructions should be followed carefully and failing to this may result in unsatisfactory performance and damage to the pump parts.

Only mechanical aspects in connection with erection and maintenance of the pumps are covered in this booklet. Civil and electrical engineering aspects are to be considered and taken care of at customers end only. The customers are requested to report the problems arising at the site to the supplier without fail. The nameplate details should be mentioned while making correspondence with the supplier/ manufacturer.

2. PRE-REQUISITES FOR SATISFACTORY OPERATION

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

a. Pump handles the liquid as specified in the order.

b. Minimum submergence is kept as shown in outline dimension drawing supplied against the order.

c. Operation and maintenance instructions are followed as given in this booklet.

d. Load of delivery pipe and other accessories such as sluice valve, reflux valve etc. is not coming directly on support plate of the pump.

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.

3. PUMP HOUSE/ TANK LAYOUT

The layout should be done after considering following.

3.1 Liquid inlet to the tank:

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

3.2 Suction tank:

The tank should be designed so as to provide-

3.2.1 Enough storage capacity to avoid sudden fluctuations in liquid levels, kinematic disturbances at the suction of the pump such as turbulence, eddies, vortices, air entrainment etc.

3.2.2 **Low velocity:**

The maximum liquid velocity of the liquid entering in the tank should not exceed 1 m/sec.

3.2.3 **Individual flow pattern:**

Where one tank houses more than one pumping sets, care must be taken to provide appropriate distances from walls, floor and adjacent pipes. It is advised that such layouts should be referred to the pump manufacturer. This is necessary to ensure individual flow pattern of each pump undisturbed by other pumps.

3.2.4 **Pump submergence:**

The lowest liquid level should be as recommended in the outline drawing supplied against order. Highest liquid level also be below specified level on the same drawing.

4. HOUSE REQUIREMENTS

These should cover mainly the following aspects.

4.1 The floor tank should be sturdy enough to take total weight of the machine including that of liquid column in the rising pipe.

4.2 Sufficient floor area for working and overhauling. In this, the following factors are to be considered.

4.2.1 Proper spacing of the pumps to avoid transmission of vibrations from one machine to another.

4.2.2 Easy and safe accessibility to the electrical switch box.

4.2.3 Space for dismantled pump parts during overhauling.

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

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

4.3.2 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.

5. STORAGE AND HANDLING

5.1 KPDS-LGT pumps are dispatched in completely assembled condition.

5.1.1 Check that all packages are in tact and open parts are not damaged in transit.

5.1.2 Report immediately discrepancies, if any to the supplier.

5.1.3 Unless the pump is to be installed immediately, repack the material in respective cases after the contents have been verified against delivery notes.

5.1.4 Do not open the packages again, unless site is completely ready for erection.

5.2 Storage

5.2.1 Storing place should be free from dust, heat, moisture etc. The floor of the store room should be hard and plane.

5.3 Handling

5.3.1 All machined surfaces are coated with a special antirust compound. If any surface is found exposed, clean it and apply a thick coating of grease or antirust compound and wrap it with paper to prevent further rusting.

5.3.2 Never drag any components or package of parts for any reason. Dragging sets in intrinsic vibration, which may distort the accuracies, parallelism etc. of machined surfaces. Distortion of accuracies might cause serious functional and operational troubles.

5.3.3 Over hanging should be avoided as far as possible. While lifting the parts by ropes, they should be properly balanced.

5.3.4 Transportation should be free from jerks. Long parts should not be handled without due supports.

CAUTION

CARE MUST BE TAKEN IN HANDLING OF ALL PARTS ESPECIALLY THE SHAFTS. THEY ARE MACHINED TO CLOSE TOLERANCES AND CAREFULLY INSPECTED AT FACTORY AND IF BENT, THEY CAN CAUSE A SERIOUS TROUBLE. A BENT SHAFT SHOULD NEVER BE USED.

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 and should be rigid enough not to vibrate.

6.2 **Levelling**

For smooth working of the pumps, it is necessary that the machined surface of the support plate on which motor rests is perfectly horizontal level and the assembly keeps up its vertical position. The rotating unit should be aligned with the vertical axis.

The whole foundation frame plain position on which the support plates to be mounted should be checked with straight edge and spirit level. The plain portion should be made horizontal by scrapping operation, if necessary. After tightening the foundation bolts ensure that the machined surface of support plate on which motor rests is horizontal within 0.05 mm.

7. TOOLS AND EQUIPMENTS

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 3m minimum and the hand chains provided should be long enough to operate it conveniently from the floor. The chain pulley block of 2 Tons capacity is most suitable.

7.2 Chain and lifting hook.

7.3 Jute ropes, crow bars and 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 accuracy of 0.02 mm per meter.

7.7 Small wire brush for cleaning threads at shafts.

7.8 Threading compounds for shafts and pipe threads.

7.9 V blocks, dial gauge with magnetic stand to check run out of shafts.

7.10 Besides above following standard tools and equipments should be available for smooth erection.

7.10.1 Files-triangular, half round and flat of different cuts and sizes.

7.10.2 Triangular scrapper, filler gauge.

7.10.3 Two sets of standard/ring spanners.

7.10.4 Set of wrenches and chain tank.

7.10.5 Adjustable spanner, screw drivers and 12”and 6”.

7.10.6 Allen keys.

7.10.7 Steel rule and steel tape.

7.10.8 Sets of taps and dies upto M16.

7.10.9 Chisel, hammer, hack saw, vice etc.

7.10.10 Emery paper.

8. ERECTION/ ASSEMBLING PROCEDURE

Follow the procedure given below in case of pumps to be erected for the first time or the 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.

8.1 Insert shaft sleeve (311) on pump shaft (180) with key (320) in proper position. Fit journal bearing (371) in casing cover (220) and fix the hex. socketted cap screws (666.1)

8.2 Insert casing cover (220) on to the pump shaft with shaft sleeve. Mount the impeller (151) on pump shaft with gasket (515) in position and tighten the impeller nut (330) with gasket (682) in between the impeller and the impeller nut.

8.3 Insert the assembly so far completed into pump casing (170)with permanite (oil) gasket (511) in proper position. Tighten the hex. nuts on casing studs in case of pump 32 & 40 cm nominal size viz. KPDS-LGT 100/32, 100/40 etc.

8.4 Mount column pipe (133.1) on casing cover (220) and tighten the nuts on casing studs.

8.5 Mount the double row ball bearing (263) on thrust bearing carrier (247) (this action is required in case of replacement of bearing).

CAUTION

DO NOT TAKE OUT THE BEARING OUT OF THE THRUST BEARING CARRIER UNLESS THE BEARING IS DAMAGED.

8.6 Mount the support plate (467) alongwith bend & rising pipe and put on column pipe. Also ensure that the bend holes are matching to the pump casing delivery flange holes. Put gasket (513.1) between pump casing and bend and tighten diametrically opposite nuts one after the other.

8.7 Insert the oil retainer (277) along with gasket (680.3) in bearing holder from bottom side. Tighten the screws holding oil retainer and bearing holder. Mount O-ring (523) on bearing holder and mount the bearing holder (254) alongwith bearing on support plate. Ensure that key/ keys (324) is/ are properly fitted under thrust bearing carrier.

8.8 Insert the oil seal (550.1) in bearing cover (270) and fix to the bearing holder. Now keep the entire assembly in vertical position and fit the bearing nut (335). Tighten the bearing nut such that the shaft is lifted up by about 0.5 to 1.0 mm. Fit the bearing lock nut (336). Tighten the bearing lock nut completely and loose the bearing nut slightly without disturbing the lock nut position. This is to ensure locking of the nut.

CAUTION: ENSURE THAT SHAFT ROTATES FREELY.

8.9 Mount the coupling spacer (195) and then mount pump coupling (390) alongwith key (321).

8.10 Mount motor stool (290) on support plate (467).

8.11 Mount the motor half coupling on motor shaft alongwith key. Mount the motor on motor stool alongwith rubber spider for “L” type Love-joy coupling. Cushions in case of “C” type couplings fitted later on. Check the angular alignment with the help of filler gauge and the parallel alignment with the help of straight edge and filler gauge. Alignment should be within 0.05 mm.

CAUTION:

A. PRIOR TO MOUNTING OF MOTOR SEE THE DIRECTION OF ROTATION OF MOTOR AND ENSURE THAT IT IS CLOCKWISE VIEWED FROM MOTOR TOP. NOTE THE ELECTRIC CONNECTION AND MARK THEM.

B. OBSERVE FROM THE MOTOR STOOL WINDOW THAT THE JAWS OF THE COUPLING ARE GETTING PROPERLY ENGAGED. ENSURE THAT MINIMUM 3MM CLEARANCE IS MAINTAINED BETWEEN THE TWO HALVES OF THE COUPLING AND THEN TIGHTEN THE GRUB SCREW ON THE COUPLING.

8.12 Tighten the nuts on motor stool to fix the motor.

8.13 Fit the rubber cushion in case of “C” type coupling. Rotate the coupling by hand. It should rotate freely.

8.14 Fix guard (388) on motor stool (290) bottom flange. Fit connection tube male (194) and tube (532) on rising pipe (142) boss, support plate (467) and bearing cover (270).

8.15 Mount the pump on tank containing oil.

9. OPERATION

9.1 Prior to starting:

9.1.1 Ensure that submergence is more than the recommended minimum on outline drawing.

9.1.2 Ensure direction of rotation by giving the driver a short run. Incorrect rotation will quickly damage the pump.

9.2 Putting the pump in operation

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

9.2.2 Ensure that the current taken by motor does not exceed the full load/ current stated on the motor name plate.

9.2.3 See that motor is not getting over loaded.

9.3 Check during running

9.3.1 The pump is running smooth. Check noise and vibrations. Vibrations should be checked at the top 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.

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

9.3.3 Motor bearings are not getting heated up excessively.

9.3.4 Check that oil temperature is not more than 80°C.

10. MAINTENANCE

10.1 Daily checks

10.1.1 Pressure gauge reading.

10.1.2 Voltage and current.

10.2 Periodical checks

10.2.1 Check the vibrations.

10.2.2 Calibration of measuring instruments.

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

10.3 Overhauling

10.3.1 With continuous daily operations spell, the pump will be due for overhaul after 24000 working hours. This work should be carried out by specialised and experienced fitters.

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

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

10.4 Follow the following procedure while dismantling the pump.

10.4.1 Unscrew the fasteners holding support plate on the flange of tank.

10.4.2 Disconnect the motor power connections. Unscrew the bolts of motor stool (290) on support plate (467) remove guard (388) and disconnect lubricating tube (532) above support plate. Take out motor stool alongwith motor.

10.4.3 Lift the entire pump with the help of the eye bolts on the support plate. Keep the pump on ground in horizontal position and support the column pipe at the free end with the help of wooden logs.

10.4.4 Disconnect the bend (280.2) at the bottom side and lubricating tube (532) between support plate and rising pipe (142).

10.4.5 Unscrew the nuts of pump casing/ casing cover studs and take out the pump casing (107). Unscrew the impeller nut (330) and take out impeller (151).

10.4.6 Take out casing cover (220) and then remove shaft sleeve (311).

10.4.7 Dismount the pump half coupling (309). Take out coupling spacer (195). Remove bearing nut and lock nuts (336 and 335). Remove bearing cover (270).

10.4.8 Take out column pipe (133.0), bearing holder (254) alongwith shaft.

10.4.9 Take out bearing holder (254) out of the shaft (180).

10.4.10 Take out bearing (263) alongwith thrust bearing carrier (247).

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

a. Double row angular contact ball bearing.

b. Journal bearing for wear and surface condition.

c. Shaft sleeve for wear and surface condition.

d. *Wear rings should be replaced if drop in hydraulic performance is more than allowable limit of the application.

* SEE 11.6 FOR GUIDE LINE FOR ALLOWABLE WEAR.

10.4.12 Replace all the damaged parts with new one. Impeller wear ring and case wear ring should be locked in position by grub screws (M6 x 6L) at least at two points.

11. TECHNICAL DATA

11.1 Direction of rotation

Direction of rotation is clockwise when viewed from motor top.

11.2 Details of antifriction bearing used

BEARING	PUMP TYPE
SKF: 3311 OR EQUIVALENT	KPDS 80/26 LGT
	KPDS 65/26N LGT
	KPDS 100/32 LGT

11.3 Journal bearing and shaft sleeve details

BUSH BORE	SHAFT SLEEVE O.D.	PUMP TYPE
40.0 DIA +0.119 +0.080	40.0 DIA -0.025 -0.009	KPDS 80/26 LGT & KPDS 65/25N LGT
55.0 DIA +0.146 +0.100	55.0 DIA -0.010 -0.029	KPDS 100/32 LGT

NOTE: JOURNAL BEARINGS NEED TO BE REPLACED IF THE CLEARANCE AFTER WEAR IS DOUBLE THE MAXIMUM CLEARANCE.

CALCULATE THE MAXIMUM CLEARANCE ABOVE INDIVIDUAL DIMENSIONS OF SHAFT SLEEVE O.D. AND JOURNAL BEARING I.D.

11.4 PERMANITE OIL GASKET SPECIFICATIONS

PUMP TYPE	PART NOS.				
	511	682	515	BEND SIZE	513.1
KPDS 80/26 LGT	266Dx 282D x 1T	38D x 28D x 1T	40D x 35D x 1T	100	200D x 80D x 1T
KPDS 65/26N LGT	266Dx 282D x 1T			100	185D x 65D x 1T
KPDS 100/32 LGT	348D x 331D x 1T	38D x 48D x 1T	44D x 50D x 1T	100	220D x105D x 1T

NOTE:

PART NOS.	DESCRIPTION
511	GASKET FOR CASING COVER
682	GASKET BETWEEN IMPELLER AND IMPELLER NUT
515	GASKET BETWEEN SHAFT SLEEVE AND IMPELLER NUT
513.1	GASKET BETWEEN PUMP CASING AND BEND

11.5 Flexible coupling

Pumps are supplied with flexible coupling Love-Joy or equivalent type rubber star or cushions. The material of flexible member is HTX rubber. For details of type of coupling and arrangement, please refer to drawing supplied against specific order.

12. TROUBLE SHOOTING

A. LOW DISCHARGE OR NO-DISCHARGE

i. Inadequate submergence.
ii. Direction of rotation improper.
iii. Wearing ring clearance too much.
iv. System static head is more than full close head of the pump.
v. Improper inlet system turbulence in sump.
vi. Air mixed with oil.
vii. System head is more than rated head.
viii. Rotational speed less than rated.

B. LOW PRESSURE

i. System head is less than rated.
ii. Air mixed up with oil.
iii. Wearing ring clearance too much.
iv. High frictional losses.
v. Rotational speed less than rated.
vi. Specific gravity of oil less than specified.

C. NOISE AND VIBRATION

i. Inadequate submergence.
ii. Turbulence inside the tank.
iii. Damaged flexible member of the coupling.
iv. Misfitting of the parts.
v. Damaged antifriction bearing or lower bush bearing.

D. JAMMING

i. Misfitting of the parts.
ii. Bend in shaft.
iii. Dry running of pump.
iv. Failure of bearings.

E. RAPID WEARING OF PARTS

i. Misfitting.
ii. Damaged journal bearing.

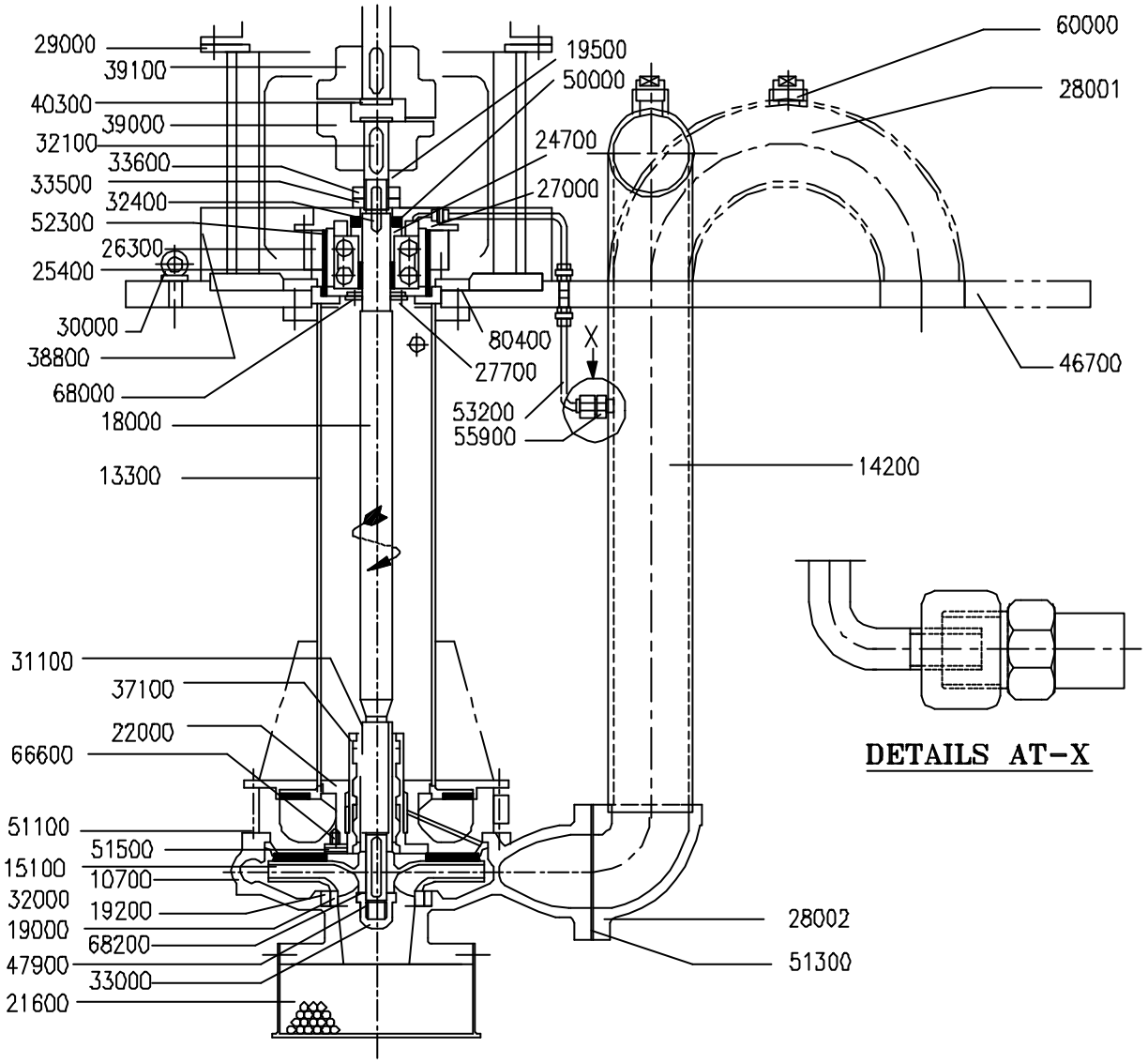
LIST OF PART CODES VS PART DESCRIPTION OF KPDS-LGT PUMPS

PART CODE	PART DESCRIPTION
10700	PUMP CASING
13300	COLUMN PIPE
14200	RISING PIPE
15100*	ENCLOSED IMPELLER
18000*	PUMP SHAFT
19000*	CASING RING SUCTION SIDE
19100*	CASING RING DELIVERY SIDE
19200*	IMPELLER RING SUCTION SIDE
19300*	IMPELLER RING DELIVERY SIDE
19500	SPACER
21600	STRAINER
22000	CASING COVER
24700	THRUST BEARING CARRIER
25400	BEARING HOLDER
26300*	DOUBLE ROW ANGULAR CONTACT BALL BEARING
27000	BEARING COVER
27700	OIL RETAINER
28001	RETURN BEND (TOP SIDE)
28002	DISCHARGE BEND (BOTTOM SIDE)
29000	MOTOR STOOL
30000	EYE BOLT
31100*	SHAFT SLEEVE PUMP SIDE
32000*	KEY FOR IMPELLER
32100	KEY FOR COUPLING
32400	KEY FOR THRUST BEARING CARRIER
33000*	IMPELLER NUT
33500	HEX LOCK NUT

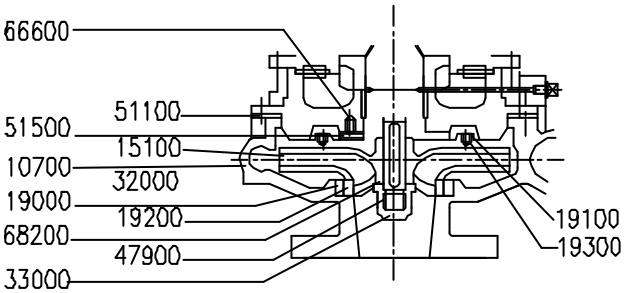
PART CODE	PART DESCRIPTION
33600	HEX LOCK NUT
37100*	JOURNAL BEARING
38800	GUARD
39000	PUMP COUPLING
39100	MOTOR COUPLING
40300*	COUPLING BLOCK
46700	SUPPORT PLATE
47900	HELICOIL LOCK INSERT
50000*	OIL SEAL DS
51100*	GASKET FOR CASING COVER
51300*	GASKET FOR CASING AND BEND
51500*	GASKET FOR SHAFT SLEEVE
52300	'O' RING FOR BEARING HOLDER
53200	TUBE FOR LUBRICATION
55900	MALE CONNECTOR FOR FLUSHING PIPING
60000	LOCKING PLUG FOR BEND
66600	HEX SOCKETTED CAP SCREW FOR SHELL FOR JOURNAL BEARING
68000	GASKET FOR OIL RETAINER
68200*	GASKET FOR IMPELLER NUT
80400*	GASKET BETWEEN BRG. HOLDER & SUPPORT PLATE

* RECOMMENDED SPARES

CROSS SECTIONAL DRAWING OF KPDS-LGT PUMP



DETAILS AT-X



FOR KPDS 100/32 LGT

GENERAL INFORMATION & SAFETY REQUIREMENTS

1.0 The products supplied by KBL have been designed with safety in mind. Where hazards cannot be eliminated, the risk has been minimised 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; YOU are responsible for using safe working practices at all times.

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

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

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

1.3 KBL requires that, all personnel that 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 should be worn where working with pressurised systems and hazardous substances. Other personnel protection equipment must be worn where local rules apply.

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 and maintenance of the equipment. Check and confirm that the manual is relevant copy 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 containers have been provided.

1.9 IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF THIS KBL PRODUCT COULD RESULT IN INJURY OR DEATH.

2.0 SAFETY INSTRUCTIONS WHILE HANDLING AND STORAGE

When lifting the pump, use the lifting points specified on general arrangement drawing. 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 fork-lift truck and chain crane sling equipment is recommended but locally approved equipment of suitable rating may be used.

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

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.

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.

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.

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 the 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 will 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 pumped 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

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.

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 components which contain 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.

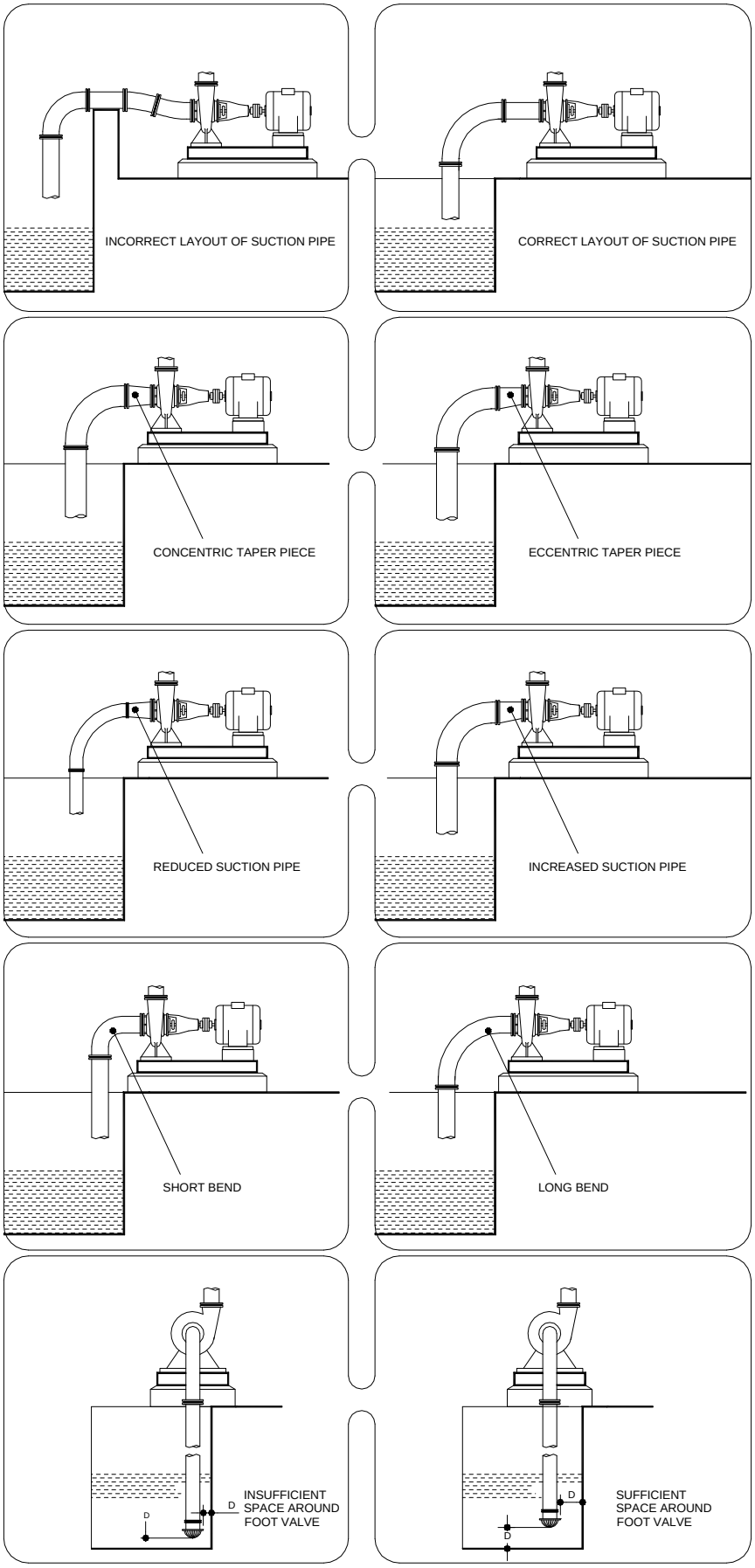
Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation of noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.

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

Ref: Proposed draft standard prEN 800:
Pumps and pump units for liquids;
General safety requirements

INCORRECT

CORRECT



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

GENERAL INSTRUCTIONS FOR INSTALLATION OPERATION & MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS

GENERAL INSTRUCTIONS FOR INSTALLATION, OPERATION & MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS

WARNING

The equipment supplied is designed for specific capacity, speed, pressure and temperature. Do not use the equipment beyond the capacities for which it is manufactured. The equipment manufactured is also shop tested for the satisfactory performance and if it is operated is 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 that 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.

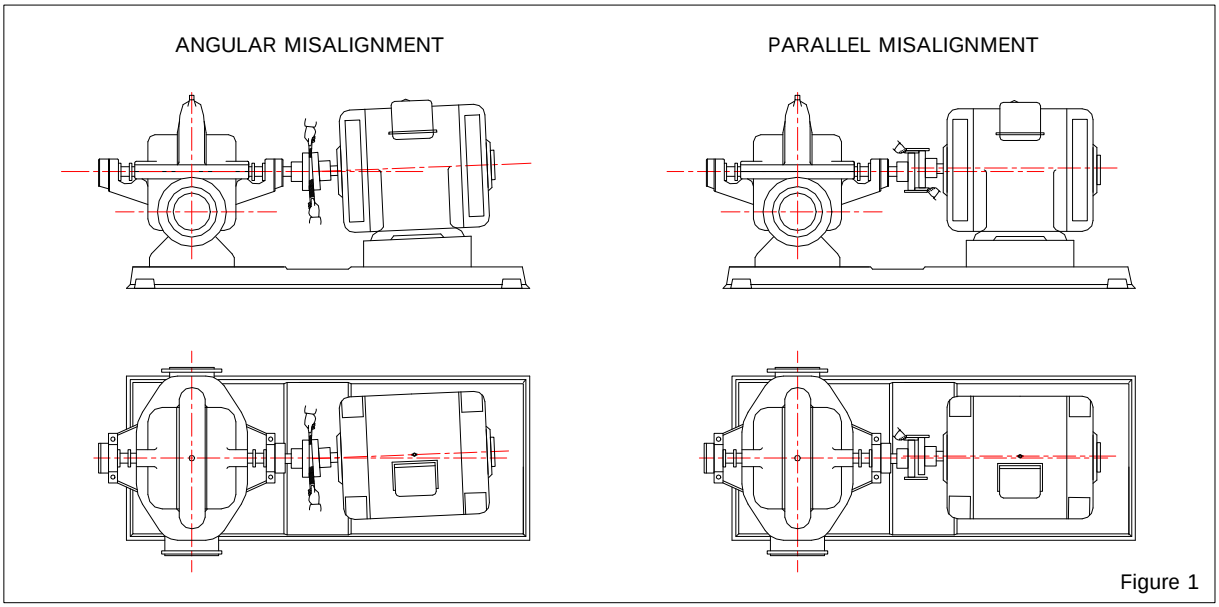


Figure 1

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 FIGURE2)

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 on an outside caliper.

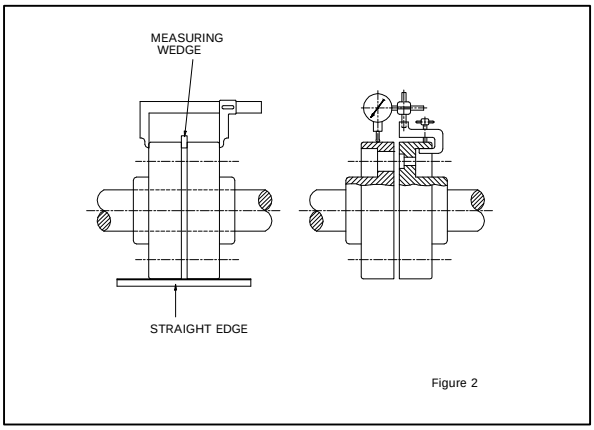
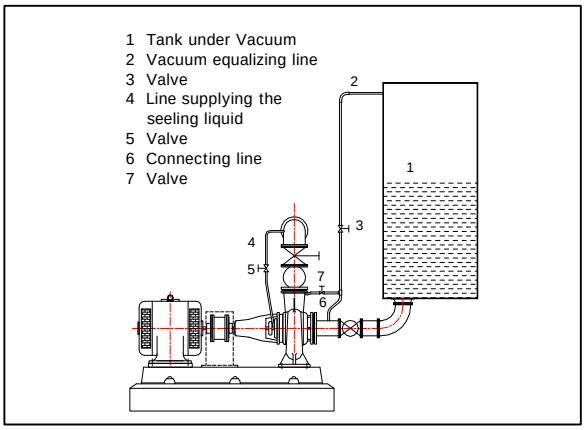


Figure 2



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

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

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

GROUTING

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

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 of 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 to that weight of the pipe lines does not fall on the pump. The use of minimum number of the bends and other fittings will minimise the frictional losses.

SUCTION PIPE

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

The end of the suction pipe must be well submerged to avoid whirlpools and ingress of air but must be kept clear of nay 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 of sluice valve (regulating valve) should be installed in the discharge line. The check valve placed between the pump and the gate valve is to protect the pump from excessive pressure and to prevent water running back through the pump in case of failure of the driving machine.

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

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

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

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

FOOT VALVE

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

STUFFING BOXES AND PACKING

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

BALL BEARINGS

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

Three monthly when on continuous duty.

Six monthly when on eight-hour per duty.

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

PRIMING

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

(1) Liquid level above pump level

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

(2) Priming with foot valve

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

   (b) When there is liquid under some pressure in the discharge pipe, priming can be effected by byepassing 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 22 56 57 58
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 58 62
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 55 58
Stuffing box leaks excessively	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 47 48 49 51 54 55 58
Motor will not start	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.