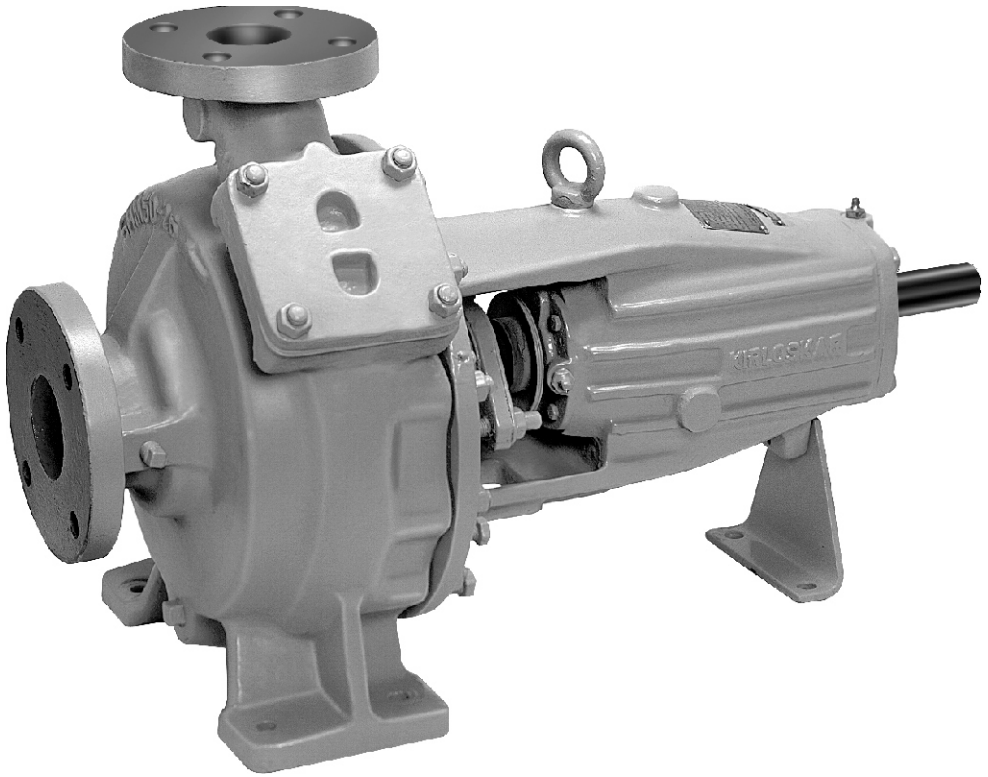
INSTRUCTIONS ON INSTALLATION OPERATION AND MAINTENANCE FOR KIRLOSKAR PUMP TYPE SHM

Enriching Lives



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

CONTENTS

PLEASE FURNISH COMPLETE NAMEPLATE DETAILS, NAME OF PARTS, PART NOS. & MATERIAL CONSTRUCTION WHILE ORDERING SPARE PARTS FOR THE PUMP.

1. GENERAL

1.1 The booklet covers instructions for following pump types of CPHM series.

UNIT-7	UNIT-9	UNIT-11	UNIT-13
50/26	80/40	100/40	150/50
65/32	100/26	150/26	200/40
80/26	100/32	150/32	
	150/26 NB	150/34	
		150/40	
		200/32	

Note:

A) The complete range of SHM pumps is covered by four driving units, thereby reducing inventory and achieving interchangeability of parts.

B) The above models can be offered with following impellers.

P- Single vane enclosed impeller
N, NB, NM- 2 Vanes enclosed impeller
Q- 3 Vanes semi open impeller
R- 8 Vanes free-flow impeller

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

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

2. INSTALLATION

2.1 For location, preparing foundation, installation, alignment, piping, general maintenance, trouble shooting, etc. the instructions given in our publication 'GENERAL INSTRUCTIONS FOR INSTALLATION, OPERATION & MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS' which is also printed alongwith this booklet must be followed carefully. If the pump is drawing liquid from the vessel under vacuum, 'Vacuum equalising connection' piping must be made as per instructions given in above publication. Pumps on hot service must have final coupling alignment made with the unit at its operating temperature.

2.2 Mounting and alignment

A flexible coupling is used to connect the pump shaft to the driver. If spacer type coupling is used the complete rotating unit can be removed from the volute without removing pump casing or motor and without disconnecting piping connections. This also avoids any re-alignment of pump and motor after re-assembly of rotating unit.

Alignment:

ALWAYS REMEMBER "A FLEXIBLE COUPLING IS NOT A UNIVERSAL JOINT".

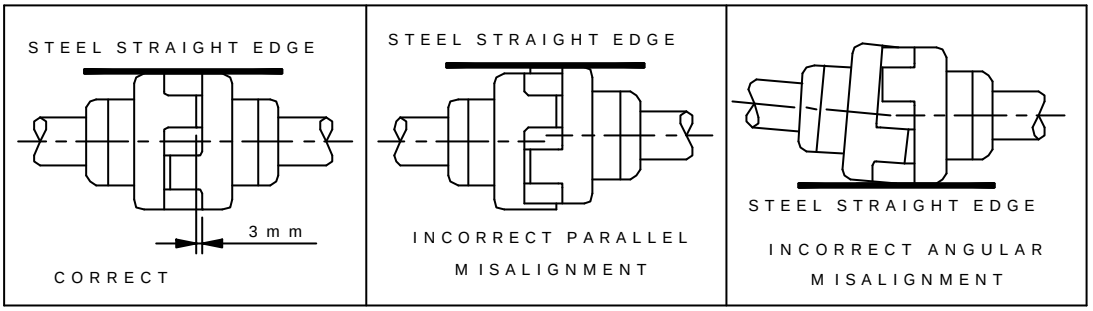
Correct alignment is essential for the smooth operation of the pump. There are two types of mis-alignment between the pump shaft and the drive shaft which are:

i) Angular mis-alignment- Shaft with axis concentric but not parallel.

ii) Parallel mis-alignment – Shaft with axis parallel but not concentric.

Mis-alignment is checked by using straight edge as shown in Fig.1

SPACER TYPE LOVEJOY COUPLING



STD. LOVEJOY COUPLING

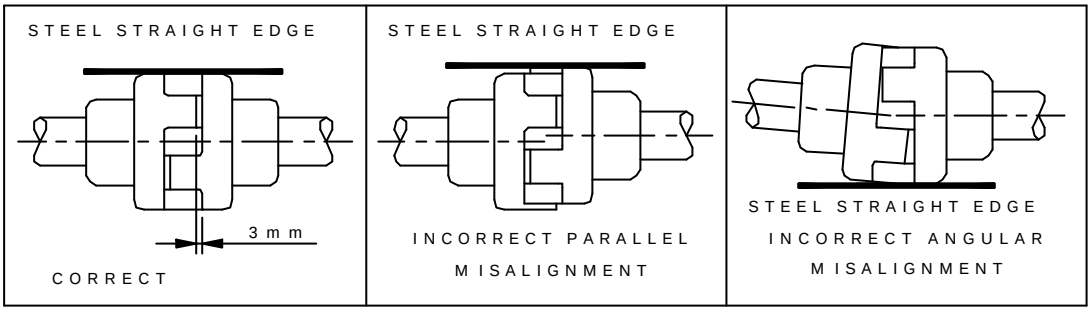


Fig. 1

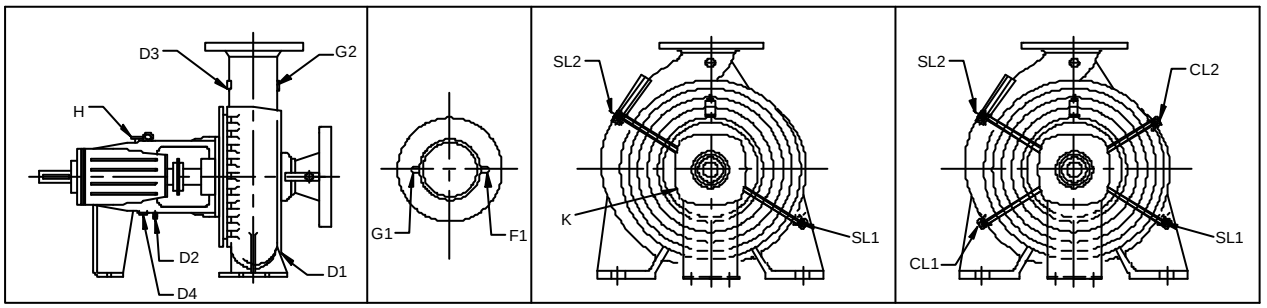
Pumps on hot service must have final coupling alignment made with the unit at its operating temperature.

2.3 Before Commissioning the pumpset, please ensure:

2.3.1 The pipe connections are flushed and tightened properly.

2.3.2 Alignment is proper.

2.3.3 Please refer to Fig.2 for plugs and piping connections in SHM pumps.



ELEVATION | VIEW FROM SUC.SIDE (SUCTION FLANGE) | VIEW FROM DRIVING END (ST. BOX WITHOUT COOLING ARRANGEMENT) | VIEW FROM DRIVING END (ST. BOX COOLING ARRANGEMENT)

FIG. 2

SHM PUMPS-TAPPING CONNECTIONS CHART

Code	Description	Location of connection
CL-1	Stuffing box cooling Water-Inlet for hot model only	On stuffing box housing bottom left, viewed from DE
CL-2	Stuffing box cooling water-outlet for hot model only	On stuffing box housing top right, viewed from DE
D1	Delivery casing drain	On delivery casing bottom side towards suction
D2*	Drip pan (against order only) drain	On brg. housing bottom
D3*	Circulation line connection from casing	On pump discharge nozzle on driving side
D4*	Bearing housing oil drain for oil lubrication only	On bearing housing bottom.
F1	Wear ring flushing	On suction neck right viewed from suction side
G1*	Gauge connection-Suction side	On suction neck left viewed from suction side
G2*	Gauge connection-Discharge	On pump discharge nozzle on suction side
H*	Feeding plug for oil lubrication only	On bearing housing top
K*	Constant level oiler for oil	On bearing housing left, viewed from DE
SL-1$	Stuffing box sealing inlet	On stuffing box housing bottom right viewed from DE
SL2#	Stuffing box sealing outlet	On stuffing box housing top left Viewed from DE

* This special provision is on request only (against order)
# Plugged in case of grease stuffing box sealing $ Grease nipple in case of grease stuffing box sealing.

2.3.4 'SHM' pumps are grease lubricated as standard supply. Grease nipples are provided on bearing cover and bearing cartridge.

2.3.5 Optional supply of oil lubrication is available. The pump is provided with constant level oiler.

2.3.6 Constant level oiler:

Fix the constant level oiler and fill the oil. Procedure for fitting the constant level oiler and method of filling oil is given below.

Constant level oiler has plastic container and aluminum body as a standard supply. Connection stem is ¼" BSP tapped and its capacity is 70ml approx.

If the constant level oiler is properly fitted and oil is filled as per instructions given, practically no attention is required as far as lubrication of bearings is concerned other than to replenish the visible reserve supply of the oil in the container (Refer Fig.3.1, 3.2 & 3.3).

Method of fitting:

Screw constant level oiler stem into the tapped hole of the bearing housing reservoir. Before fitting oiler, check the level of the tapped hole with the help of turned bar with ¼" BSP tapping at one end and a spirit level (see Fig.3.1). If the level is incorrect and oiler tilts downward, oil will not flow from oiler into the reservoir. (see Fig.3.2). Hence it is necessary to check the level before fitting in the constant level oiler.

Method of filling the oil:

Tilt the container (as shown in Fig.3.3) and fill it with oil through stem of the oiler. Replace the container and allow oil to flow into reservoir. The oil in the container shall flow into the bearing housing reservoir and shall become empty. Repeat above procedure till the level in the reservoir is equal to the level for which the oiler is adjusted. When the desired level is attained the oil in container shall remain steady at a position. Visible level of the oil in the container indicates that bearing housing reservoir is filled up to the mark.

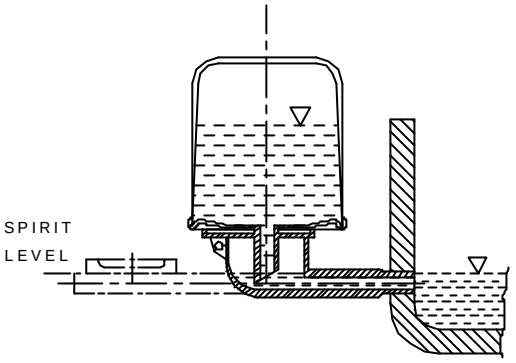


Fig. 3.1

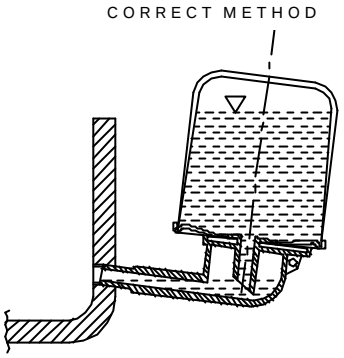


Fig. 3.2

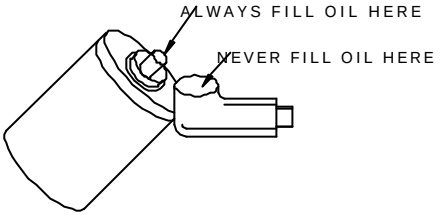


Fig 3.3

Fig. 3

CAUTION

1. In no case oil should be filled in directly into the bearing housing reservoir, through breather cap.

2. Replenish the visible reserve supply of oil in the container as oil is used up.

3 OPERATION

3.1 Before starting the pump check the following:

3.1.1 The pump rotates freely by hand.

3.1.2 Fill the grease/oil for the bearings, if not done earlier. The bearings are packed with grease in the factory for grease lubricated pumps. However if the pump is stored for a longer time it is necessary to refill the grease in the bearings. Check the level of the oil in constant level oiler is up to the mark, when oil lubricated.

3.1.3 The sealing liquid and cooling water connections are properly tightened and adjusted.

3.1.4 The direction of rotation of driver. It should correspond to the direction of the rotation of the pump.

3.1.5 The pump casing and suction pipe is fully primed with the liquid.

3.1.6 Valve on delivery side is closed.

3.1.7 The cock for pressure gauge connection is closed.

3.1.8 The stuffing box packing is properly tightened.

3.2 **Starting the pump:**

3.2.1 Start the pump. Let the prime mover pick up its full speed.

3.2.2 Open the valve on delivery line slowly to reduce the starting load on the motor.

3.2.3 Regulate the required flow by adjusting the delivery valves.

3.2.4 Open the cock for pressure gauge connection.

3.3 **During running the pump check the following things and regulate, if necessary.**

3.3.1 The pump is running smooth.

3.3.2 The flow of sealing liquid and cooling water is uninterrupted. It necessary provide sight glass in between the piping.

3.3.3 The bearings are not getting abnormally hot.

3.3.4 The gland is properly tightened to given leakage of approx. 60 drops per minute through stuffing box.

3.3.5 Head and capacity developed by the pump is as specified.

3.3.6 Power consumption is within the limit.

3.3.7 Ensure that there is no mechanical friction in the pump.

3.3.8 Stop the pump immediately, if any defects are detected. Do not start the pump unless defects are rectified. Report immediately to the supplier, if it is not possible to rectify the defects.

3.4 **During stopping the pump**:

3.4.1 Close the valve on delivery side.

3.4.2 Stop the motor.

3.4.3 Close the cooling water and sealing liquid connections.

3.4.4 If the pump is not required to be operated for a long time, drain the casing completely. If the pump is required to be stored for a long time, the bearing housing should be dried internally with hot air and should be flushed with moisture-free protective, such as light oil or kerosene.

4. **TECHNICAL DATA**

4.1 **Direction of rotation:**

The direction of rotation is clockwise when viewed from driving end.

4.2 Specification of bearings, oil seals, bearing lock nuts, ‘O’ rings etc.

Part Code	Description	UNIT NO.			
		SHM-7	SHM-9	SHM-11	SHM-13
26001	Ball Bearing DS	SKF-6307	SKF-6309	SKF-6411	SKF-6413
26002	Ball Bearing PS	SKF-6307	SKF-6309	SKF-6411	SKF-6413
26400	Cylindrical roller bearing PS for heavy duty arrangement	SKF-NU307	SKF-NU309	SKF-NU411	SKF-NU413
50001	Oil seal DS	32x45x7T	42x72x10T	50x78x13T	60x85x13T
50002	Oil seal PS	35x52x10T	45x62x10T	55x80x13T	65x85x13T
33600	Bearing lock nut DS	M35x1.5RH SKF-KM-7	M45x1.5RH SKF-KM-9	M55x2 RH SKF-KM-11	M65x 2RH SKF-KM-13
41500	Bearing lock washer	M-35 SKF-MB 7	M-35 SKF-MB 9	M-55 SKF-MB 11	M-65 SKF-MB 13
52300	'O' ring for Cartridge DS	102 ID x 3 thick	123 ID x 3 thick	160 ID x 3 thick	182 ID x 3 thick
48500	Internal circlip for roller Ball brg. PS	B80 x 2.5 thick	B100 x 3 thick	B 140 x 4 thick	B160 x thick
48501	Internal circlip for Ball brg. DS	B80 x 2.5 thick	B100 x 3 thick	B140 x 4 thick	B160 x 4 thick
44300	Constant level oiler ¼" BSP	70ml A1 with plastic container			
44100	Grease nipple	¼" BSP	¼" BSP	¼" BSP	¼" BSP
47900	Helicoil Screw lock insert	SL-C16CNx16	SL-C24CNx24	SL-C24CNx36	-

Note: Bearings, bearing lock nut/washers of SKF make or equivalent are used.

4.3 Lubrication

4.3.1 Grease lubricated bearings are standard supply and can be identified by grease nipples fixed.

The specifications of grease are given below. It should conform to the following grades or their equivalents available in the market.

INDIAN OIL	-	SERVOGEM - 3
HINDUSTAN PETROLEUM	-	NETRA-3 OR LITHON-3
CALTEX	-	STAR FAX-3

Grease replenishment quantity- The bearings are grease packed in the factory. At site the following quantity of fresh grease should be added at regular intervals.

SHM-7	10 Grams approx.
SHM-9	15 Grams approx.
SHM-11	25 grams approx.
SHM-13	32 grams approx.

4.3.2 When oil lubricated, the lubricating oil should conform to following grades of oil available in the market.

INDIAN OIL	SERVOSYSTEM –100
HINDUSTAN PETROLEUM	ENCLO-57

4.3.2.1 Quantity of Oil in bearing housing

SHM-7	0.7 Lit approx
SHM-9	0.8 Lit approx
SHM-11	1.0 Lit approx
SHM-13	1.2 Lit approx

The oil used should be a highly refined straight mineral product of high demulsibility, free from running and acid forming tendencies. Detergent oil may cause foaming and emulsion difficulties and should not be used. The oil should be filled in with the help of constant level oiler. For filling and operation instructions, please refer to 2.3.6.

4.3.3 Bearing temperature:

a) Maximum allowable bearing temperature is 80° C.

b) In case of new bearings, renew grease/oil after about 200 hrs. and then about once in a year, if the bearing temperature is always below 50°. If the bearing temperature is up to 80°C then grease/oil should be renewed after about every 6 months.

4.4 Specification of stuffing box packing, gasket packings etc.

Part Code	Description	UNIT NO.			
		SHM-7	SHM-9	SHM-11	SHM-13
	Packing ring arrangement with lantern ring	2 + L +3	2 + L +3	2 + L +3	2 + L +3
43001	Gland packing size for 5 ring (Champion style 1800)	10 x 1080 mm	10 x 1260 mm	12.5 x 1330 mm	12.5x1620 mm
68200	Gasket for impeller Nut/ Screw (permanite) (ID x OD x Thick)	32x50x1 mm	38.5x56x1 mm	52x64x1 mm	58x75x1 38.5x56x1 for lock nut
51500	Gasket for shaft sleeve (permanite) (ID x OD x Thick)	48x55x1 mm	38x62x1 mm	72.5x80x1 mm	82.5x90x1 mm
51100	Gasket for casing cover & pump casing (permanite) (ID x OD x Thick)	265x285x1 330x350x1 mm	265x285x1 330x350x1 405x425x1 mm	265x285x1 330x350x1 405x425x1 mm	420x440x1 515x535x1 mm
52300	'O' ring for cooling chamber (ID x Thick)	80 x 3	100 x 3	123 x 3	132 x 3

4.5 Cooling of stuffing box

4.5.1 Cool the packed gland stuffing box when pumping liquid temperature is above 90°C. However with stuffing box cooling, the temperature of pumping liquid should not exceed 140°C.

4.5.2 Quantity of stuffing box cooling water with reference to temperature and nominal impeller diameter in cms.

Full nominal impeller dia. in cms.	Cooling Water Quantity At Various Pumping Liquid Temperatures	
	110°C	140°C
26	0.21	0.24
32	0.23	0.28
40	0.26	0.31

Cooling quantities mentioned are in m^3/hr.
Maximum temperature of cooling water at outlet - 50°C
Maximum permissible cooling water pressure – 4 kg/cm^2

4.6.1 INTERCHANGEABILITY OF PARTS

PART DESCRIPTION	Pump Type	50 / 26	80 / 26	65 / 32	100 / 26	150 / 26NB	100 / 32	80 / 40	80 / 40NM	150 / 26	150 / 32	200 / 32	150 / 34	100 / 40	150 / 40	200 / 40	150 / 50
	Unit No.	SHM7			SHM9					SHM11						SHM13	
Pump Casing		1	2	3	4	5	6	7	8	5	9	10	11	12	13	14	15
Inspection Hole Cover		1	1	1	2	3	2	1	1	3	3	3	3	2	3	3	3
Impeller		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Casing ring		1	2	3	4	5	4	2	2	5	5	6	5	4	5	7	8
Casing Cover		1	1	2	3	3	4	5	5	6	7	7	8	9	9	10	11
Cooling Chamber		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Gland		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Lantern Ring		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Gland Packing Size		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Shaft		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Shaft Sleeve		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Liquid Deflector P.s.		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Impeller Key		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Coupling Key		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Bearing Cover		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Bearing Cartridge		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Impeller Screw/Nut		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Bearing Housing		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Spacer For Brg.Cartridge		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Drip Pan		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Bearing Housing		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Bearing P.S.		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Bearing D.S.		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Bearing Lock Nut		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Bearing Lock Washer		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Stuffing Box Bush		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Internal Circlip		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Oil Seal D.S.		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Oil Seal P.S.		1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4
Allen Key For Impeller Screw		1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear Plate For Impeller		1	2	3	4	-	5	6	-	7	8	9	10	11	12	13	14
Small ‘O’ring For Wear Plate		1	2	3	4	-	4	2	-	5	5	6	5	4	5	7	8
Large ‘O’ring For Wear Plate		1	1	2	1	-	2	3	-	1	2	2	4	5	5	5	6
Suction Inspection Piece		1	2	3	4	5	4	2	2	5	5	6	5	4	5	6	5

IDENTICAL FIGURES IN LINE INDICATE INDENTICAL PARTS

4.6 Interchangeability:

Parts standardisation is optimised utilising interchangeable components to cover a very wide performance. This unique feature enable the customer to have very low spare parts inventory even though he may have many sizes of these pumps. Interchangeability chart is given in 4.6.1

5. MAINTENANCE

Preventive maintenance schedule is the periodical checks and precautions by which possibilities of failures and breakdown are minimised.

5.1 **Daily Checks**:

5.1.1 An hourly record of suction and delivery pressure, discharge quantity, input to the pump driver should be maintained.

5.1.2 Bearing temperature, oil level, stuffing box leakage, stuffing box temperature, cooling water inlet and outlet and outlet temperature should be checked. This gives an idea of mechanical performance of the pump.

5.1.3 Noise and the vibrations are the first signs of impending troubles like cavitaion, air lock, bearing failure, choking of impeller or casing and such other operation troubles. The pump performance should therefore, be checked for noise and the vibration.

5.2 **Periodical checks**:

5.2.1 The temperature of the bearing should be measured by a thermometer. Safe maximum temperature a bearing can attain is 80°C.

5.2.2 The lubricants of the bearings should be checked. The lubricant might get contaminated with foreign material or get blackened due to overheating. In such cases, bearings should be flushed and charged with fresh lubricants.

5.2.3 Check the stuffing box leakage. Normal leakage of approx. 60 drops per minute is recommended for safe operation. If the leakage is more the stuffing box packing might have worn out or shaft sleeve might have worn out or lantern ring is displaced. In case the packings are worn out all the packing rings should be replaced. Replacement of one or two rings or addition of rings should never be done.

5.2.4 The alignment of pump unit should be checked. Due to operational vibrations, atmospheric temperature or stress induced by the weight of piping the alignment may get disturbed.

5.2.5 Sufficient quantity of suitable type of lubricant and stuffing box packing should be kept for daily and emergency use.

5.2.6 Calibrate the measuring instruments.

5.3 Annual checks

5.3.1 The pumps should be overhauled completely to check the clearance and to replace worn-out parts. Clearance between impeller and casing ring, shaft sleeve andstuffing box bush, lantern ring and the shaft sleeve etc. are very important. The bearings should be cleaned thoroughly and lubricated properly. The stuffing box should be repacked by correctly located the lantern ring.

5.3.2 The effects of liquid handled on pump components should be checked. If abnormal corrosion/erosion is observed, the component should be replaced with that of suitable material.

5.3.3 The auxiliary pipe lines and functioning of the auxiliaries should be checked. The main pipe also should be checked for scaling, leakage etc.

5.3.4 The measuring instruments, gauges etc. should be recalibrated.

5.3.5 Full running test may be carried out to check whether there is any fault in the performance, in comparison with original performance.

5.3.6 Piping supports should be checked so that the pipe do not induce unwanted stresses on the pump.

6. PROCEDURE FOR DISMANTLING AND RE-ASSEMBLING.

6.1 Overhauling-

With normal daily operation, the pump will be due for overhaul after about one year. This work is to be done by skilled personnel. Complete pump is to be taken out from bed.

6.2 Dismantling:

6.2.1 Remove the delivery and suction piping holding down bolts and nuts.

6.2.2 Remove all external piping connections such as
a) Sealing
b) Cooling water connections
c) Flushing etc.

6.2.3 In case of pumps with spacer type flexible coupling disconnect pump & motor valves from coupling spacer and remove coupling spacer. Coupling spacer shall fall down. In case of ordinary flexible couplings, remove motor from the base.

6.2.4 Remove the bolts from pump feet and base.

6.2.5 Remove the pump from bed and take it on to a table for stripping.

6.2.6 Unscrew and remove the nuts of the studs holding the casing with casing cover and/or with bearing housing.

6.2.7 Lift the rotating unit sub-assembly by the hook provided on bearing housing and remove it from delivery casing.

6.2.8 Hold the pump coupling and unscrew the impeller Nut/screw by using box spanner/allen key.

6.2.9 Remove the impeller from shaft by using a puller.

6.2.10 Remove the casing cover sub-assembly along with gland packed stuffing box, if casing cover is sand witched type.
If casing cover is held by studs and nuts on to the bearing housing, remove these nuts and take out casing cover sub-assembly.

6.2.11 Remove the sleeve from pump shaft. If necessary use a puller.

6.2.12 Remove the liquid deflector.

6.2.13 Unscrew the grub screw holding the coupling and take out coupling from shaft. Make use of puller.

6.2.14 Remove the screws holding the bearing cover and cartridge to the bearing housing. Remove bearing cover PS.

6.2.15 Remove the shaft along with bearings and DS cartridge from the bearing housing.

6.2.16 Remove the circlip from the cartridge by circlip puller and remove the cartridge by slight hammering.

6.2.17 Hold the shaft and remove the bearing nut. Take out the lock washer.

6.2.18 Remove the bearings from the shaft by use of bearing puller.

6.2.19 Remove the oil seals from cartridge and bearing cover using the holes provided in the oil seal cover.

6.2.20 Remove the nuts holding the split gland.

6.2.21 Take out the clamping plate and remove gland halves.

6.2.22 Remove the gland packings/lantern ring.

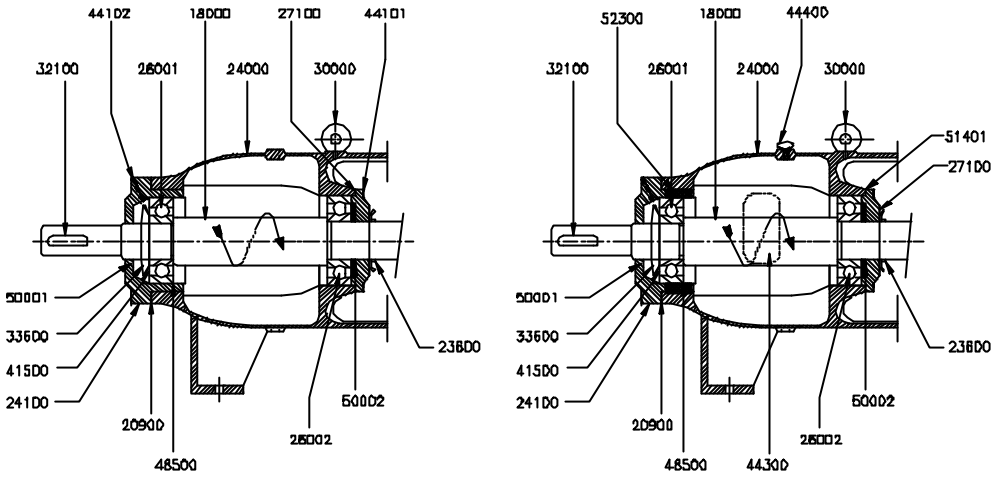
6.3 Re-assembly

Before re-assembly, all the parts should be thoroughly cleaned with Kerosene, petrol or Benzene to remove the dust, rust etc. After cleaning, the necessary parts should be replaced with new.

6.3.1 Mount drive side (26001) and pump side (26002) deep groove ball bearings on the shaft (18000).

CAUTION

a) Use Arbor Press while fitting the bearings. However, it is recommended that bearings should be heated in oil bath at temperature 70° to 80 °C and then fitted. (Refer Fig.4)



BEARING HOUSING (GREASE LUBRICATED) BEARING HOUSING (OIL LUBRICATED) (AGAINST ORDER)

Fig.4

b) Slide in ball bearing on shaft by hand to make sure that it is square with shaft. Press evenly the inner race of the bearing until bearing is seated firmly against the shaft shoulder.

c) Do not use hammer to fit the bearings. Do not mark the shaft, especially where it contacts the oil seal.

6.3.2 Tighten lock nut (33600) after inserting the lock washer (41500) in proper position on driver side ball bearings. Fold one lip of lock washer in the slot of bearing lock nut to lock it.

6.3.3 Put oil seal (50001) in the bearing cartridge DE (24100).Insert DE bearing alongwith shaft in bearing cartridge.
Put 'O' ring on the cartridge in case of oil lubrication only. Insert internal circlip (48500) in the inner groove of the cartridge. Put a spacer on bearing cartridge, in case of SHMN, SHMR and SHMP pumps and shims in case of SHM-Q pumps. Insert the bearing cartridge from DE of the pump shaft.

6.3.4 Insert the alongwith ball bearings at DE and NDE and bearing cartridge at DE into the bearing housing (24000) from driving end.

6.3.5 Tighten the bearing cartridge on the bearing housing with the help of hexagonal screws.

6.3.6 Replace oil seal (50002) in bearing cover PS (27100). Tighten the bearing cover PS on bearing housing with the help of hexagonal screws.

6.3.7 Slide the liquid deflector (23600) from NDE of shaft. Tighten the deflector on shaft by using grub screw.

6.3.8 Slide the clamping plate (22400) from NDE of shaft.

6.3.9 Push the shaft sleeve (31100) into the shaft till it touches the collar on the shaft.

6.3.10 Fit the stuffing box neck bush (35000) into the casing cover (22000).

6.3.11 Put the gasket (51500) on the impeller hub in proper position.

6.3.12 Fit the impeller key (32000) on the shaft. It should enter partly in the shaft sleeve.

6.3.13 Put the casing cover (22000) on the bearing housing. Tighten it by studs and nuts to the bearing housing.

6.3.14 Push the impeller (15100/15300/16600) on the shaft till it touches the shaft sleeve.

6.3.15 Fix the coupling key (32100) on shaft at D.E. Put the spacer coupling half pump side on the shaft and tighten the grub screw to fix the coupling.

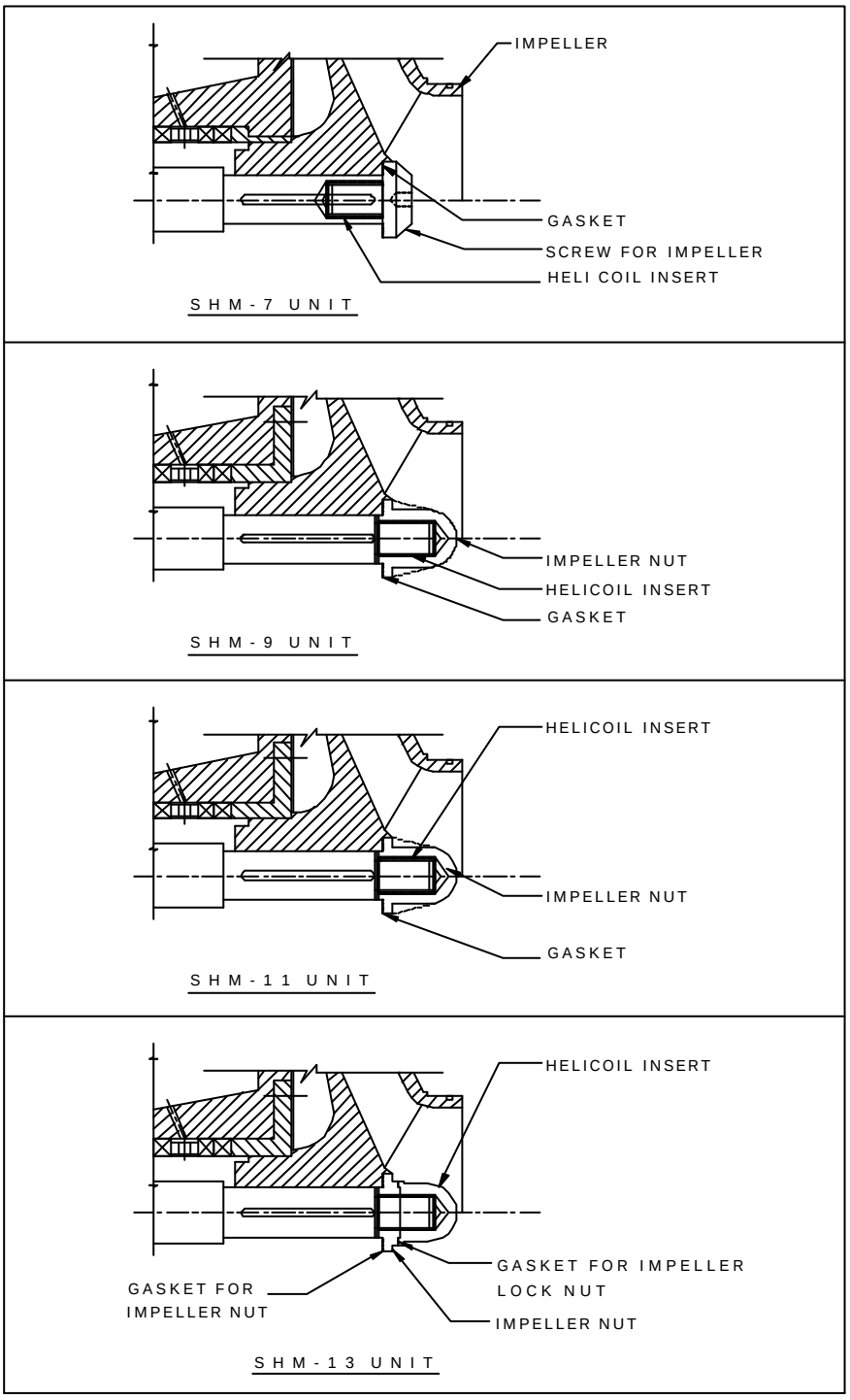


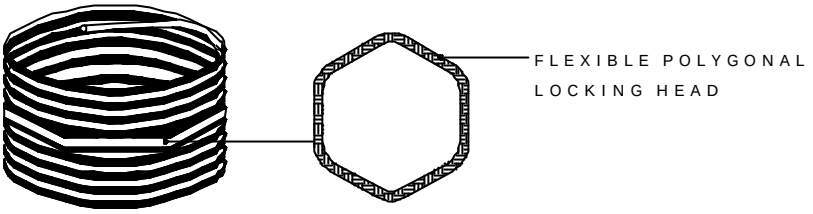
Fig. 5

6.3.16 Insert the helicoil lock insert (47900) at NDE of shaft fro 7 unit and tighten impeller screw (66900) in shaft by holding the coupling.

For 9 & 11- unit insert the helicoil screwlock insert (47900) in impeller nut (33200) and tighten it on the shaft at NDE.

For 13-unit nut lock nut arrangement is used for impeller locking.

a) Tighten impeller nut (33002) fully.
b) Tighten impeller lock nut (33001) fully.
c) Hold impeller lock nut firmly in position and slightly loosen impeller nut. This will ensure positive locking of impeller.



HELICOIL-SCREW LOCK INSERT
Fig.6

6.3.17 Slide this complete backpullout assembly into pump casing (10500). Insert studs in the pump casing (10500) and casing cover (22000). Tighten all nuts on the stud firmly and evenly.

6.3.18 **Pump with Gland Packing**

6.3.18.1 In case of pumps with gland packings only, insert the gland packing (43001) and lantern ring in two halves (22700) in the order of 2+L+3.

6.3.18.2 Put the split gland in two halves (22900) with clamping plate (22400) and tighten the gland stud nuts.

6.3.19 **Piping Connection**

6.3.19.1 Rotate the shaft by hand and ensure free rotation.

6.3.19.2 Fit all accessories such as sealing water, flushing water, cooling water connections as per order.

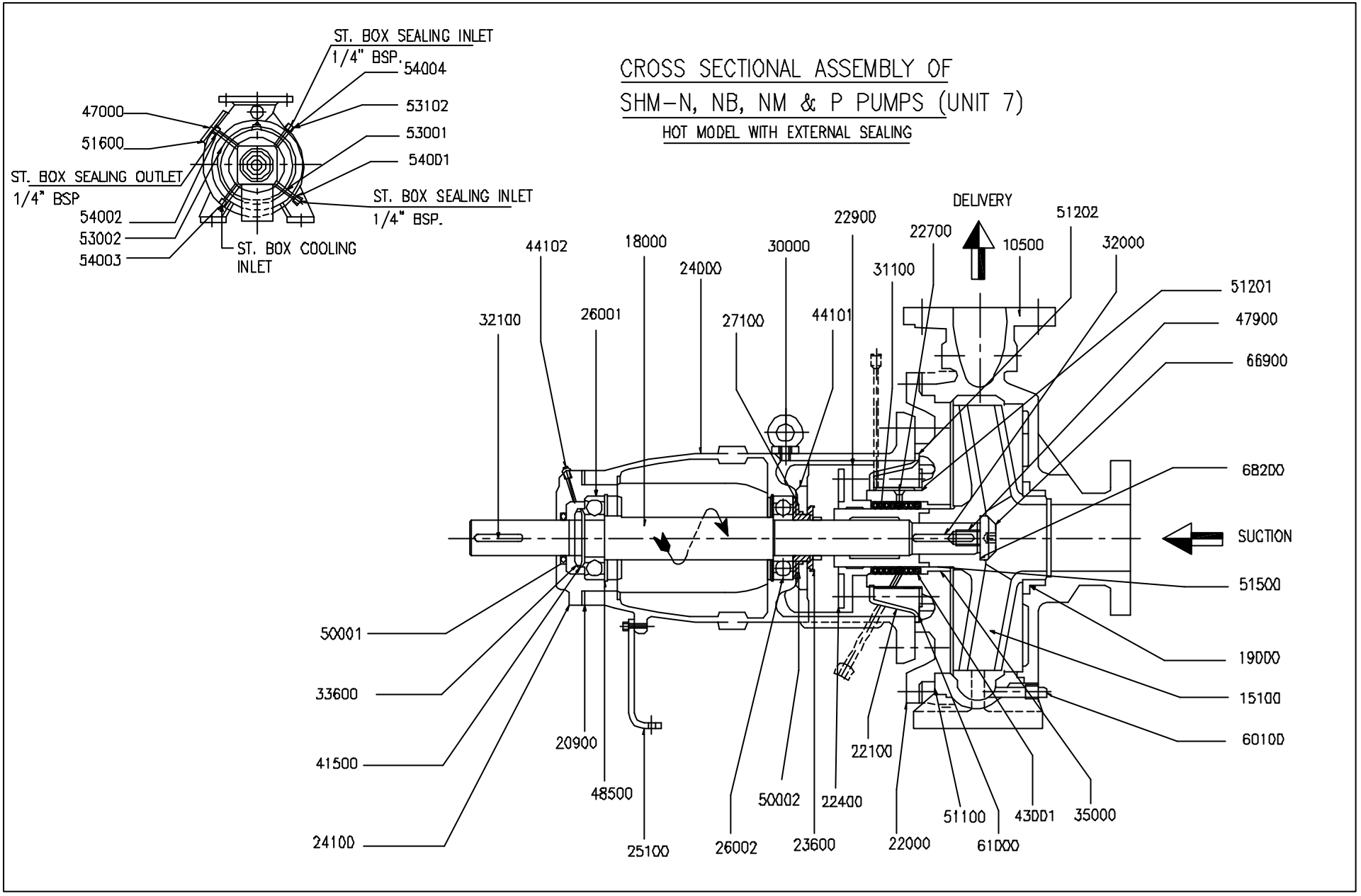
6.3.19.3 Make suction and delivery piping connections properly.

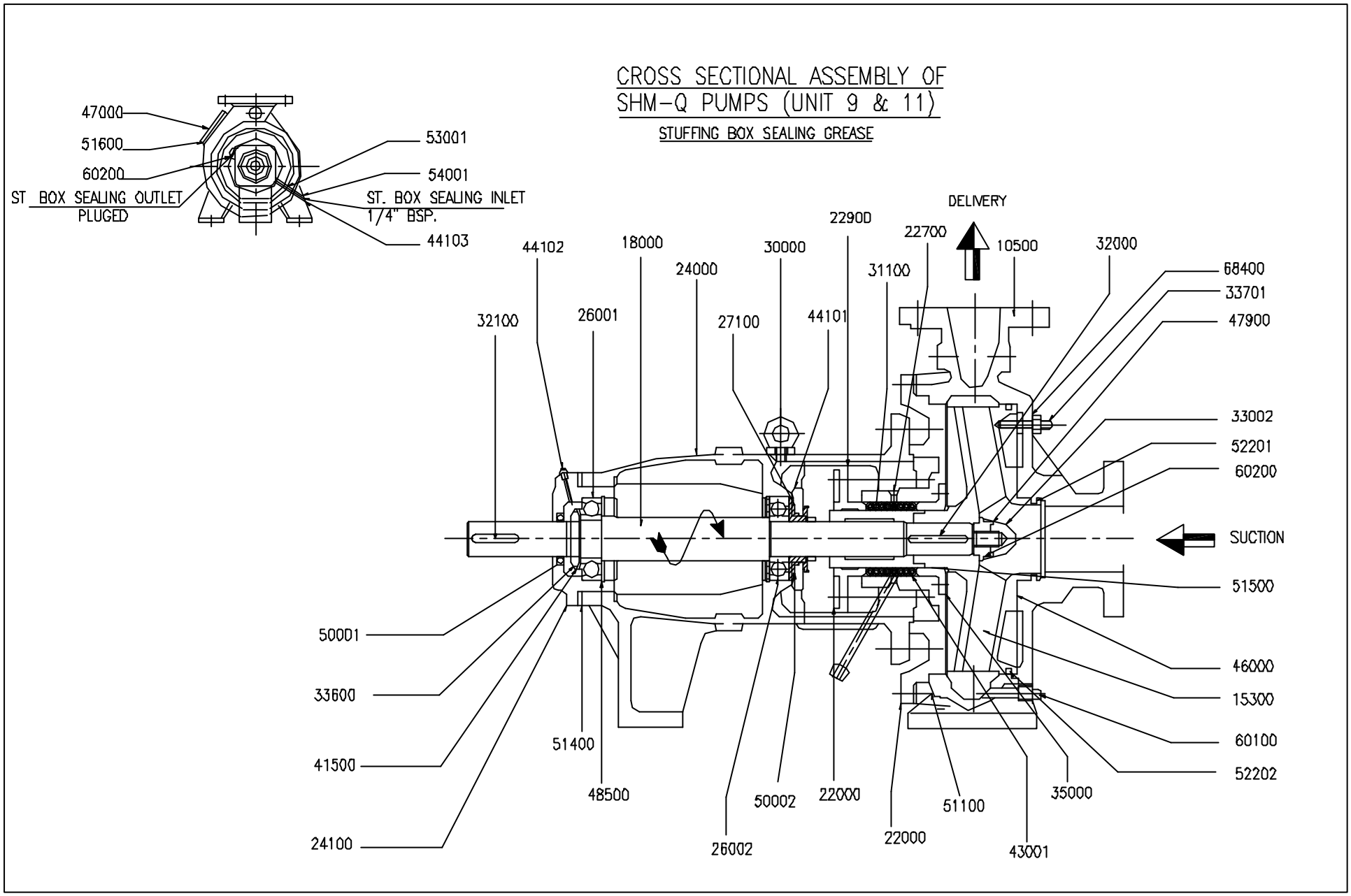
PART LIST FOR SHM PUMPS

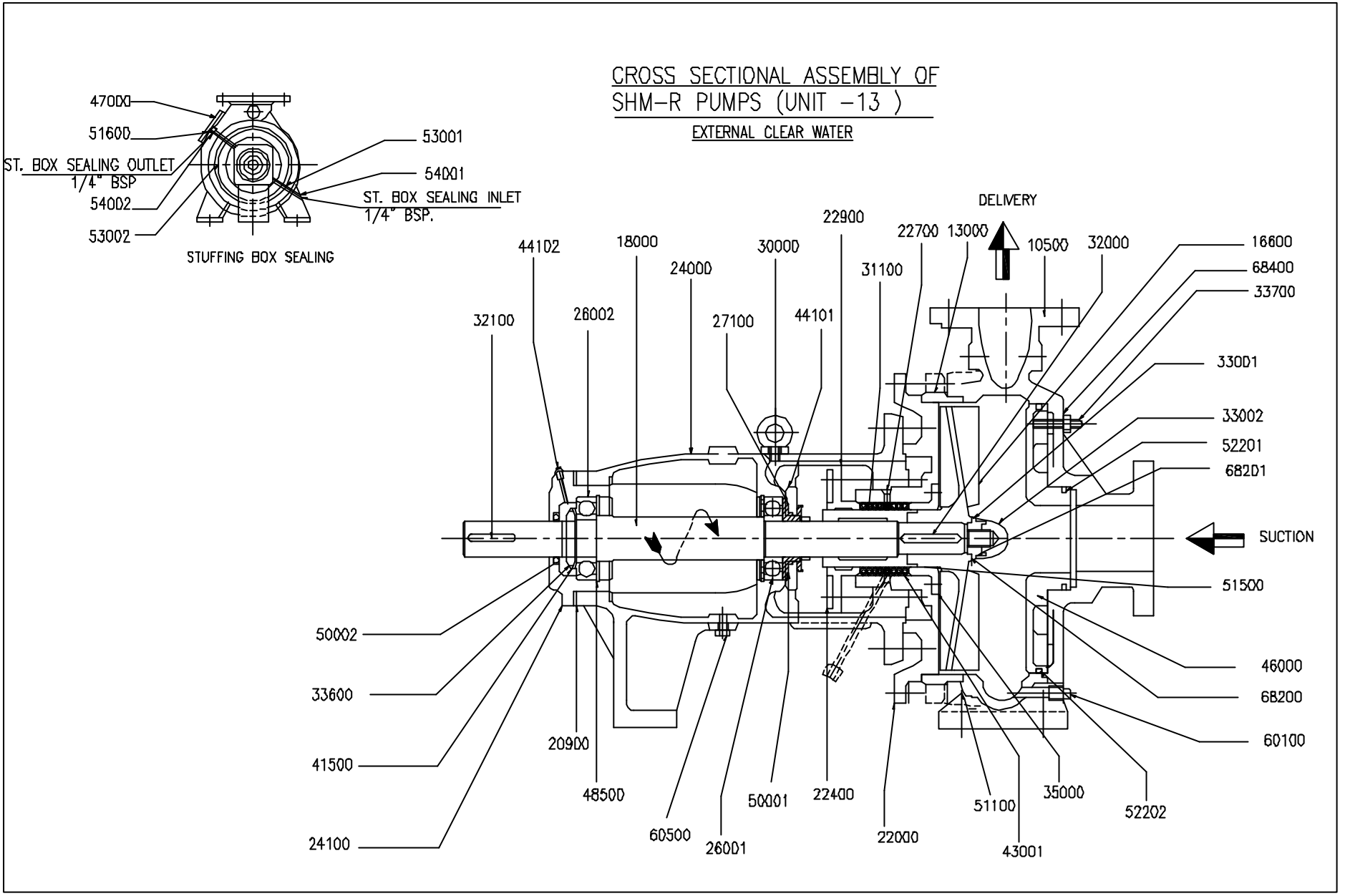
PART CODE	PART DESCRIPTION
10500	Pump casing
13000	Pump casing spacer
*15100	Impeller enclosed
*15300	Impeller semi open
*16600	Impeller free flow
*18000	Pump shaft
*19000	Casing wear ring
20900	Spacer for cartridge
22000	Casing cover
22100	Cooling chamber
22400	Clamping plate
22700	Lantern ring
22900	Split gland
23600	Liquid deflector
24000	Bearing housing
24100	Bearing cartridge
25100	Support foot (7-unit)
*26001	Bearing driving end
*26002	Bearing non driving end
27100	Bearing cover
30000	Lifting eye bolt
*31100	Shaft sleeve
*32000	Key for impeller
*32100	Key for coupling
*33001	Impeller lock nut
*33002	Impeller nut
33600	Round lock nut
33701	Accorn nut for wear plate
33702	Hex. nut for inspection hole cover
*35000	Stuffing box bush
*41500	Lock washer for bearing nut
*43001	Gland packing
44101	Grease nipple for bearing cover
44102	Grease nipple for bearing cartridge
44103	Grease nipple for bearing sealing
44300	Constant level oiler
44400	Oil feeding plug
*46000	Wear plate
47000	Inspection hole cover for pump casing
47101	Protection cover- delivery side
47102	Protection cover suction side
*47900	Hel. Screw lock insert
*48500	Internal circlip for bearing cartridge
*50001	Oil seal driving side
*50002	Oil seal non driving side
*51100	Gasket for casing cover
*51201	Gasket for cooling chamber inside

PART CODE	PART DESCRIPTION
*51202	Gasket for cooling chamber outside
*51400	Metallic gasket for cartridge
*51401	Gasket for bearing cover
*51500	Gasket for impeller and shaft sleeve
*51600	Gasket for inspection hole cover
*52201	‘O’ ring for wear plate
*52202	‘O’ ring for wear plate
*52300	‘O’ ring for bearing cartridge
*52500	‘O’ ring for casing cover and cooling chamber
53001	Pipe nipple for casing cover sealing inlet
53002	Pipe nipple for casing cover sealing outlet
53101	Pipe nipple for cooling chamber inlet
53102	Pipe nipple for cooling chamber outlet
54001	Socket for sealing pipe nipple
54002	Socket for sealing pipe nipple
58100	Hex. nut for casing stud
58201	Hex. nut for stud of casing cover/bearing holder
58202	Hex. nut for stud of gland
59000	Stud for casing
59101	Stud for casing cover/bearing holder
59102	Stud for gland
59400	Stud for wear plate
59600	Stud for inspection hole cover
60001	Pipe plug for suction gauge connection
60002	Pipe plug for delivery gauge connection
60100	Pipe plug for casing drain
60200	Pipe plug for sealing pipe nipple outlet
60500	Pipe plug for brg. Housing drain
60900	Pipe plug for flushing
61000	Cylindrical pin for casing cover
62600	Washer for accorn nut of wear plate
63001	Hex. screw for casing cover release
63002	Hex. release screw for bearing cartridge
63100	Hex. screw for bearing cover
63200	Hex. release screw for bearing cartridge
*65000	Hex. socket grub screw for casing wear ring
65400	Hex. socket grub screw for liquid deflector
65900	Hex. screw for bearing cartridge
66600	Cap screw for stuffing box bush
*66900	Screw for impeller (7 unit)
67101	Cooling name plate inlet
67102	Cooling name plate outlet
67601	Sealing name plate inlet
67602	Sealing name plate outlet
*68200	Gasket for impeller screw/ impeller nut
*68201	Gasket for impeller locknut
*68400	Gasket for accorn nut of wear plate

* Recommended spares for two year normal working.


CROSS SECTIONAL ASSEMBLY OF
SHM-N, NB, NM & P PUMPS (UNIT 7)
HOT MODEL WITH EXTERNAL SEALING
ST. BOX SEALING INLET
1/4" BSP.
54004
53102
53001
54001
ST. BOX SEALING INLET
1/4" BSP.
47000
51600
ST. BOX SEALING OUTLET
1/4" BSP
54002
53002
54003
ST. BOX COOLING
INLET
DELIVERY
SUCTION
44102
18000
24000
30000
22900
22700
10500
51202
32000
31100
51201
47900
66900
32100
26001
27100
44101
68200
51500
19000
15100
60100
50001
33600
41500
24100
20900
48500
25100
50002
22400
26002
23600
22100
22000
51100
61000
43001
35000


CROSS SECTIONAL ASSEMBLY OF
SHM-Q PUMPS (UNIT 9 & 11)
STUFFING BOX SEALING GREASE
47000
51600
60200
ST BOX SEALING OUTLET
PLUGED
53001
54001
ST. BOX SEALING INLET
1/4" BSP.
44103
DELIVERY
SUCTION
44102
18000
24000
30000
22900
22700
10500
32000
31100
68400
33701
47900
32100
26001
27100
44101
33002
52201
60200
51500
50001
33600
41500
24100
51400
48500
50002
22000
26002
22000
51100
43001
35000
46000
15300
60100
52202


CROSS SECTIONAL ASSEMBLY OF
SHM-R PUMPS (UNIT -13)
EXTERNAL CLEAR WATER
47001
51600
ST. BOX SEALING OUTLET
1/4" BSP
54002
53002
53001
54001
ST. BOX SEALING INLET
1/4" BSP.
STUFFING BOX SEALING
DELIVERY
SUCTION
44102
18000
24000
30000
22900
22700
13000
10500
32000
16600
68400
33700
32100
26002
27100
44101
31100
33001
33002
52201
68201
51500
50002
33600
41500
24100
20900
48500
60500
26001
50001
22400
22000
51100
43001
35000
52202
46000
68200
60100

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.

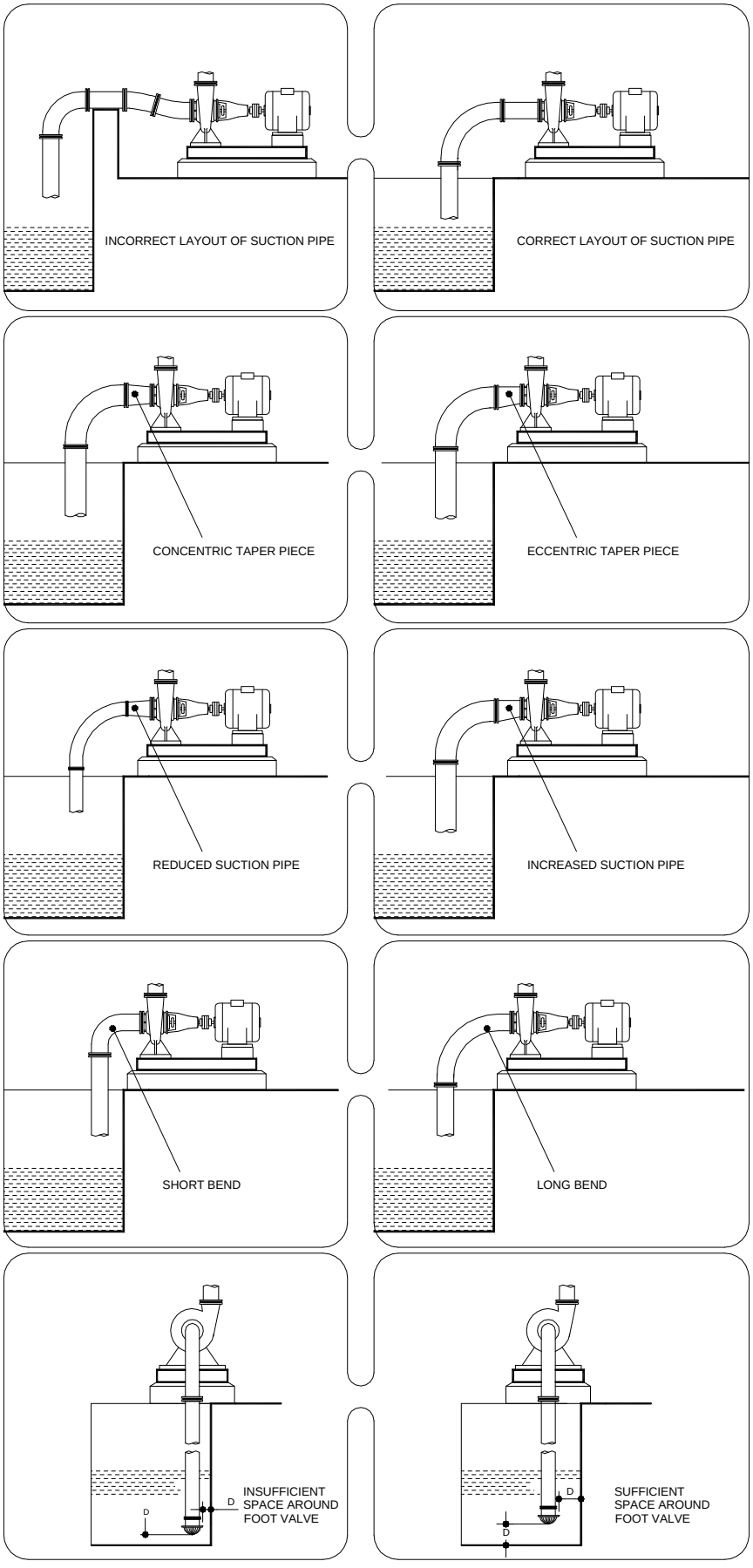
Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation of noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.

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.

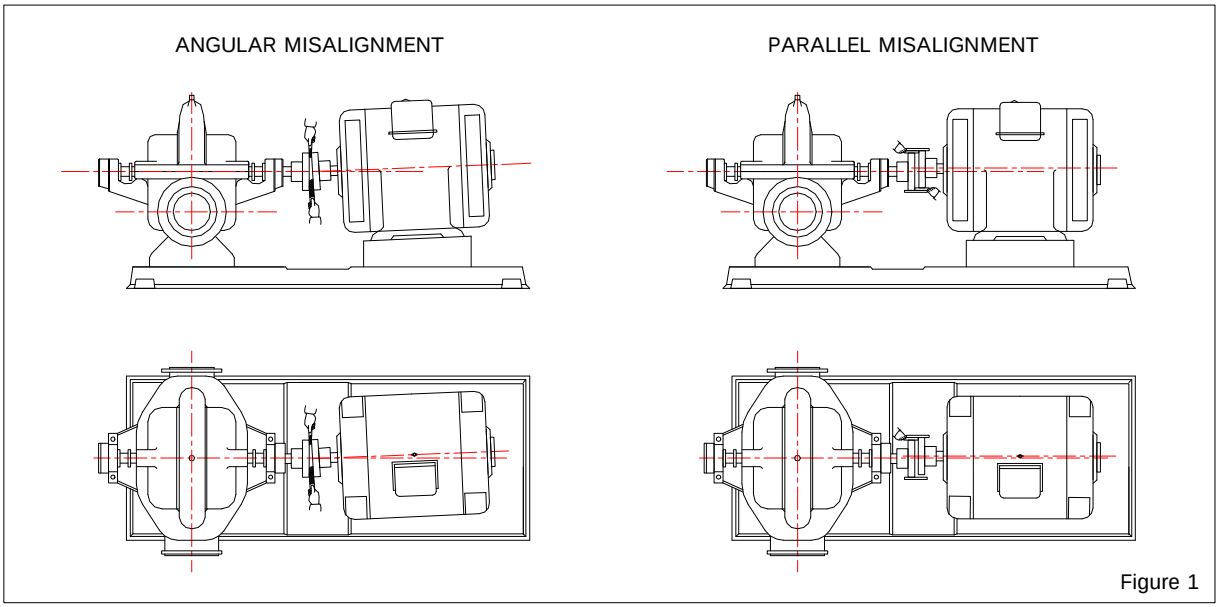


Figure 1

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.

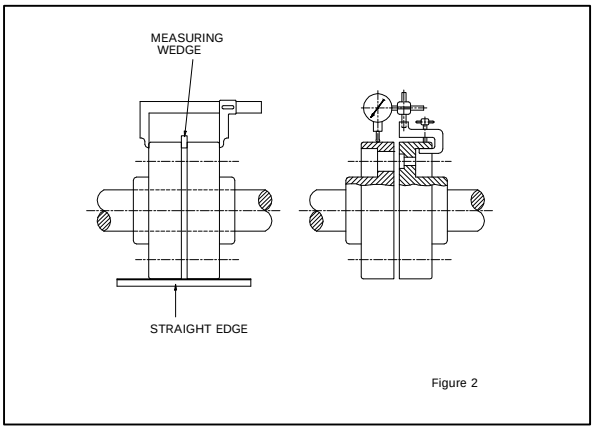
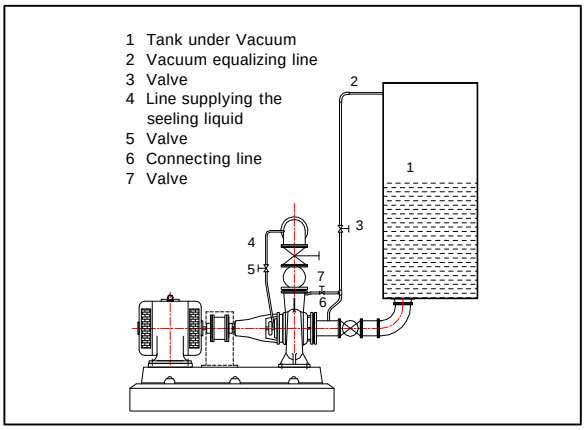


Figure 2



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 SHVT

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

CONTENTS

PLEASE FURNISH COMPLETE NAMEPLATE DETAILS, NAME OF PARTS, PART NOS. AND MATERIAL OF CONSTRUCTION WHILE ORDERING SPARE PARTS FOR THE PUMPS.

CAUTION:

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

1. INTRODUCTION

This booklet covers instructions for following type of SHVT pumps.

SHVT 50/26 SHVT 65/32 SHVT 80/26	7 Unit	SHVT 150/26 SHVT 150/32 SHVT 100/40 SHVT 200/32 SHVT 150/40	11 Unit
SHVT 100/26 SHVT 150/32 SHVT 80/40	9 Unit		
		SHVT 200/40 SHVT 150/50	13 Unit

It is very essential that these instructions be followed in every detail during installation operation and maintenance. Ensure that these instructions are made available to all persons responsible for installation, operation and maintenance of the pumps. Failure to follow these instructions may lead to unsatisfactory working or damage to the pump. Any special problem arising at site should be referred to the supplier. Full name plate details should be furnished while exchanging correspondence in connection with these pumps.

2. FOUNDATION

The following factors should be considered while designing the foundation.

2.1 Dimensional requirements.

2.2 Strength of the foundation.

2.3 Leveling the foundation.

2.4 Rechecking of the levels.

2.1 Dimensional requirements:

The location of the foundation bolts should be as per the general arrangement drawing supplied in advance.

2.2 Strength of foundation:

The foundation should be suitable to take load of pump, motor etc. to absorb any vibration and to form permanent rigid support.

The total load is borne by sole plates/base plates. In order to take this load (including safety factor for vibration) the sole plate should be firmly grouted in the concrete. If possible, sole plates should be welded to the reinforcement of the concrete. Sole plates should not get loose or form pockets with the foundation even with vibration.

For the pumps mounted on girders the sole plates should be properly welded on girders/ beams. In turn girders should be firmly embedded in the walls of the pump house.

The foundation and grouting should be done by the experienced civil engineering personnel.

2.3 Leveling the foundation:

The guidelines for grouting and leveling of the sole plates are as under:

a. It is essential to check the level of the sole plates individually and in combination.

b. The top surfaces of the sole plates be leveled to the accuracy of 0.05 mm/m. First of all one sole plate should be adjusted for height and leveled by putting shims below them. Then other sole plate should be leveled with respect to this sole plate with the help of straight edge and spirit level.

c. Before allowing the concrete to set check the level of sole plates individually and in combination as there is a possibility of distortion while pouring concrete.

d. After setting of the concrete, recheck the levels on surfaces of sole plates. Bring the sole plates in levels to the accuracy of 0.05 mm/m by grinding or filling if distortion has taken place due to setting.

e. If the sole plates are produced by the client directly at their end, then ensure that the sole plates are machined to close tolerance and polished.

2.4 Checking of the level:

Check the level of the sole plates frequently whenever the pump is dismantled for overhauling.

3. PROCEDURE FOR DISMANTLING AND RE-ASSEMBLY

3.1 Overhauling-

With normal daily operation the pump will be due for overhaul after about one year. This work is to be done by skilled personnel. Complete pump is to be taken out from support plate.

3.2 Dismantling:

3.2.1 Remove the delivery and suction piping holding down bolts and nuts.

3.2.2 Remove all external piping connections such as:
a. Sealing
b. Cooling water connections (if applicable)
c. Flushing etc.

3.2.3 Remove shafting by adopting procedure given in section 4.1, 4.2 of this booklet.

3.2.4 Remove the nuts from the support plate and pump casing.

3.2.5 Remove the pump from support plate and take it on to a table for stripping.

3.2.6 Unscrew and remove the nuts holding the casing with casing cover and/or with bearing housing.

3.2.7 Lifting the rotating unit sub-assembly by the hook provided on bearing housing and remove it from delivery casing (10500).

3.2.8 Hold the pump coupling and unscrew the impeller nut (33001) for SHVT 9 & 11 unit pumps. For SHVT 7 unit pumps remove impeller screw (66900) and for SHVT 13 unit pumps unscrew lock nut (33002) as well as impeller nut.

3.2.9 Remove impeller from shaft by using a puller. The plate of puller is to be fixed to impeller wearing ring boss and screw to be held in shaft end.

3.2.10 Remove the casing cover sub-assembly along with gland packed stuffing box, if casing cover is sandwiched type.
If casing cover is held by studs and nuts on to the bearing housing, remove these nuts and take out casing cover sub-assembly.

3.2.11 Remove the sleeve (31100) from pump shaft. If necessary use a puller.

3.2.12 Remove the liquid deflector (23600).

3.2.13 Unscrew the grub screw holding the pump coupling hub and take out coupling from shaft. Make use of puller.

3.2.14 Remove the screws holding the bearing cover (27100) and cartridge (24100) to the bearing housing.

3.2.15 Remove the shaft (18000) along with bearings and DS cartridge from the bearing housing (24000).

3.2.16 Remove the circlip from the cartridge by circlip puller and remove the cartridge by slight hammering.

3.2.17 Hold the shaft and remove the bearing nut (33600). Take out the lock washer (41500).

3.2.18 Remove the bearings from the shaft by use of puller.

3.2.19 Remove the oil seals (50001 and 50002) from cartridge and bearing cover using holes provided in the oil seal cover.

3.2.20 Remove the nuts holding the split gland (22900).

3.2.21 Take out the clamping plate (22400) and remove gland half.

3.2.22 Remove the gland packings/lantern ring (22700).

3.3 Re-assembly

3.3.1 Before re-assembly all the parts should be thoroughly cleaned with Kerosene, petrol or Benzene to remove the dust, rust etc.

3.3.2 Mount driver side (26001) and pump side (26002) deep groove ball bearings on the shaft.

CAUTION:

a. Use arbor press while fitting the bearings. However, it is recommended that bearings should be heated in oil bath at temperature 70° to 80 °C and then fitted.

b. Slide in ball bearing on shaft by hand and make sure that it is square with shaft. Press evenly the inner race of the bearing until bearing is seated firmly against the shaft shoulder.

c. Do not use hammer to fit the bearings. Do not mark the shaft, especially where it is in contact with the oil seal.

3.3.3 Tighten lock nut after inserting the lock washer (41500) in proper position on driver ball bearings. Fold one lip of lock washer in the slot of bearing lock nut to lock it.

3.3.4 Put oil seal in the bearing cartridge DE. Insert internal circlip (485) in the inner groove of the cartridge. Put a spacer on bearing cartridge in case of SHM-N, SHM-R and SHM-P pumps and shims in case of SHM-Q pumps. Insert the bearing cartridge from DE of the pump shaft.

3.3.5 Insert the shaft alongwith ball bearings at DE and NDE and bearing cartridge at DE into the bearing housing from driving end.

3.3.6 Tighten the bearing cartridge on the bearing housing with the help of hexagonal screws.

3.3.7 Fit the oil seal in bearing cover PS. Tighten the bearing cover PS on bearing housing with the help of hexagonal screws.

3.3.8 Slide the liquid deflector from NDE of shaft. Tighten the deflector on shaft by using grub screws.

3.3.9 Push the shaft sleeve (31100) into the shaft till it touches the collar on the shaft.

3.3.10 Fit the stuffing box neck bush (35000) into the casing cover if worn out.

3.3.11 Put the gasket (51500) on the impeller hub in proper position.

3.3.12 Fit the impeller key (32000) on the shaft. It should enter partly in the shaft sleeve.

3.3.13 Put the casing cover (22000) on the bearing housing. Tighten it by studs and nuts to the bearing housing.

3.3.14 Push the impeller (15100) on the shaft till it touches the shaft sleeve.

3.3.15 Fix the coupling key on shaft at D.E. Put the pump side coupling half on the shaft and tighten the grub screw to fix the coupling.

3.3.16 Insert the helicoil lock insert (47900) in the impeller nut for 9 &11 units and in the shaft for 7 unit, put gasket (68200) on it and tighten it in the shaft by holding the pump coupling hub. For unit-13 pumps tighten impeller nut & lock nut to tighten the impeller without helicoil insert.

3.3.17 Slide this complete backpullout assembly into pump casing duly fitted with studs. Tighten all nuts on the stud firmly and evenly.

3.3.18 In case of pumps with gland packings only, insert the gland packing (43001) and lantern ring in two halves (22700) in the order of 2 + L + 3.

3.3.19 Put the split gland in two halves (22900) with clamping plate (22400) and tighten the gland stud nuts.

3.3.20 Rotate the shaft by hand and ensure free rotation.

3.3.21 Fit all accessories such as sealing water, flushing water, cooling water connections as per order.

3.3.22 Make suction and delivery piping connections properly.

4. MAINTENANCE

Preventive maintenance schedule is the periodical checks and precautions by which possibilities of failure and breakdowns are minimised.

4.1 Daily Checks:

4.1.1 An hourly record of suction and discharge pressure, discharge quantity, input to the pump driver should be maintained.

4.1.2 Bearing temperature, oil level, stuffing box leakage, stuffing box temperature, cooling water inlet and outlet and outlet temperature should be checked. This gives an idea of mechanical performance of the pump.

4.1.3 Noise and the vibrations are first signs of impending troubles like cavitation, air lock, bearing failure, choking of impeller or casing and such other operating troubles. The pump performance should therefore be checked for noise and vibration.

4.2 **Periodical checks**:

4.2.1 The temperature of the bearing should be measured by a thermometer. Safe maximum temperature a bearing can attain is 80°C.

4.2.2 The lubricants of the bearings should be checked. The lubricant might get contaminated with foreign material or get blackened due to overheating. In such cases, bearings should be flushed and charged with fresh lubricants.

4.2.3 Check stuffing box leakage. Normal leakage of approx. 60 drops per minute is recommended for safe operation. If the leakage is more the stuffing box packing might have worn out or lantern ring is displaced. In case the packings are worn out all the packing rings should be replaced. Replacement of one or two rings or addition of rings should never be done.

4.2.4 The alignment of the pumping unit should be checked. Due to operational vibrations, atmospheric temperature or stress induced by the weight of the piping the alignment may get disturbed. Sufficient quantity of suitable type of lubricant and stuffing box packing should be kept for daily and emergency use.

4.2.5 Calibrate the measuring instruments.

4.3 Annual checks

4.3.1 The pump should be overhauled completely to check the clearance and to replace worn out parts. Clearances between impeller and casing ring, shaft sleeve and stuffing box bush, lantern ring and the shaft sleeve etc. are very important.

4.3.2 The bearing should be cleaned thoroughly and lubricated properly. The stuffing box should be repacked by correctly located the lantern ring.

4.3.3 The effects of liquid handled on pump components should be checked. If abnormal corrosion/erosion is observed, the component should be replaced with that of suitable material.

4.3.4 The auxiliary pipe lines and functioning of the auxiliaries should be checked. The main pipe also should be checked for scaling, leakage etc.

4.3.5 The measuring instruments, gauges etc. should be recalibrated.

4.3.6 Full running test may be carried out to check whether there is any fault in the performance, in comparison with original performance.

4.3.7 Piping supports should be checked so that the pipe do not induce unwanted stresses on the pump.

5. TRANSMISSION SHAFT UNIT/ DRIVING UNIT ASSEMBLY

5.1 Transmission shaft assembly includes major components like motor stool (29000) and metaflex flexible drive shaft (18500).

5.1.1 Assemble the motor on motor stool. The motor shaft should align with pump shaft within 0.05 mm.

5.1.2 Assemble the metaflex flexible drive shaft to motor shaft coupling and pump shaft coupling with the help of soc. Head bolts.

5.1.3 Make the electrical connections and check for correct direction of rotation.

5.2 Dismantling

5.2.1 Disconnect metaflex flexible drive shaft from motor and pump coupling hubs by loosening soc. Head bolts.

5.2.2 Switch off the power supply and remove the motor terminal connections. Disconnect the motor from motor stool (290) and remove the same along with hub. Lift the metaflex flexible drive shaft and keep the same on motor stool floor in horizontal position.

5.2.3 Disconnect the motor stool.

5.3 Re-assembly

5.3.1 Place the motor stool on the foundation. Take the metaflex flexible drive shaft and clean it properly.

For further assembly please refer 5.1.1 to 5.1.3.

6. OPERATION

6.1 **Before starting the pump, check the following:**

6.1.1 The pump rotates freely by hand.

6.1.2 The sealing liquid and cooling water connections are properly tightened and adjusted.

6.1.3 The direction of rotation of driver. It should correspond to the direction of the rotation of the pump.

6.1.4 The pump casing and suction pipe is fully primed with the liquid.

6.1.5 Valve on delivery side is closed.

6.1.6 The cock for pressure gauge connection is closed.

6.1.7 The stuffing box packing is properly tightened.

6.2 **Starting the pump:**

6.2.1 Start the pump. Let the prime mover pick up its full speed.

6.2.2 Open the valve on delivery line slowly to reduce the starting load on the motor.

6.2.3 Regulate the required flow by adjusting the delivery valve.

6.2.4 Open the cock for pressure gauge connection.

6.3 **During running the pump, check the following things and regulate, if necessary:**

6.3.1 The pump is running smoothly.

6.3.2 The flow of sealing liquid is uninterrupted. If necessary provide a sight glass in between the piping.

6.3.3 The bearings are not getting abnormally hot.

6.3.4 The gland is properly tightened to given leakage of approx. 60 drops per minute through stuffing box.

6.3.5 Head and capacity developed by the pump is as specified.

6.3.6 Power consumption is within the limit.

6.3.7 Ensure that there is no mechanical friction in the pump.

6.3.8 Stop the pump immediately, if any defects are detected. Do not start the pump unless the defects are rectified. Report immediately to the supplier if it is not possible to rectify the defects.

6.4 **During stopping the pump:**

6.4.1 Close the valve on delivery side.

6.4.2 Stop the motor.

6.4.3 Close the sealing liquid connections.

6.4.4 If the pump is not required to be operated for a long time, drain the casing completely. If the pump is required to be stored for a long time, the bearing housing should be dried internally with hot air and should be flushed with moisture free protective, such as light oil or kerosene.

7. TECHNICAL DATA

7.1 **Direction of rotation:**

The direction of rotation is clockwise when viewed from driving end.

7.2 Specification of bearings, oil seal and quantity of oil fill and ‘O’ rings etc.

Part Code	Description	UNIT NO.			
		SHM-7	SHM-9	SHM-11	SHM-13
26001	Ball Bearing DS	SKF-6307	SKF-6309	SKF-6411	SKF-6413
26002	Ball Bearing PS	SKF-6307	SKF-6309	SKF-6411	SKF-6413
26400	Cylindrical roller bearing PS for heavy duty arrangement	SKF-NU307	SKF-NU309	SKF-NU411	SKF-NU413
50001	Oil seal DS	32 x 45 x 7	42 x 72 x 10	50 x 78 x 13	60 x 85 x 13T
50002	Oil seal PS	35 x 52 x 10	45 x 62 x 10	55 x 80 x 13	65 x 85 x 13T
33600	Bearing lock nut DS	M35x1.5RH SKF-KM-7	M45x1.5RH SKF-KM-9	M55x2 RH SKF-KM-11	M65x 2RH SKF-KM-13
41500	Bearing lock washer	M-35 SKF-MB7	M-35 SKF-MB9	M-55 SKF-MB11	M-65 SKF-MB13
48500	Internal circlip for rolle brg. PS	B80 x 2.5 thick	B100 x 3 thick	B 140 x 4 thick	B160 x 4 thick
48501	Internal circlip for Ball brg. DS	B80 x 2.5 thick	B100 x 3 thick	B140 x 4 thick	B160 x 4 thick
44101 & 44102	Grease nipple	¼" BSP	¼" BSP	¼" BSP	¼" BSP

7.3 Lubrication

7.3.1 Grease lubricated bearings are standard supply.

The specifications of grease are given below. It should conform to the following grades or their equivalents available in the market.

INDIAN OIL - SERVOGEM - 3
HINDUSTAN PETROLEUM - NETRA-3 OR LITHON-3

7.4 Specification of stuffing box packing, gasket packing etc.

Part Code	Description	UNIT NO.			
		SHM-7	SHM-9	SHM-11	SHM-13
	Packing ring arrangement with lantern ring	2 + L +3	2 + L +3	2 + L +3	2 + L +3
43000	Gland packing size for 5 ring	10 x 1080 mm	10 x 1260 mm	12.5 x 1330 mm	12.5x1620 mm
68200	Gasket for impeller Nut/ Screw mm	32x50x1 mm	38.5x56x1 mm	52x64x1 mm	58x75x1mm & 38.5x56x1 (for lock nut)
51500	Gasket for shaft sleeve (ID x OD x Thick)	48x55x1 mm	62x70x1 mm	72.5x80x1 mm	82.5x90x1.5 mm
51100	Gasket for casing cover & pump casing (permanite) (ID x OD x Thick)	265x285x1 mm	330x350x1 mm	405x425x1 mm	420x440x1 mm
52300	'O' ring for cooling chamber (ID x Thick)	80 x 3	100 x 3	123 x 3	132 x 3

7.5 Cooling of stuffing box

7.5.1 Cool the packed gland stuffing box when pumping liquid temperature is above 90°C.

7.5.2 Cool the mechanical seal, stuffing box when pumping liquid temperature is above 140°C. this limit is subject to change as per seat manufacturers recommendation.

7.5.3 Quantity of stuffing box cooling water with reference to temperature and nominal impeller diameter in cms.

Full nominal impeller dia. in cms.	COOLING WATER QUANTITY AT VARIOUS PUMPING LIQUID TEMPERATURES				
	110°C	150°C	200°C	250°C	300°C
26	0.21	0.24	0.30	0.40	0.54
32	0.23	0.28	0.37	0.48	0.63
40	0.26	0.31	0.43	0.55	0.71

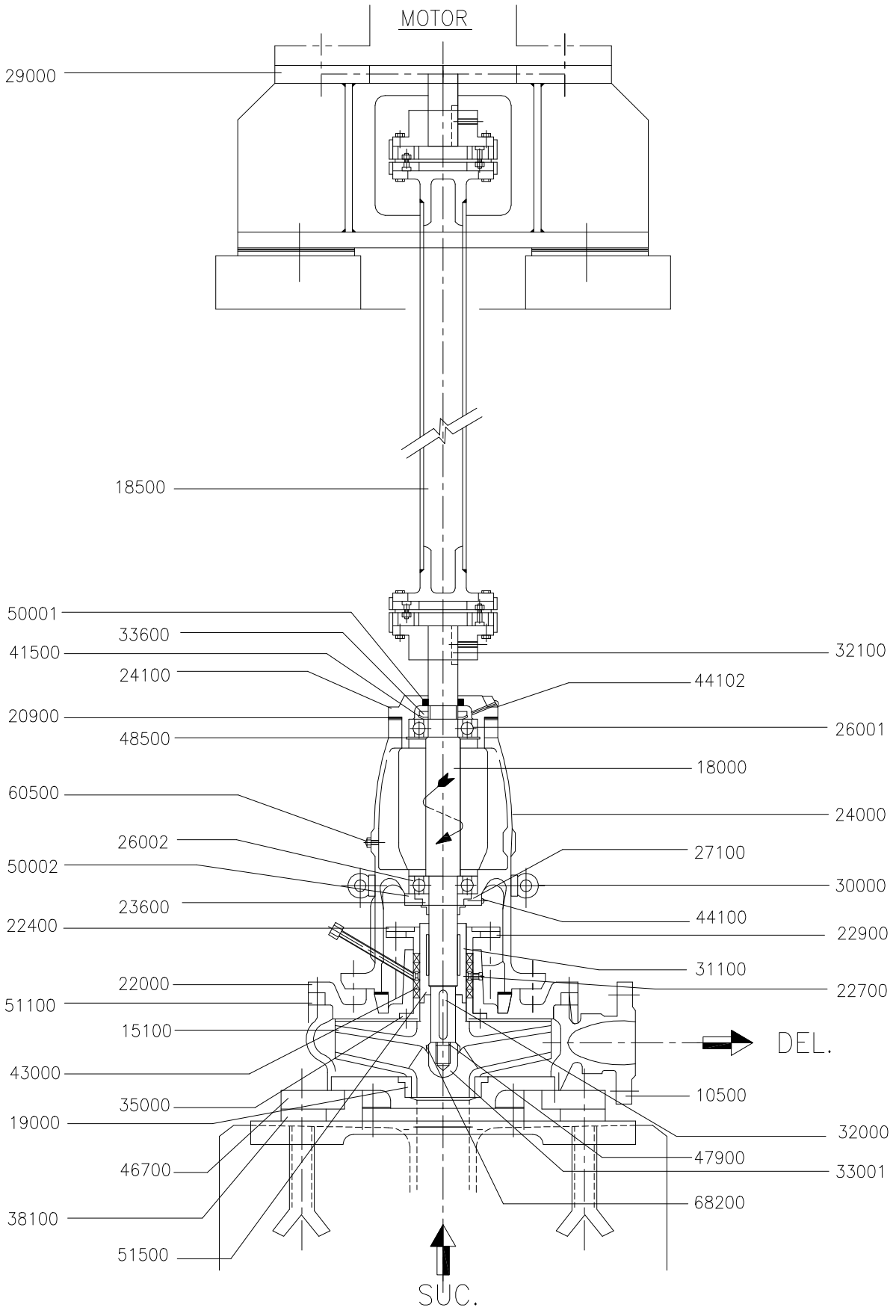
Cooling quantities mentioned are in m^3/hr.
Maximum temperature of cooling water at outlet - 50°C
Maximum permissible cooling water pressure – 6 kg/cm^2

SPARE PARTS LIST OF SHVT PUMP

SR.	PART CODE	DESCRIPTION
01	10500	PUMP CASING
02	* 15100	ENCLOSED IMPELLER
03	* 18000	PUMP SHAFT
04	* 19000	CASING WEAR RING
05	20900	SPACER FOR BRG. CARTRIDGE
06	22000	CASING COVER
07	22400	CLAMPING PLATE
08	* 22700	LANTERN RING
09	* 22900	SPLIT GLAND
10	* 23600	LIQUID DEFLECTOR
11	* 31100	SHAFT SLEEVE
12	* 32000	KEY FOR IMPELLER
13	* 35000	STUFFING BOX BUSH
14	* 43000	GLAND PACKING
15	24000	BEARING HOUSING
16	24100	BEARING CARTRIDGE
17	* 26001	BALL BEARING
18	* 26002	BALL BEARING
19	27100	BEARING COVER PS
20	30000	LIFTING EYEBOLT
21	* 32100	KEY FOR COUPLING
22	* 33600	BEARING LOCK NUT
23	* 41500	LOCK WASHER
24	44101	GREASE NIPPLE
25	44102	GREASE NIPPLE
26	48500	INTERNAL CIRCLIP
27	* 50001	OIL SEAL (D.S.)
28	* 50002	OIL SEAL (P.S.)
29	* 51100	GASKET FOR PUMP CASING
30	* 51500	GASKET FOR SHAFT SLEEVE
31	* 68200	GASKET FOR IMPELLER NUT
32	60500	PIPE PLUG FOR BRG. HSG. DRAIN
33	29000	MOTOR STOOL
34	47900	HELICOIL INSERT
35	33001	IMPELLER NUT
36	46700	SUPPORT PLATE
37	38100	SOLE PLATE
38	18500	METAFLEX FLEXIBLE DRIVE SHAFT

* RECOMMENDED SPARES.

KIRLOSKAR BROTHERS LTD. KIRLOSKARVADI , DIST–SANGLI 416 308 (INDIA)	DRG. NO.
CROSS SECTIONAL ASSEMBLY OF SHVT PUMP	TC 169 SD 001 0



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.

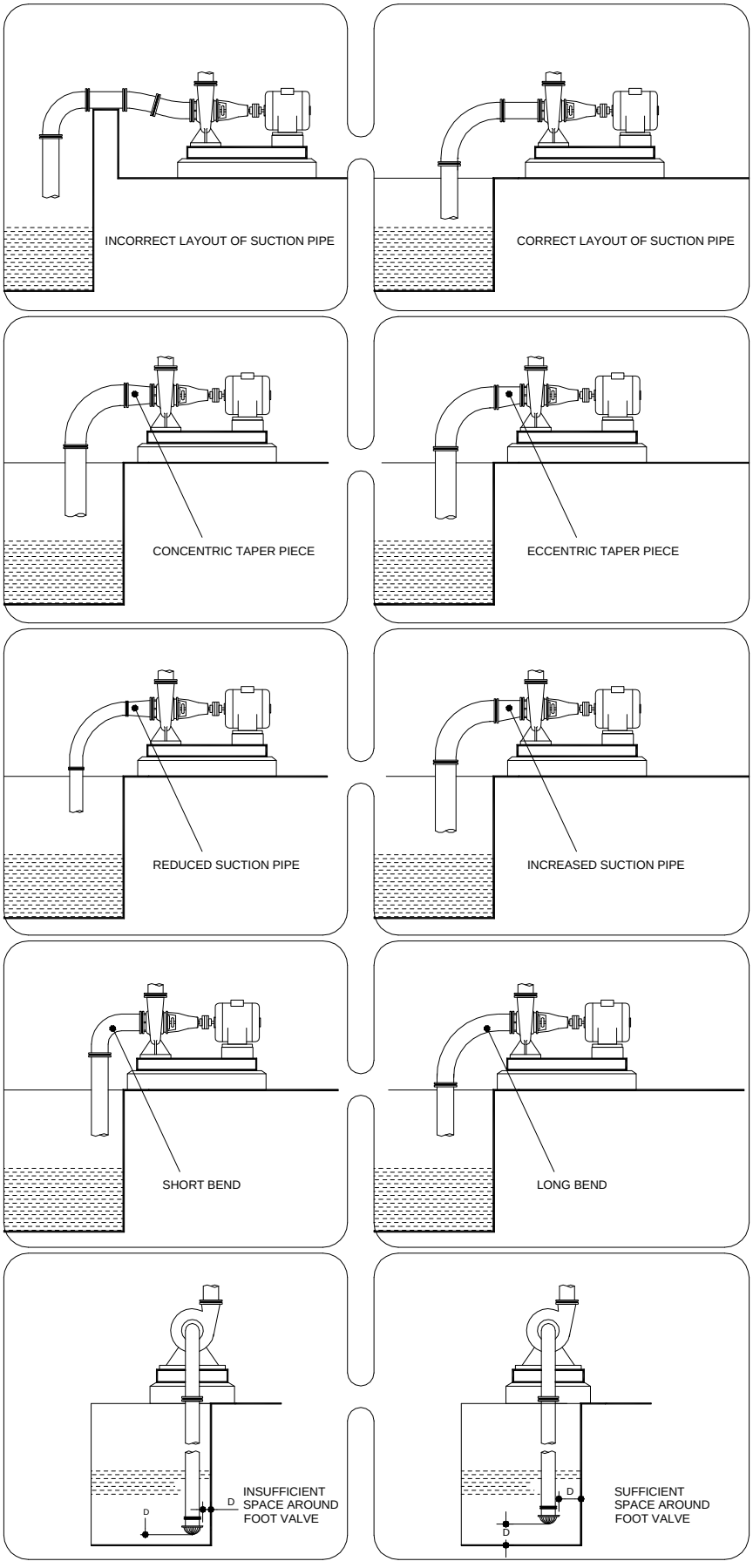
Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation of noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.

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.

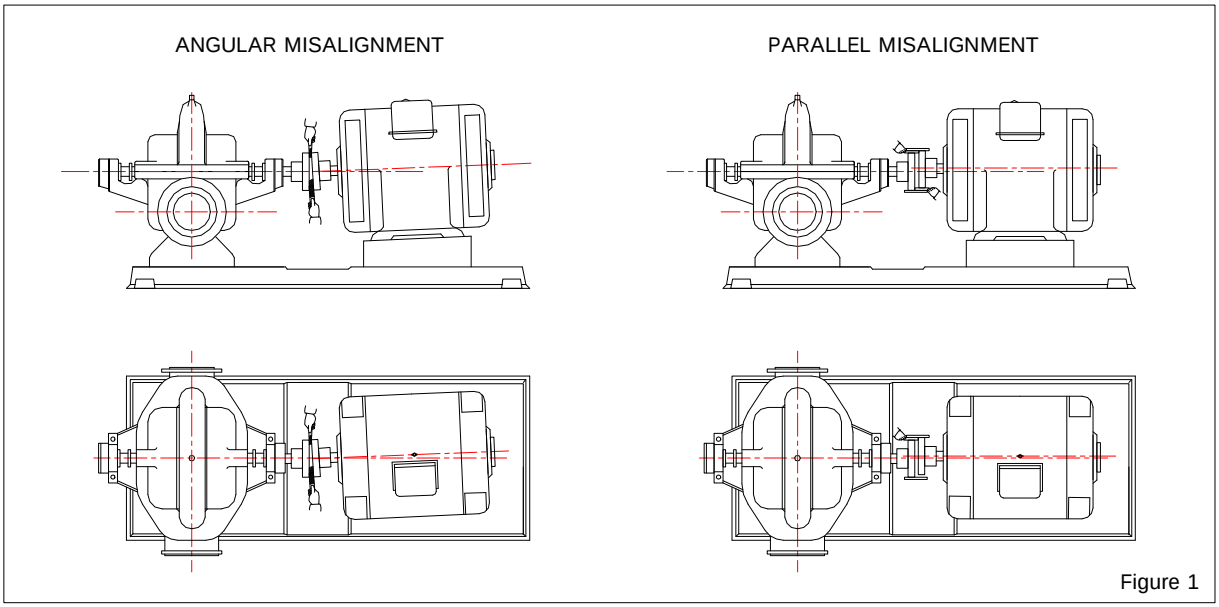


Figure 1

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.

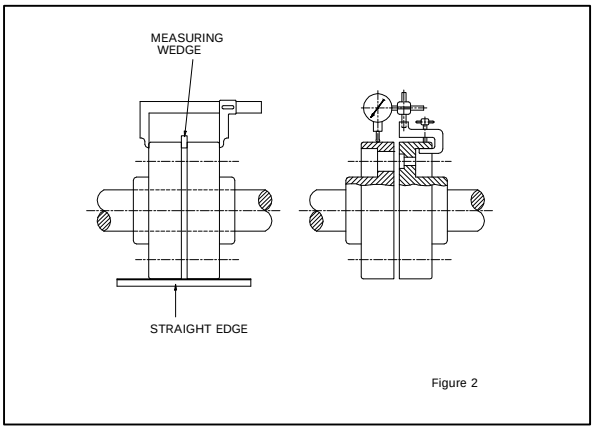
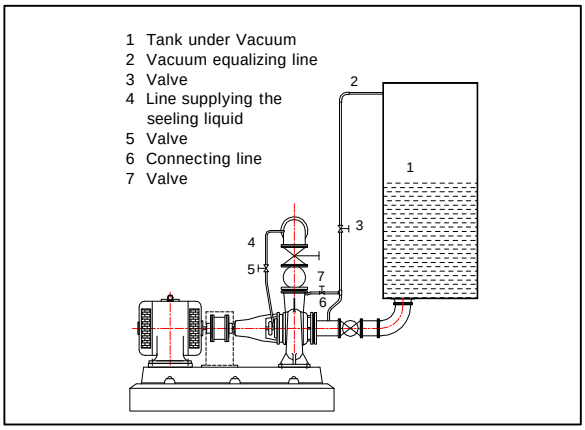


Figure 2



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.