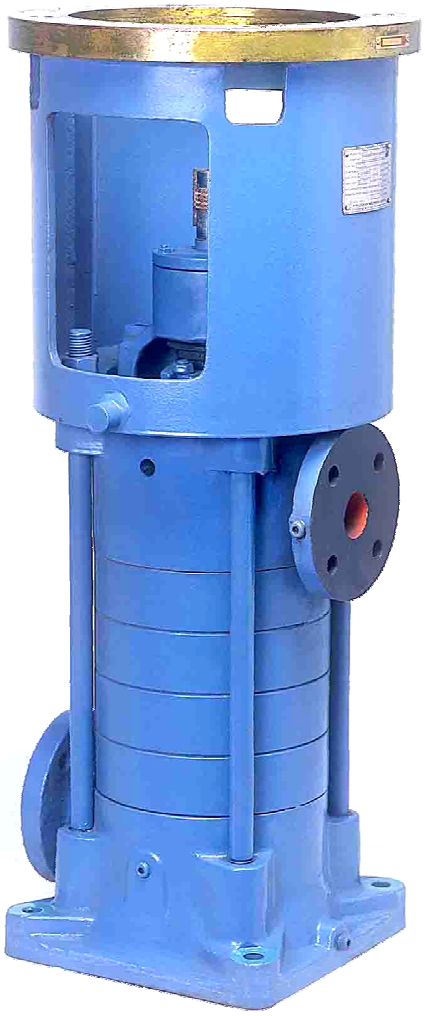
Enriching Lives

INSTRUCTIONS ON INSTALLATION, OPERATION AND MAINTENANCE FOR KIRLOSKAR PUMP TYPE RKB-Vertical



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 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 our arise solely from faulty workmanship or defective material.

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

– KIRLOSKAR BROTHERS LIMITED

CONTENTS

PLEASE FURNISH PUMP TYPE, NAME OF THE PART, PART NUMBER, MATERIAL CONSTRUCTION AND OTHER NAME PLATE DETAILS WHILE ORDERING SPARE PARTS FOR THE PUMP.

CAUTION :

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

1. GENERAL

1.1 The Booklet covers instructions for following types of RKB Vertical (Cold Model) Pumps.

RKB 32-9EV
RKB 40-12LV
RKB 40-14HV
RKB 50-15E/LV
RKB 50-16HV
RKB 65-19E/LV
RKB 100-23EV
RKB 125-27V
RKB 125-30V
RKB 150-34V
RKB 200-37V

1.2 Cold Model pumps (without stuffing box cooling arrangement) are supplied for liquid having temperature utpo 90°C.

1.3 Pumps, when properly installed and given due care in operation and maintenance, should operate satisfactority for a long period of tifme. When the pump is received sometime before the actual use of the pump, 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, general maintenance, trouble shooting etc. the instructions given in our publication "INSTRUCTION MANUAL ON CENTRIFUGUAL PUMPS" which is printed alongwith this manual must be followed carefully. The auxiliary piping connection to the pump must be made as under after installation and before commissioning the pump sets.

2.2 **Flushing/Quenching of Mechanic l Seal -**

Whenever pump is supplied with mechanical seals, the flushing plan as recommended in O/A shall have to be followed. Separate cross sectional drawing with flushing and quenching details shall be supplied against O/A. If you do not receive the same, please ask for the same before commissioning of the pumps.

3. OPERATION

3.1 **Before starting the pump check the following :**

3.1.1 The pump rotates freely by hand.

3.1.2 Bearings at DE is greased properly.

3.1.3 If pump is with external flushing arrangement to bush bearing then please ensure that external flushing connection is given and flushing liquid is supplied to the pump. (Refer Fig. No. CT 114 82 003 0)

3.1.4 The direction of rotation. It should correspond to the direction of rotation of the pump. (Please note that direction of rotation of pump is anticlockwise when viewed from driving end.)

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

3.1.6 Sluice 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 for gland packed pump.

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 side slowly.

3.2.3 Open the cock of pressure gauge connection.

3.2.4 Throttle the discharge valve to the required duty conditions, if required.

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/flushing liquid is uninterupted.

3.3.3 Power consumption is within the limit.

3.3.4 The bearings are not getting heated up excessively.

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

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

3.3.7 Leakage through stuffing box is normal. There should be a leakage of 60-80 drops/ minute.

3.3.8 Stop the pump immediately, if any defects are detected. Do not start the pump unless the defects are rectified.

3.4 **During stopping the pump**

3.4.1 Close the valve on delivery side.

3.4.2 Stop the motor.

3.4.3 If the pump is not required to be operated for a long time, drain the casing.

4. TECHNICAL DATA

4.1 **Direction of rotation**

It is anti-clockwise when viewed from driving end. Please refer to the Arrow Name plate attached to pump for the direction.

4.2 **Bearings**

Pump size	BEARING AT N. D. E.											
	STAGE											
	2	3	4	5	6	7	8	9	10	11	12	13
RKB 32-9EV	← 6306 →											
RKB 40-12LV	← 2 x 7307 BG →											
RKB 40-14HV												
RKB 50-15E/LV	← 2 x 7308 BG →											
RKB 50-16HV												
RKB 65-19E/LV	← 2 x 7309 BG →											
RKB 100-23EV	← 2 x 7310 BG →											
RKB 125-27V	← 2 x 7311 BG →											
RKB 125-30V	← 2 x 7312 BG →											
RKB 150-34V	← 2 x 7313 BG →											
RKB 200-37V	← 2 x 7314 BG →											

NOTE : 1) Above bearing details at DE are applicabfle for pumps operating at 50 c/s only.
2) Bearing of SKF or equivalent make.
3) Pair of angular contact ball bearings in face to face arrangement.

4.3 **Lubrication of Bearings**

4.3.1 DE bearing is lubricated by grease.

4.3.2 **Grease Specifications**

The grease usued for lubrication should conform to one of the following grades-

Indian Oil Corporation	–	Servogem 3 (For 1450 rpm.)
Indian Oil Corporation	–	Servogem 2 (For 2900 rpm.)
Hindustan Petroleum	–	Alvina Grease 3 (For 1450 rpm.)
Hindustan Petroleum	–	Alvina Grease 2 (For 2900 rpm.)

4.3.3 **Bearing Temperature**

Bearing temperature should not rise above 80°C.

4.3.4 **Regreasing period**

The grease should be refilled after every 1000 running hours.

4.4 Flushing of bearing bush on nondriving side :

For this please refer Drawing No. CT 114 82 003 0 indicating internal flushing and external flushing arrangement. Standard supply is with internal flushing arrangement. External flushing arrangement is optional supply for which feeding of external clear, cold liquid at pressure higher than suction pressure by about 1 bar is required.

4.5 **Stuffing Box Packing Details**

The chart below indicates the stuffing box packing arrangement on suction and delivery side of the pump.

Pump Type	Packing Arrangement	Packing Size
RKB 32-9EV		– 10 mm x 10 mm
RKB 40-12LV &		– 10 mm x 10 mm
RKB 40-14 HV		
RKB 50-15E/LV &	6 Rings	– 10 mm x 10 mm
RKB 50-16HV	on Delivery Side	
RKB 65-19E/LV		– 12 mm x 12 mm
RKB 100-23EV		– 12 mm x 12 mm
RKB 125-27V		– 14 mm x 14 mm
RKB 125-30V		– 14 mm x 14 mm
RKB 150-34V		– 14 mm x 14 mm
RKB 200-37V		– 16 mm x 16 mm

Self lubricated asbestos packing (non metallic) — champion style 1800 or equivalent should be used unless otherwise specified.

4.6 O-ring and key specifications

Material of O-ring shall be Nitrile rubber

4.6.1 'O' RING SIZE SPECIFICATIONS

Pump Type 'RKB'	Stage Part No. 522.1/522.3	Diffuser Part No. 522.2	Shaft Sleeve (Gland Packed) Part No. 522
	ID X T	ID X T	ID X T
32-9EV	148.82 x 3.53	81 x 3	31.6 x 2.4
40-12LV & 40-14HV	190.1 x 3.53	99.5 x 3	36.5 x 3
50-15E/LV & 50-16H	202.8 x 3.53	104.37 x 3.53	41.5 x 3
65-19E/LV	240.9 x 3.53	120.25 x 3.53	46.5 x 3
100-23EV	278.99 x 3.53	129.77 x 353	49.5 x 3
125-27V	355.19 x 3.53	158.35 x 3.53	55.5 x 3
125-30V	385 x 3T	174.3 x 5.7	60.33 x 3.53
150-34V	436 x 4T	200 x 6.3	75.57 x 5.33
200-37V	468 x 6T	215.27 x 6.99	69.22 x 5.33

4.6.2 KEY SIZES FOR 'RKB' PUMPS

Location	Key for Coupling	Key for First Impeller	Key for Stage Impeller	Key for Last Impeller
Part Code No. Pump Type 'RKB'	321	320	320.1	320.2
32-9EV	8 x 7 x 054L	6 x 4 x 025L	6 x 4 x 014L	6 x 4 x 044L
40-12LV & 40-14HV	8 x 7 x 050L	6 x 4 x 025L	6 x 4 x 020L	6 x 4 x 055L
50-15E/LV & 50-16HV	10 x 8 x 075L	8 x 7 035L	8 x 7 x 025L	8 x 7 x 064L
65-19E/LV	12 x 8 x 100L	10 x 8 x 060L	10 x 8 x 044L	10 x 8 x 080L
100-23EV	14 x 9 x 100L	10 x 8 060L	10 x 8 x 050L	10 x 8 x 100L
125-27V	14 x 9 x 100L	10 x 8 060L	10 x 8 x 050L	10 x 8 x 100L
125-30V	16 x 10 x 100L	12 x 8 x 060L	12 x 8 x 044L	12 x 8 x 110L
150-34V	18 x 11 x 130L	12 x 8 x 075L	12 x 8 x 050L	12 x 8 x 130L
200-37V	18 x 11 x 130L	12 x 8 x 075L	12 x 8 x 050L	12 x 8 x 130L

4.7 Coupling

Coupling shall be supplied alongwith the pump only if O/A specifies so. Coupling type shall be flexible pin bush type or Love-joy type.

4.8 **Pressure Relaxation Piping** **See Page No. 24**
(Please refer Drg. No. TP 129-84-003-0)

Whenever discharge pressure exceeds 22 bars, pump is supplied with a special piping which connects the chamber just before the delivery side stuffing box to a lower pressure region. This piping is provided in order to reduce the pressure of liquid acting on the stuffing box to minimise leakage through gland. The chart enclosed indicates the stage to which the pipe is to be connected. The chart holds good only if suction pressure is below 2 bars. Alternative arrangement shall be recommended if suction pressure exceeds 2 bars.

4.9 **Specification for oil seals**

Oil seals at DE & NDE are identical.

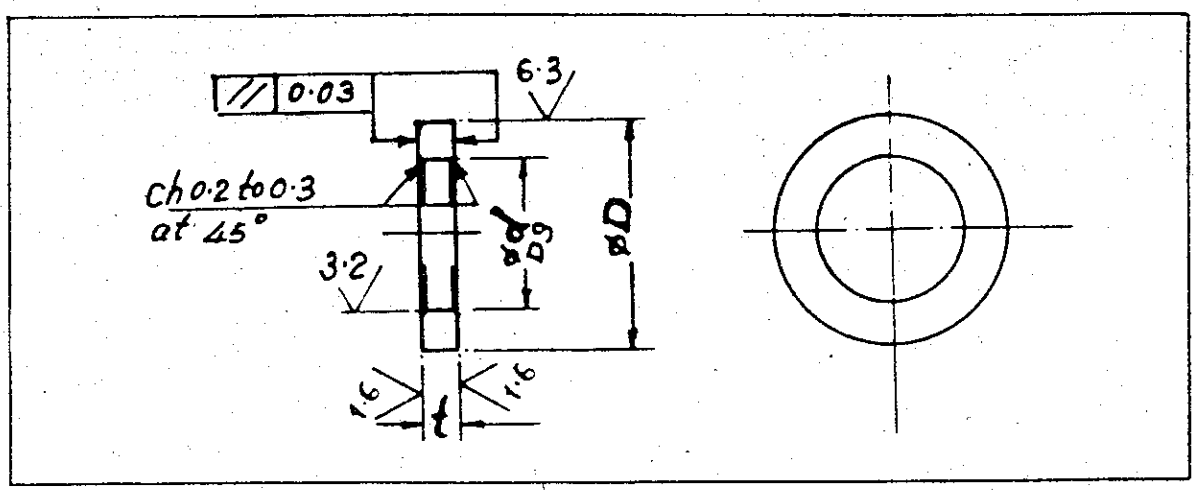
PUMP TYPE		OIL SEAL SIZE
RKB 32-9EV	—	40 x 52 x 7 thick
RKB 40-12LV	—	45 x 60 x 8 thick
RKB 40-14HV	—	
RKB 50-15E/LV	—	52 x 68 x 8 thick
RKB 50-16HV	—	
RKB 65-19E/LV	—	58 x 72 x 8 thick
RKB 100-23EV	—	65 x 85 x 10 thick
RKB 125-27V	—	72 x 95 x 10 thick
RKB 125-30V	—	80 x 110 x 13 thick
RKB 150-34V	—	90 x 110 x 13 thick
RKB 200-37V	—	100 x 125 x 12 thick

Material of oil seal shall be Nitrile rubber with steel spring.

4.10 **TORQUES FOR TIE BAR NUTS**

Sr. No.	Pump Type	Number of Stages	Torque in Kg. M.
1.	RKB 32-9EV	2 to 6 7 to 10	8.0 9.0
2.	RKB 40-12LV RKB 40-14HV	2 and 3 4 to 7 8 & 9	16.0 18.0 20.0
3.	RKB 50-15E/LV RKB 50-16HV	2 to 4 5 to 7 8 & 9	25.0 29.0 35.0
4.	RKB 65-19E/LV	2 to 4 5 to 6	60.0 70.0
5.	RKB 100-23EV	2 to 3 4 to 5 6	51.0 56.0 61.0
6.	RKB 125-27V	2 to 4 5 to 7 8	40.0 45.0 50.0
7.	RKB 125-30V	2 to 5 6 to 7	60.0 70.0
8.	RKB 150-34V	2 to 4 5 to 6	35.0 70.0
9.	RKB 200-37V	2 to 3 4 to 5	125.0 140.0

4.11 DIMENSIONS OF WASHER FOR RKB PUMPS



ALL DIMENSIONS ARE IN MM
UNSPECIFIED TOLERANCE —Js 13.

Pump Type	D	d	Dg	Thickness of washer t	Theoretical Thickness 'B'
RKB 32-9EV	40	30	+0.117 +0.065	6	3.5±0.6
RKB 40-12LV RKB 40-14HV	46	35	+0.142 +0.080	6	3.5±0.6
RKB 50-15E/LV RKB 50-16HV	52	40	+0.142 +0.080	6	3.3±0.6
RKB 65-19E/LV	58	45	+0.142 +0.080	6	4±0.6
RKB 100-23EV	62	50	+0.142 +0.080	6	4±0.6
RKB 125-27V	72	55	+0.174 +0.100	8	5.5±0.8
RKB 125-30V	80	60	+0.174 +0.100	8	5.8±0.8
RKB 150-34V	90	65	+0.174 +0.100	10	7±0.9
RKB 200-37V	90	70	+0.174 +0.100	10	7±0.9

Note : Initially washer is to be manufactured with thickness 't' as specified above. The washer shall have to be machined to required thickness at the time of assembly of the individual pump considering the axial movement of pump shaft on either side.

5. MAINTENANCE

Preventive maintenance schedule and periodical checks are the precautions by which possibilities of failure and break-down are made remote.

5.1 Daily Checks

5.1.1 Pressure gauge reading.

5.1.2 Bearing temperature.

5.1.3 Voltage and Current.

5.1.4 Leakage through stuffing box.

5.1.5 Noise and Vibrations.

5.2 Periodical Maintenance

5.2.1 Grease to the bearing at DE & NDE.

5.2.2 Change the stuffing box packing.

5.2.3 Check the alignment of the pumpset.

5.2.4 Check the sealing and pressure relaxation piping for leakage and blockage.

5.2.5 **Calibrate the measuring instruments**

6. OVERHAULING

6.1 With normal daily operating spell, the pump will be due for overhaul after about 5000 working hours. This work should be carried out by trained and experienced personnel.

6.2 Dismantling

6.2.1 Remove the delivery and suction pipe connections.

6.2.2 Take out sealing water, pressure relaxation piping (if applicabfle) and other connections.

6.2.3 Unscrew the tierod nuts (584), remove washers (623).

6.2.4 Remove motor alongwith motor stool (290).

6.2.5 Remove the pump from foundation and place it on a plain table or platform. Remove pump half coupling. Drain the liquid from suction casing by removing drain plug.

6.2.6 Take out bearing cover NDE (271).

6.2.7 Unlock lock washer (415) and unscrew lock nut (336).

6.2.8 Take out bearing housing (240.1) alongwith bearing/bearings. For this purpose use two jaw puller.

6.2.9 Remove adjustable washer (209.1), liquid deflector (236). Distance sleeve (317), gland (223), O-ring (522) and shaft sleeve (311).

6.2.10 Take out delivery casing (101).

6.2.11 Take out tie bars (341).

6.2.12 Remove diffuser (128) from the delivery casing alongwith O-ring (522.2).

6.2.13 Take out impeller (151) and then remove key (320/320.1/320.2). Remove stage casing (124) alongwith O-ring (522.1).

6.2.14 Repeat procedure given in 6.2.13 till you reach first stage impeller.

6.2.15 Remove first stage impeller (151). Take out key (320.1).

6.2.16 Remove shaft (180) alongwith the sleeve (310 from suction casing.

6.2.17 Remove shaft sleeve (310).

6.2.18 After dismantling, all the parts are to be cleaned and checked thoroughly for wear, tear and damage impeller, diffusers, casings or wear rings and interstage bushes need to be replaced if drop in head and capacity of the pump is substantial.

6.2.19. All the damaged parts should be replaced by new one.

6.2.20 Inspect all the 'O' rings carefully. Replace the damaged ones. It is advisable to use NEW 'O' RINGS instead of used ones.

6.3 REASSEMBLING :

Applicable for vertical cold pumps.

Please ensure the following prior to assembly of the pump.

1) Bronze bush is fitted properly in the suction casing.

2) Grub screw in between bronze bush and suction casing is tightened fully.

3) Drain plug at the bottom of suction casing and plug for external flushing is fitted in the body.

4) All parts are free from burr and these are cleaned thoroughly with Kerosene/ Thinner.

5) Lock nut at NDE side is tightened fully on the shaft and nut is locked with grub screw on the shaft.

6) All impellers are with balancing holes and are not choked.

7) 'O' rings, keys and gland packings are of correct sizes.

8) 6 Nos. of packings are used in delivery casing stuffing box.

9) Please check runout of shaft by dial gauge. It should be within 0.05 mm.

6.4 ASSEMBLY PROCEDURE

1) Tighten locknut (336.1) in the shaft at NDE and that nut is locked with grub screw on the shaft.

2) Mount shaft sleeve (310) suction side on the shaft from DE.

3) Insert the shaft so fare assembled inside the suction casing (113) bore. Please ensure that bush bearing is fitted in the suction casing.

4) Give proper support to shaft at bottom side (non driving end) as shown in sketch 1.

5) Place the key for first impeller (320) in the keyway on the shaft. Mount the impeller (151), match the key way on the impeller to that on the shaft sleeve. (First stage impeller should be of full diameter, in case other impellers are trimmed to suit the duly conditions)

6) Mount 'O' ring (522.3) on suction casing.

7) Insert diffuser with guide vanes (129) on the impeller hub.

8) Mount the stage casing (124) on suction casing.

9) Place the key for stage impeller (320.1) in the keyway on the shaft. Mount the impeller (151).

10) Repeat procedure from (6) to (9) till you reach the final stage impeller.

(Please ensure that stage casing with tapped hole is fitted at proper stage, if the pump requires piping for relaxation of stuffing box pressure.)

Last stage diffuser is without back vanes and is to be fitted in delivery casing. Mount 'O' ring (522.2) on diffuser and then fit it in delivery casing in position such that the slot provided on diffuser engages properly on the lug provided inside delivery casing.

11) Insert delivery casing (101) into the main assembly. Please ensure that the stuffing box cavity is filled with gland packing and gland (223) is mounted.

12) Insert the tie bars (341) from delivery side.

13) Tighten tie bar nuts. Please refer to technical data chart for recommended torques for tightening of tie bar nuts.

14) Mount shaft sleeve (311). Fit 'O' ring (522.0).

15) Fit the distance sleeve (317) alongwith the deflector (236).

16) Mount bearing housing (240.1) alongwith the oil seal (500.0) on delivery casing.

17) Insert adjustable washer (209.1)

Adjustable washer plays very important role in locating the rotating unit of the pump with respect to stationary unit. The adjustable washer thickness varies from pump to pump in the range shown in Technical Date Chart (Refer to dimension "B"). Washer thickness need not be changed unless a number of impellers and/or diffusers and/or stage casings are replaced by new ones. Follow procedure given below to decide the exact washer thickness.

a) Use washer of "t" thickness supplied alongwith the pump as a spare (if ordered). For dimensions of "t" refer Technical Data Chart.

b) Insert washer of "t" thickness and then mount dummy piece. The dimensions of dummy piece should match with the actual bearing dimensions of the antifriction bearing/bearings at NDE. The tolerance on OD, ID and width of the dummy piece should be as follows :

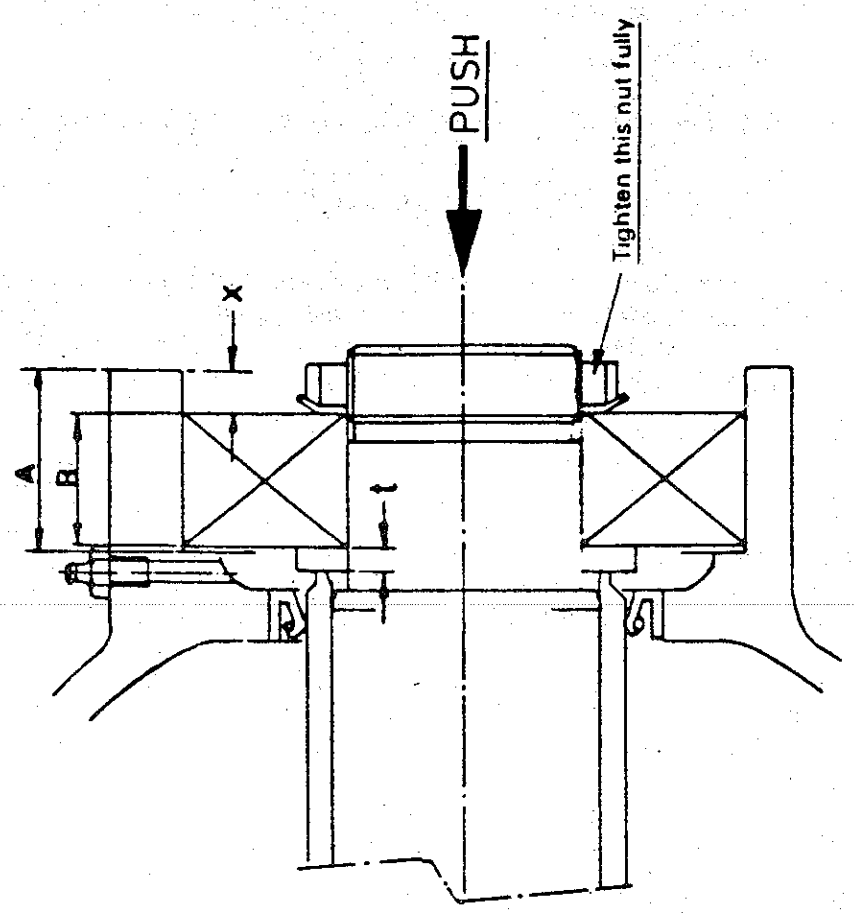
OD	—	—1.0 mm —.5 mm
ID	—	+.5 mm +.1 mm
Thickness	—	+.1 mm

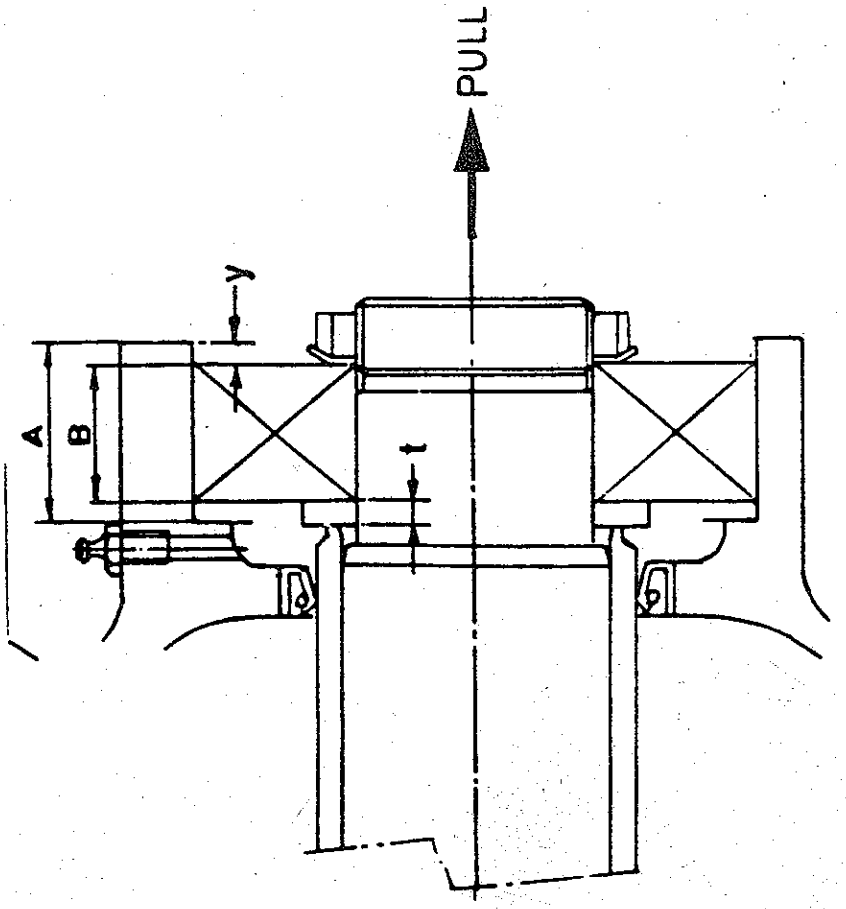
Note : Use of dummy piece is recommended to avoid cumbersome operation of fitting and removal of actual bearing. Actual bearing may alternatively be used in case dummy piece is not available.

c) Tighten bearing locknut (336), with a suitable hook spanner and a torque specified as below. Remove support given to shaft at bottom side (NDE, Refer step no. 4)

PUMP TYPE	TORQUE Kg.-m.
RKB 32-9EV	8.5
RKB 40-12LV & RKB 40-14HV	12.0
RKB 50-15E/LV & RKB 50-16HV	20.0
RKB 65-19E/LV	24.0
RKB 100-23EV	29.0
RKB 125-27V	37.0
RKB 125-30V	46.0
RKB 150-34V	30.0
RKB 200-37V	93.0

d) Refer to figure 1. Now push the shaft i.e. rotating assembly towards suction and measure the gap between dummy piece (bearing) and bearing housing. Call it "X".





Washer thickness = $t - \left[\frac{x+y}{2}\right] - (A - B)$

Issue Date :25/09/2000
Last Revision Date :

e) Pull the shaft i.e. rotating assembly towards delivery casing and measure the same dimension and call it "Y" See figure 6.

(For figures please refer page No. 14).

f) Calculate adjustable washer thickness by using following formula.

$$\text{Thickness} = t + \left[\frac{(x + y)}{2}\right] - (A - B)$$

g) Remove lock nut and dummy piece. Take out adjustable washer of "t" thickness and machine it to calculated dimensions. Washer machined should have faces parallel within 0.05 mm and thickness should be within + 0.05 mm to that of calculated thickness.

h) Insert the adjustable washer on the shaft.

6.4.15 **Gland Packed Pump**

Mount antifriction bearing at NDE on the shaft. Insert lock washer (415) and tighten lock nut (336). Tighten the lock nut with half the toruqe specified under the clause 6.4.14c. Fit the bearing cover NDE (271).

Note : After this try to rotate distance sleeve (317) at DE & NDE and ensure that they do not rotate by hand. This serves as a check for proper assembly. If the distance sleeve rotates it indicates that lock nut is not sufficiently tightened.

6.4.16 Loose the tie bar nuts (584).

6.4.17 Mount motor stool (290) on delivery casing.

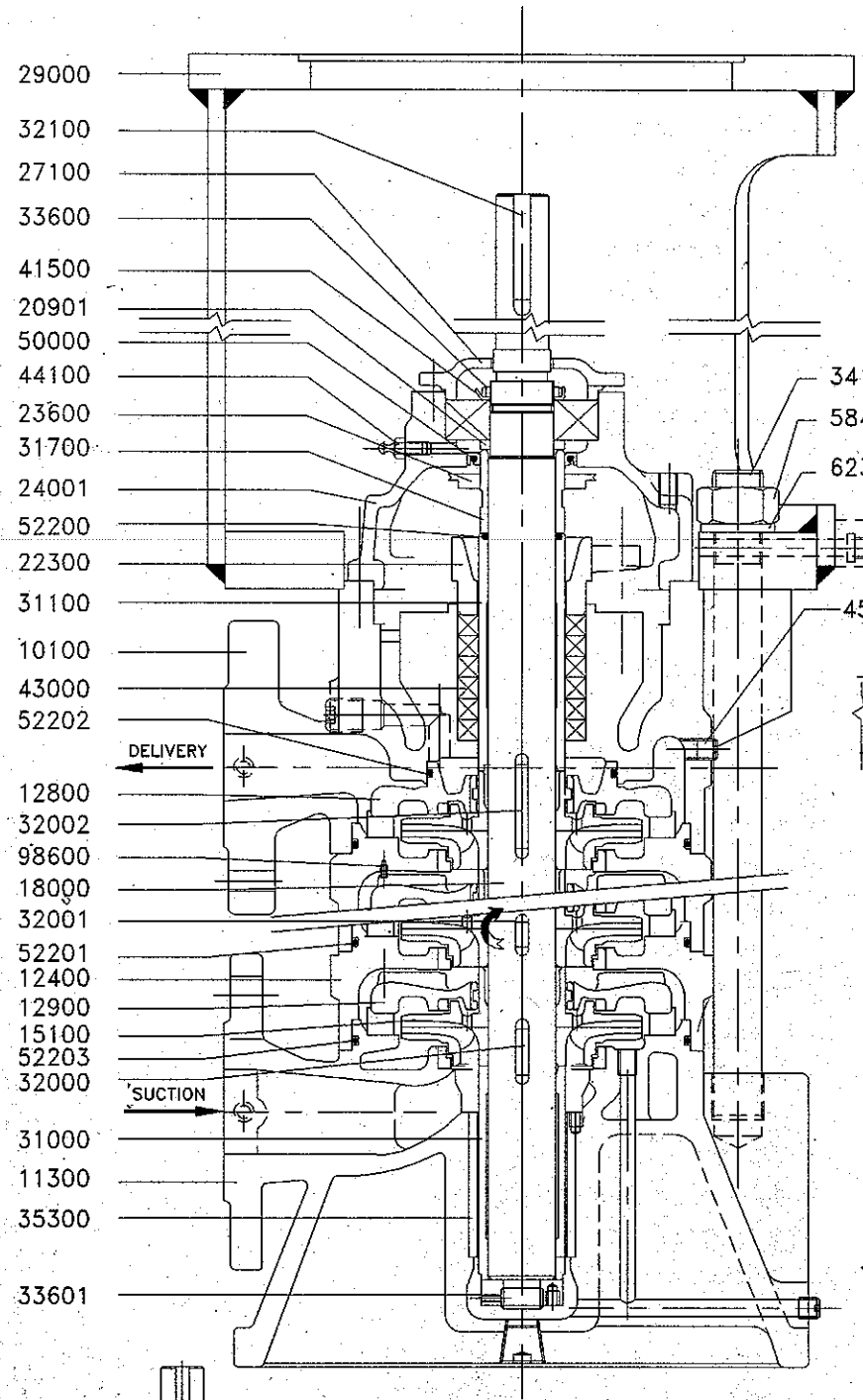
6.4.18 Tighten tie bar nuts (584) alongwith washer (623). Please refer to technical data chart for recommended torque for tightening of tie bar nuts.

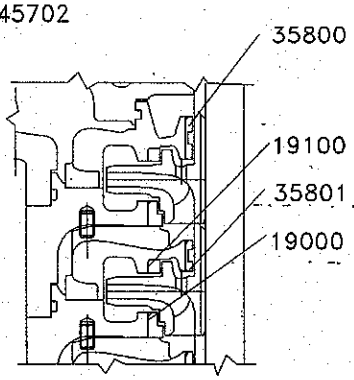
6.4.19 Finally ensure that pump rotates freely by hand.

7. SPECIFICATION LIST OF RKBV PUMPS

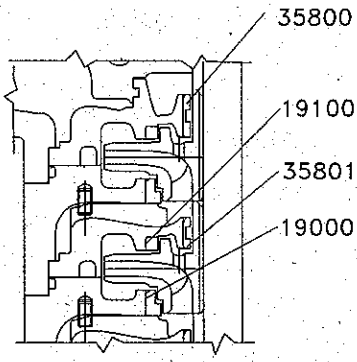
Part Code	Part Description
10100	Delivery Casing
11300	Suction Casing
12400	Stage Casing
12800	*Diffuser
12900	*Diffuser with Guide Vanes
15100	*Enclosed Impeller
18000	*Pump Shaft
19000	*Wear Ring (Suc. Side)
19100	*Wear Ring (Del. Side)
20901	Adjustable Washer
22300	Gland
23600	Liquid Deflector
24001	*Deep Groove Ball Bearing
26300	*Angular Contact Ball Bearing
27100	Bearing Cover (DE)
29000	Motor Stool
31000	*Shaft Sleeve (Suction Side)
31100	*Shaft Sleeve (Delivery Side)
31700	Distance Sleeve
32000	*Key for First Impeller
32001	*Key for Stage Impeller
32002	*Key for Last Impeller
32100	*Key for Coupling
33600	Bearing Lock Nut
33601	Lock Nut
34100	Tie Bar
35300	*Bush Bearing
35801	*Inter-stage Bush for D.W.G.V.
35802	*Interstage Bush for Diffuser
41500	Washer for Bearing Lock nut
43000	*Gland Packing
44100	Grease Nipple
45702	Drain Plug for Del. Casing
50000	*Oil Seal (DE)
52200	*'O' Ring for Shaft Sleeve
52201	*'O' Ring for Stage Casing
52202	*'O' Ring for Diffuser
52203	*'O' Ring for Suction Casing
58400	Hex Nut for Tie Bar
62300	Washer for Tie Bar
98600	Grub Screw

* – Recommended Spares

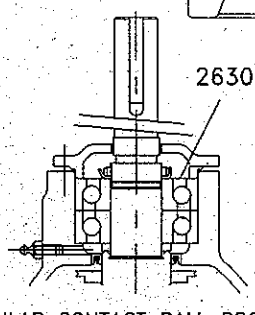




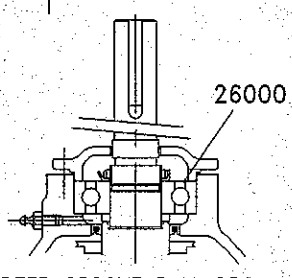
CROSS SECT. ASSEMBLY OF PUMP UNIT SHOWING RENEWABLE WEAR PARTS FOR RKB-9 TO RKB-14



CROSS SECT. ASSEMBLY OF PUMP UNIT SHOWING RENEWABLE WEAR PARTS FOR RKB-15 & ABOVE



ANGULAR CONTACT BALL BRG. ARRGT. AT - DRIVING END FOR RKB 12 & ABOVE



DEEP GROOVE BALL BRG. ARRGT. AT - DRIVING END FOR RKB-9 ONLY

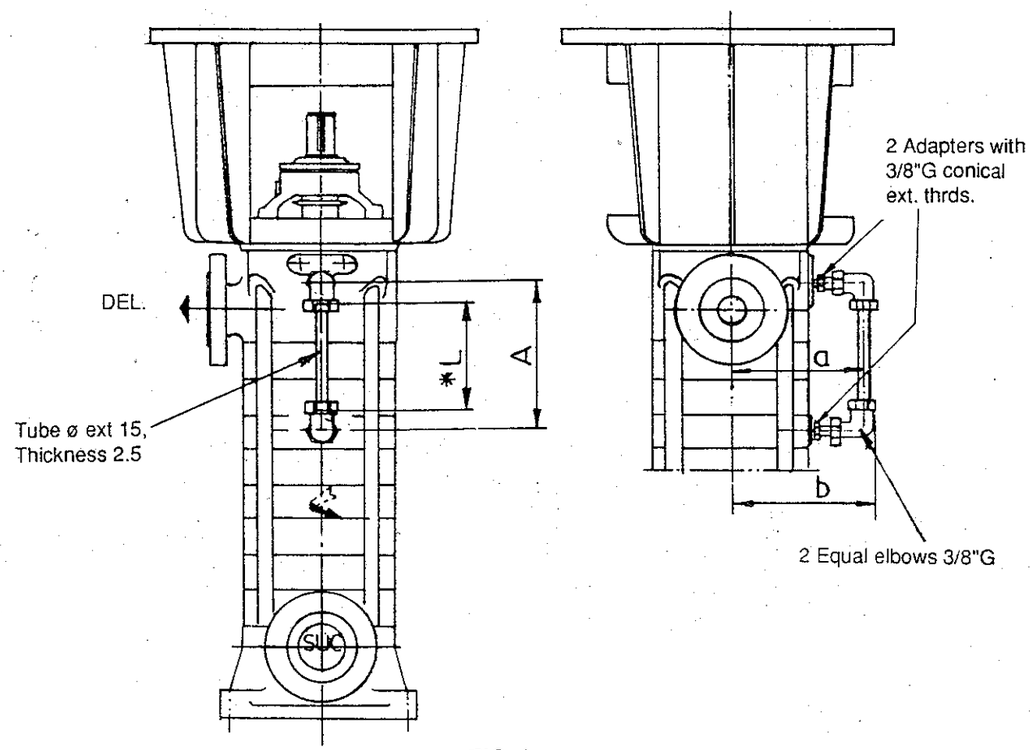
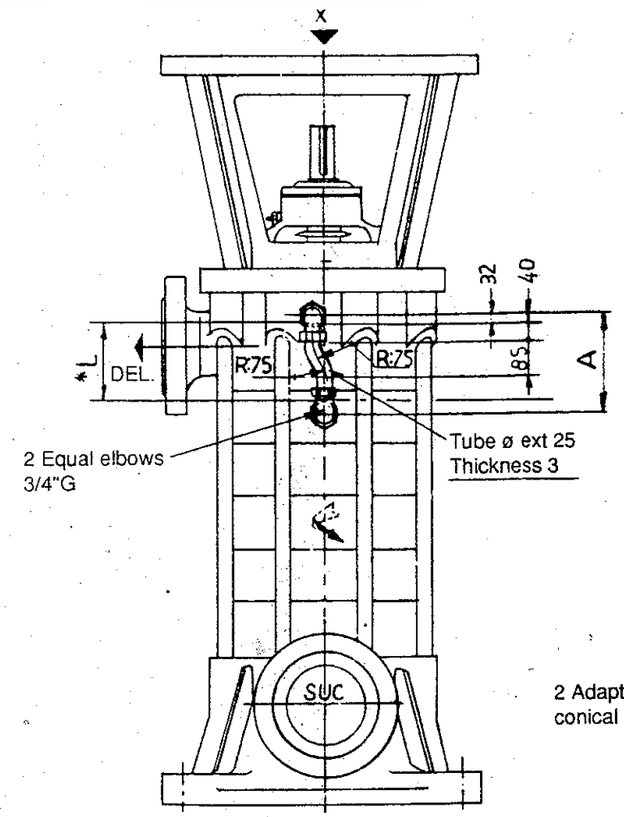


FIG. I



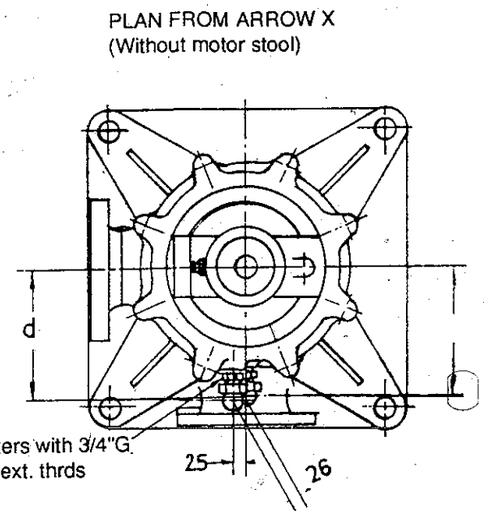


FIG. II

All dimensions are in mm except specified

PUMP TYPE	Max. no. of stages	Fig. No.	Always connect to stage	No. OF STAGES 2 A	2 L	3 A	3 L	4 A	4 L	5 A	5 L	6 A	6 L	7 A	7 L	8 A	8 L	9 A	9 L	10 A	10 L	a	b	c	d
RKB 9	10	—	—	●		●		●		●		●		●		●		●		●		—	—	—	—
RKB 12	9	—	—	●		●		●		●		●		●		●		●				—	—	—	—
RKB 15	9	I	6	✱		✱		✱		✱		✱		✱		168	138	228	198			170	190	—	—
RKB 19	6	I	5	✱		✱		✱		✱		141	111									210	230	—	—
RKB 23 ■	5	II	4	✱		✱		✱		178	138											273	290	—	—
RKB 27	8	—	—	●		●		●		●		●		●		●						—	—	—	—
RKB 30	7	—	—	●		●		●		●		●		●								—	—	—	—
RKB 34	6	II	5	✱		✱		✱		✱		230.5	195									—	—	318	325
RKB 37	5	—	—	●		●		●		●												—	—	—	—

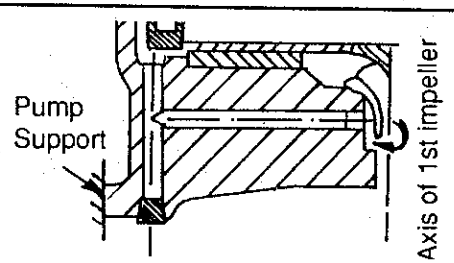
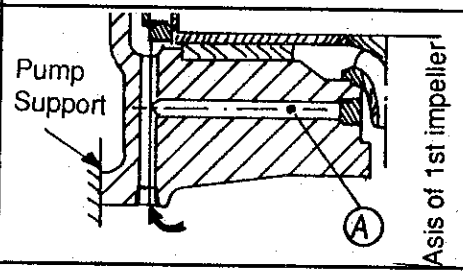
NOTES— 1) ✱ Pipe lengths specified above are greater than required Pipe to the required length to be cut at the time of assembly.
2) ● Piping not applicable for all stages.
3) ✱ Piping not applicable up to stages ——→

LIMITATIONS FOR SUCTION PRESSURE OF 2 BARS

LEAK OFF PRESSURE WATER PIPING FOR RKB VERTICAL PUMPS

DRG. No.
TP 101-84-004-0

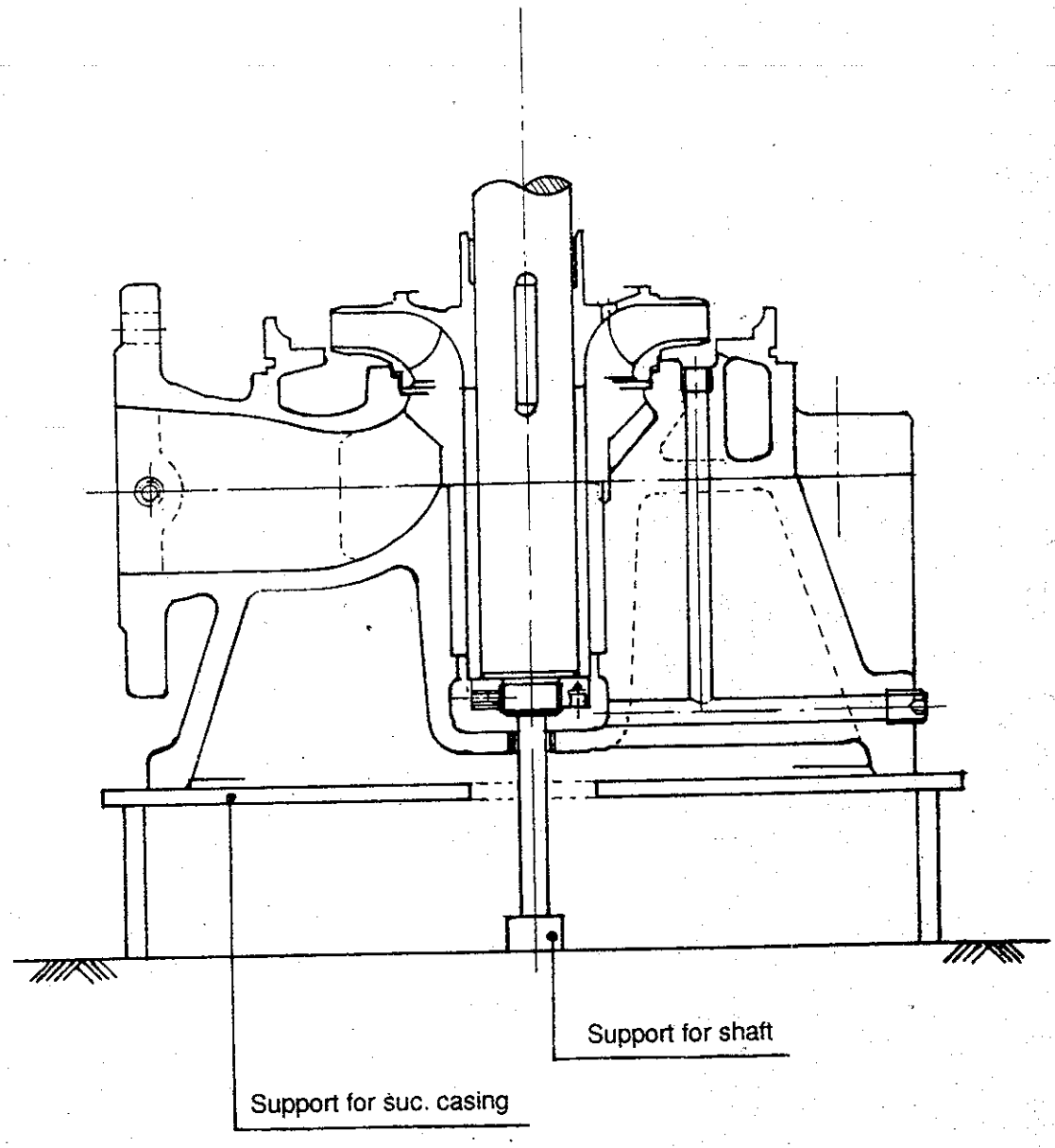
FLUSHING OF BEARING BUSH - VERTICAL PUMPS

ARANGEMENT	SCHEMATIC PLAN	SUPPLY CONDITION	ADDITIONAL DETAILS
I. Internal Flushing Suction Side		Standard	
II. External Flushing Suction Side		On Demand of Application	Plug Connection A Feeding of clear water having pressure higher than suction pressure by 1 bar.

DRG. NO.
CT 114 82 003 - 0

SKETCH NO. 1

RKB VERTICAL PUMP ASSEMBLY PROCESS



GENERAL INFORMATION & SAFETY INSTRUCTIONS

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. Installation, operation & maintenance personnel must use safe working practices at all the times.

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

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

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

1.3) Most accidents involving product operation, maintenance and repair are caused by failure to observe safety rules or precautions. An accident can often be avoided by recognizing potentially situations before an accident occurs. A person must be aware of potential hazard associated in activities of installation, operation & maintenance of equipments.

1.4) 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.

1.5) Ear defenders should be worn where the specified Equipment noise level exceeds locally defined safe Levels. Safety glasses or goggles or face shield should be worn where working with pressurised systems and hazardous substances. Other personal protection equipment must be worn where local rules apply. Wear safety shoes, helmets and cotton overalls (Apron) when you enter pump house. Noise level should not exceed 90 dbA and 110 dbA for motor driven and engine driven pumps respectively.

1.6) Do not wear loose clothing or jewelry, which could catch on the controls or become trapped in the equipment.

1.7) Read the instruction manual before installation, operation or maintenance of the equipment. Check and confirm that the manual is relevant copy by comparing pump type on the nameplate and with that on the manual.

1.8) Note the 'Limits of product application permissible use' specified in the manual. Operation of the equipment beyond these limits will increase the risk from hazards noted below and may lead to premature and hazardous pump failure.

1.9) Clear and easy access to all controls, gauges and dials etc. must be maintained at all times. Hazardous or flammable materials must not be stored in pump rooms unless safe areas or racking and suitable container,have been provided.

1.10) Use suitable earthing and tripping devices for electrical equipments.

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

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

3.0) SAFETY INSTRUCTIONS WHILE HANDLING AND STORAGE

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

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

4.0) SAFETY INSTRUCTIONS WHILE ASSEMBLY & INSTALLATION

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

5.0) SAFETY INSTRUCTIONS WHILE COMMISSIONING & OPERATION

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

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

Check that 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 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 car 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.

6.0) SAFETY INSTRUCTIONS WHILE MAINTENANCE & SERVICING

Do not attempt repairs, you do not understand. Use proper tools.

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

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

Isolate the equipment before any maintenance work is done. Switch off the main supply, remove fuses, apply lockouts where applicable and affix suitable isolation warning signs to prevent inadvertent reconnection. In order to avoid the possibility of maintenance personnel inhaling dangerous fumes or vapours locations by removal of bearing housing and shaft assembly to a suitable maintenance area.

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

Wear a suitable mask or respirator when working with packing and gasket 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.

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

Dispose of all wastes like gaskets, gland packing, oil, batteries, packing material etc. in accordance with local regulations. Normally this would involve incineration of liquid waste and controlled landfill of polymerised material.

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

KIRLOSKAR BROTHERS LIMITED
UDYOG BHAVAN. TILAK ROAD. PUNE 411002 (INDIA)

HISTORY CARD

Pump Type _____

Serial No. _____

Material Construction _____

O/A No. _____

Total Head _____

Discharge _____

Speed _____

bhp/kw _____ _____

Motor hp _____

Location _____

Application _____

Liquid Handled _____
(Name)

Chemical Composition _____

Sp. Gravity _____ pH Value _____

Temperature _____

Suspended Solid % _____

Nature of Liquid - Abrasive/Corrosive/
Inflammable.

Stuffing Box Packing/Mechanical Seal

SpecLfication _____

Type _____ Size _____

Material Code _____

Sealing /Recirculation Self/External
Liquid

Pressure _____ Quantity _____

Cooling Connection Yes/No

Size _____ Quantity _____

Date of Commissioning _____

Special Remarks

ROUTINE MAINTENANCE
(Dates of Replenishing/Refilling/Checking)

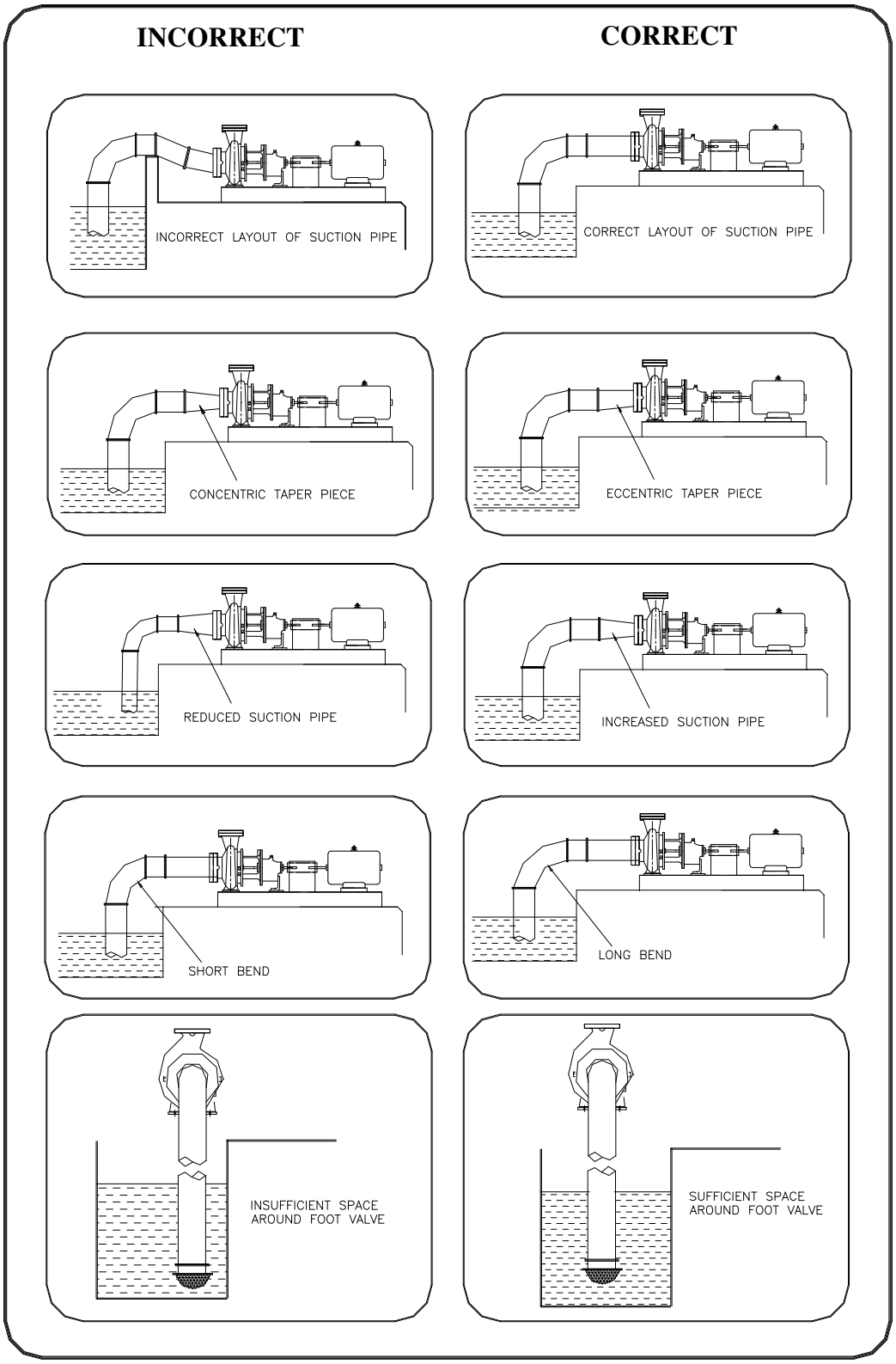
Stuffing Box Packing			Lubricating Oil/Grease			Checking	Overhauls

REPLACEMENT DETAILS

Name of Part	Date of Replacement	Reason for Replacement	Serviced by	Remarks
Impeller				
Pump Shaft				
Shaft Sleeve				
Casing Rings				
Bearings				
Stuffing Box Bush/Mech. Seal				
Other parts				

GENERAL INSTRUCTIONS FOR MAINTENANCE, OPERATION & MAINTENANCE OF

KIRLOSKAR CENTRIFUGAL PUMPS



GENERAL INSTRUCTIONS FOR MAINTENANCE, 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 satisfactory performance and if it is operated in excess of the conditions for which it is manufactured, the equipment is subjected to excessive stresses and strains.

LOCATION

The pump should be located as near the liquid source as possible. This will minimize suction lift and pump will give better performance.
Ample space should be provided on all the sides so that the pump can be inspected while in operation and can be serviced whenever required.

FOUNDATION

The foundation should be sufficiently substantial to sustain any vibrations and to form a permanent rigid support for the base plate. This is important in maintaining the alignment of a directly 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 of two and one half diameter larger than the bolt should be used to allow movement for the final position of the foundation bolts.

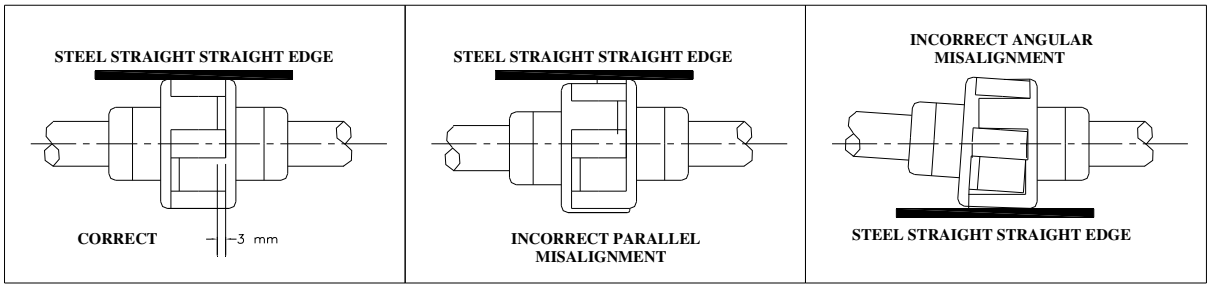
ALIGNMENT

Pumps and the drivers supplied by the manufacturers, mounted on a common base plate are accurately aligned before dispatch. However as the alignments are likely to be disturbed during transit to some extent and hence must not be relied upon to maintain the factory alignment. Re-alignment is necessary after the complete unit is been leveled 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-check periodically.

FLEXIBLE COUPLING

A flexible coupling will not compensate for the 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. There are two types of misalignments.

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



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

LEVELING 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 misalignment 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 the driver are in level. Check the coupling faces, suction and discharge flanges for the horizontal and vertical position by means of spirit level.

FLEXIBLE COUPLING ALIGNMENT

The two halves of the coupling should be at least 3 mm apart so that they cannot touch each other when the driver shaft is rotated. Necessary tools for approximately checking are straight edge or an outside caliper. A check for parallel misalignment 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 the positions. Care must be taken that the straight edge must be parallel to the axis of the shaft.

GROUTING

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

FACTORS THAT MAY DISTURB ALIGNMENT

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

1. Setting, seasoning of the foundation.
2. Pipe strains distorting or shifting the machines.
3. Wear of the bearing.
4.

PIPING

Both suction and delivery pipes and accessories should be independently supported near the pump, so that when the flanges, bolts are tightened no strains will be transmitted to the pump casing. It is usually advisable to increase the size of both the suction and delivery pipe at the pump nozzles in order to decrease the loss of

head due to friction and for the same reason piping should be arranged with minimum possible bends as possible, or it should be made with long 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. It can be achieved by supporting the pipelines at appropriate locations.

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 leakages. 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 pocket in the top of the reducer and the pipe. Use an eccentric piece instead.

The end of the suction pipe must be well submerged to avoid whirlpools and ingress of air but must be kept clear of any deposits of mud, silt grit etc. The pipe must be away from any side of the wall by 450 mm. the end of the strainer must 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 EQUALIZING LINE (AND LIQUID LINE)

If the pump draws from a system under vacuum an equalizing 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 the 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 in to the pump or chocking the foot-valve and for this purpose an efficient strainer should be provided.

STUFFING BOXES AND PACKING (only for gland packed pump)

Stuffing boxes should be carefully cleaned and 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 don't 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 the 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 re-lubrication periods under normal condition.
Three monthly when on continuous duty.
Six monthly when on eight hour per day duty.
The bearings and housings should be completely cleaned and recharged with fresh grease after 2500 hrs. or the nearest pump overhaul time.

PRIMING

No pumping action occurs unless the pump casing is filled with the liquid. Pump casing and suction pipe must therefore be completely filled with 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 the air vent.
   b. When there is liquid under some pressure in the discharge pipe, priming can be effected by bypassing the pressured liquid around the check and gate valve. Of course, the initial priming must be affected 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 at the top of casing can be used to remove air from pump 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 at 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 the check valve.

STUFFING BOXES (only for gland packed pump)

Do not tighten the glands excessively. A slight dipping 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 the rings are worn out, the clearance becomes greater and more water passes back into the suction side. The rings 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 / mechanical seal 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 pump as stamped on the number 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 unfavorable 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 vapor 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.