



Enriching Lives

# **INSTRUCTIONS ON INSTALLATION, OPERATION AND MAINTENANCE FOR KIRLOSKAR PUMP TYPE RKB**



**KIRLOSKAR BROTHERS LIMITED**

YAMUNA' Survey No. 98/ 3 to 7, Baner, Pune – 411045, India.



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## **WARRANTY**

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

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

**KIRLOSKAR BROTHERS LIMITED**



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

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



## 1. GENERAL

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- 2.1 The booklet covers instructions for cold model of RKB 50/15E, 9 STG pump.
- 2.2 Cold Models pumps (without stuffing box cooling arrangement) are supplied for liquid having temperature up to 90°C.
- 2.3 Pumps when properly installed & given due care in operation & maintenance should operate satisfactorily for a long period of time.
- 2.4 When the pump is received, sometime before the actual use of pump, it should be inspected & located in dry place. The shaft should be rotated once in a month to prevent pitting of bearing surfaces.

## 2. Safety Instructions:

### 2.1: General Information

Please read the manual thoroughly prior to installation of unit. The Health and Safety instructions shall be read and fully understood. The instructions in this document shall also be read and fully understood.

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

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

#### **Caution**

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

- 2.1.2 Access to the equipment should be restricted to the personnel responsible for installation, operation and maintenance and they must be qualified, adequately trained and supplied with the appropriate tools for their respective tasks.
- 2.1.3 KBL firmly insists that all personnel responsible for installation, operation and maintenance of the equipment must read the manual before any work is done.
- 2.1.4 **Caution** Ear defenders should be worn where the specified equipment noise level exceeds locally defined safe levels. Safety glasses or goggles should be worn where working with pressurized systems and hazardous substances. Other personal protection equipment must be worn where local rules apply.
- 2.2 **Caution** *DO NOT* wear loose or frayed clothing or jewellery, which could catch on the controls or becomes trapped in the equipment.
- 2.3 Operation of the equipment for the application other than for which it is supplied can increase the risk from hazards. Please consult KBL before making such change in the application of the equipment.
- 2.4 Improper installation, operation and maintenance of the product supplied by KBL could result in injury or death.
- 2.5 Within the manual, safety instructions are marked with safety symbols

Hazard.



This symbol refers to general mechanical aspects of safety.

Hazard.



This symbol refers to electrical safety.

**Caution**

This symbol is used to introduce safety instructions, non-observance for which may lead to damage to the machine and its functions.

## **2.6: Transport handling and storage instructions:**

### **2.6.1 Transport.**

Pumps are dispatched in duly assembled condition. Lubricating oil in the bearing housing is drained prior to dispatch of pump. Pumps are protected against corrosion and packed for transport by normal road, rail and sea carriers.

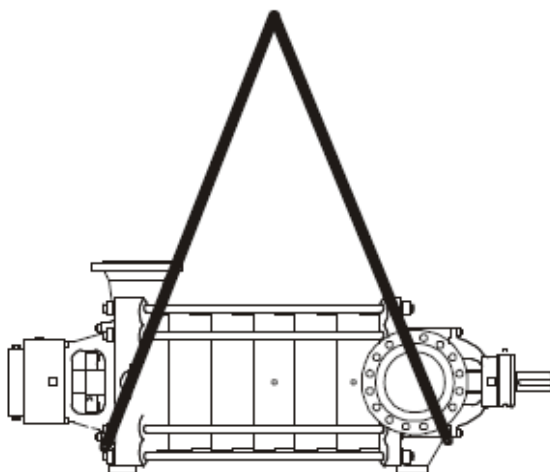
### **2.6.2: Handling:**

#### **Crushing hazard.**

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

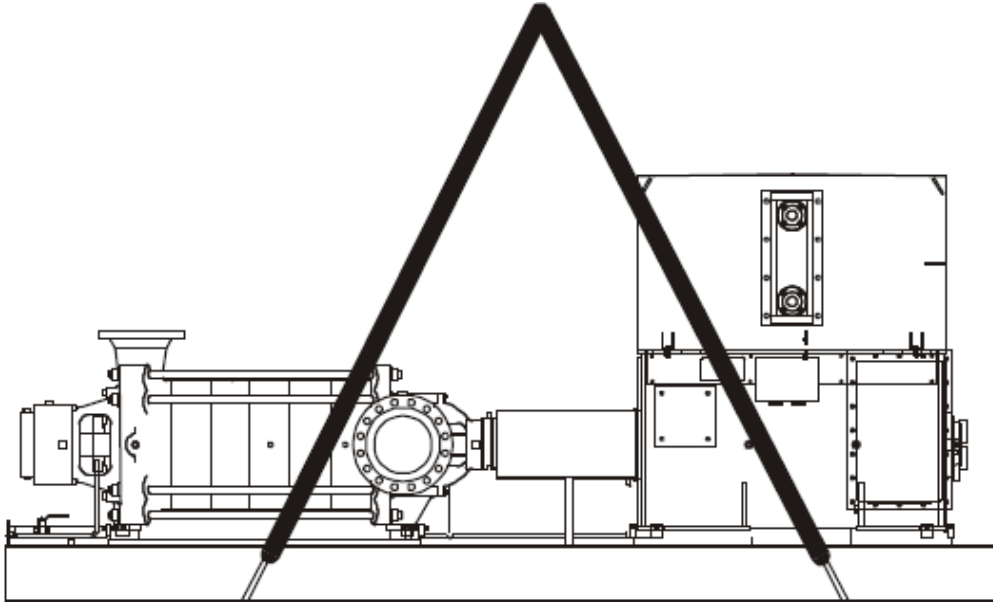
The use of suitable fork lift truck and four chain crane sling equipment is recommended but locally approved equipment rating may be used.

Pump should be slung as shown.



#### **Caution**

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



### 2.6.3: Storage.

#### 2.6.3.1: Temporary storage for up to six weeks.

If the pump unit is not be used immediately it should be stored carefully in a horizontal position, in a sheltered, dry location.

#### **Caution**

Additional rust preventive should be applied to all unpainted carbon steel or cast iron parts, and should not be removed until final installation.

#### 2.6.3.2: Long Term Storage.

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

- a) Ensure that the bearings are packed with the recommended grease, to prevent moisture from entering around the shaft.

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

**Shearing Hazard.**

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

**Caution**

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

**2.6.3.3: Exposed or Extreme Conditions Storage.**

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

### **3. Equipment schedule:**

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#### **3.1 Installation:**

- 3.1.2** For location, preparing foundation, installation, alignment, piping, general maintenance, trouble shooting etc. the instructions given in our publication - 'GENERAL INSTRUCTIONS FOR INSTALLATION OPERATION AND MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS' which is also printed along this booklet must be followed very carefully.



### 3.1.3 MOUNTING AND ALIGNMENT

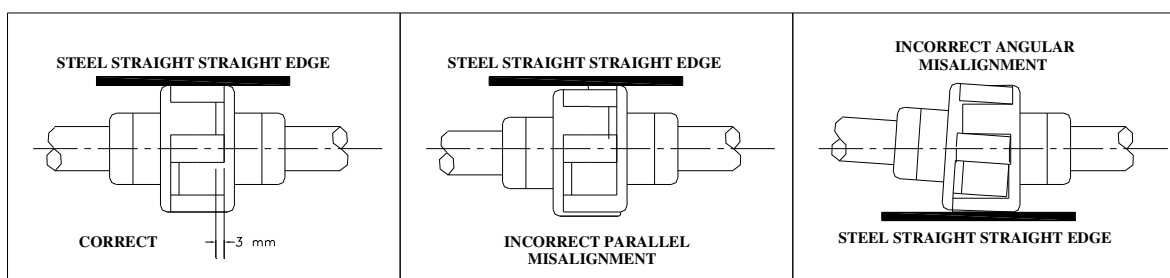
A jaw-flex type coupling is used to connect pump shaft to the driver. Follow the instructions as shown below.

### 3.1.4 ALIGNMENT

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

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

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



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

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

### 3.1.4 Before commissioning the pump set, please ensure:

- 1) The pipe connections are flushed and tightened properly.
- 2) Alignment is proper.
- 3) Auxiliary piping connections such as sealing connections, cooling connections etc are made. Details of sealing liquid are given in our supply order.

## 4. OPERATION.

### 4.1 Before starting the pump check the following:

- 1) The pump rotates freely by hand.
- 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.
- 3) However if the pump is stored for a longer time it is necessary to refill the grease in the bearings. Check the level of oil in the constant level oiler when pump is oil lubricated.
- 4) The sealing liquid and cooling water connections are properly tightened and adjusted.

- 5) The direction of rotation of driver. It should correspond to the direction of rotation of pump.
- 6) The pump casing and the suction pipeline is fully primed with the liquid.
- 7) Valve on delivery side is closed.
- 8) The cock for pressure gauge connection is closed.
- 9) The stuffing box packing is properly tightened.

#### 4.2 Starting the pump

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- 1) Start the pump. Let the prime mover pickup it s full speed.
- 2) Open the valve on delivery line gradually.
- 3) Regulate the required flow by adjusting the delivery valve.
- 4) Open the cock for pressure gauge connection.

#### 4.3 During running the pump

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**Check the following things and regulate if needed –**

- 1) The pump is running smoothly.
- 2) The flow of sealing liquid and cooling water is uninterrupted. If necessary, provide sight glass in the piping.
- 3) The bearings are not getting abnormally hot.
- 4) The gland is properly tightened to give leakage of approximate 60-80 drops per minute through stuffing box.
- 5) Head and capacity developed by the pump is as specified.
- 6) Power consumption is within limit.
- 7) Ensure that there is no mechanical friction in the pump.

- 8) **Caution** 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.

#### 4.4 During stopping the pump

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- 1) Close the valve on the delivery line.
- 2) Stop the motor.
- 3) Close the cooling water and sealing liquid connections.

- 4) **Caution** 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.

## 5.0 TECHNICAL DATA:

### 5.1 Models:

5.1.1 'RKB' types of pumps are available in models as given in table below.

SR NO.	PUMP TYPE	MAX. STAGES
1	RKB – 32/9E	16
2	RKB – 32/14H	14
3	RKB - 40/12L	14
4	RKB – 40/14H	12
5	RKB – 50/15E	14
6	RKB – 50/15L	14
7	RKB – 50/16H	11
8	RKB – 50/26	8
9	RKB – 65/19E	12
10	RKB – 65/19L	12
11	RKB – 65/19LM	12
12	RKB - 65/19H	12
13	RKB – 65/24	11
14	RKB - 100/23E	11
15	RKB – 125/27	11
16	RKB - 125/30	10
17	RKB – 150/34	9
18	RKB – 200/37	8
19	RKB – 250/46K	6
20	RKB – 250/46DK	5

5.1.2 RKB pumps are suitable for clear liquids having temp -30 to + 90 deg C .

5.2 Direction of rotation: The direction of rotation is clockwise when viewed from driving end. Against specific requirement pump suitable to anticlockwise rotation shall be supplied.

#### Caution

Please refer to the Arrow Name plate attached to pump for the direction.

5.3 Bearings: The shaft is supported with antifriction roller bearing at driving end and pair of angular contact ball bearing at non-driving end in face to face arrangement. The bearing specifications are given below. The designations of bearings are as per SKF catalogue. However, equivalent bearing in type, capacity and dimensions can also be used.



Pump size	Bearing at D.E	Bearing at N.D.E
RKB – 32/9E	NU 306	6306
RKB – 32/14H	6305	6305
RKB - 40/12L	NU 307	2 x 7307BG
RKB – 40/14H		
RKB – 50/15E	NU 308	2 x 7308BG
RKB – 50/15L		
RKB – 50/16H	NU308	2 x 7308BG
RKB – 50/26	NU 308	2 x 7308BG
RKB – 65/19E	NU 309	2 x 7309BG
RKB – 65/19L		
RKB – 65/19LM		
RKB – 65/19H		
RKB – 65/24	NU 413	2 X 7314BG
RKB - 100/23E	NU 310	2 X 7310BG
RKB – 125/27	NU 411	2 X 7311BG
RKB - 125/30	NU 412	2 X 7312BG
RKB – 150/34	NU 413	2 X 7313BG
RKB – 200/37	NU 414	2 X 7314BG
RKB – 250/46	NU319	Spherical Roller Brg.SKF 2220E
		Spherical Roller Thrust Brg. SKF 29422E

NOTE: - 1) Above bearing details at DE & NDE applicable for clockwise pump operating at 50 c/s only.

2) Bearing of SKF or equivalent make.

3) Pair of angular contact ball bearing are fitted in face to face condition

4) In case of anticlockwise direction pump, NDE becomes DE and DE becomes NDE.

#### 5.4 Bearing temperature:

Maximum allowable temperature of bearings: 80°C

#### 5.5 Lubrication of Bearing:

Bearings are grease lubricated. Bearings are lubricated during assembly of pump at our factory. The regressing should be done after every 1000 hours of running. To recharge the bearing with fresh grease, use a grease gun through the nipples provided.

#### **Caution**

DO NOT APPLY LUBRICANT WHEN PUMP IS RUNNING.

Following lubricant grades available in the market are suitable.

[A] **GREASE:**

NAME	GREASE SPECIFICATION	
	SPEED 1450 RPM	SPEED 2900 RPM
INDIAN OIL	SERVOGEM-3	SERVOGEM-2
HINDUSTAN PETROLEUM	ALVINA GREASE-3	ALVINA GREASE-2
INTERNATIONAL GRADE	NLGI-3	NLGI-2

[B] **OIL QUANTITY APPLICABLE ONLY FOR RKB 250/46:**

Oil capacity for DE Bearing	0.300 liter
Oil capacity for NDE Bearing	3.0 liter

5.6 Stuffing box: Stuffing box sealing arrangement-

5.6.1 Sealing to Lantern ring: - One of the following methods fit to be employed. This is applicable for horizontal pumps only with gland packing arrangement, (For this please refer to Drg. No ct 127-82-001-0).

5.6.2 Self sealing: - If order specifies sealing through liquid pumped, self sealing arrangement shall be provided. For this lantern ring is connected to first stage internally.

5.6.3 External sealing:- If order specifies sealing through external compatible liquid, supply liquid externally. Pressure recommended is one Kg/cm<sup>2</sup> (G) / max than suction pressure and quantity required shall be 0.05 m<sup>3</sup>/hr.max.

5.6.4 Grease sealing: - If order specifies grease sealing, pump is provided with a grease nipple at the suction side stuffing box. Through this grease nipple, grease is required to be pushed in with the help of grease gun.

NOTE- In the stuffing box of the delivery side, lantern ring is not provided as sealing to stuffing box is not required on delivery side

### 5.7. Stuffing box packing and lantern ring –

Please refer to the following chart for stuffing box packing size and position of lantern ring.

Pump type	Packing Arrangement	Packing Size
RKB – 32/9E	1 + L + 4	10 mm x 10 mm
RKB – 32/14H	1 + L + 2	8 mm x 8 mm
RKB - 40/12L	1 + L + 4	10 mm x 10 mm
RKB – 40/14H	1 + L + 4	10 mm x 10 mm
RKB – 50/15E	1 + L + 4	10 mm x 10 mm
RKB – 50/15L	1 + L + 4	10 mm x 10 mm
RKB – 50/16H	1 + L + 4	10 mm x 10 mm
RKB – 50/26	1 + L + 4	10 mm x 10 mm
RKB – 65/19E	1 + L + 4	12 mm x 12 mm
RKB – 65/19L	1 + L + 4	12 mm x 12 mm
RKB – 65/19LM	1 + L + 4	12 mm x 12 mm
RKB - 65/19H	1 + L + 4	12 mm x 12 mm
RKB – 65/24	1 + L + 4	14 mm x 14 mm
RKB - 100/23E	1 + L + 4	12 mm x 12 mm
RKB – 100/23M	1 + L + 4	12 mm x 12 mm
RKB – 125/27	1 + L + 4	14 mm x 14 mm
RKB - 125/30	1 + L + 4	14 mm x 14 mm
RKB – 150/34	1 + L + 4	14mm x 14 mm
RKB – 200/37	1 + L + 4	16 mm x 16 mm
RKB – 250/46	2 + L + 3	20 mm x 20 mm

### 5.8. 'O' – ring & key specification :-

Material of o-ring shall be Nitrile rubber.

### 5.9. 'O' RING SIZE SPECIFICATION

Pump type	Stage Part No. 52201/52203	Diffuser Part No.52202	Shaft Sleeve (Gland Packed) Part no. 52200
RKB – 32/9E	148.82 ID X 3.53 T	81.0 ID X 3 T	31.6 ID X 2.4 T
RKB – 32/14H	172 ID X 3 T	-----	23 ID X 3T
RKB - 40/12L	190.1 ID X 3.53 T	99.5 ID X 3.53 T	36.5 ID X 3 T
RKB – 40/14H	190.1 ID X 3.53 T	99.5 ID X 3.53 T	36.5 ID X 3 T
RKB – 50/15E	202.8 ID X 3.53 T	104.37 ID X 3.53 T	41.5 ID X 3 T
RKB – 50/15L	202.8 ID X 3.53 T	104.37 ID X 3.53 T	41.5 ID X 3 T



RKB – 50/16H	202.8 ID X 3.53 T	104.37 ID X 3.53 T	41.5 ID X 3 T
RKB – 50/26	322 ID X 4 T	104.37 ID X 3.53 T	41.5 ID X 3 T
RKB – 65/19E	240.9 ID X 3.53 T	120.25 ID X 3.53 T	46.5 ID X 3 T
RKB – 65/19L	240.9 ID X 3.53 T	120.25 ID X 3.53 T	46.5 ID X 3 T
RKB – 65/19LM	240.9 ID X 3.53 T	120.25 ID X 3.53 T	46.5 ID X 3 T
RKB - 65/19H	240.9 ID X 3.53 T	120.25 ID X 3.53 T	46.5 ID X 3 T
RKB – 65/24	297 ID X 4 T	170 ID X 4 T	75.57 ID X 5.33 T
RKB - 100/23E	278.99 ID X 3.53 T	129.27 ID X 3.53 T	49.5 ID X 3 T
RKB – 100/23M	278.99 ID X 3.53 T	129.27 ID X 3.53 T	49.5 ID X 3 T
RKB – 125/27	355.19 ID X 3.53 T	158.35 ID X 3.53 T	55.5 ID X 3 T
RKB - 125/30	385 ID X 3 T	174.3 ID X 5.7 T	60.33 ID X 3.53 T
RKB – 150/34	436ID X 4 T	200 ID X 6.3 T	75.57 ID X 5.33 T
RKB – 200/37	468 ID X 6 T	215.27 ID X 6.99 T	69.22 ID X 5.53 T
RKB – 250/46	586 ID X 6T	283 ID X 6T	95 ID X 4T

#### 5.10. 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	32100	32000	32001	32002
RKB – 32/9E	8 X 7 X 54L	6 X 4 X 25L	6 X 4 X 14L	6 X 4 X 44L
RKB – 32/14H	8 X 7 X 54L	6 X 4 X 25L	6 X 4 X 20L	6 X 4 X 44L
RKB - 40/12L	8 X 7 X 50L	6 X 4 X 25L	6 X 4 X 20L	6 X 4 X 55L
RKB – 40/14H	8 X 7 X 50L	6 X 4 X 25L	6 X 4 X 20L	6 X 4 X 55L
RKB – 50/15E	10 X 8 X 75L	8 X 7 X 45L	6 X 4 X 25L	8X 7 X 64L
RKB – 50/15L	10 X 8 X 75L	8 X 7 X 45L	6 X 4 X 25L	8X 7 X 64L
RKB – 50/16H	10 X 8 X 75L	8 X 7 X 45L	6 X 4 X 25L	8X 7 X 64L
RKB – 50/26	10 X 8 X 75L	8 X 7 X 45L	8 X 7 X 32L	8 X 7 X 72L
RKB – 65/19E	12 X 8 X 100L	10 X 8 X 60L	10 X 8 X 44L	10 X 8 X 80L
RKB – 65/19L	12 X 8 X 100L	10 X 8 X 60L	10 X 8 X 44L	10 X 8 X 80L
RKB – 65/19LM	12 X 8 X 100L	10 X 8 X 60L	10 X 8 X 44L	10 X 8 X 80L
RKB - 65/19H	12 X 8 X 100L	10 X 8 X 60L	10 X 8 X 44L	10 X 8 X 80L
RKB – 65/24	18 X 11 X 80L	12 X 8 X 75L	12 X 8 X 50L	12 X 8 X 75L
RKB - 100/23E	14 X 9 X 100L	10 X 8 X 60L	10 X 8 X 50L	10 X 8 X 100L
RKB – 100/23M	14 X 9 X 100L	10 X 8 X 60L	10 X 8 X 50L	10 X 8 X 100L
RKB – 125/27	14 X 9 X 100L	10 X 8 X 60L	10 X 8 X 50L	10 X 8 X 100L
RKB - 125/30	16 X 10 X 100L	12 X 8 X 60L	12 X 8 X 44L	12 X 8 X 110L
RKB – 150/34	18 X 11 X 130L	12 X 8 X 75L	12 X 8 X 50L	12 X 8 X 130L
RKB – 200/37	18 X 11 X130L	12 X 8 X 75L	12 X 8 X 50L	12 X 8 X 130L
RKB – 250/46	25X14X150L	16X10X150L	16X10X110L	16X10X210L

5.11. Coupling:-Coupling shall be supplied along with the pump only if specifies so. Coupling type shall be preferably jaw flex type used.

## 5.12. Pressure Relaxation Piping :-

(Please refer Dwg. No. TP129-88-003-0)

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

## 5.13. Specification for oil seals

Oil seals at DE & NDE are identical.

PUMP TYPE	OIL SEAL SIZE
RKB – 32/9E	40 X 52 X 7 Thick
RKB – 32/14H	NOT APPLICABLE
RKB - 40/12L	45 X 60 X 8 Thick
RKB – 40/14H	45 X 60 X 8 Thick
RKB – 50/15E	52 X 68 X 8 Thick
RKB – 50/15L	52 X 68 X 8 Thick
RKB – 50/16H	52 X 68 X 8 Thick
RKB – 50/26	52 X 68 X 8 Thick
RKB – 65/19E	52 X 68 X 8 Thick
RKB – 65/19L	52 X 68 X 8 Thick
RKB – 65/19LM	52 X 68 X 8 Thick
RKB - 65/19H	52 X 68 X 8 Thick
RKB – 65/24	NOT APPLICABLE
RKB - 100/23E	65 X 85 X 10 Thick
RKB – 100/23M	65 X 85 X 10 Thick
RKB – 125/27	72 X 95 X 10 Thick
RKB - 125/30	80 X 110 X13 Thick
RKB – 150/34	90 X 110 X 13 Thick
RKB – 200/37	100 X 125X 12Thick
RKB – 250/46	NA

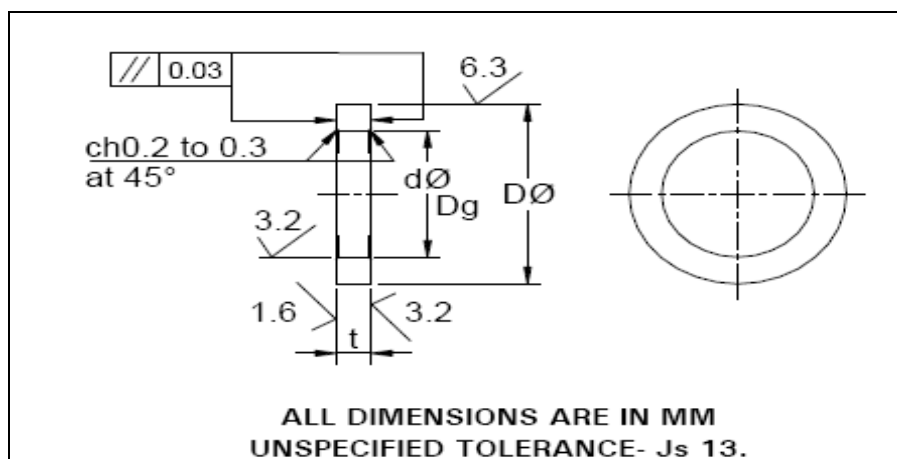
Material of oil seal shall be Nitrile rubber with steel spring  
For RKB 32/14H Pump oil seals are not used.



# 5.14. TORQUE FOR TIE BAR NUTS:

Sr. No	Pump Type	Number of Stages	Torque in Kg. M
1	RKB – 32/9E RKB – 32/14H	1 to 6	8
		7 to 10	9
		11 to 13	10
2	RKB - 40/12L RKB – 40/14H	2 and 3	16
		2 to 7	18
		5 to 11	20
3	RKB – 50/15E RKB – 50/15L RKB – 50/16H RKB – 50/17	2 to 4	25
		5 to 7	29
		8 to 11	35
4	RKB – 50/26	2 to 3	15
		3 to 5	24
		4 to 7	34
		8	40
5	RKB – 65/19E RKB – 65/19L RKB – 65/19LM RKB - 65/19H	2 to 4	60
		5 to 7	70
		8 to 9	80
6	RKB – 65/24	2 to 3	65
		4 to 6	75
		7 to 9	85
7	RKB - 100/23E RKB – 100/23M	2 to 3	51
		4 to 5	56
		6 to 8	61
8	RKB – 125/27	2 to 4	40
		5 to 7	45
		8 to 10	50
		11 to 13	55
		14	57
9	RKB - 125/30	2 to 5	60
		6 to 9	70
		10 to 13	80
10	RKB – 150/34	2 to 4	35
		5 to 8	70
		9 to 12	95
12	RKB – 200/37	2 and 3	125
		4 and 5	140
		6 and 7	155
		8 to 11	172

## 5.15. DIMENSIONS OF WASHER FOR RKB PUMPS.



Pump Type	D	d D9	Thickness of washer (t)	Theoretical Thickness (B)
RKB – 32/9E	40	30	6	3.5
RKB – 32/14H	Not applicable			
RKB - 40/12L	46	35	6	3.5
RKB – 40/14H				
RKB – 50/15E	50	40	6	3.3
RKB – 50/15L				
RKB – 50/16H				
RKB – 50/26				
RKB – 65/19E	58	45	6	4
RKB – 65/19L				
RKB – 65/19LM				
RKB - 65/19H				
RKB – 65/24	90	70	10	6
RKB - 100/23E	62	50	6	4
RKB – 100/23M				
RKB – 125/27	72	55	8	5.5
RKB - 125/30	80	60	8	4
RKB – 150/34	90	65	10	4
RKB – 200/37	90	70	10	4
RKB – 250/46	115	90	10	7.75

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.

For RKB 32/14H Pump adjustable washer is not used.

## 6.0 PREVENTIVE MAINTENANCE:

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

### 6.1 Daily checks:-

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- 6.1.1 Hourly record of suction and delivery pressure, discharge quantity input to the pump driver should be maintained.
- 6.1.2 Bearing temperature, stuffing box leakage / stuffing box temperature, this gives an idea of mechanical performance of the pump.
- 6.1.3 Noise and vibrations are the 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 vibrations.

### 6.2 Periodical checks:

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- 6.2.1 The temperature of the bearing should be measured by thermometer. Safe maximum working temperature of the bearing is 80°C.
- 6.2.2 The lubricants of the bearing 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.
- 6.2.3 Check for the stuffing box leakage.
- 6.2.4 The alignment of the pump unit should be checked. Due to operational vibrations, atmospheric temperature or stress induced by the weight of the piping, the alignment may get disturbed.
- 6.2.5 Sufficient quantity of suitable type of lubricant should be ready for daily and emergency use.
- 6.2.6 Calibrate the measuring instrument.

### 6.3 Annual checks:

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- 6.3.1 The pump should be overhauled completely to check the clearance and to replace worn-out parts. Clearance between impeller and casing rings, shaft sleeves and throat bush, lantern ring and shaft sleeve etc are very important. The bearings should be cleaned thoroughly and lubricated.

- 6.3.2 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.
  - 6.3.3 The auxiliary pipelines and functioning of the auxiliary system should be checked. The main pipe also should be checked for scaling, leakage etc.
  - 6.3.4 The measuring instruments, gauges etc should be recalibrated.
  - 6.3.5 Full running test may be carried out to check whether there is any fault in the performance, in comparison with original performance.
  - 6.3.6 Piping supports should be checked so that the pipes do not induce unwanted stresses on the pump.
- 

## **7.0 OVERHAULING:-**

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- 7.1 Procedure for dismantling and re-assembly  
While dismantling and re-assembling, the cross-sectional assembly drawing and specification part list should be referred.
- 7.2 Dismantling:  
Follow the following simple steps to dismantle the pump.
  - 7.2.1 Isolate power supply to motor.
  - 7.2.2 Shut off valves controlling flow to and from the pump.
  - 7.2.3 Drain the liquid from pump by removing the drain plug, or open the pump casing drain cock.
  - 7.2.4 Remove all auxiliary tubing and piping.
  - 7.2.5 We recommend matching the punch mark of the coupling halves.
  - 7.2.6 In case of the pumps with spacer type flexible couplings, disconnect coupling (pump half and motor half) from the coupling spacer and remove coupling spacer. In case of ordinary flexible couplings, remove the motor from the base.
  - 7.2.7 Remove the delivery and suction pipe connections.
  - 7.2.8 Remove the pump from the base plate and place it on a plain table or platform. Remove pump half coupling.
  - 7.2.9 Drain the liquid from suction and delivery casing by removing the drain plugs.
  - 7.2.10 Loosen the gland (22300) at DE & NDE.
  - 7.2.11 Take out bearing cover NDE (27100).
  - 7.2.12 Unlock lock washer (41500) and unscrew the locknut (33600).
  - 7.2.13 Take out bearing housing (24001) along with bearing/bearings. For this purpose use two jaw puller. Do not use hammer to remove brg. / brg. housing.
  - 7.2.14 Remove adjustable washer (20901), liquid deflector (23600), distance sleeve (31700), gland (22300), 'O' ring (52200), shaft sleeve (31100).

**Caution**

In case of pumps with mechanical seals, remove mechanical seal cover (23100) along with seal-insert carefully. Similarly remove shaft sleeve (31502) along with rotating parts of the mechanical seals.

- 7.2.15 Unscrew the tie rod nuts (58400) remove washers of tie bar (62300).
- 7.2.16 Take out delivery casing (11100).
- 7.2.17 Take out tie bars (34100).
- 7.2.18 Remove diffuser (12800) from the delivery casing along with 'O' ring (52202).
- 7.2.19 Take out impeller (15100) and then remove key (32000/32001/32002). Remove stage casing (12400) along with 'O' ring (52201).
- 7.2.20 Repeat procedure given in **7.2.19** till you reach first stage impeller.
- 7.2.21 Now start dismantling from DE. Remove bearing cover (27000).
- 7.2.22 Unlock lock washer (41500) and unscrew lock nut (33600).
- 7.2.23 Take out bearing housing (24000) along with roller bearing outer race.
- 7.2.24 For gland packed pump- remove gland packing from the stuffing box and take out the entire shaft (18000) out of suction casing (11300) along with shaft sleeve (31000), distance sleeve (31700), deflector (23600), gland (22300) and inner race of roller bearing etc.

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▪ **For Mechanical Seal Pump:**

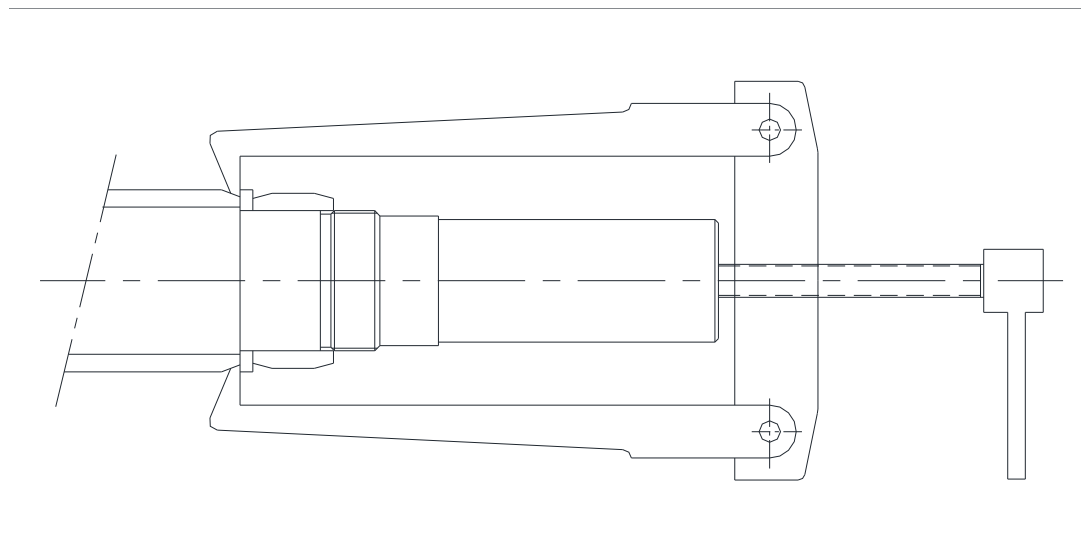
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Remove inner race of roller bearing, washer (20900), distance sleeve (31700), deflector (23600), and mechanical seal cover (23100) insert and shaft sleeve (31501) along with rotating parts of mechanical seal carefully.

**Caution:**

Remove inner race of roller bearing by using one of the following methods. Do not hammer to remove the inner race.

- a. Use bearing two jaw puller as shown in figure No.1. For this, two holes of 10mm dia. are provided on distance sleeve (31700).
- b. Use induction heater for localized heating of inner race and remove it after sufficient heating.  
(Please refer fig. 1)



- For gland packed pumps:

Remove inner race of the bearing by using one of the following methods.

- a. Use same method as shown in figure No.1 i.e. uses of bearing puller.
- b. Use of induction heater for localized heating of inner race and remove it after sufficient heating.
- c. Remove shaft sleeve (31000), O-ring (52200), distance sleeve(31700) from the shaft end other than at the inner race of roller bearing and then removes inner race of bearing along with washer(20900).

- **For Mechanical Seal Pumps:**

- 1 After dismantling, all parts are to be cleaned and checked thoroughly for wear tear and damage. Impellers, diffusers, casings or wear rings and inter stage bushes need to be replaced if drop in head and capacity of the pump is substantial.
- 2 All the damaged parts should be replaced by new ones.
- 3 Inspect all 'O' rings carefully. Replace the damaged ones. It is advisable to Use NEW O – rings instead of used ones.

### **7.3 Re-assembly :**

- 7.3. A. This procedure covers re-assembly of pump after complete dismantling of the pump. Before re-assembly, all the parts should be thoroughly cleaned in kerosene, petrol or benzene to remove the dust, rust etc. After cleaning the necessary parts should be replaced.

Caution:

- a) Use arbour press while fitting the bearings. However it is recommended that bearings should be heated in oil bath or by heater at temperature 70 to 80°C and then fitted. (If hot oil bath is not available then ARBOUR PRESS must be used).



Use gloves while fitting bearings from hot oil bath.

- b) Slide inboard ball bearing on shaft by hand, 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) Don't use hammer to fit the bearings. Do not damage the shaft surface especially where it is in contact with oil seal.
1. All parts are free from burr and those are cleaned thoroughly with kerosene/thinner.
  2. Balancing holes provided on impellers are not choked.
  3. Replacement components such as 'O' rings, gland packing, keys etc. are of correct size.
  4. Grub screw (98600) is fitted in the stage casings.
  5. Drain plugs are fitted on suction casing & delivery casing body.
  6. Air vent plug is fitted on suction casing body.
  7. The sequence of gland packing is as given above and packing arrangement
  8. Check run out of shaft by dial gage. It should be within 0.05 mm.
  9. Insert washer (20900) on the shaft.

### **7.3.B. Gland Packed Pump:-**

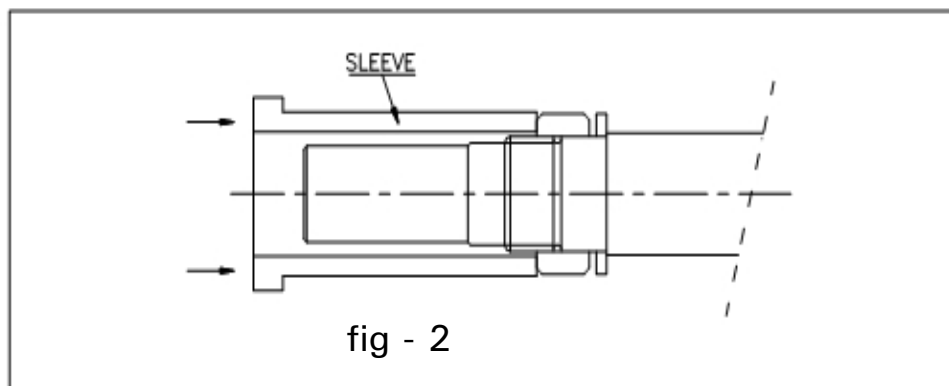
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Mount the washer for bearing & inner race of the roller bearing (26400). Insert lock washer and tighten lock nut (33600). Lock the lock washer.

### Caution:

Adopt one of the following methods for mounting the inner race-

- a. Heat inner race by induction heating or heating in an oil bath at a temperature of about 80° C and then mount.
- b. Use a sleeve and drive the inner race as shown in fig 2.



### Mechanical Seal pump

Take a dummy spacer ring having length equal to inner race of roller bearing. It should fit loose on the shaft for ease of removal. Insert this dummy ring and tighten locknut (33600).

- 7.3.1 Mount shaft sleeve (31000), distance sleeve (31700) on pump shaft (18000) at driving side. Insert dummy ring before washer (20900) on the shaft on driving side.

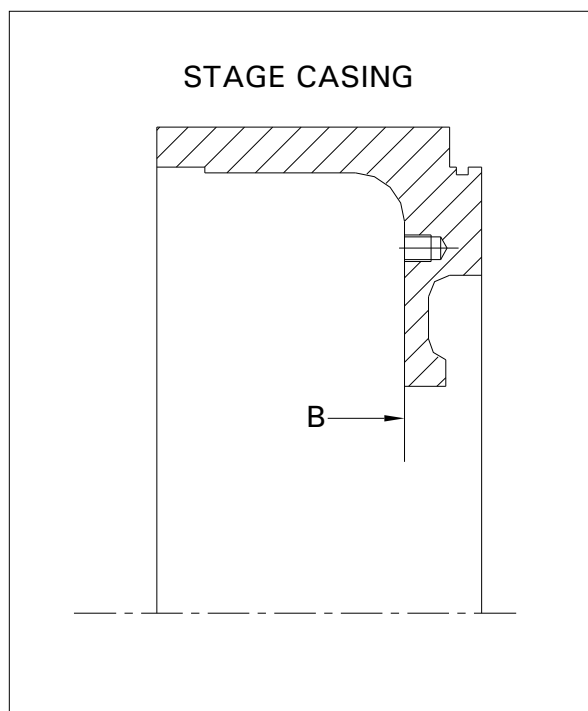
Note: Mount shaft sleeve (31501) without mechanical seal.

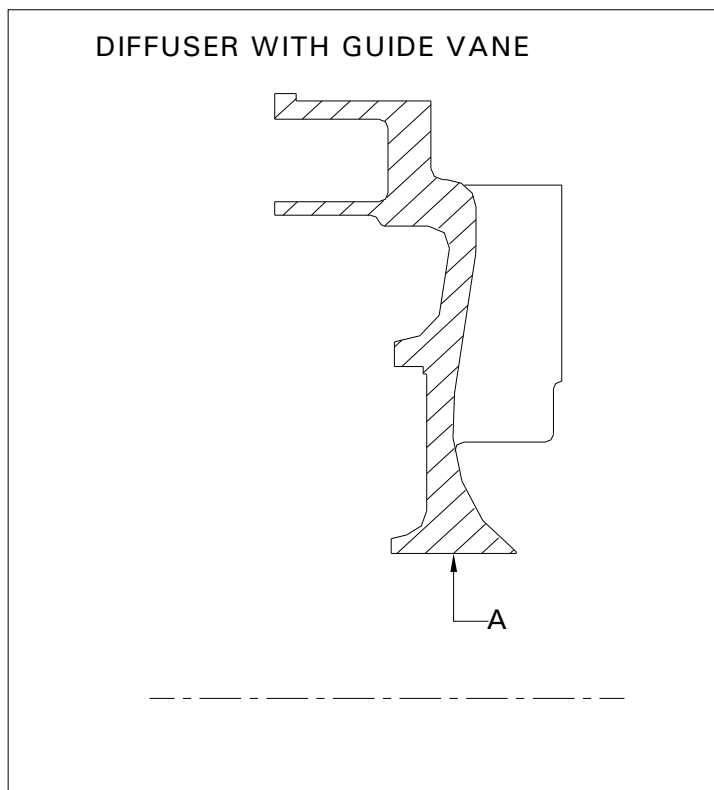
- 7.3.2 Insert the shaft so far assembled parts inside the suction casing (11300) bore. Insert gland (22300) on the shaft prior to inserting the shaft into suction casing in case of gland packed pumps. (PLEASE REFER FIG -3)
- 7.3.3 Replace oil seal (50000) in bearing housing (24000) if it is removed.
- 7.3.4 Gland packed pumps Mount bearing housing (24000). Mount the outer race of the roller bearing (26400), inside the bearing housing and fix the bearing cover (27000).
- 7.3.5 Replace or refit the case wear rings (19000/19100) and inter stage bush (35801) and (35800) if pump is with renewable wear parts.



**Caution**

If they are removed, please note that the case wear rings and inter stage bush should be fitted such that it flush the surface 'B' of the stage casing(12400) and inter stage bush flush the surface 'A' of the diffuser with guide vanes (12900) and diffuser (12800).





- 7.3.6 Place key (32000/32001/32002) and mount the impeller (15100). Insert diffuser with guide vanes (12900) inside the stage casing (12400). Mount 'O' ring (52201/52203) on casing and fit the stage casing along with guide vanes on the casing.
- 7.3.7 Repeat procedure given in 7.3.6 till you reach the final stage impeller.
- 7.3.8 Insert diffuser (12800) inside the delivery casing (11100) with 'O' ring (52202) in its position. Insert the delivery casing (11100) into the main assembly

**Caution**

Please note that diffuser is provided with a slot and delivery casing is provided with lug to locate the diffuser position. The diffuser should be carefully inserted to match the slot with lug.

- 7.3.9 Insert the tie bar long (34100). Screw the tie bar short (34100) into the suction casing (11300) in case of pumps having 8 tie bars. Tighten the tie bar nuts. Please refer 5.14 to Tech. Data chart for recommended torques for tightening of tie bar nuts.
- 7.3.10 Gland Packed pump:-  
Mount shaft sleeve (31100), 'O' ring (52200), distance sleeve (31700). Insert gland (22300) and liquid deflector (23600) on del side.

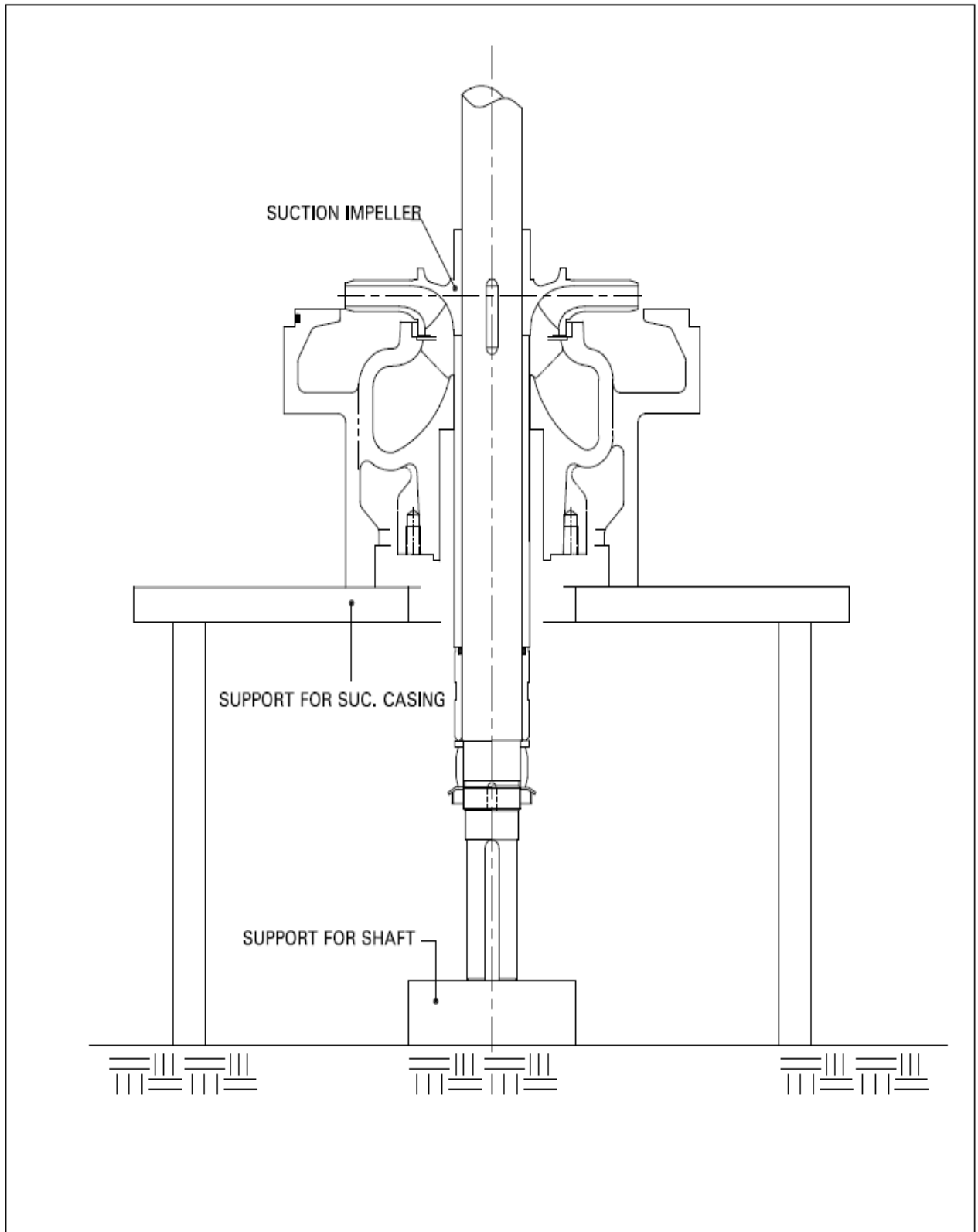


FIG - 3

## Mechanical Seal Pump.

- 7.3.11 Mount shaft sleeve 31502 without mounting the mechanical on it. Mount distance sleeve 31700.
- 7.3.12 Replace oil seal (50000) if it is removed in bearing housing (24001). Mount the bearing housing.
- 7.3.13 Insert adjustable washer (20901).

**Caution**

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 Data Chart (Refer to dimension "B"). Washer thickness needs not to 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 along with 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 dimension of dummy piece should match with the actual bearing dimensions of antifriction bearing/bearings at NDE. The tolerance on OD, ID and width of dummy piece should be as given below.

O.D. = -1.0 mm

-0.5 mm

I.D. = +0.5 mm

+ 0.1 mm

Thickness = +/- 0.1 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.

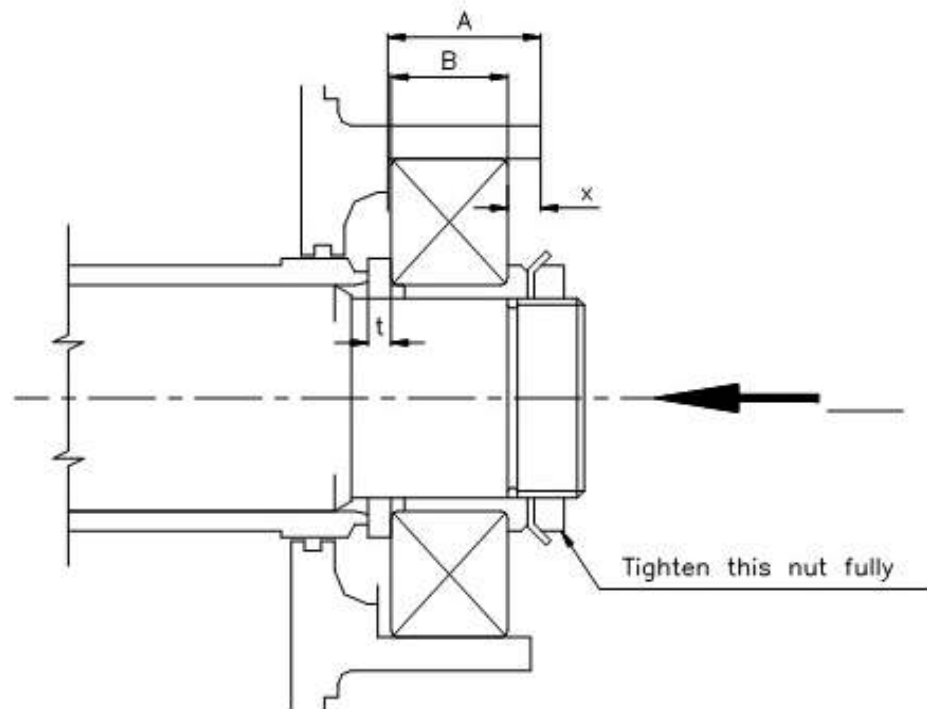


FIG.NO.-4

FIG. 5

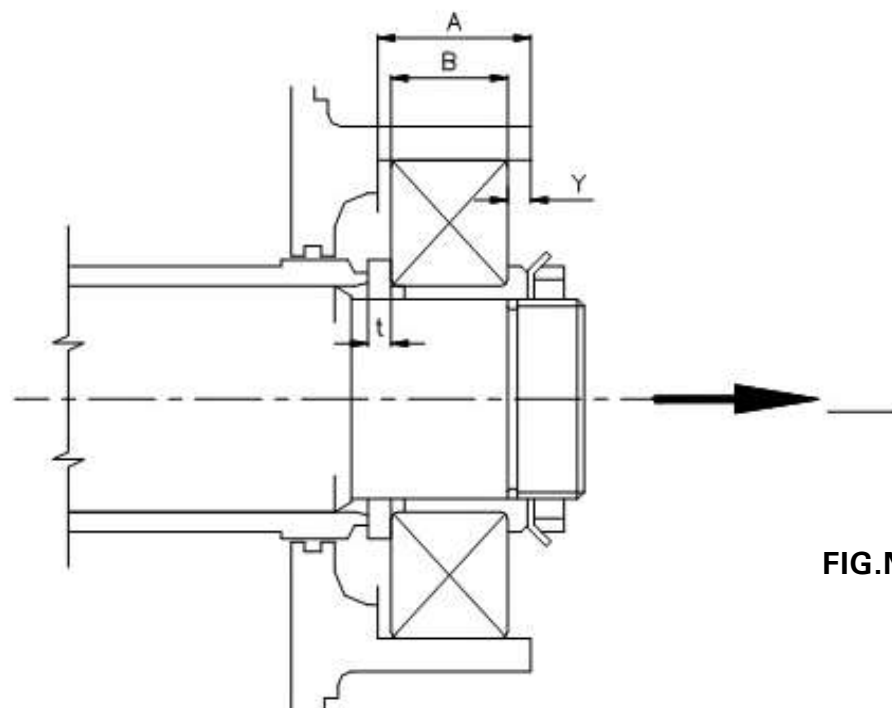
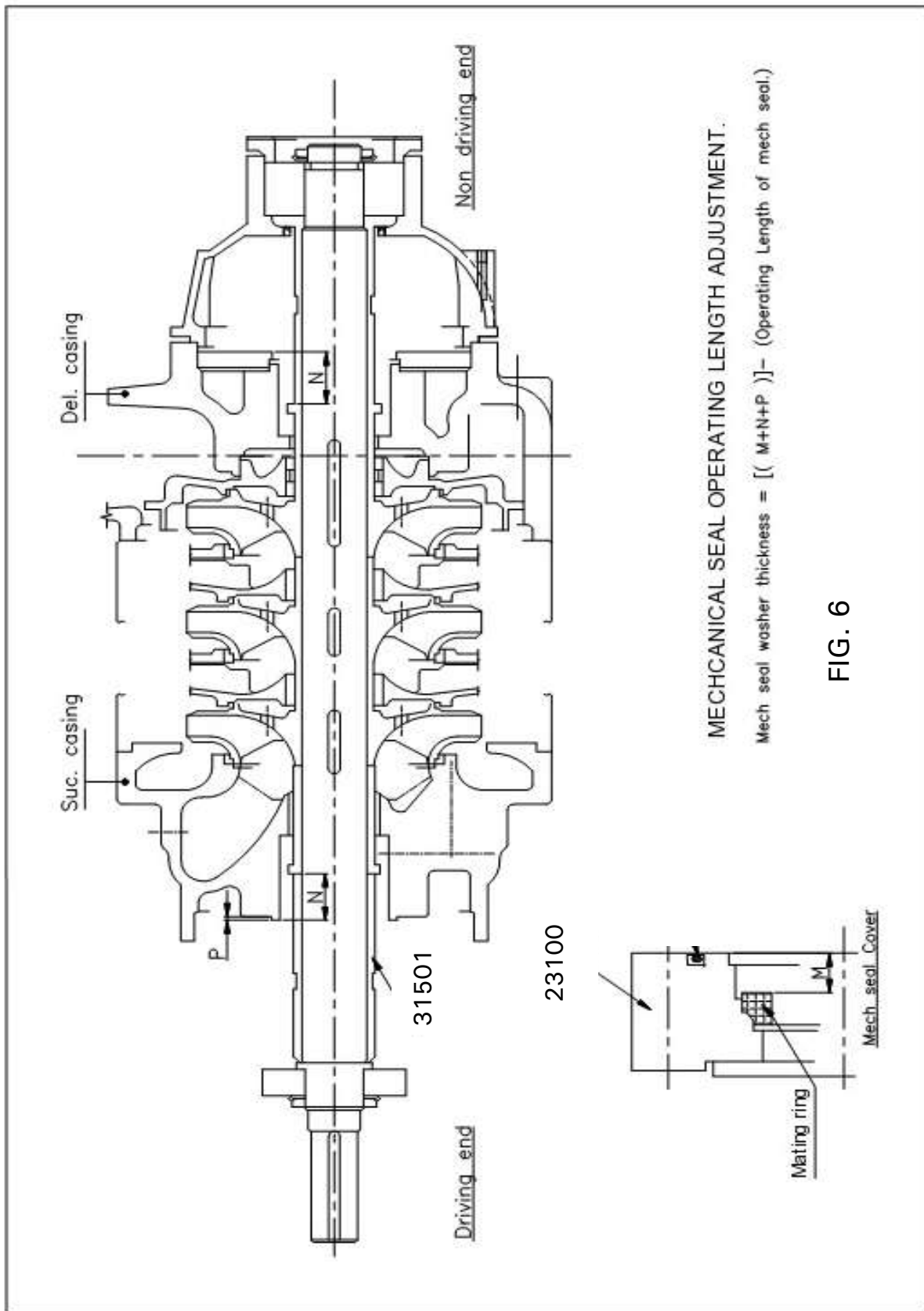


FIG.NO.-5

$$\text{WASHER THICKNESS} = t + \left( \frac{X+Y}{2} \right) - (A-B)$$



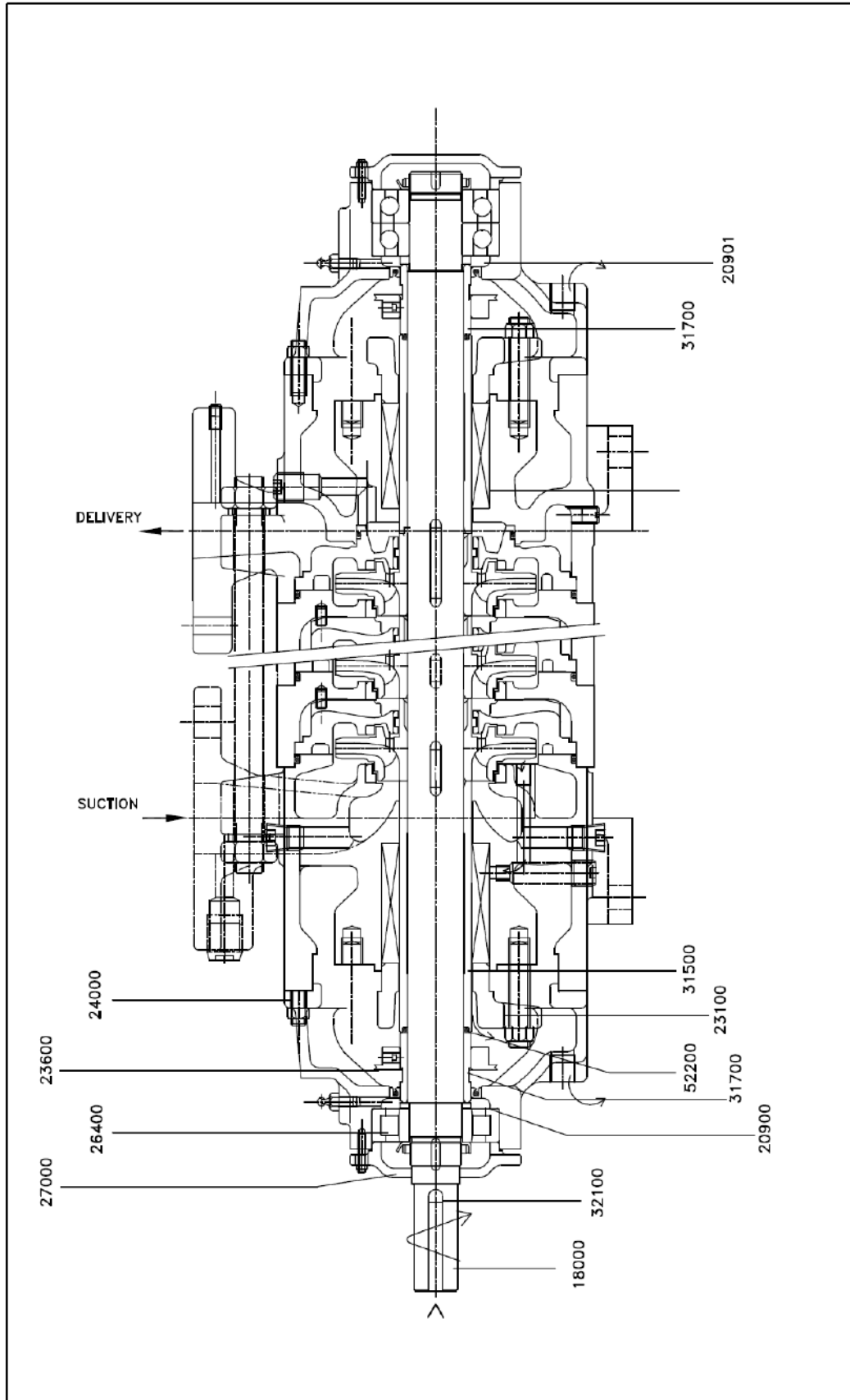


FIG. 7

- c) Tighten bearing lock nut (33600), with a torque as specified below.
- d) Refer to Fig. No.4. Now push the shaft i.e. rotating assembly towards suction and measure the gap between the dummy piece (bearing) and bearing housing. Call it 'X'.
- e) Pull the shaft i.e. rotating assembly towards delivery casing and measure the same dimension and call it 'Y' See Fig.No.5.
- f) Calculate adjustable washer thickness by using following formula.

$$\text{Washer thickness} = t + (X + Y)/2 - (A-B)$$

- g) Remove lock nut (33600) 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.

### 7.3.14 Gland Packed Pump

Mount antifriction bearing at NDE on the shaft. Insert lock washer (41500) and tighten lock nut (33600). Tighten the lock nut with half the torque specified under the clause. Fit the bearing cover NDE (27100).

**NOTE:** After this, try to rotate distance sleeve (31700) at DE & NDE and ensure that they do not rotate by hand. This serves as check for proper assembly. If distance sleeve rotates, it indicates that lock nut is not sufficiently tightened.

### Mechanical Seal Pump

Mount the dummy piece on the shaft. Tighten the lock nut (33600) with half the torque indicated under clause 5.14 Note that so far we have assembled the pump without mechanical seal. In case of mechanical seal it is essential to maintain operating length of seal equal to that specified on the cross sectional drawing supplied to you against O/A. To maintain the operating length, mechanical seal washers are used at DE/NDE. The width of this washer shall vary from pump to pump and need to be calculated at the time of assembly.

We discuss below a typical case. Please refer to figure 6 & 7.  
Follow following steps-

- a) Mark position of the cooling chamber for hot model plate / st.box face face on the sleeve.



- b) Measure distance "M" i.e. distance between seal insert face and mechanical seal cover.
- c) Take out sleeve and measure distance 'N'. Also measure distance 'P' on the suction and delivery side.
- d) Calculate mechanical seal washer thickness using the formula given below-

$$\text{Washer thickness} = (M + N - P) - (\text{Operating length of mech. Seal})$$

- e) Calculate washer thickness at suction and delivery side separately.
- f) Prepare mechanical seal washers of calculated thicknesses.

**7.3.15** Mount mechanical seal washer (20902/20903) on suction and delivery shaft sleeves respectively. Mount rotating assembly of mechanical seal on shaft sleeves.

**7.3.16** Mount shaft sleeve (31502) on delivery side. Insert mechanical seal cover (23100) with seal insert properly fitted in. Tighten the nut to fit the mechanical seal covers completely. Do not forget to mount 'O' rings (52205) before fitting the mechanical seal covers.

**7.3.17** Insert 'O' ring (52200) and mount distance sleeve (31700)

**7.3.18** .Mount bearing housing (24001) and insert adjustable washer (20901).

**7.3.19** Mount antifriction bearing at NDE. Apply pressure/force on inner race of bearing while fitting it. Hold the shaft in place at the other end while pushing the bearing inside. Induction heating of inner race of bearing is advisable for easy and safe fitting.

**7.3.20** Mount shaft sleeve (31000) on suction side. Insert mechanical seal cover (23100) with seal insert properly fitted in it. Place O-ring (52202) and fit mechanical seal cover completely.

**7.3.21** Insert O-ring (52200) and mount distance sleeve (31700).

**7.3.22** Mount bearing housing (24000) and insert washer (20900). Fit inner race of roller bearing. Please refer to clause No. **7.3.B** for fitting instructions of inner race.

**7.3.23** Insert lock washer and tighten lock nut (33600). Lock the lock washer. Similarly insert lock washer and tighten lock nut at NDE. Tighten the lock nut with half the torque specified under the clause 5.14. Lock the lock washer.

**NOTE:** After this, try to rotate distance sleeve (31700) at DE and NDE and ensure that they don't rotate by hand. This serves as a check for

proper assembly. If distance sleeve rotates, it indicates that lock nuts are not sufficiently tightened.

Fit bearing covers (27000/27100) at NDE and DE. Following steps to be followed for both gland packed and mechanical seal pumps.

**7.3.24** Fit bearing covers (2700/27100) at DE & NDE. Following steps to be followed for both gland packed and mechanical seal pumps.

**7.3.25** Put the pump on the base plate. Connect suction and discharge piping. Re-align the set.

---

### **Maintenance tools required:**

No special tools are required for dismantling and reassembling. Toolbox containing a general set of tools such as different size ring spanners, torque wrenches, open ended spanners, light ball peen hammer, wooden mallet, various sizes Allen keys etc serves the purpose. It is important to ensure that the suitable lifting equipment is available and that the work is carried out in clean area.

## **7. OPERATION**

**7.1** Before starting the pump please check the following.

7.1.1 The pump rotates freely by hand.

7.1.2 Level of the oil in the constant level oiler [fill in the lubricating oil, if not done earlier].

7.1.3 Sealing water and cooling water connections are properly tightened and adjusted.

7.1.4 The direction of rotation. It should corresponds to the direction of rotation of pump.

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

7.1.6 Sluice valve on delivery side is closed.

7.1.7 The cock for pressure gauge connection is closed.

7.1.8 The stuffing box packing is properly tightened.

### **7.2 Starting the pump –**

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

7.2.2 Open the valve on delivery side slowly.

7.2.3 Open the cock of pressure gauge connection.

7.2.4 Throttle the discharge valve to the required duty conditions.

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

7.3.1 The pump is running smooth.

- 7.3.2 The flow of sealing water and cooling water is uninterrupted. Check the temperature of cooling water outlet.
- 7.3.3 Power consumption is within the limit.
- 7.3.4 The bearings are not getting heated up excessively.
- 7.3.5 Head and capacity developed by pump is as specified.
- 7.3.6 Ensure that there is no mechanical friction in the pump.
- 7.3.7 Leakage through stuffing box is normal.
- 7.3.8 Stop the pump immediately, if any defects are detected. Do not start the pump unless defects are rectified.

#### 7.4 During stopping the pump –

- 7.4.1 Close the valve on delivery side.
- 7.4.2 Stop the motor.
- 7.4.3 Close the cooling water and sealing water connections.
- 7.4.4 If the pump is not required to be operated for a long time, drain the casings immediately. Also drain the lubricating oil.

Cross-section Assembly Drawing:

## 8.0 SPARE PART LIST AND CROSS SECTIONAL DRAWING

### SPECIFICATION LIST FOR RKB PUMPS:-

PART CODE	PART DESCRIPTION	QTY
11000	Delivery casing	1
11300	Suction casing	1
12400	Stage casing	(N-1)
12400	Stage casing with diffuser (For RKB32/14H only)	(N-1)
12800*	Diffuser	1
12900*	Diffuser with guide vanes	(N-1)
15100*	Enclosed impeller	N
18000*	Pump shaft	1
20900	Washer	1
20901	Adjustable washer	1
22300	Gland	2
22700	Lantern ring	1
23600	Liquid deflector	2
24000	Bearing housing (DE)	1
24001	Bearing housing (NDE)	1
26000	Deep groove ball bearing (Only for RKB32/9E)	1
26000	Deep groove ball bearing (for RKB 32/14H)	2
26300*	Angular contact ball bearing	1
26400*	Roller bearing (DE)	1



27000	Bearing cover (DE)	1
27100	Bearing cover (NDE)	1
31000*	Shaft sleeve (suction side)	1
31100*	Shaft sleeve (delivery side)	1
31700	Distance sleeve	2
32000*	Key for first impeller	1
32001*	Key for stage impeller	(N-2)
32001*	Key for last impeller	1
32100	Key for coupling	1
33600	Bearing lock nut	2
34100	Tie bar	** 4/8
35501	Inter stage bush for D.W.G.V.	(N-1)
35801*	Inter stage bush for diffuser	1
41500*	Washer for bearing lock nut	2
43000*	Gland packing	1
44100	Grease nipple	2
48600	External circlip (for RKB32/14H only)	2
50000*	Oil seal (DE & NDE)	2
52200*	'O' ring for shaft sleeve	2
52201*	'O' ring for stage casing	(N-1)
52202*	'O' ring for diffuser	1
52203*	'O' ring for suction casing	1
58200	Hex. nut for gland stud	4
58400	Hex. nut for tie bar	8
60000	Gauge plug for delivery casing	1
60001	Gauge plug for suction casing	1
60100	Drain plug for del casing	1
60101	Drain plug for suc casing	1
60101	Sealing plug for suction casing	1
60200	Vent plug	1
62300	Washer for tie bar	8
98600	Grub screw	(N-1)

\* RECOMMENDED SPARES

N-No of stages

\*\*Up to RKB65/19 models Qty = 4, and above RKB 65/19 QTY = 8

# KIRLOSKAR BROTHERS LIMITED

CROSS SECTIONAL DRAWING FOR RKB

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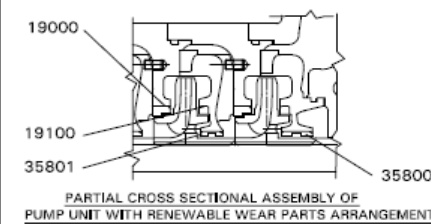
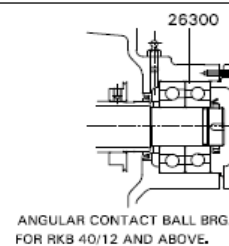
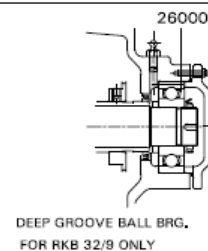
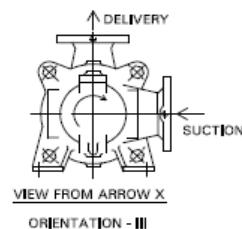
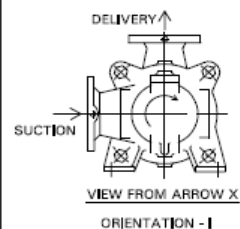
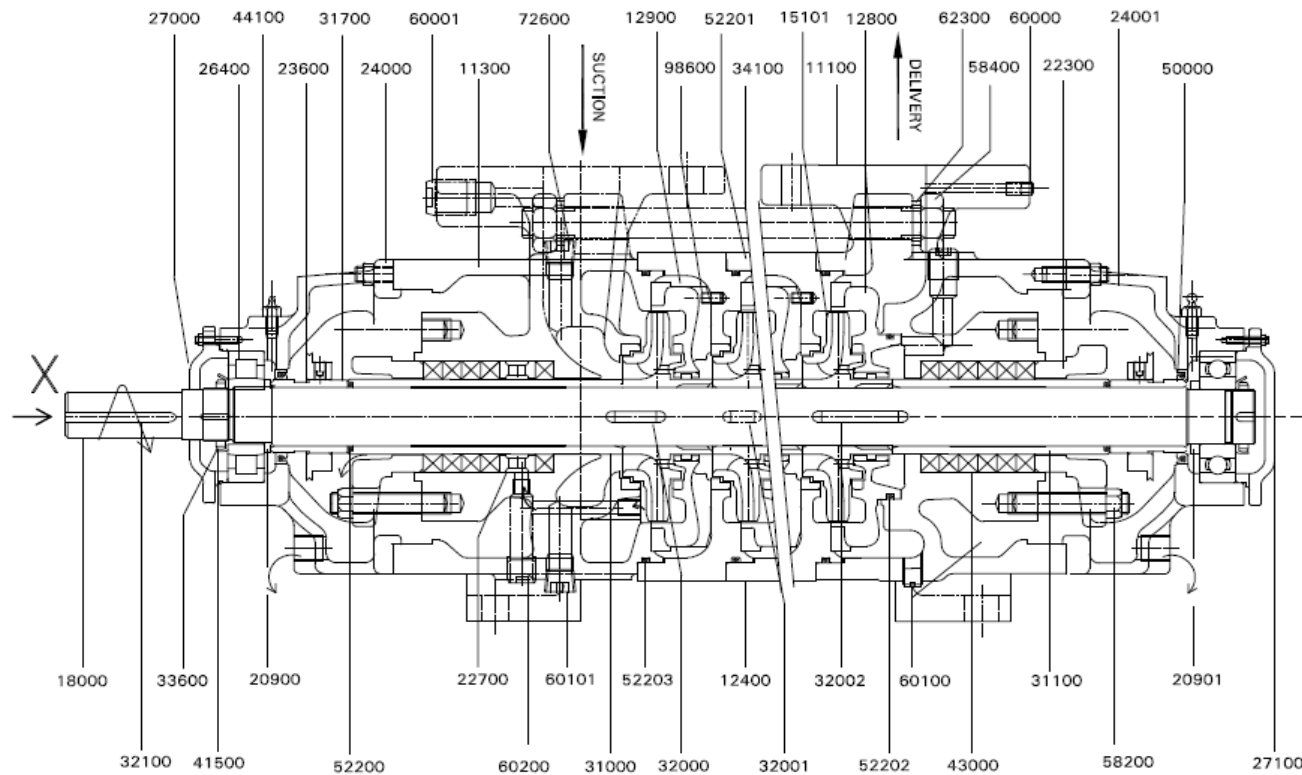


FIG:8

## 8.1: Configuration and function:

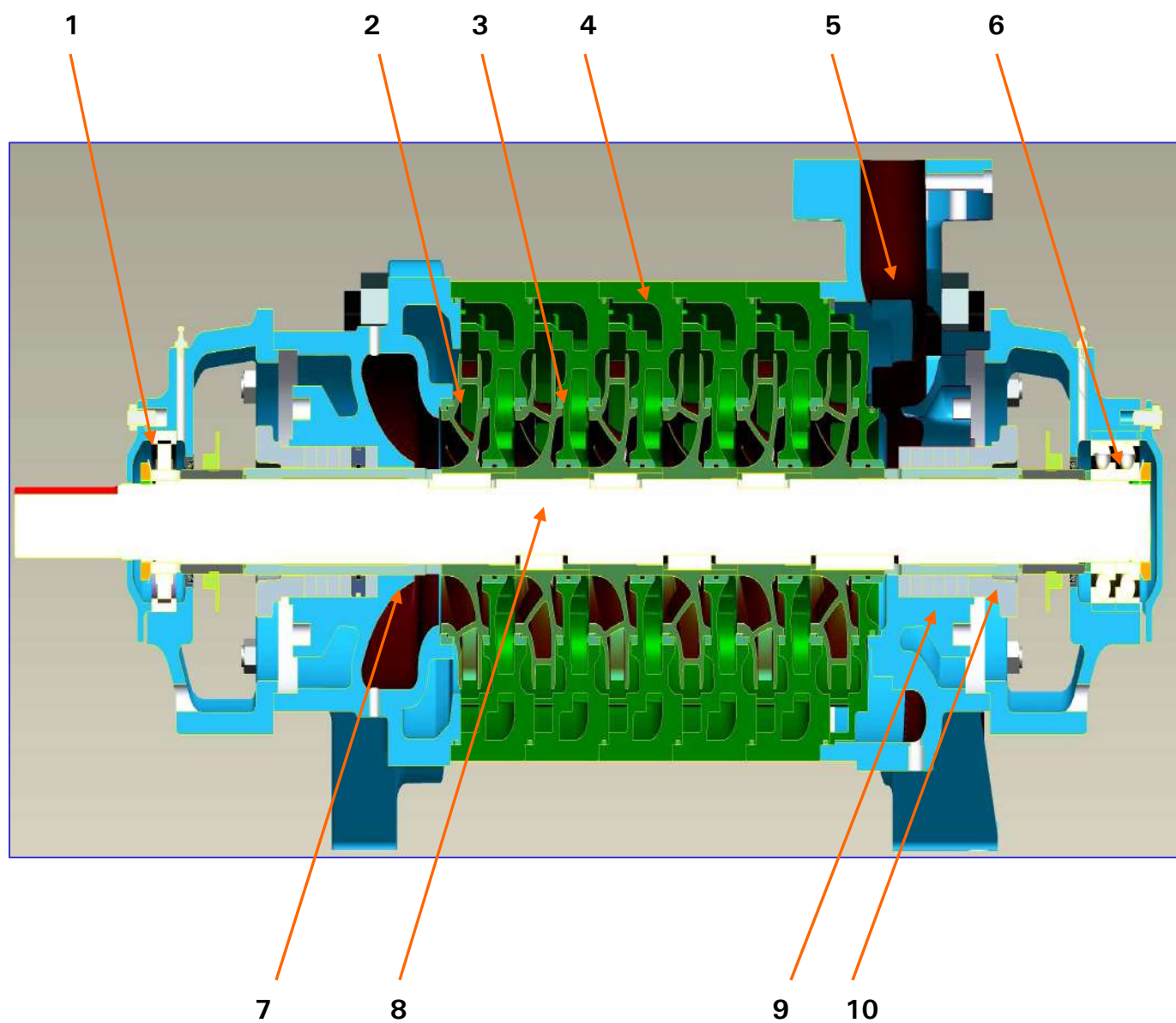


FIG:9

1	ROLLER BEARING	2	IMPELLER
3	DIFFUSER	4	STAGE CASING
5	DELIVERY CASING	6	BALL BEARING
7	SUCTION CASING	8	SHAFT
9	SHAFT SEAL HOUSING	10	GLAND

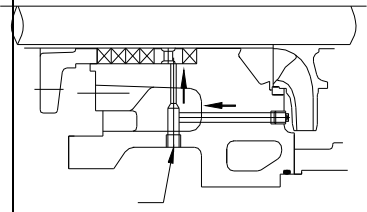
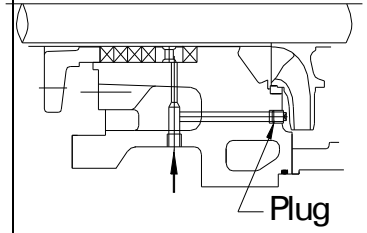
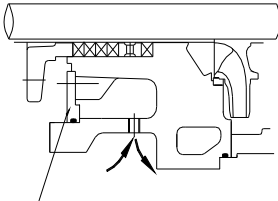
11	BEARING HOUSING		
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The pump is designed with an axial fluid inlet and a radial outlet. The hydraulic system runs in its own bearing and is connected to the motor via a shaft coupling.

Function: The fluid enters the pump via the suction casing (7) and is accelerated by the rotating impeller (2), resulting in a cylindrical flow towards the outside of the pump. At the flow contour of the stage casing (4) the kinetic energy of the fluid is converted into pressure energy and the fluid is routed to the next impeller (2) via the diffuser (3). This process is repeated in all stages until the fluid has passed the last impeller (2). It then passes through the discharge casing (5) to the discharge nozzle, from where it leaves the pump. Behind the last impeller (2), the hydraulic system is closed off by a seal housing (9) through which drive shaft (8) passes. The shaft passage through the seal housing is sealed towards the atmosphere by a shaft seal or gland packing (10). The drive shaft (8) is supported by ball bearing (6) and roller bearing (1) located in bearing housing (11) is connected with the suction (7) casing and delivery casing (5).

DRG.NO. CT 127-82-001-0

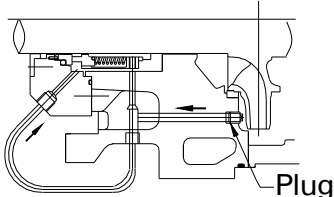
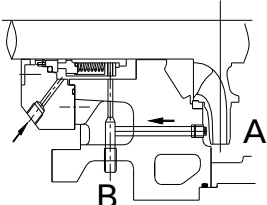
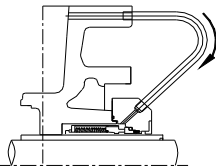
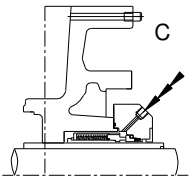
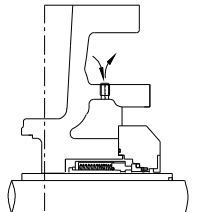
### SEALING OF GLAND PACKING-HORIZONTAL PUMPS

ARRANGEMENT	SCHEMATIC PLAN	SUPPLY CONDITON	ADDITIONAL DETAILS
I. Internal Sealing Suction Side		Standard	
II. External Sealing Suction Side		On Demand of Application	Plug Connection A Feeding of clear water having pressure having higher than suction pressure by 1 bar
III. Without Sealing On Delivery Side		Standard	
IV. Cooling arrangement Suction Side and Delivery Side		Necessary when temp. of water pumped is more than 105°C	Feeding of cooling water at 7 bars maximum pressure.

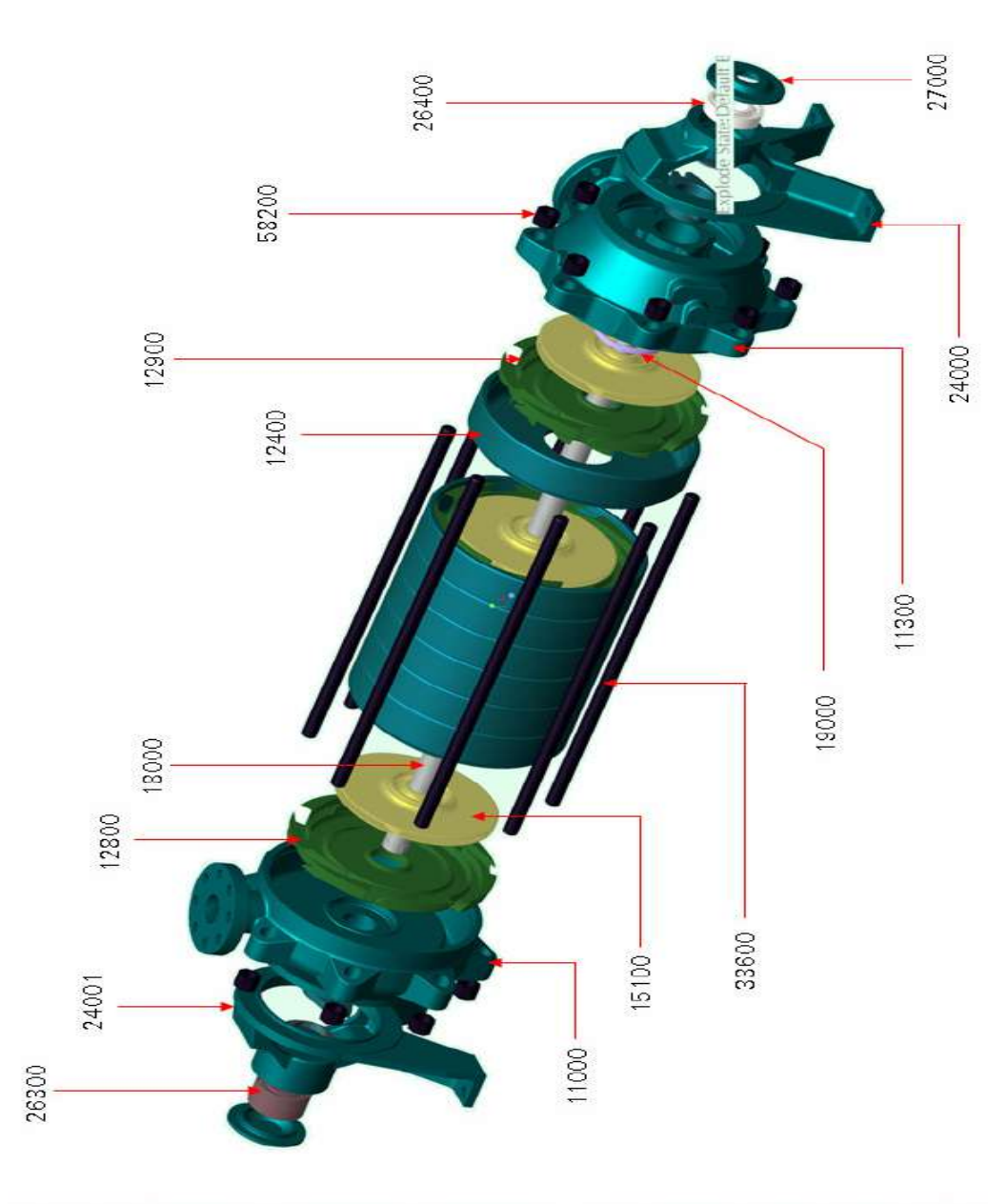


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### FLUSHING OF MECHANICAL SEALS HORIZONTAL PUMPS

ARRANGEMENT	SCHEMATIC PLAN	SUPPLY CONDITION	ADDITION DETAILS
I. Internal flushing Suction Side		Standard	
II. External flushing Suction Side		On demand of application	Plug connection A & B Feeding of clear water having pressure high than suction pressure by 1 bar
III. Internal flushing Delivery side		Standard	
IV. External flushing Delivery side		On demand of application	Plug connection 'C'
V. Cooling arrangement Suction side and delivery side		Necessary when temp. of water pumped is more than 80 C	Feeding of cooling water at 7 bars maxi. pressure.

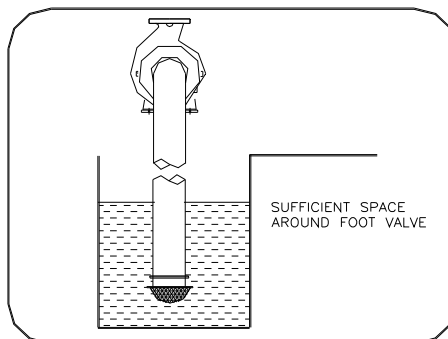
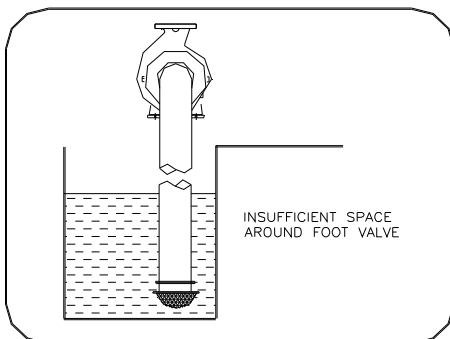
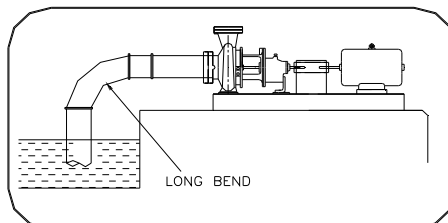
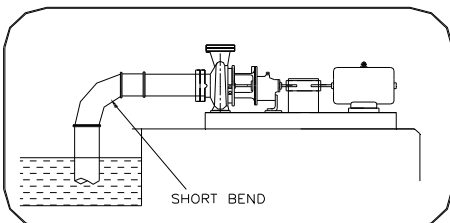
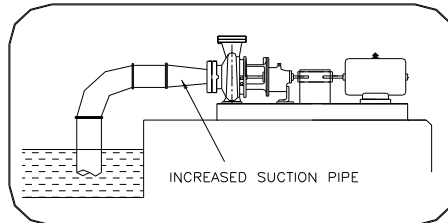
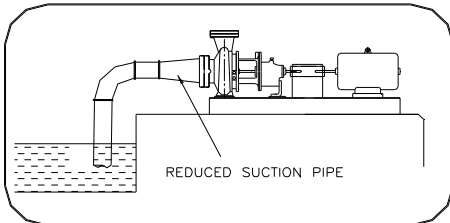
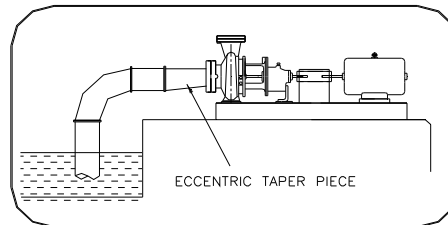
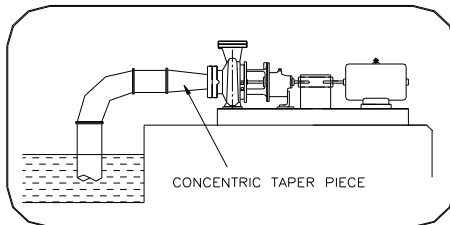
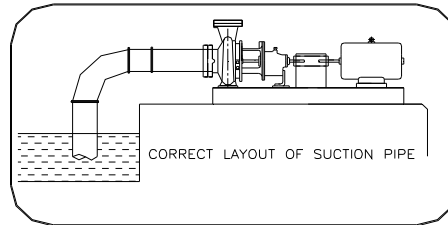
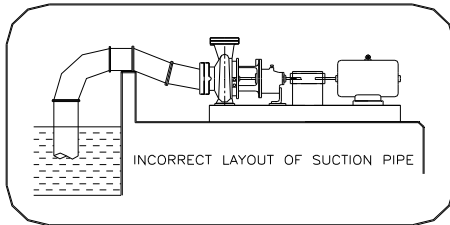
## EXPLODED VIEW



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

## INCORRECT

## CORRECT





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

## WARNING

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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

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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

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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

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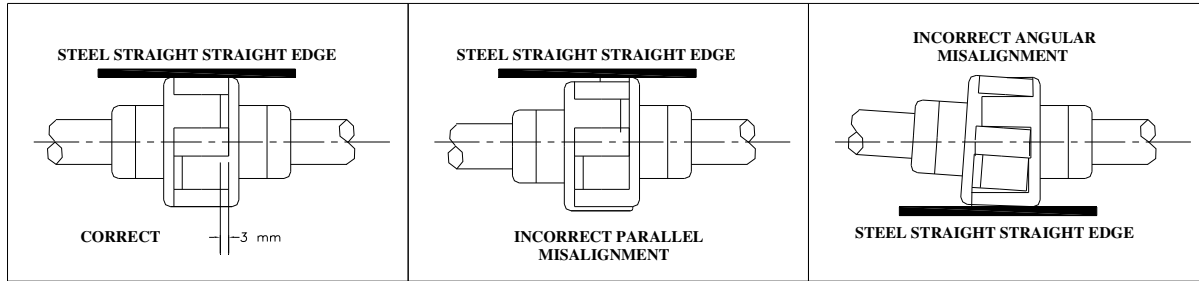
Pumps and the drivers supplied by the manufacturers, mounted on a common base plate are accurately aligned before dispatch. However as the alignments are likely to be disturbed during transit to some extent and hence must not be relied upon to maintain the factory alignment. Re-alignment is necessary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

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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:

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

## 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.

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**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.

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**DELIVERY PIPE**

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

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

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**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 pump set.

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.

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**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.

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**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 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 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 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 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.

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. Sealing liquid omitted.
26. Packing incorrectly fitted.
27. Gland tightened too much/slanted.
28. Packing not suitable for operating conditions.
29. Shaft sleeve worn in the region of the packing.
30. Bearing worn out.
31. Specified oil level not maintained.
32. Insufficient lubrication of bearings.
33. Ball bearings over-lubricated.
34. Oil/Grease quality unsuitable.
35. Ball bearing incorrectly fitted.
36. Axial stress on ball bearings (no axial clearance for rotor).
37. Bearings dirty.
38. Bearings rusty (corroded).
39. Axial thrust too great because of worn casing rings, relief holes obstructed.
40. Insufficient cooling water supply to stuffing box cooling.
41. Sediment in the cooling water chamber of the stuffing box cooling.
42. Alignment of coupling faulty or coupling loose.
43. Elastic element of coupling worn.
44. Pump casing under stress.
45. Pipeline under stress.
46. Shaft runs untrue.
47. Shaft bent.
48. Rotor parts insufficiently balanced.
49. Rotor parts touching the casing.
50. Vibration of pipe work.
51. Non-return valve gets caught.
52. Contaminated delivery liquid.
53. Obstruction in delivery line.

54. Delivery flow too great.
55. Pump unsuitable for parallel operation.
56. Type of pump unsuitable.
57. Incorrect choice of pump for existing operating conditions.
58. Voltage too low/power supply overloaded.
59. Short circuit in the motor.
60. Setting of starter of motor too high.
61. Temperature delivery liquid too high.