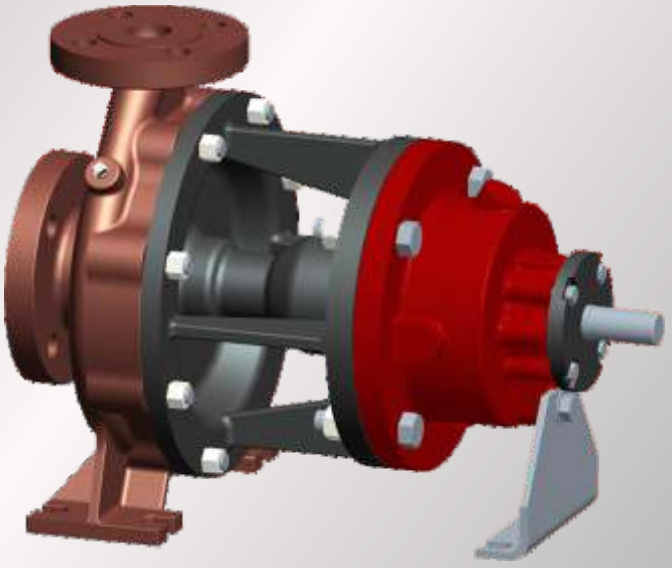
Enriching Lives

Instructions on installation, operation and maintenance for Kirloskar Pump - Air Cooled Type "AT"



KIRLOSKAR BROTHERS LIMITED
A Kirloskar Group Company
Established 1888

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

Table of contents

1 GENERAL

1.1 'KIRLOSKAR' make Air Cooled Thermic Fluid" AT" series pumps are of back pull out design which enables to remove the rotating unit of pump for inspection and repairs without disturbing suction and delivery pipe connections.

1.2 The booklet covers instructions for installation, operation & maintenance of following model –

Unit 5	**Unit 7**
AT32/20	AT40/26
AT40/20	AT50/26
AT50/20	AT65/20
	AT80/20

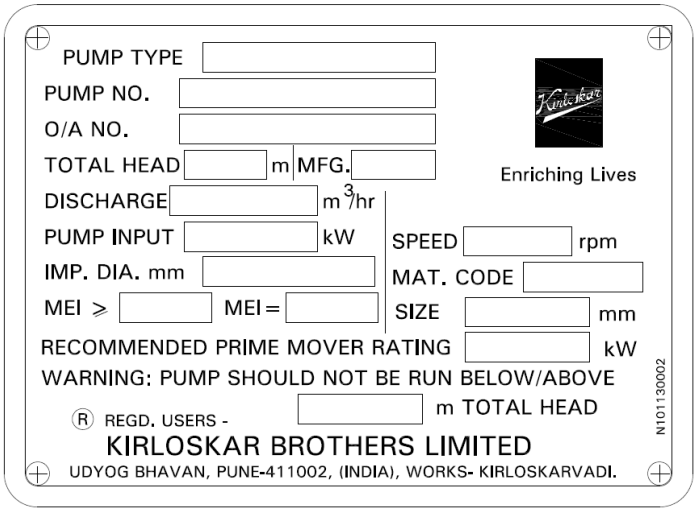
1.3 Applications:

1) Thermic fluid
2) Synthetic oil
3) Hot oil etc

1.4 Nameplate information:

Every pump has the following nameplate fitted to bearing housing or casing cover provided with necessary identification of the pump and its
Specific hydraulic characteristics.

The nameplate 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.



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

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

2. Safety Instructions:

2.1: General Information

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

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

2.1.1 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 whose nonobservance may lead to damage to the machine and its functions.

2.1.2 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

2.1.3 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.

2.1.4 This product must be serviced by qualified personnel who are familiar With the design and operation of this product and the system with the essential safety aspects involved.

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

2.1.6 Our guarantee will be valid only if the installation, operation, maintenance and repairs of this pump are carried out in accordance with these instructions. The plant operator is to make sure that the

contents of these instructions are fully understood by the operating personnel. During operation, periodic inspections should be made to assure safe operation under the prevailing conditions

2.1.7 Ear defenders should be worn where the specified equipment noise level exceeds locally defined safe levels. Safety glasses or goggles should be worn where working with pressurized systems and hazardous substances. Other personal protection equipment must be worn where local rules apply.

2.1.8 Any modification may be made to the product only after consultation with the manufacturer. Using spare parts and accessories authorized by the manufacturer is a relevant safety aspect. Only genuine spare parts which are in accordance with the original delivery (in the parts list) are to be used.

2.2 **CAUTION** *DO NOT* wears 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.

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.

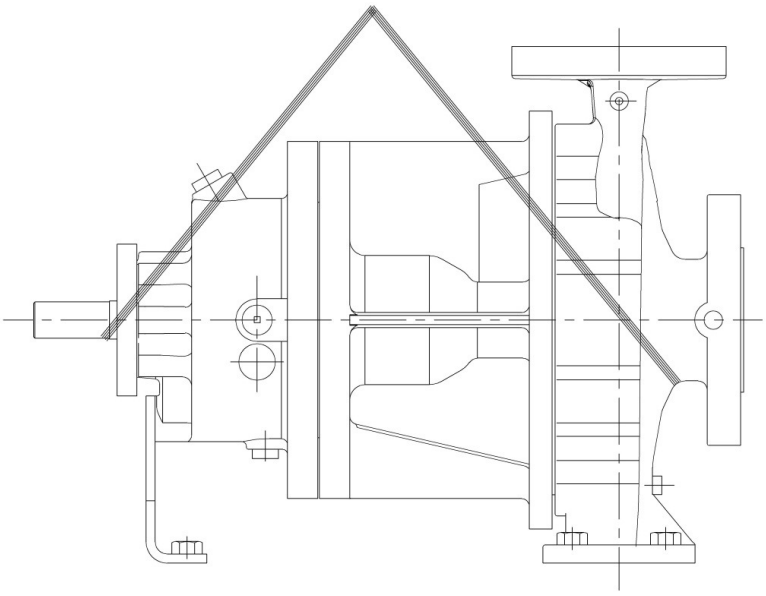
2.6.2: Handling

Crushing hazard.

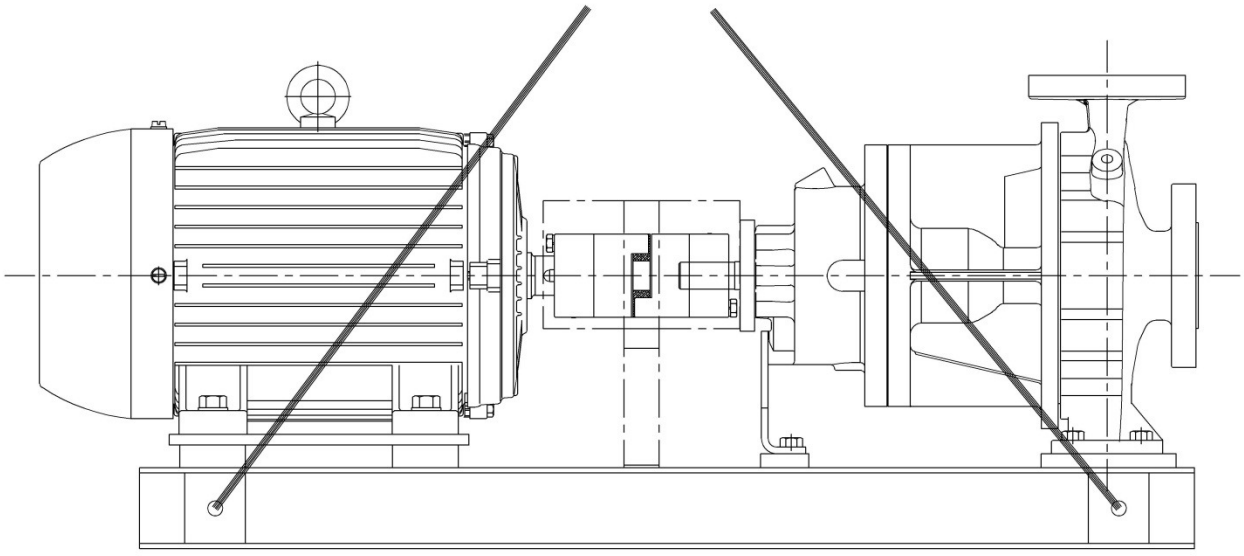
When lifting the pump or pump set, use lifting equipment having a safe working load rating suitable for the weight specified. Use suitable slings for lifting the pump which is not provided with lifting points.

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

Pump should be slung as shown.



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. 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 precautions to be taken:

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

b) Remove the glands, packings 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 pump shaft should be manually rotated periodically to prevent pitting of the bearing surfaces due to moisture

Shearing Hazard.

Do NOT place fingers or hands etc. into the suction or discharge pipe outlets and do NOT touch impeller, if rotated this may cause severe injury.

Fill the bearing housing with recommended 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:

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

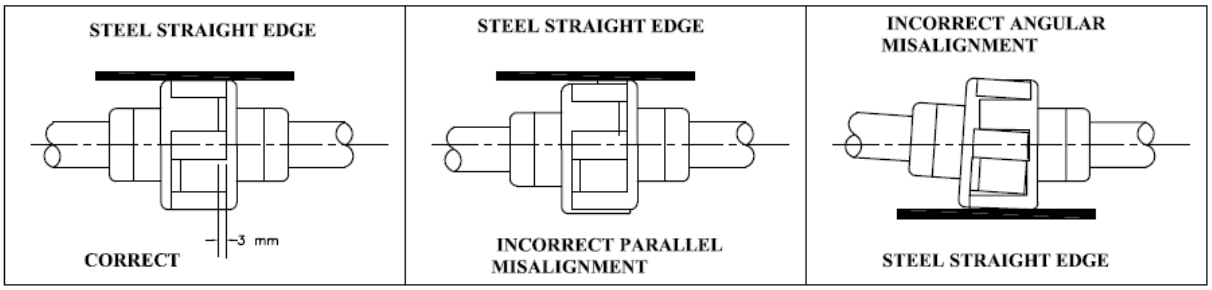
A spacer type flexible coupling is used to connect pump shaft to the driver. By using spacer type of coupling, the complete rotating unit can be removed from the volute without removing pump casing or rotor and without disconnecting piping connections. This also avoids any realignment of pump and motor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

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. Maximum allowable misalignment is 1°



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 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

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 reasons:

a) Setting, Seasoning of the foundation.
b) Pipe strains, distorting or shifting of the machines.
c) Wear of the bearings.

3.1.5 Before commissioning the pump set, please ensure:

A. The pipe connections are flushed and tightened properly.

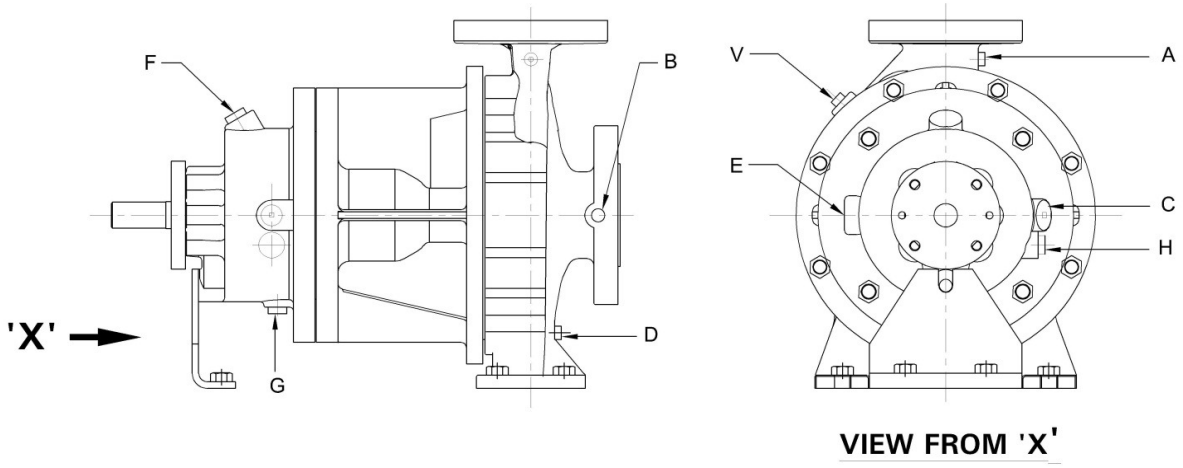
B. Alignment is proper.

C. Auxiliary piping connections such as sealing connections, cooling connections, drain connection etc. are made wherever applicable.

D. External connection to the pump if applicable, must be made after installation and before commissioning of pump.

Annexure- I

Following tapings are provided on Pump Casing and bearing housing:



VIEW FROM 'X'

SR. NO.	CODE OF PORT	DESCRIPTION	SIZE OF CONNECTION (NPT)
1.	A	Casing Delivery Gauge Connection	¼"
2.	B	Suction Gauge Connection	¼"
3.	C	Overflow Oil Outlet	¼"
4.	D	Casing Drain	½"
5.	E	Oil Level (Sight Glass)	¼"
6.	F	Oil Filling Tap	¼"
7.	G	Bearing Housing Drain Connection	¼"
8.	H	Mech. Seal Leakage Detection Connection	¼"
9.	V	Casing Vent Connection	¼"

4. OPERATION

4.1 EQUIPMENT DESCRIPTION:

Pumps dimensionally conforming to EN 22858 (DIN 24256). The pump is foot mounted for given temperature range up to 350ºC. Heat barrier is created by way of cooling the stuffing box region & sufficient space is kept between stuffing box and bearing, so that heat is not conducted to bearing.

The Pump casing has axial suction and top center line delivery, radially split with self-venting design. Smooth hydraulic passage ensures higher efficiency. Delivery flanges and supporting feet are cast integral with the pump casing.

The impellers are of enclosed type. Hydraulic balancing of impellers is achieved either by back vanes or by balance holes depending upon magnitude of axial thrust. The impellers are dynamically balanced. Reliable fixing of impeller on shaft is achieved by using helical insert under impeller nut.

The shaft is supported between antifriction ball bearing & sliding bush bearings. The critical speed of shaft is sufficiently above the operating speed. The shaft is critically machined and ground to maintain concentricity.

The Stuffing Box is sealed by grafoil packing & added operational reliability for safety with stuffing Box throttle and cooling section design. As liquid temperature is higher, pump is designed for optimum temperature reduction with long thermal barrier and large surface area. No additional cooling is required.

The unique heat dissipation of the bearing housing ensures the low temperature at the seal faces & bearings. The bearings used are factory pre-lubricated (sealed) deep groove ball bearing for life.

4.2 EQUIPMENT OPERATION:

4.2.1 Before starting the pump check the following:

1) The pump rotates freely by hand.
2) Fill the pumping liquid having ambient temperature into bearing housing up to mark shown on side glass by removing plug connection (F). Refer Annexure- I
3) The DE side deep groove ball bearing is factory sealed (sealed bearings); lifetime grease filling at factory. No external lubrication is required
4) The direction of rotation of driver shall be corresponding to the direction of rotation of the pump.
1) The pump casing and the suction pipe line is fully primed with the liquid. If positive suction is available priming is not required.
5) Valve on delivery side is closed.
6) The cock for pressure gauge connection is closed.

4.2.2 Starting the pump

2) Start the pump. Check the direction of rotation of the pump. If direction rotation is correct, Let the prime mover pickup its full speed. Else, change the electrical connections and restart the pump.
3) Open the valve on delivery line gradually.
4) Regulate the required flow by adjusting the delivery valve.
5) Open the cock for pressure gauge connection.
6) Ensure pump is operated at rated total head.

4.2.3 During running of the pump check, ensure the following and also take necessary actions if required.

1) The pump is running smooth.
2) If Leakage through bearing housing is found, stop the pump immediately.
3) The bearings are not getting abnormally hot.
4) Head and capacity developed by the pump is as specified.

5) Power consumption is within limit.

6) Ensure that there is no mechanical friction.

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

4.2.4 during stopping the pump

1) Close the valve on the delivery line.

2) Stop the motor.

3) Do not touch the any part of the pump unless the temperature is reduce upto ambient temperature.

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

Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation from noxious and toxic gases, skin and eye contact or penetration.

Electric shock and accidental starting hazard:

Isolate the equipment before any maintenance work is done. Switch off the mains supply, remove fuses, apply lockouts where applicable and affix suitable isolation warning signs to prevent inadvertent re-connection.

In order to avoid the possibility of maintenance personnel inhaling dangerous fumes or vapours, it is recommended that maintenance work be carried out away from the pump location by removal of the rotating unit assembly to a suitable maintenance area.

5. MAINTENANCE MANUAL:

5.1 MAINTENANCE EHS INSTRUCTIONS:

Following hazards may arise during maintenance work.

 Fluid Pressure Jet Hazards

 Check and ensure that the pump operates at below the maximum Working Pressure specified.

Before attempting any maintenance on a pump, ensure 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. The plant operator should carry this out and a certificate of cleanliness obtained before starting work. To avoid any risk to health it is also advisable to wear protective clothing as recommended by the site safety officer, especially when removing old packing that may be contaminated.

5.1 GENERAL Maintenance DOCUMENTS

Maintenance documents:

a) Pump Sectional assembly drawing with part list
b) Pump Outline dimension drawing
c) Exploded View

Specific Maintenance data:

5.2 **Overhauling:**

With normal daily operating spell, the pump will be due for overhaul after about 5000 working hours. The overhauling of the pump should be done by skilled personnel.

Procedure for dismantling and re-assembly
While dismantling and re-assembly cross sectional assembly drawing and part list should be referred.

Procedure for dismantling and re-assembly

5.2.1 DISMENTALING

Follow the following simple steps to dismantle the pump.

5.2.1.1 Isolate power supply to motor.

5.2.1.2 Shut off valves which for controlling flow to and from the pump.

5.2.1.3 Wait till the all pump and its accessories as well as surrounding system temperature is reached upto ambient.

5.2.1.4 Drain the liquid from pump and bearing housing by removing the drain plug, or open the pump casing drain cock.

5.2.1.5 We recommend matching the punch mark of the coupling halves.

5.2.1.6 In case of the pumps with spacer type flexible couplings, disconnect the 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.

5.2.1.7 Remove the support foot (25100) hold down bolts.

5.2.1.8 Adjust string or chain tension to support the weight of the back pull out assembly.

5.2.1.9 Remove pump half coupling after unscrewing grub screw. Coupling half should be removed with the help of suitable extraction device. To avoid damage to the bearings, coupling half should not be knocked out of shaft.

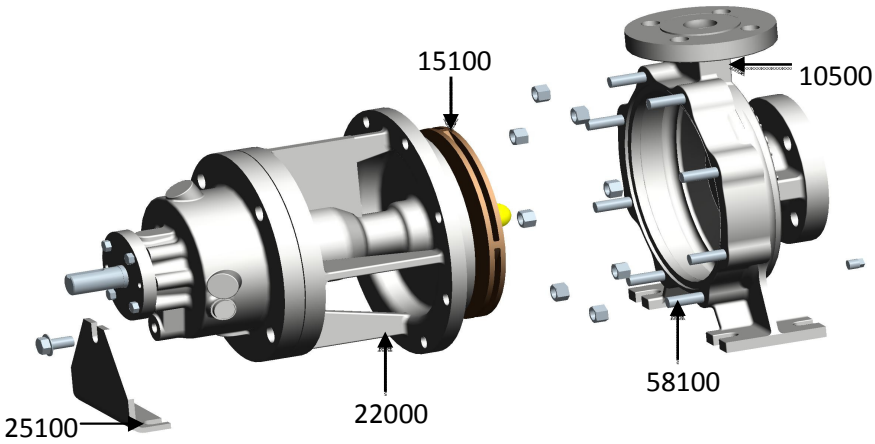
CAUTION

5.2.1.10 Take out coupling key (32100).

5.2.1.11 Remove the hexagonal nuts (58100) from casing stud holding the casing cover (22000) to pump casing (10500).

5.2.1.12 Tighten the release screw provided in casing cover. Turn bolts evenly through a quarter turn at both sides.

5.2.1.13 Slightly pulls out the driving unit till impeller (15100) clears the pump casing (10500)

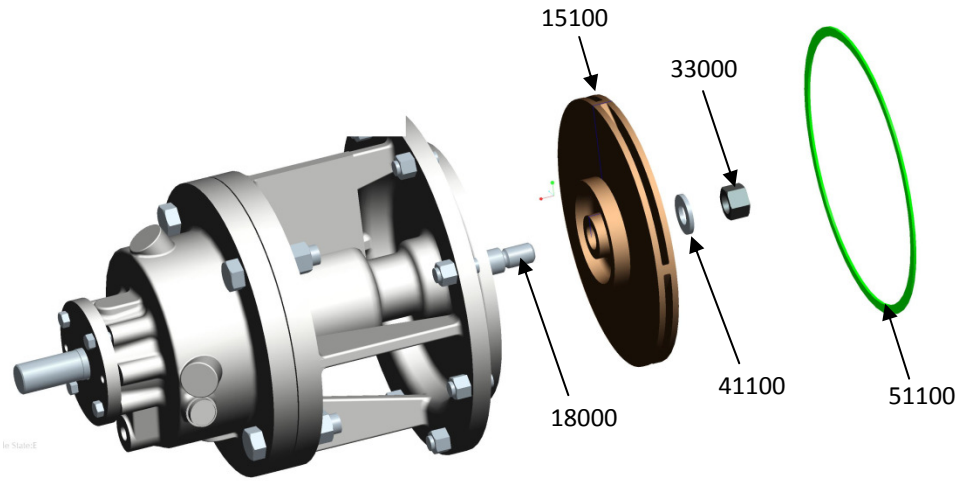


5.2.1.14 Place this rotating unit with casing cover on a table or at clear & clean place for further dismantling.

5.2.1.15 Remove casing gasket (51100) from casing cover (22000).

5.2.1.16 Unscrew the Hex Nut (33000) & Remove spring washer (41100).

5.2.1.17 Take out the impeller (15100) from pump shaft (18000).



5.2.1.18 Removal of Casing cover from bearing housing: For this following steps should be taken:

a) Remove the Hex Nut (58200) and Hex bolts (63100) from casing cover (22000) and bearing housing. (24000)

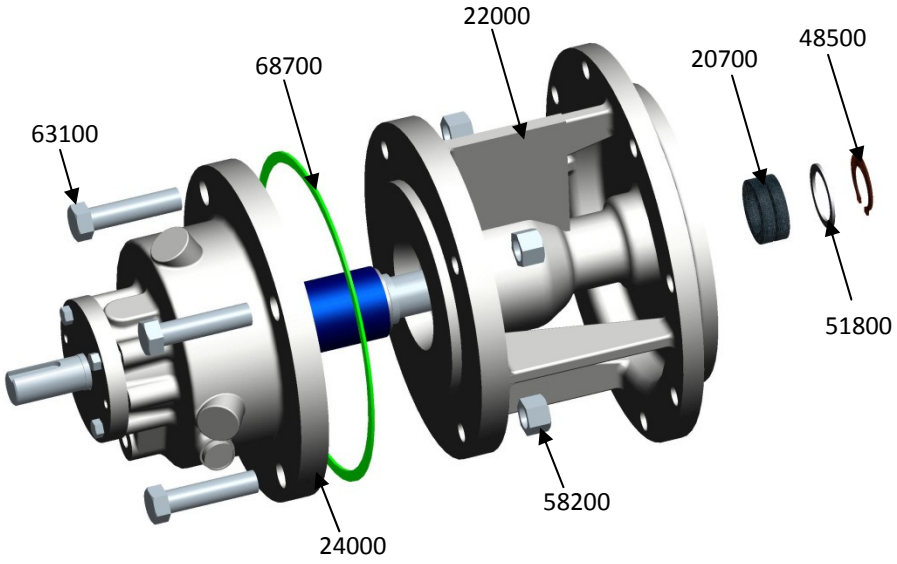
b) Use the removed Hex bolt (63100) to release bearing housing from casing cover.

c) Slightly pullout the driving unit assembly from casing cover.(22000)

d) Remove the Gasket (68700) from bearing housing (24000) and casing cover (22000)

5.2.1.19 Remove the internal circlip (48500) using circlip flyer tool.

5.2.1.20 Remove the spacer (51800) and St. Box packing (20700).



5.2.1.21 Loosen the Hex bolts (63100) holding bearing cover (27000) (driving end) Remove carefully bearing cover.

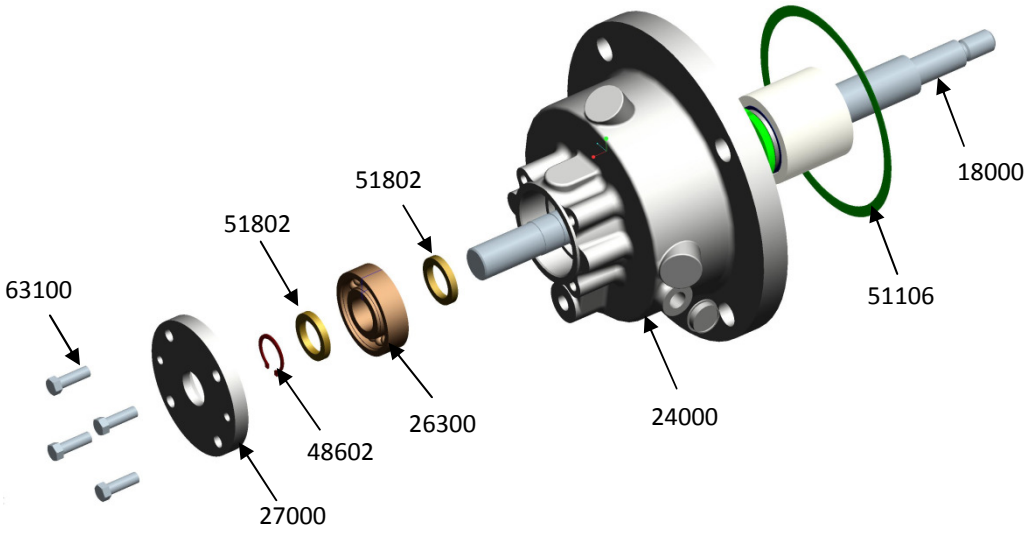
5.2.1.22 Remove the bearing internal circlip (48602) using circlip flyer tool.

5.2.1.23 Remove the washer (51802) from pump shaft (18000)

5.2.1.24 Force pump shaft (18000) carefully in the direction of non-driving end.

5.2.1.25 Remove stationary seal face of mechanical seal carefully and keep safe area being a brittle material.

5.2.1.26 Remove the back washer (51802) and ball bearing (26300) by using rubber or nylon mallet.



5.2.1.27 To dismantle shaft seal arrangement and bearing bush:

a) Remove the mechanical seal assembly (23000) carefully and keep the safe area being rotary face is brittle.

b) Remove the washer (51802) from shaft and remove internal circlip (48602) from shaft using circlip flyer.

c) Remove the bearing lock nut (33600) and Lock washer (41500) from the shaft

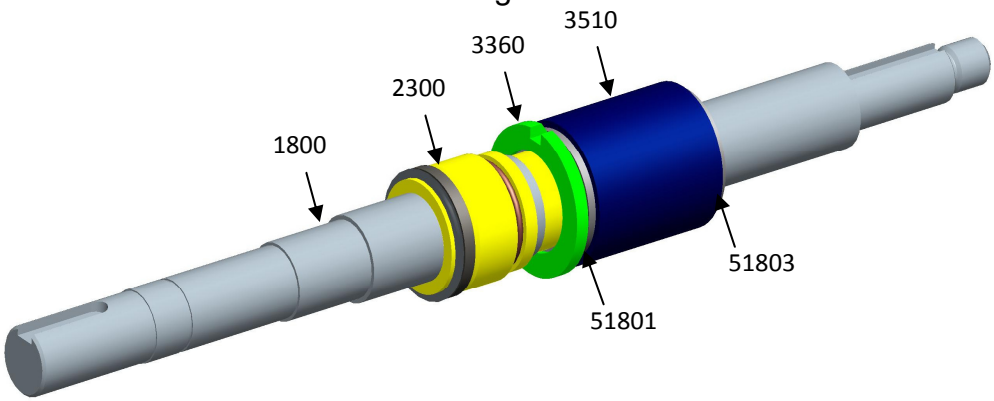
d) Remove the washer (51803) from pump shaft DE side

e) Remove the internal circlip (48603) NDE side from shaft

f) Remove the washer (51803) from pump shaft NDE side

h) Remove the internal bearing bush (35101)

i) Remove the internal tolerance rings from shaft.



CAUTION

Push the internal bearing bush (35100) by manually or on arbour press with uniform pressure.

During and after dismantling:

1. Wash all old grease/oil from ball bearings and housings with kerosene or white spirit and thoroughly dry bearings. Renew them if they do not rotate smoothly with no sign of jamming and freely but with slackness, or if running surfaces of balls show any deterioration. Coat bearing with rust preventive oil and wrap in greaseproof paper.
2. Mount shaft between point centres or on rollers and place stem of dial indicator in contact with the shaft. Set the indicator dial at zero and turn the shaft slowly by hand. Reading at any point must not vary more than 0.05mm.
3. Examine the internal and external sliding bearing bush for wear.
4. Examine the Mechanical seal condition like seal faces, O-rings for wear.

5.2.2 Re-assembly:

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.

5.2.2.1 The assembly of the pump unit is carried out in the reverse order of dismantling.

CAUTION

Use arbour press while fitting the bearings. However it is recommended that ball bearings should be heated in oil bath at temperature 70 to 80^0C and then fitted. (If hot oil bath is not available then ARBOUR PRESS must be used).

a) **Use gloves while fitting bearings from hot oil bath.**

b) Slide inboard ball bearing on bearing housing 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 bearing sealed cap surface while arbour pressing.

5.3 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, circlip flyer, 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.

5.4 PREVENTIVE MAINTENANCE:

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

5.4.1 Daily checks:

5.4.1.1 Hourly record of suction and delivery pressure, discharge quantity input to the pump driver should be maintained.

5.4.1.2 Bearing temperature, seal leakage from bearing housing connection, this gives an idea of mechanical performance of the pump.

5.4.1.3 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.

5.4.2 **Periodical checks:**

5.4.2.1 The temperature of the bearing should be measured by thermometer. Safe maximum working temperature of the bearing is 80°C.

5.4.2.3 Check seal leakage from bearing housing by removing plug (H).

5.4.2.4 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.

5.4.2.5 Sufficient quantity of suitable type of lubricant should be ready for daily and emergency use.

5.4.2.6 Calibrate the measuring instrument.

5.4.3 **Annual checks:**

5.4.4.1 The pump should be overhauled completely to check the clearance and to replace worn-out parts. Clearance between impeller and casing, internal sliding bearing bush and External sliding bearing bush are very important. The bearings should be cleaned thoroughly and lubricated.

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

5.4.4.3 The auxiliary pipelines and functioning of the auxiliary system should be checked. The main pipe also should be checked for scaling, leakage etc.

5.4.4.4 The measuring instruments, gauges etc should be recalibrated.

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

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

5.4.4 **Mechanical Seal**:

The mechanical seal is a precision product having been subjected to quality control throughout all stages of manufacture. The seals are designed to accommodate reasonable tolerances in the equipment, however in order to obtain the maximum life with trouble free performance, the equipment should be adequately maintained.

When mechanical seal is functioning satisfactorily without any leakage, the preventive maintenance is not advocated. If leakage occurs, a through check up is needed. While fitting the mechanical seals in the pump initially by KBL, due care is taken for its proper fitment.

Like other parts in the equipment the mechanical seals are subject to wear at the mating faces of the rotating and stationary ring. The rate of wear will differ with the operating conditions and various other factors such as lubricating property of the liquid pumped, the presence of impurities in liquid and other operating conditions. In view of this no firm recommendations can be given for renewal of seal rings / complete seals.

The mechanical seal is optional feature and supply will be of unbalanced type mechanical seal only and no further operating length adjustments are required.

5.5 **CORRECTIVE MAINTENANCE**

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 referring
the table for 'Break Down Check Points' given at the end of this manual.

6. TECHNICAL DATA:

6.1 Direction of rotation:

The direction of rotation is clockwise when viewed from driving end

6.2 Bearings:

The shaft is supplied with deep groove ball bearing at driving end and sliding bush bearing at non-driving end. The bearing specifications are given below. The designations of bearings are as per SKF catalogue. However, equivalent bearing in type, capacity and dimensions are also used.

BEARING DETAILS:

Driving Unit	Max. Speed (RPM)	Min. Speed (RPM)	Bearing Life (Hrs)	Deep groove Ball Bearing size	
				Driving End	Non driving End
5	2900	980	25000	6305 2Z (1nos.)	As per mfg. specification
7	2900	980	25000	6307 2Z (1nos.)	

6.3 Lubrication:

6.3.1 The bearings used are factory pre-lubricated deep groove ball bearing for life.

6.3.2 The mechanical seal lubrication is lubricated by pumped liquid.

6.4 Stuffing Box:

6.4.1 Stuffing box sealing arrangement-

Self-pumped liquid sealing is standard supply.

6.4.2 Stuffing box packing specification-

GRAFOIL (GRAPHITED) – Graphited garfoil packing is used in the pump as a standard supply which is suitable for higher temperature application.

6.4.3 Stuffing box packing Sizes

Please refer to the following chart for stuffing box packing size

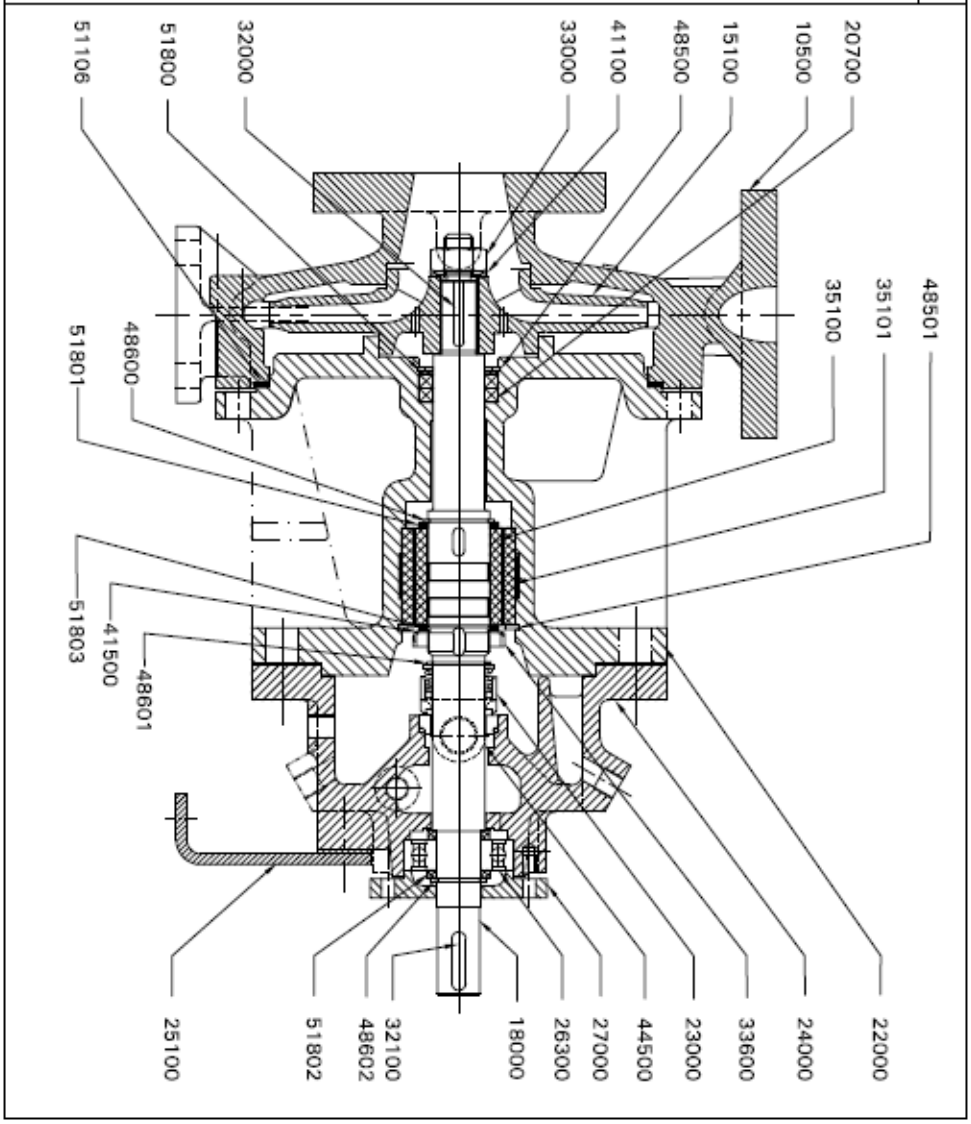
UNIT	STUFFING BOX PACKING SIZE [mm]	QTY
5	29 ID X 45 OD X 8 W	2 nos.
7	42 ID X 62 OD X 10 W	2 nos.

6.4.4 RECOMONDED SPARES:

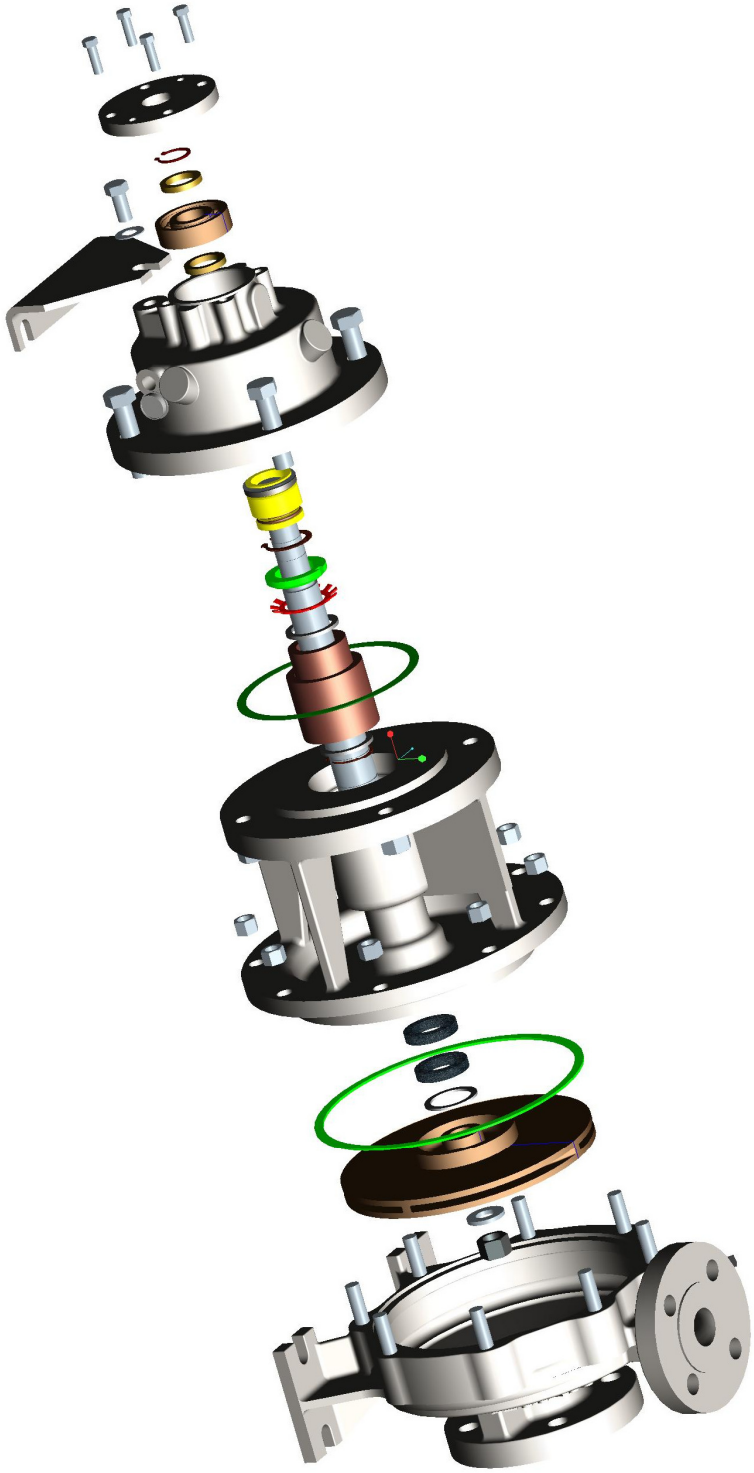
SR. NO.	PART NO.	PART DESCRIPTION	QTY.
1.	15100	ENCLOSED IMPELLER	01.
2.	18000	PUMP SHAFT	01.
3.	20700	ST.BOX PACKING RING	02.
4.	23000	MECHANICAL SEAL	01.
5.	25100	SUPPORT FOOT	01.
6.	26300	BALL BEARING	01.
7.	32000	KEY FOR IMPELLER	01.
8.	33000	HEX NUT FOR IMPELLER	01.
9.	35100	INTERNAL BEARING BUSH	01.
10.	35101	IEXTERNAL BEARING BUSH	01
11.	51106	GASKET FOR PUMP CASING	01.
12.	51700	GASKET FOR SIGHT GLASS	01.
13.	51800	WASHER	01.
14.	51801	WASHER	01.
15.	51802	WASHER	01.
16.	51803	WASHER	01.
17.	68202	GASKET FOR IMP. NUT	01.

7.0 CROSS SECTIONAL DRAWING AND PART DESCRIPTION FOR – AT 32/20 PUMP

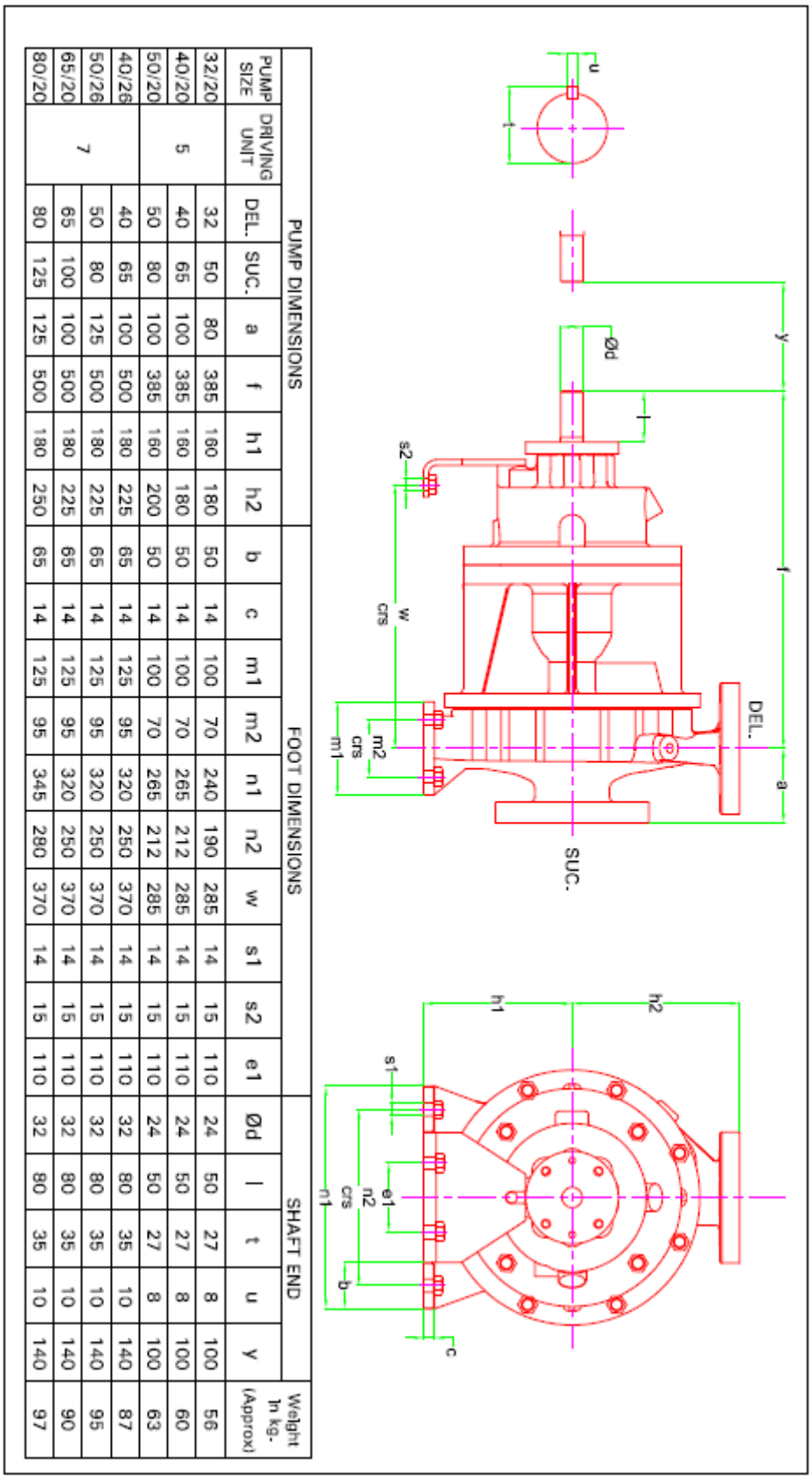
PART NO	QTY.	PART DESCRIPTION
10500	01	PUMP CASING
*15100	01	ENCLOSED IMPELLER
*18000	01	PUMP SHAFT
20700	02	ST.BOX PACKING RING
22000	01	CASING COVER
*23000	01	MECHANICAL SEAL
24000	01	BEARING HOUSING
*25100	01	SUPPORT FOOT
*26300	01	BALL BEARING
27000	01	BEARING COVER D.E.
*32000	01	KEY FOR IMPELLER
32100	01	KEY FOR COUPLING
33000	01	IMPELLER NUT
33600	01	LOCK NUT
35100	01	INTERNAL BEARING BUSH
35101	01	EXTERNAL BEARING BUSH
*41100	01	SPRING WASHER FOR IMP. NUT
41500	01	LOCK WASHER FOR BRG. NUT
44500	01	OIL LEVEL SIGHT GLASS
48500	01	INTERNAL CIRCLIP
48501	01	INTERNAL CIRCLIP
48600	01	EXTERNAL CIRCLIP
48601	01	EXTERNAL CIRCLIP
48602	01	EXTERNAL CIRCLIP
*51106	01	GASKET FOR PUMP CASING
*51800	01	WASHER
*51801	01	WASHER
*51802	02	WASHER
*51803	01	WASHER



8.0 EXPLODED VIEW



9.0 General Outline Dimension



PUMP SIZE	DRIVING UNIT	PUMP DIMENSIONS					FOOT DIMENSIONS								SHAFT END				Weight In kg. (Approx)
		DEL.	SUC.	a	f	h1	h2	b	c	m1	m2	n1	n2	w	s1	s2	e1	Ød	l	t	u	y	
32/20	5	32	50	80	385	160	180	50	14	100	70	240	190	285	14	15	110	24	50	27	8	100	56
40/20		40	65	100	385	160	180	50	14	100	70	265	212	285	14	15	110	24	50	27	8	100	60
50/20		50	80	100	385	160	200	50	14	100	70	265	212	285	14	15	110	24	50	27	8	100	63
40/26	7	40	65	100	500	180	225	65	14	125	95	320	250	370	14	15	110	32	80	35	10	140	87
50/26		50	80	125	500	180	225	65	14	125	95	320	250	370	14	15	110	32	80	35	10	140	95
65/20		65	100	100	500	180	225	65	14	125	95	320	250	370	14	15	110	32	80	35	10	140	90
80/20		80	125	125	500	180	250	65	14	125	95	345	280	370	14	15	110	32	80	35	10	140	97

GENERAL INFORMATION & SAFETY REQUIREMENTS:-

1.1 The products supplied by KBL have been designed with safety in mind. Where hazards cannot be eliminated, the risk has been minimized by the use of guards and other design features. Some hazards cannot be guarded against and the instructions below MUST BE COMPLIED WITH for safe operation. These instructions cannot cover all circumstances; YOU are responsible for using safe working practices at all times.

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

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

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

1.4 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 and maintenance.

1.5 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.

1.6 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 personnel 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.

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

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

1.9 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.

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

1.11 Use suitable earthling and tripping devices for electrical equipments.

1.12 IMPROPER INSTALLATION, OPERATION OR MAINTENANCE 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.

2.0 SAFETY INSTRUCTIONS WHILE HANDLING AND STORAGE

When lifting the pump, use the lifting points specified on general arrangement drawing. Use lifting equipment having a safe working load rating suitable for the weight specified. Use suitable slings for lifting pump which is not provided with

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

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

3.0 SAFETY INSTRUCTIONS WHILE ASSEMBLY & INSTALLATION

Shaft alignment must be checked again after the final positioning of the pump unit and connection to pipe work 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 pipe work may result in distortion of the pump casing, with the possibility of early pump failure.

4.0 SAFETY INSTRUCTIONS WHILE COMMISSIONING & OPERATION.

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

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

Check that the pump is primed. Pump should never be run dry as the pumped liquid acts, as lubricant for the close running fits surrounding impeller and damage will be incurred.

Failure to supply the stuffing box or mechanical seal with cooling of flush water may result in damage and premature failure of the pump.

Do not touch surfaces which during normal running will be sufficiently hot to cause injury. Note that these surfaces will remain hot after the pump has stopped; allow sufficient time for cooling before maintenance. Be cautious and note that other parts of the pump may become hot if a fault is developing.

Do not operate water pumps in temperatures below freezing point, without first checking that the pumped fluid is not frozen and the pump is free to turn. Pumps in these environments should be drained down during inactivity and re-primed before starting.

In addition to local or site regulations for noise protection, KBL recommend the use of personal ear protection equipment in all enclosed pump rooms and particularly those containing diesel engines. Care must be taken to ensure that any audible alarm or warning signal can be heard with ear defenders worn.

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

5.0 SAFETY INSTRUCTIONS WHILE MAINTENANCE & SERVICING

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 vapors locations by removal of bearing housing and shaft assembly to a suitable maintenance area.

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

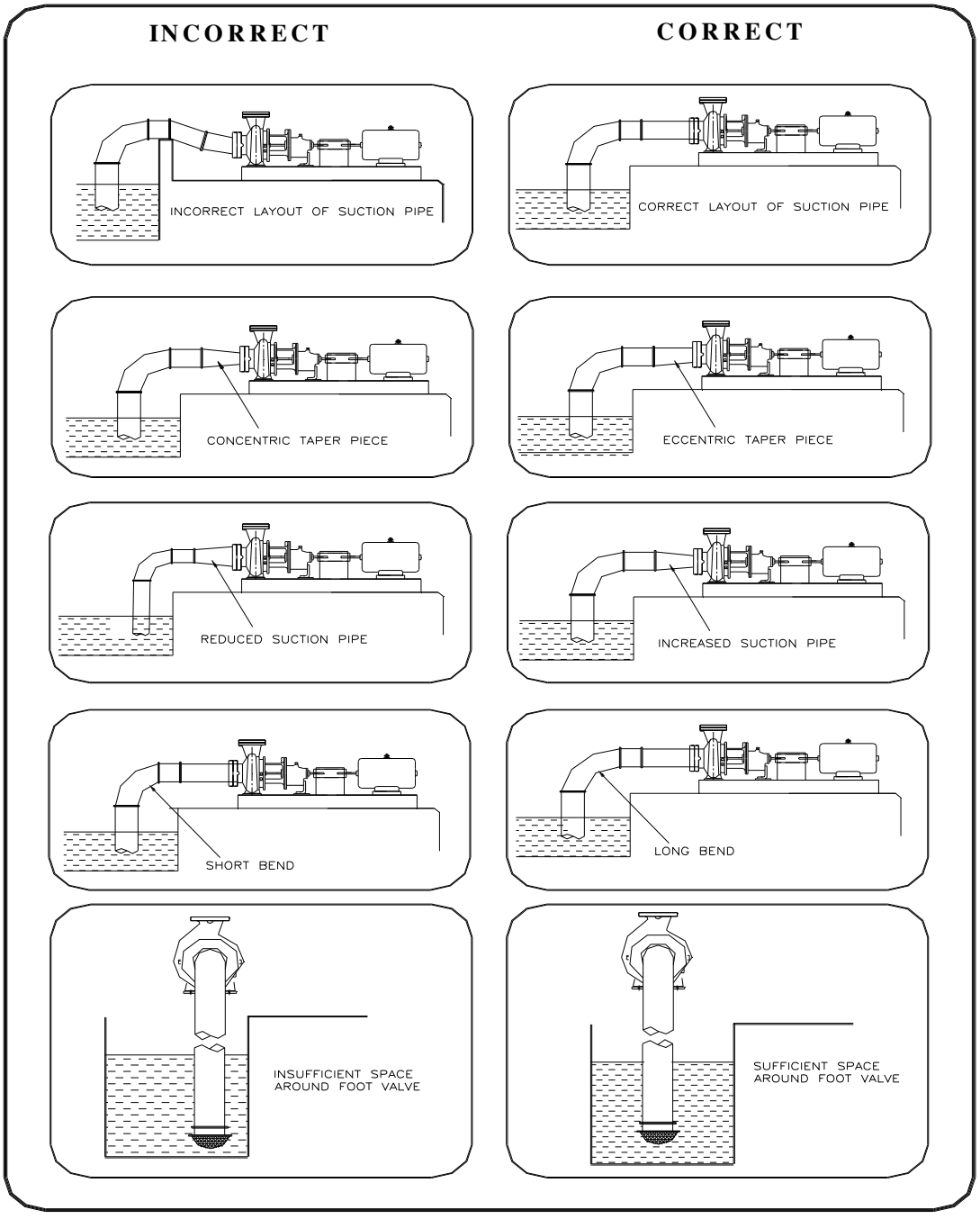
Wear a suitable mask or respirator when working with packing and gasket components which contain fibrous material, as these can be hazardous when the fibrous dust is inhaled. Be cautious, if other supplier' s components have been substituted for genuine KBL parts, these may then contain hazardous materials.

Store all oily rags or other flammable material in a protective container in a safe place. Does not weld or flame cut on pipes/tubes that 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 polymerized material.

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

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



WARNING

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

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.

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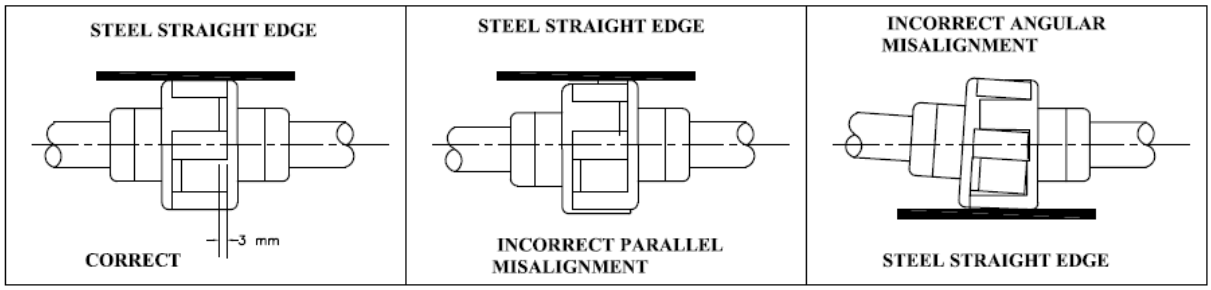
1) Angular misalignment – shaft with axis concentric, but not parallel.

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.

F**LEXIBLE 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.

G**ROUTING**

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:

e) Setting, seasoning of the foundation.
f) Pipe strains distorting or shifting the machines.
g) 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.

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 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.

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.

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.

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

B**e**fore stopping the pump; close the gate valve. This will prevent water hammer on the check valve.

STUFFING BOXES (only for gland packed pump)

D o 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.

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

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. Lantern ring in the stuffing box is not positioned below the sealing liquid Inlet.
24. Packing incorrectly fitted.
25. Gland tightened too much/slanted.
26. Packing not suitable for operating conditions.
27. Shaft sleeve worn in the region of the packing.
28. Bearing worn out.
29. Insufficient lubrication of bearings.
30. Ball bearings over-lubricated.
31. Oil/Grease quality unsuitable.
32. Ball bearing incorrectly fitted.
33. Axial stress on ball bearings (no axial clearance for rotor).
34. Bearings dirty.
35. Bearings rusty (corroded).
36. Axial thrust too great because of worn casing rings, relief holes obstructed.
37. Insufficient cooling water supply to stuffing box cooling.
38. Sediment in the cooling water chamber of the stuffing box cooling.
39. Alignment of coupling faulty or coupling loose.
40. Elastic element of coupling worn.
41. Pump casing under stress.
42. Pipeline under stress.
43. Shaft runs untrue.

44. Shaft bent.
45. Rotor parts insufficiently balanced.
46. Rotor parts touching the casing.
47. Vibration of pipe work.
48. Non-return valve gets caught.
49. Contaminated delivery liquid.
50. Obstruction in delivery line.
51. Delivery flow too great.
52. Pump unsuitable for parallel operation.
53. Type of pump unsuitable.
54. Incorrect choice of pump for existing operating conditions.
55. Voltage too low/power supply overloaded.
56. Short circuit in the motor.
57. Setting of starter of motor too high.
58. Temperature delivery liquid too high.

Enriching Lives

KIRLOSKAR BROTHERS LIMITED

A Kirloskar Group Company
Established 1888

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