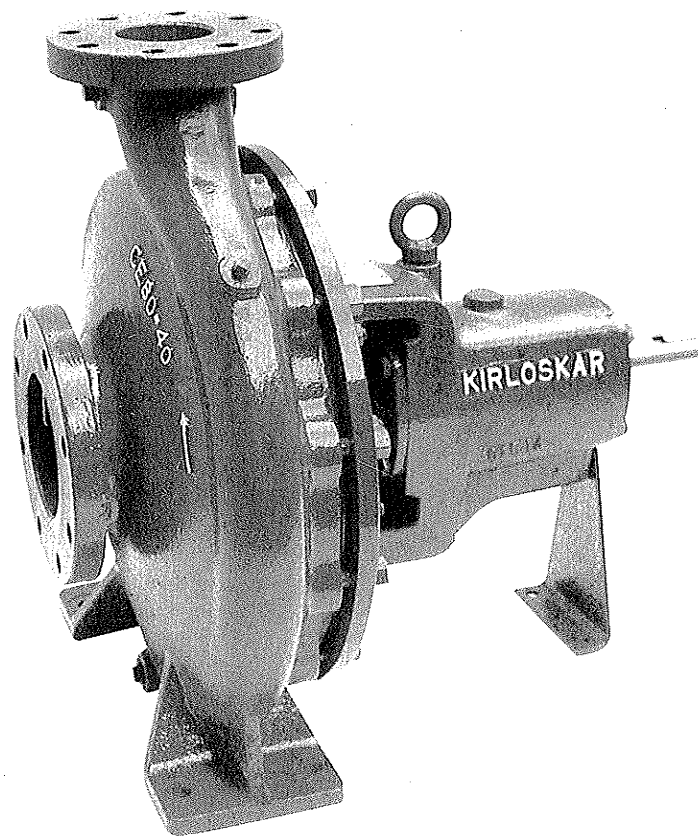


# INSTRUCTIONS ON INSTALLATION, OPERATION AND MAINTENANCE FOR KIRLOSKAR PUMP **TYPE CE**



Enriching Lives



**KIRLOSKAR BROTHERS LIMITED**

UDYOG BHAVAN, TILAK ROAD, PUNE - 411 002

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

## **KIRLOSKAR BROTHERS LIMITED**

CORPORATE OFFICE : UDYOG BHAVAN, TILAK ROAD PUNE 411 002. (INDIA)

### **W A R R A N T Y**

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

**- KIRLOSKAR BROTHERS LIMITED**

## **C O N T E N T S**

1. GENERAL.
2. INSTALLATION.
3. OPERATION.
4. TECHNICAL DATA.
5. MAINTENANCE.
6. OVERHAULING.
7. SPARE PARTS LIST AND  
CROSS SECTIONAL DRAWINGS.

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

## **1. GENERAL :**

- 1.1 The booklet covers instructions for following models of CE pumps.

### **UNIT CE PUMP MODELS**

UNIT-3032/13, 40/13, 50/13, 65/13, 32/16, 40/16, 50/16, 32/20, 40/20.

UNIT-40A 65/16, 80/16, 50/20, 65/20, 40/26, 50/26.

UNIT-40B 100/16, 80/20, 100/20, 65/26, 80/26, 50/32, 65/32[C].

UNIT-50125/20, 100/26, 125/26, 65/32, 80/32, 100/32, 125/32, 80/40, 100/40.

- 1.2 KIRLOSKAR CE pumps are of back pull out design which enables to remove the rotating unit of pump for inspection and repairs without disturbing the pipe connections.
- 1.3 The complete range of CE pump is covered by Four driving units thereby reducing inventory and achieving interchangeability of parts.
- 1.4 Pumps when properly installed and given due care in operation and maintenance should operate satisfactorily for a long period.
- 1.5 When the pump is received, sometime before the actual use of pump it should be inspected and located in dry place. The coupling should be rotated once in a month to prevent pitting of bearing surfaces.

## **2. INSTALLATION :**

- 2.1 For location, preparing foundation, installations, alignment, general maintenance, trouble shooting etc the instruction given in our publication "General instructions for installation, operation and maintenance of Centrifugal Pumps" which is printed with this booklet must be followed carefully.
- 2.2 The external sealing connection to the pump, if applicable, must be made after installing and before commissioning the pump.
- 2.3 The vacuum equalising connection should be made if the pump suction is under vacuum conditions.

## **3. OPERATION :**

- 3.1 Before starting the pump – Check the following.
- 3.1.1 The pump rotates freely by hand.
- 3.1.2 Sealing connection, if any, is properly tightened and adjusted.
- 3.1.3 Fill in the grease for bearings, if not done earlier. The bearings are packed with grease initially at the factory. However, if the pump is stored for a longer time it is necessary to refill the grease in bearings.
- 3.1.4 The direction of rotation of motor corresponds to the direction of rotation of the pump.
- 3.1.5 The pump and suction pipe is fully primed with the liquid.
- 3.1.6 Valve on the delivery side is closed.
- 3.1.7 Stuffing box packing is properly tightened.
- 3.1.8 The cock for pressure gauge connection is closed.

### 3.2 Starting the pump –

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

3.2.2 Open the valve on delivery side slowly.

3.2.3 Open the cock for pressure gauge connection.

### 3.3 During running the pump –

Check the following and regulate, if necessary.

3.3.1 The pump is running smooth.

3.3.2 The flow of sealing liquid [if external liquid is provided for sealing purpose] is uninterrupted.

3.3.3 Leakage through stuffing box is normal. There should be leakage of 60-80 drops per minute.

3.3.4 The bearings not getting heated-up excessively.

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

### 4.1 Bearings :

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

Sr. No.	PUMP UNIT	BEARING No. SKF OR EQUIV.	
		DE	NDE
1.	UNIT-30	6306	6306
2.	UNIT-40A	6308	6308
3.	UNIT-40B	6308	6308
4.	UNIT-50	6310	6310

### 4.2 Lubrication :

4.2.1 Bearings are grease lubricated. Bearings are initially lubricated during assembly of pump at our factory. The regreasing should be done after every 100 hours of running. To recharge the bearings with fresh grease, use a grease gun through the two nipples provided. DO NOT APPLY LUBRICANT WHEN PUMP IS RUNNING.

4.2.2 Pumps are also supplied with oil lubricated bearings against specific orders.

4.2.3 Following lubricant grades available in the market are suitable.

#### [ A ] GREASE :

NAME.	GREASE SPECIFICATION	
	SPEED 1450 RPM	SPEED 2900 RPM
INDIAN OIL	SERVOGEN-3	SERVOGEM-2
CALTEX	STARFAK-3	STARFAK-2
HINDUSTAN	NATRA-3 OR	NATRA-2 OR
PETROLEUM	LITHON-3	LITHON-2

## [ B ] OIL :

INDIAN OIL	SERVO SYSTEM 100	SERVO SYSTEM 68
HINDUSTAN PETROLEUM	ENKLO-57	ENKLO-53

### 4.3 Stuffing box :

#### 4.3.1 Stuffing box sealing arrangement –

Self liquid sealing is standard supply. External liquid seal arrangement can be provided on request.

#### 4.3.2 Stuffing box packing specification –

Champion type 3116 – Graphited cotton greasy packing is used in the pump as a standard supply. However, stuffing box packing suitable for liquid handled is supplied against specific requirements.

#### 4.3.3 Stuffing box packing and lantern ring –

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

UNIT	STUFFING BOX PACKING [ MM ]	LENGTH OF PACKING [MM]	PACKING ARRANGEMENT AND POSITION OF LANTERN RING [L] FROM IMPELLER SIDE.
30	8.5	510	2 + L + 2
40A	10	650	2 + L + 2
40B	10	650	2 + L + 2
50	10	840	2 + L + 2

## 5. MAINTENANCE :

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

### 5.1 Daily checks –

#### 5.1.1 Pressure gauge reading.

#### 5.1.2 Bearing temperature.

#### 5.1.3 Leakage through stuffing box.

#### 5.1.4 Noise and vibration.

#### 5.1.5 Voltage and current.

#### 5.1.6 Constant flow of external sealing liquid if provided.

## **5.2 Periodical maintenance –**

- 5.2.1 Replenish the grease.
- 5.2.2 Change the stuffing box packing.
- 5.2.3 Check the alignment of the pumpset.
- 5.2.4 Calibrate the measuring instruments.
- 5.2.5 Check the sealing connections for leakage etc.

## **6. OVERHAULING :**

### **6.1 General –**

- 6.1.1 If the pump has been maintained and serviced carefully, breakdowns which necessitate the pump being dismantled should not occur often.
- 6.1.2 If fault occurs, cause should be located, if possible, before dismantling [see "check points" under enclosed trouble shooting chart].
- 6.1.3 If the pump is being dismantled, all parts must be carefully handled, avoiding blows and shocks.
- 6.1.4 All parts must be carefully cleaned and tested for wear. Recondition or replace parts where necessary.
- 6.1.5 Where new joints are made, correct thickness must be maintained.
- 6.1.6 After reassembly, the rotor must turn easily by hand, otherwise premature damage may occur.

WITH NORMAL DAILY OPERATING SPELL, THE PUMP WILL DUE FOR OVERHAUL AFTER ABOUT 5000 WORKING HOURS. THIS WORK SHOULD BE DONE BY SKILLED PERSONNEL.

## **6.2 Dismantling –**

### **6.2.1 General –**

- a. When dismantling the pump, the volute casing can remain fastened to the base plate and mounted in the pipe work, providing the foundation bolts in support foot are of the "loose bolt" type.
- b. When using a spacer coupling, the driver need not be removed.
- c. Match-marking of parts is recommended before removing spacer. This ensures original state of mounting on reassembly.
- d. Suitable extraction devices are to be used when removing and mounting coupling halves.
- e. To avoid damage to bearings, the coupling halves must not be knocked on or off the shaft.

### **6.2.2 To remove impeller –**

- a. Drain liquid from the casing [105] by removing plug [601].
- b. For units with a spacer coupling, removing the spacer, otherwise disconnect and remove the motor. Undo fixing screws securing support foot [251] to base plate.



- c. If fitted, disconnect the sealing liquid lines.
- d. Unscrew nuts from the pump casing studs.
- e. Remove the casing cover[220] and the bearing housing or frame [240] complete with rotor, using screw-drivers or similar tools which will fit into the gap between the pump casing[105] and the casing cover[220].
- f. After undoing the impeller nut [330] in a anticlockwise direction, the impeller[151] can be pulled off and impeller key[320] removed.

### 6.2.3 To dismantle shaft seal arrangement –

- a. Clamped casing cover units – The following pumps sizes come with this arrangement.

32/13	40/13	50/13	65/13			
			65/16	80/16	100/16	
			80/20	100/20		
				125/20	100/26	125/26

- b. Soft packed pumps – remove gland nuts and withdraw gland [223]. Unpack stuffing box. Remove impeller[151] as above. Remove casing cover [220] from the bearing housing. Draw shaft sleeve [311] off end of shaft [180].

- c. Bolted casing cover units – The following pump sizes come within this arrangement.

32/16	40/16	50/16				
32/20	40/20	50/20	65/20			
40/26	50/26	65/26	80/26			
	50/32	65/32	80/32	100/32	125/32	
				80/40	100/40	

- d. Soft packed pumps – Remove gland nuts and withdraw gland [223]. Unpack stuffing box. Remove impeller [151] as above. Remove casing cover nuts and draw casing cover from the bearing housing [240], disengaging spigot and recess. Draw shaft sleeve [311] off end of shaft [180].

### 6.2.4 To dismantle bearing –

- a. Follow section 6.2.1, 6.2.2 and 6.2.3 above as appropriate.
- b. Pull deflector [236] off end of shaft [180].
- c. Remove coupling and coupling key [321] from shaft [180].
- d. Remove screws for bearing cover and draw DE bearing cover [270] out of bearing housing [240] and off end of shaft.
- e. Carefully remove the bearing housing circlip ring [485].
- f. The pump shaft [180] can now be carefully driven with its bearings out of the bearing housing [240], in the direction of the drive end, for the DE bearing [260] to just clear the bearing housing [240].
- g. The second bearing housing circlip ring [485] can now be removed.

- h. The NDE bearing [260] can be pressed through the end of the bearing housing. Care must be taken to ensure the bearing passes centrally through the bore of the bearing housing.
- i. NDE bearing [260] can be pressed off impeller end of shaft [180].
- j. DE bearing [260] can be pressed off drive end of shaft [180], after the careful removal of the shaft circlip ring [480].

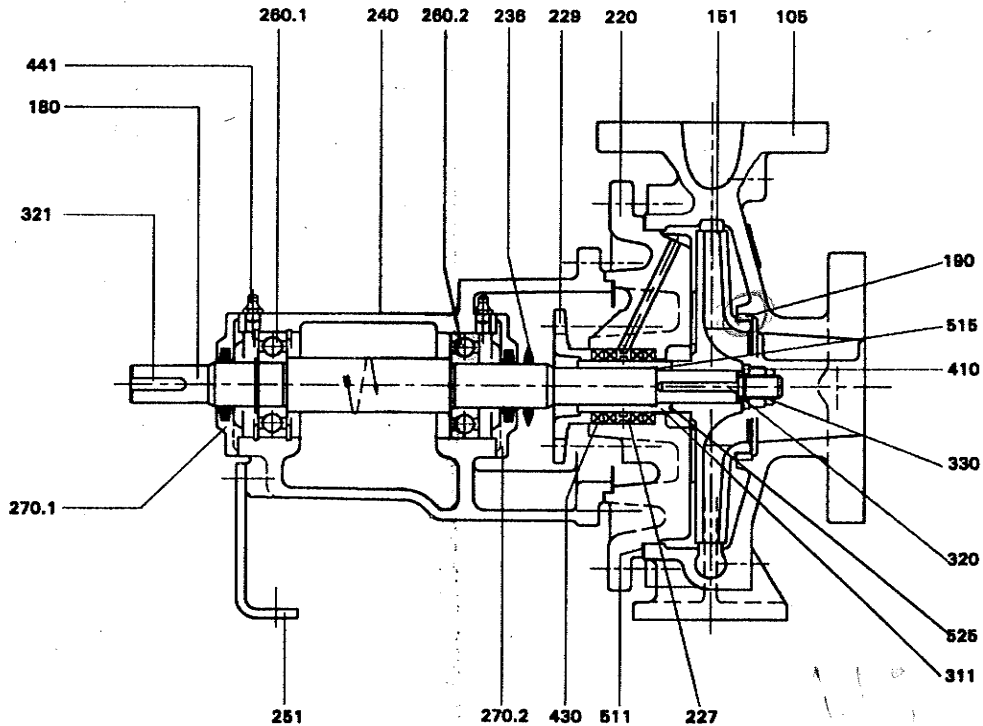
### **6.3 During and after dismantling –**

- 6.3.1 Wash all old grease 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 without slackness, or if running surfaces of balls show any deterioration. Coat bearings with rust preventive oil and wrap in greaseproof paper.
- 6.3.2 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 0.05 mm.
- 6.3.3 Examine shaft sleeve for wear and check for true. It is important that the surfaces of the sleeve, which run in the stuffing box, against soft packing, are concentric and not scored or damaged. If true of shaft is satisfactory, remount the shaft as in 6.3.2 above, but with the sleeve fitted and check for true with dial indicator. Indicator readings must not vary more than 0.08 mm.

### **6.4 Re-assembly –**

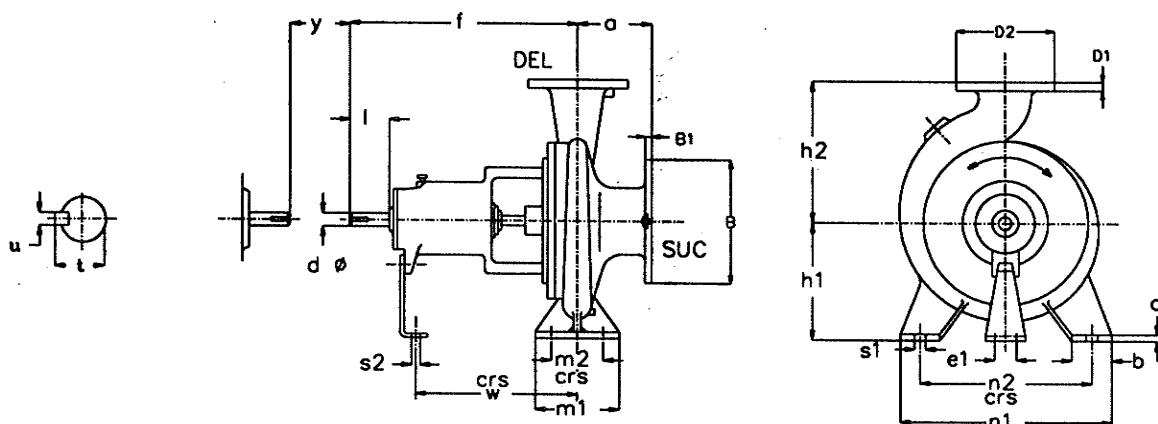
- 6.4.1 Ensure that all parts to be refitted [especially new parts] are free from burrs, with screw threads and abutting faces clean and free from damage.
  - 6.4.2 The assembly of the pump unit is carried out in the reverse order of dismantling.
  - 6.4.3 If the shaft is to be fitted with new bearings, it is necessary to warm these to a temperature of 80°C. The bearings must locate against the shoulders of the shaft.
  - 6.4.4 Prior to assembly of bearings, they should be packed with clean, good quality lubricating grease [see Lubrication Section]. DE and NDE bearing covers [270] should also be lightly packed with grease, before sliding over shaft end, locating and securing to bearing housing [240].
  - 6.4.5 When assembling the shaft, ensure a new length of PTFE cord is fitted as shaft sealant [525] in sleeve [311] end groove.
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# CROSS-SECTIONAL DRAWING OF 'CE' PUMP



PART	DESCRIPTION	PART	DESCRIPTION
105	PUMP CASING	320	KEY FOR IMPELLER
151	ENCLOSED IMPELLER	321	KEY FOR COUPLING
180	PUMP SHAFT	330	IMPELLER NUT
190	CASING WEAR RING	410	WASHER FOR IMPELLER NUT
220	CASING COVER	430	GLAND PACKING
227	LANTERN RING	441	GREASE NIPPLE
229	GLAND	511	GASKET FOR CASING COVER
236	LIQUID DEFLECTOR	515	GASKET FOR SHAFT SLEEVE & SHAFT
240	BEARING HOUSING	525	'V' RING FOR SLEEVE & IMPELLER
251	SUPPORT FOOT		
260	DEEP GROOVE BALL BEARING		
270	BEARING COVER		
311	SHAFT SLEEVE		

# GENERAL OUTLINE DIMENSIONS DRAWING OF 'CE' PUMPS



PUMP SIZE	DRIVING UNIT	PUMP DIMENSIONS						FOOT DIMENSIONS										SHAFT END							
		DEL	SUC	a	f	h1	h2	b	c	m1	m2	n1	n2	w	s1	s2	e1	d	l	t	u	y			
32/13	30	32	50	80	385	112	140	50	14	100	70	190	140	285	14	15	110	24	50	27	8	100			
32/16						132	160					240	190												
32/20						160	180					210	160												
40/13		40	65	100		112	140					240	190												
40/16						132	160					240	190												
40/20						160	180					265	212												
50/13		50	80			132	160					240	190												
50/16						160	180					265	212												
65/13						65	100					160	180										65	125	95
40/26	40A	40	65		100	500	180	225	65	14	125	95	320	250	370	14	15	110	32	80	35	10	140		
50/20		50	80				160	200	65		125	95	265	212											
50/26							180	225	65		125	95	320	250											
65/16		65	100	160	200		280	212																	
65/20				180	225		320	250																	
80/16		80	125	125	180		225	320		250															
50/32	40B	50	80	125	500		225	280	65	14	125	95	345	280	370	14	15	110	32	80	35	10	140		
65/26		65	100	125			200	250	80	16	160	120	360	280		18									
80/20		80	125	125			180	250	65	14	125	95	345	280		14									
80/26		80	125	125		225	280	80	16	160	120	400	315	18											
100/16		100	125	150		225	280	65	14	125	95	320	250	14											
100/20		100	125	125		200	280	80	16	160	120	360	280	18											
65/32	50	65	100	125	530	225	280	80	16	160	120	400	315	370	18	15	110	42	110	45	12	140			
80/32		80	125	125		250	315					435	355												
80/40				125		280	355					400	315												
100/26				140		225	280					400	315												
100/32		100	125			250	315					500	400												
100/40						280	355					100	18										200	150	500
125/20						250	315	80	16	160	120	400	315												
125/26		125	150	140		530	250	355	80	16	160	120	400										315	18	
125/32							280	100	18	200	150	500	400										23		

## GENERAL INFORMATION & SAFETY INSTRUCTIONS

- 1.0) The products supplied by KBL have been designed with safety in mind. Where hazards cannot be eliminated, the risk has been minimised by the use of guards and other design features. Some hazards cannot be guarded against and the instructions below **MUST BE COMPLIED WITH** for safe operation. These instructions cannot cover all circumstances. Installation, operation & maintenance personnel must use safe working practices at all the times.
- 1.1) KBL products are designed for installation in designated areas, which are to be kept clean and free of obstructions that may restrict safe access to the controls and maintenance access points.

A Pump Duty Nameplate is fitted to each unit and must not be removed. Loss of this plate could make identification impossible. This in turn could affect safety and cause difficulty in obtaining spare parts. If accidental loss or damage occur, contact KBL immediately.
- 1.2) Access to the- equipment should be restricted to the person not responsible for installation, operation and maintenance and they must be trained, adequately qualified and supplied with appropriate tools for their respective tasks.
- 1.3) Most accidents involving product operation, maintenance and repair are caused by failure to observe safety rules or precautions. An accident can often be avoided by recognizing potentially situations before an accident occurs. A person must be aware of potential hazard associated in activities of installation, operation & maintenance of equipments.
- 1.4) KBL requires that, all personnel that are responsible for installation, operation or maintenance of the equipment, have access to and study the product instruction manual **BEFORE** any work is done and that they will comply with all local and industry based safety instructions and regulations.
- 1.5) Ear defenders should be worn where the specified Equipment noise level exceeds locally defined safe Levels. Safety glasses or goggles or face shield should be worn where working with pressurised systems and hazardous substances. Other personal protection equipment must be worn where local rules apply. Wear safety shoes, helmets and cotton overalls (Apron) when you enter pump house. Noise level should not exceed 90 dbA and 110 dbA for motor driven and engine driven pumps respectively.
- 1.6) Do not wear loose clothing or jewelry, which could catch on the controls or become trapped in the equipment.
- 1.7) Read the instruction manual before installation, operation or maintenance of the equipment. Check and confirm that the manual is relevant copy by comparing pump type on the nameplate and with that on the manual.
- 1.8) Note the 'Limits of product application permissible use' specified in the manual. Operation of the equipment beyond these limits will increase the risk from hazards noted below and may lead to premature and hazardous pump failure.
- 1.9) Clear and easy access to all controls, gauges and dials etc. must be maintained at all times. Hazardous or flammable materials must not be stored in pump rooms unless safe areas or racking and suitable container, have been provided.
- 1.10) Use suitable earthing and tripping devices for electrical equipments.
- 2.1) **IMPROPER INSTALLATION, OPERATION, MAINTENANCE, LUBRICATION, REPAIR OF THIS KBL PRODUCT COULD RESULT IN INJURY OR DEATH.**

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

### **3.0) SAFETY INSTRUCTIONS WHILE HANDLING AND STORAGE**

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

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

### **4.0) SAFETY INSTRUCTIONS WHILE ASSEMBLY & INSTALLATION**

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

### **5.0) SAFETY INSTRUCTIONS WHILE COMMISSIONING & OPERATION**

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

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

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

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

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

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

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

## 6.0) SAFETY INSTRUCTIONS WHILE MAINTENANCE & SERVICING

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

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

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

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

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

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

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

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

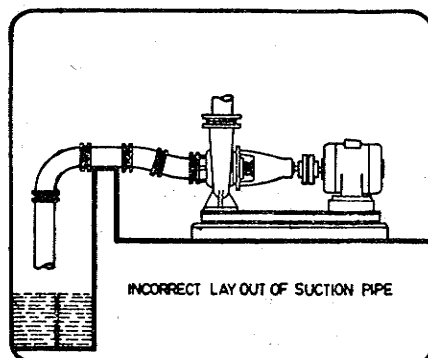
Adequacy of suitable crane should be checked before lifting the pump/pump components. Also condition of pulleys, chain and lifting shackles should be checked before use.



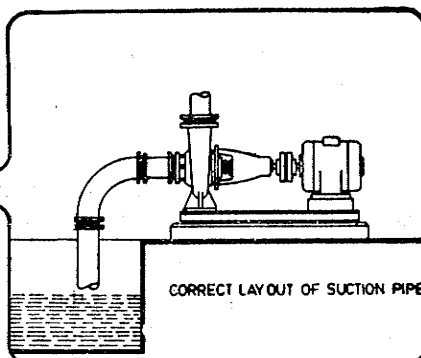
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INCORRECT

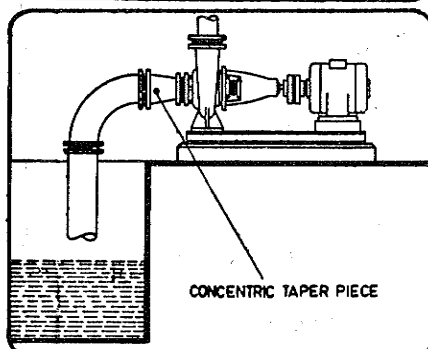
CORRECT



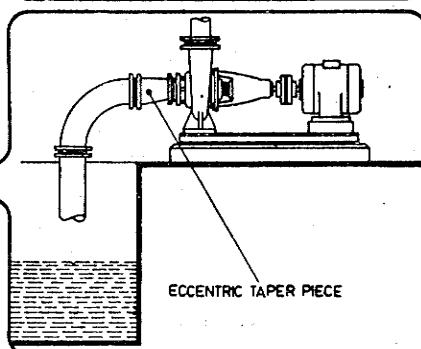
INCORRECT LAY OUT OF SUCTION PIPE



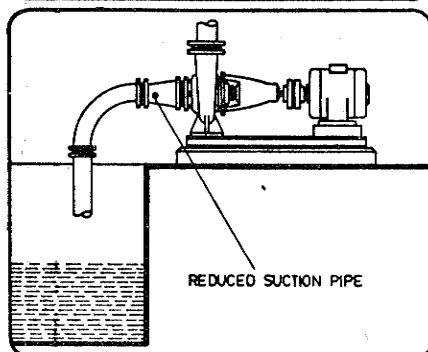
CORRECT LAY OUT OF SUCTION PIPE



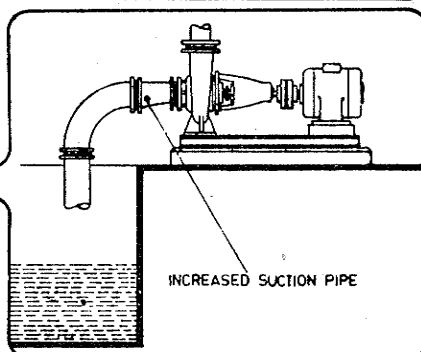
CONCENTRIC TAPER PIECE



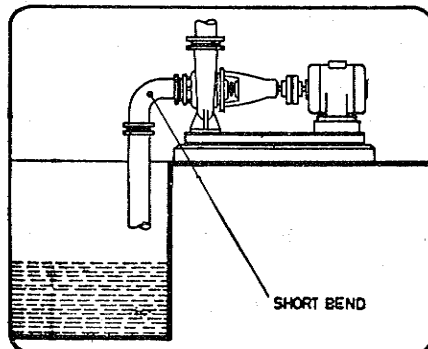
ECCENTRIC TAPER PIECE



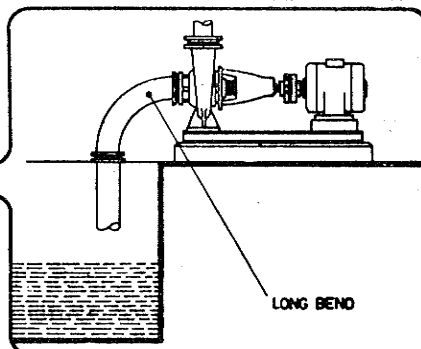
REDUCED SUCTION PIPE



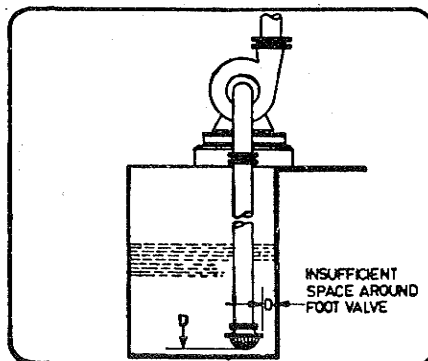
INCREASED SUCTION PIPE



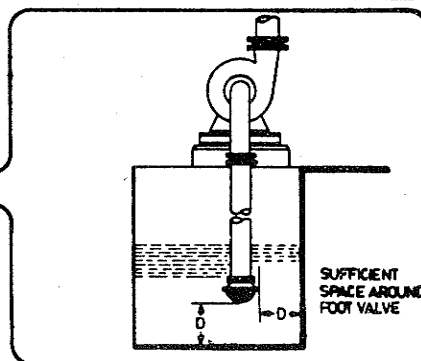
SHORT BEND



LONG BEND



INSUFFICIENT SPACE AROUND FOOT VALVE



SUFFICIENT SPACE AROUND FOOT VALVE

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

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



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

## WARNING

The equipment supplied is designed for specific capacity, speed, pressure and temperature. Do not use the equipment beyond the capacities for which it is manufactured. The equipment manufactured is also shop tested for the satisfactory performance and if it is operated in excess of the conditions for which it is manufactured, the equipment will be subject to excessive stresses and strains.

## LOCATION

The pump should be located as near the liquid source as possible. This will minimise the suction lift and pump will give better performance.

Ample space should be provided on all the sides so that the pump can be inspected while in operation and can be serviced conveniently whenever required.

## FOUNDATION

The foundation should be sufficiently substantial to absorb any vibration and to form a permanent rigid support for the base plate. This is important in maintaining the alignment of a direct connected unit. A concrete foundation on a solid base is advisable. Foundation bolts of the proper size should be embedded in the concrete located by a drawing or template. A pipe sleeve about two and one-half diameter larger than the bolt should be used to allow movement for the final position of the foundation bolts.

## ALIGNMENT

Pumps and drivers that are supplied by the manufacturers, mounted on a common base plate are accurately aligned before despatch. However as the alignments are likely to be disturbed during transit to some extent and therefore must not be relied upon to maintain the factory alignment. Re-alignment is necessary after the complete unit has been levelled on the foundation and again after the grout has been set and foundation bolts have been tightened. The alignment must be checked after the unit is piped up and re-checked periodically.

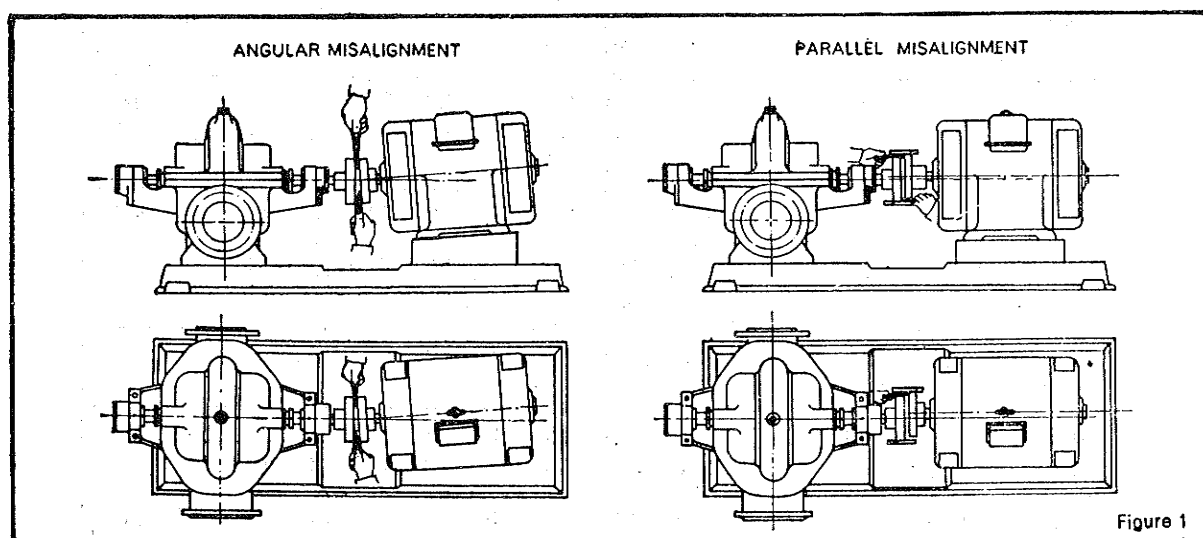
## FLEXIBLE COUPLING

A flexible coupling will not compensate for misalignment of the pump and driver shafts. The purpose of the flexible coupling is to compensate for temperature changes and to permit the movement of the shafts without interference with each other while transmitting power from the driver to the pump.

## TYPE OF MISALIGNMENT (SEE FIGURE 1)

There are two types of misalignment between the pump shaft and the driver shaft.

- (a) Angular misalignment : Shafts with axis concentric but not Parallel.
- (b) Parallel misalignment : Shafts with axis Parallel but not concentric.



## LEVELLING THE UNIT

When the unit is received with the pump and driver mounted on the base plate, it should be placed on the foundation and the coupling halves disconnected. The coupling should not be reconnected until all alignment operations have been completed. The base plate must be supported evenly on wedges inserted under the four corners so that it will not be distorted or sprung by the uneven distribution of the weight. Adjust the wedges until the shafts of the pump and driver are in level. Check the coupling faces, suction and discharge flanges for the horizontal or vertical position by means of spirit level.

## FLEXIBLE COUPLING ALIGNMENT (SEE FIGURE 2)

The two halves of the coupling should be at least 4 mm apart so that they cannot touch each other when the driver shaft is rotated. Necessary tools for approximately checking are straight-edge and on an outside caliper.

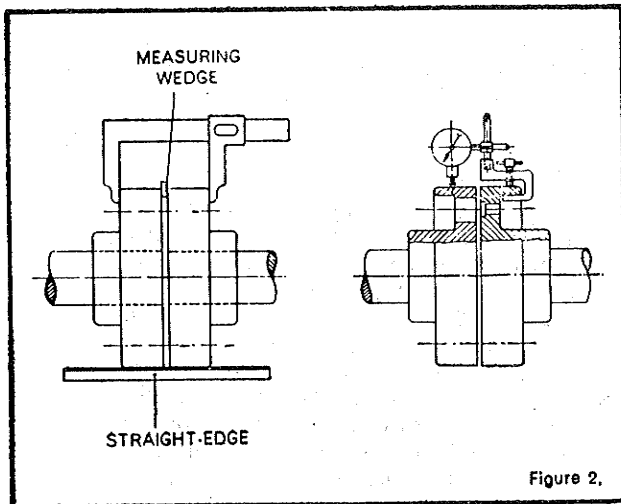
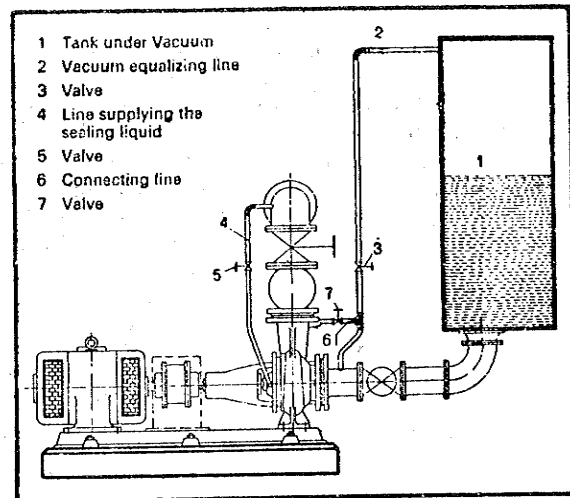


Figure 2.



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

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

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

#### GROUTING

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

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

#### PIPING

Both suction and delivery pipes and accessories should be independently supported near the pump so that when the flanges bolts are tightened no strain will be transmitted to the pump casing. It is usually advisable to increase the size of both suction and delivery pipes at the pump nozzles in order to decrease the loss of head from friction and for the same reason piping should be arranged with as minimum bends as possible, as these should be made with a 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. Adequate supports should be given to pipe lines so that the weight of the pipe lines does not fall on the pump. The use of minimum number of the bends and other fittings will minimise the frictional losses.

#### SUCTION PIPE

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

The end of the suction pipe must be well submerged to avoid whirlpools and ingress of air but must be kept clear of any deposits of mud, silt, grit etc. The pipe must be clear from any side of wall by at least 450 mm. The end of the suction pipe should be provided with a strainer of sufficient open area.

#### DELIVERY PIPE

A check ( non-return) valve and a gate 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.

#### VACUUM EQUALIZING LINE (AND LIQUID LINE) (SEE FIGURE 3)

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

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

## **FOOT VALVE**

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

## **STUFFING BOXES AND PACKING**

Stuffing boxes should be carefully cleaned and the packing placed in them. Be sure that sufficient packing is placed at the back of the water seal cage. If the water to be pumped is dirty or gritty, sealing water should be piped to the stuffing boxes from clean outside source of supply in order to prevent damage to the packing and shaft. In placing the packing, each packing ring should be cut to the proper length so that ends come together but do not overlap. The succeeding rings of packing should not be pressed too tight as it may result in burning the packing and cutting the shaft. If 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 relubrication periods under normal conditions.

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 hours or the nearest pump overhaul time.

## **PRIMING**

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

- (1) Liquid level above pump level.

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

- (2) Priming with Foot Valve.

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

(b) When there is liquid under some pressure in the discharge pipe, priming can be effected by bypassing the pressure liquid around the check and gate valve. Of course, the initial priming must be effected from some outside source.

NOTE : In this case, the foot valve must be capable of withstanding pump pressure and possible surge.

- (3) Priming by ejector : An ejector operated by steam, compressed air or water under pressure and connected to air vent on top of casing can be used to remove air from and prime the pump on suction lift installations.
- (4) Priming by dry vacuum pump : A hand or power pump sucks in all the air from the casing and the suction pipe, and thus primes the system.

## **STARTING**

The pump must not be started without being primed. Be sure that the driver rotates in the proper direction as indicated by a direction arrow on the pump casing.

## **RUNNING**

On account of its simple construction, the centrifugal pump requires practically no attention while running. Lubrication of the bearings and manipulation of the glands are the only things that need attention from the operator.

## **STOPPING**

Before stopping the pump, close the gate valve. This will prevent water hammer on check valve.

## **STUFFING BOXES**

Do not tighten the glands excessively. A slight dripping of water from the stuffing boxes when pump is running keeps packing in good condition.

## **CASING RINGS**

Casing rings are fitted in the casing to reduce the quantity of water leaking back from the high pressure side to the suction side. These casing rings are fitted to maintain a small clearance and depend on the water in the pump for lubrication. When they are worn out, the clearance becomes greater and more water passes back into the suction. They must be replaced from time to time to restore the pump efficiency to its normal value.

## SPARE PARTS

A set of ball bearings, a set of casing rings and a set of gland packing rings must always be kept at hand to ensure uninterrupted service from the pump. While ordering for spare parts, always give type, size and serial number of the pump as stamped on the name plate.

## PUMP TROUBLE

When investigating trouble with Kirloskar pumps, always remember that pumps have been tested at the factory and are mechanically correct when sent out. Discounting the possibility of damage during transit, most of the trouble in the field is due to faulty installation. Investigation shows that the majority of troubles with centrifugal pumps result from faulty conditions on the suction side.

## BREAKDOWN-CAUSE-CHECK POINTS

In case of breakdown we recommend the location of the fault by using the following table.

BREAKDOWN	CHECK POINTS											
Pump does not deliver	1	7	8	9	10	11	12	14	15	17		
	18	19	23	25	26	56	57	58				
Pump delivers at reduced capacity	1	2	3	4	5	6	7	8	9	10		
	11	12	13	14	15	17	18	19	20	21		
	22	56	57	58								
Delivery performance deteriorates	1	3	7	9	10	11	12	13	14	19		
	20	21	22	23	24	53	57	62				
Pump delivers too much	16	56	57	58								
Delivery is interrupted	1	3	6	7	8	9	10	11	12	13		
	14	15	16	19	22	23	25	26	56	57		
	58	62										
After stopping pump runs in reverse direction	52											
Very noisy	1	2	5	6	7	8	11	12	13	15		
	19	20	22	54	55	56	57	62				
Unsteady running of pump	19	20	22	31	32	33	35	36	37	38		
	39	40	43	44	47	48	49	50	51	54		
	55	58										
Stuffing box leaks excessively	24	27	28	29	30	31	47	48	49	53		
Fumes from stuffing box	22	23	24	25	26	27	28	29	30	41		
	42	43										
Pump rotor locked in standstill position.	22	45	46	50								
Pump is heating up and seizing	23	24	25	26	27	28	29	30	40	41		
	42	45	46	47	48	49	50	54				
Bearing temperature increases	19	20	21	22	31	32	33	34	35	36		
	37	38	39	40	41	42	43	44	45	46		
	47	48	49	51	54	55	58					
Motor will not start	14	22	60									
Motor gets hot or burns out	14	22	27	28	40	43	50	55	56	57		
	58	59	60	61								
Motor is difficult to start	14	22	27	28	45	46	50	58	59	60		

# CHECK POINTS

- 1 Suction pipe, foot valve choked.
- 2 Nominal diameter of suction line too small.
- 3 Suction pipe not sufficiently submerged.
- 4 Too many bends in the suction line.
- 5 Clearance around suction inlet not sufficient.
- 6 Shut off valve in the suction line in unfavourable position.
- 7 Incorrect layout of suction line (formation of air pockets).
- 8 Valve in the suction line not fully open.
- 9 Joints in the suction line not leak-proof.
- 10 Air leaking through the suction line & stuffing box etc.
- 11 Suction lift too high.
- 12 Suction head too low (difference between pressure at suction connection and vapour pressure too low).
- 13 Delivery liquid contains too much gas and/or air.
- 14 Delivery liquid too viscous.
- 15 Insufficient venting.
- 16 Number of revolutions too high.
- 17 Number of revolutions too low.
- 18 Incorrect direction of rotation (electric motor incorrectly connected, leads of phases on the terminal block interchanged).
- 19 Impeller clogged.
- 20 Impeller damaged.
- 21 Casing rings worn out.
- 22 Separation of crystals from the flow of pumping liquid (falling below the temperature limit/equilibrium temp).
- 23 Sealing liquid line obstructed.
- 24 Sealing liquid contaminated.
- 25 Lantern ring in the stuffing box is not positioned below the sealing liquid inlet.
- 26 Sealing liquid omitted.
- 27 Packing incorrectly fitted.
- 28 Gland tightened too much/slanted.
- 29 Packing not suitable for operating conditions.
- 30 Shaft sleeve worn in the region of the packing.
- 31 Bearing worn out.
- 32 Specified oil level not maintained.
- 33 Insufficient lubrication of bearings.
- 34 Ball bearings over-lubricated.
- 35 Oil/Grease quality unsuitable.
- 36 Ball bearing incorrectly fitted.
- 37 Axial stress on ball bearings (no axial clearance for rotor).
- 38 Bearings dirty.
- 39 Bearings rusty (corroded).
- 40 Axial thrust too great because of worn casing rings, relief holes obstructed.
- 41 Insufficient cooling water supply to stuffing box cooling.
- 42 Sediment in the cooling water chamber of stuffing box cooling.
- 43 Alignment of coupling faulty or coupling loose.
- 44 Elastic element of coupling worn.
- 45 Pump casing under stress.
- 46 Pipeline under stress.
- 47 Shaft runs untrue.
- 48 Shaft bent.
- 49 Rotor parts insufficiently balanced.
- 50 Rotor parts touching the casing.
- 51 Vibration of pipe work.
- 52 Non-return valve gets caught.
- 53 Contaminated delivery liquid.
- 54 Obstruction in delivery line.
- 55 Delivery flow too great.
- 56 Pump unsuitable for parallel operation.
- 57 Type of pump unsuitable.
- 58 Incorrect choice of pump for existing operating conditions.
- 59 Voltage too low/power supply overloaded.
- 60 Short circuit in the motor.
- 61 Setting of starter of motor too high.
- 62 Temperature of delivery liquid too high.