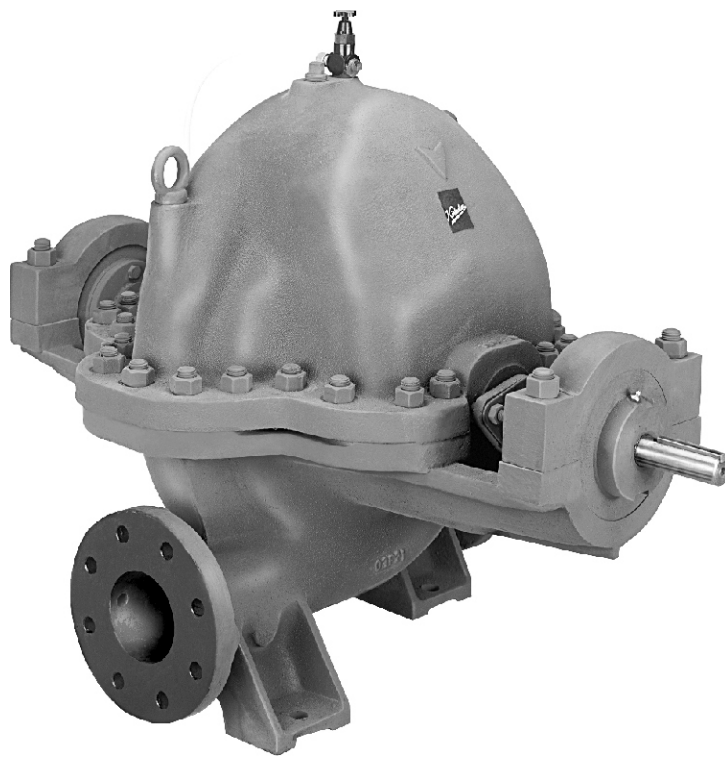


INSTRUCTIONS ON INSTALLATION OPERATION AND MAINTENANCE FOR KIRLOSKAR PUMP TYPE DSM (STANDARD)



Enriching Lives



KIRLOSKAR BROTHERS LIMITED

UDYOG BHAVAN, TILAK ROAD, PUNE - 411 002

KIRLOSKAR BROTHERS LIMITED
Udyog Bhavan, Tilak Road, Pune 411 002 (India)

WARRANTY

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

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

KIRLOSKAR BROTHERS LIMITED

CONTENTS

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 THE PARTS, PART NOS. AND MATERIAL OF CONSTRUCTION WHILE ORDERING SPARE PARTS FOR THE PUMPS.

1. GENERAL:

- 1.1 The booklet covers instructions for following models of DSM pumps.
Type of pump:
DSM-1E
DSM-2E
65-DSM, 315M
DSM-3
DSM-3ME
DSM-4RM, RSM-4RN, DSM-4RR
DSM-5B
DSM6-15°, DSM6-30°
DSM-150-45
- 1.2 These are Horizontal split Casing type, two stage pumps. This construction enables to remove the rotating unit without disturbing pipe connections and alignment.
- 1.3 Pumps when properly installed and given due attention in operation and maintenance should operate satisfactorily for a long period.
- 1.4 When the pump is received, sometime before the actual use of pump, it should be inspected and stored in dry place. The coupling should be rotated once in a month to prevent pitting of bearing surfaces.

2 INSTALLATION :

For location, preparing foundation, installation, alignment, general maintenance, trouble shooting etc., the instructions given in our publication **“General Instructions for Installation, Operation & Maintenance of Kirloskar Centrifugal Pumps.”** which is also printed alongwith this booklet must be followed carefully.

- 2.1 The sealing connection piping to the pump stuffing box must be made after installing and before commissioning the pump. This piping is supplied only for 65DSM 315M, DSM-4RM, DSM-4RN, DSM-4RR, DSM-5B, DSM-6 and DSM 150-45 pumps. For other pumps, sealing connection is integral.
- 2.2 Put gland packing and lantern ring, if it is sent separately along with the pump. For DSM-3, 65 DSM 315M also DSM 1E, DSM 2E, DSM 3ME and DSM-4RM, DSM-4RN, DSM-4RR pumps, stuffing boxes are packed with packing before despatch. For balance pumps gland packings and lantern rings are sent separately along with the pumps.

3. OPERATION:

3.1 Before starting the pump. Check the following:

- 3.1.1. The pump rotates freely by hand.
- 3.1.2. Sealing connection provided is properly tightened and adjusted.
- 3.1.3. Fill in the grease for bearings, if not done earlier.
- 3.1.4. The direction of rotation of motor corresponds to the direction of rotation of the pump.
- 3.1.5. The pump and the 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 the 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

- 3.3.1 The pump is running smooth.
- 3.3.2 The flow of sealing liquid water is uninterrupted.
- 3.3.3 Leakage through stuffing box is normal. There should be leakage is 60 to 80 drops/ min.
- 3.3.4 The bearings are not getting heated up excessively.
- 3.3.5 Head and capacity developed by the pump is as specified.
- 3.3.6 Power consumption is within the limit.
- 3.3.7 Ensure that there is no mechanical friction in the pump.
- 3.3.8 Stop the pump immediately, if any defects are noticed. Do not start the pump unless the defects are rectified. Report immediately to the supplier if it is not possible to rectify the defects.

3.4 During stopping the pump:

- 3.4.1 Close the valve on delivery side.
- 3.4.2 Stop the motor.
- 3.4.3 If the pump is not required to be operated for a long time, then drain the casing completely.

4. TECHNICAL DATA:

4.1 Direction of rotation

The standard direction of rotation is anticlockwise when viewed from driving end. The pump suitable for clockwise rotation can also be supplied against specific requirements.

4.2 Rotational speed

Normally the pumps are supplied suitable for speed of 1450 rpm. Please contact supplier if the pump is to be used for higher speeds.

4.3 Bearings

The shaft is supplied with antifriction ball bearings at driving end and non-driving end. The details of the bearings are given in the technical data chart. The designations of bearings are as per SKF catalogue. However, equivalent bearings in type, capacity and dimensions are also used.

4.4 Lubrication

- 4.4.1 Type of lubricant – The bearings are grease lubricated.
- 4.4.2 Quantity of grease – Please refer to Technical Data chart.
- 4.4.3 Refilling period – After 1000 hours of running.
- 4.4.4 Bearing temperature – The permissible bearing temperature rise is 40°C above ambient temperature.
- 4.4.5 Grades of recommended grease
Following grades of grease of their equivalents available in the market are suitable for bearing lubrication.

INDIAN OIL - SERVOGEM - 3
CALTEX - STARFAK - 3
HINDUSTAN PETROLEUM NATRA- 3 OR LITHON - 3

4.5 Stuffing box

- 4.5.1 Stuffing box – The stuffing boxes are extra deep to reduce the leakage.
- 4.5.2 Stuffing box sealing – Lantern ring provided for sealing purpose is used only in first stage stuffing box. Normally clear cold self liquid only is used for sealing. Grease Sealing/ External sealing can be provided against specific request.
- 4.5.3 Stuffing box packing
Champion Style–3316–Graphited Cotton Grease packing is used in the pump as a standard supply. However, stuffing box packing suitable for liquid handled is supplied against specific requirements.
For DSM-3, 65 DSM-315 M, DSM 1E, DSM 2E, DSM 3ME, DSM-4RM, DSM-4RN, DSM-4RR pumps the stuffing box packing is sent duly packed in the pump. For other pumps the packing and lantern ring are sent separately alongwith the pump.
- 4.5.4 Stuffing box packing size – Please refer Technical Data Chart.
- 4.5.5 Flexible couplings – The pumps are supplied with LOVE-JOY type & pin bush type flexible couplings. Details (of rubber bushes) are given in Technical Data Chart.
- 4.5.6 Packing between upper and lower half casing-
Dalmia Duplex board packing paper to be used of following thickness.

Pump Type	Packing thickness in mm
DSM-1	0.8 mm
DSM-1E	
DSM-2	
DSM-2E	
DSM-3	
DSM-3M	
DSM-3ME	
65 DSM-315M	
DSM-4RM, DSM-4RN, DSM-4RR	
DSM-5	
DSM-5B	
DSM6-15°, DSM6-30°	
DSM 150-45	

4.5.7 TECHNICAL DATA CHART

Pump type	Flange Size In mm Del. X Suc.	Ball bearing No. SKF or equiv.		Qty. of Grease Per Brg. Gms.	St. box packing Size in mm		Position of Lantern ring (L) from Impeller side (NDE side)	No. of Packing Rings		Coupling Type
		Driving end	Non driving End		Size x length			DE	NDE	
DSM-1E	50 X 65	6305	6305	100	6 Sq. x 1525		3 + L + 2	7	5	Love-Joy Type – SW -110
DSM-2E	65 X 80	6306	6306	100	10 Sq. x 2135		4 + L + 2	7	6	Love-Joy Type – SW -110
65 DSM 315M	65 X 80	6306	6306	100	10 Sq. x 2300		3 + L + 2	7	5	Love-Joy Type – SW -190
DSM-3	80 X 100	6307	6307	100	10 Sq. x 1650		5	5	5	Love-Joy Type – CW-226
DSM-3ME	”	”	”	”	”	”	”	”	”	”
DSM-4RM	100 X 125	6309	3309	150	12 Sq. x 2290		2 + L + 3	7	5	Pin Bush Type – CW-226
DSM-4RN	100 X 125	”	”	150	”	”	”	”	”	”
DSM-4RR	100 X 125	”	”	150	”	”	”	”	”	”
DSM-5B	125 X 150	21309cc	”	150	12 Sq. x 3180		3 + L + 3			Love-Joy Type – CW -276
DSM-6, DSM6-15 DSM6-30°	150 X 200	6315	6413	150	16 Sq. x 6250		4 + L + 4	10	8	Pin Bush Type – 360φ
DSM150-45	150 X 175	N310	2 x 7310 BG	150	12 Sq. x 2820		2 + L + 3	6	5	Pin Bush Type – 310φ

5. MAINTENANCE:

Preventive maintenance schedule is the periodical checks and precautions by which possibilities of failure and breakdown 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.

5.2 Periodical Maintenance

- 5.2.1 Replenish the grease.
- 5.2.2 Check 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 and cooling connections for leakage etc.

6. OVERHAULING:

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

6.1 Dismantling and Assembling procedure

All DSM pumps are similar in construction except some minor changes in the parts. The important changes are:

- 6.1.1 Shaft sleeves (310,311) are not provided in DSM-3 and DSM-1E, 2E, 3ME pumps.
- 6.1.2 Stuffing box bushes (350) are not provided in DSM-1E, 2E, 65 DSM-315M, DSM-4RM, DSM-4RN, DSM-4RR and DSM-150-45 pumps.
- 6.1.3 Separate lantern ring (227) is not provided in DSM-3, DSM-3ME pump since the same is made integral with Stuffing Box Bush.
- 6.1.4 Threaded shaft sleeves (310, 311) are used in DSM-4RM, DSM-4RN, DSM-4RR pump where as other sleeves are keyed ones.
- 6.1.5 Coupling spacer (195) is not provided in DSM-4RM & DSM-150-45 pumps
- 6.1.6 Coupling nut (332) is not provided in DSM-4RM, DSM-6 and DSM-150-45 pumps.
- 6.1.7 Allen bolts are provided for top & bottom casing of DSM 150-45 pump where as other pumps have standard bolt nuts and studs with nuts. Please refer to the cross sectional drawings and spare parts list given in this booklet while dismantling and reassembling.

6.2 Dismantling

- 6.2.1 Uncouple the pump from the prime mover by removing coupling bolts, nuts and rubber bushes.
- 6.2.2 Remove –
 - Sealing Connections
 - Priming funnel, air vent
 - Grease cup/ nipples and other fittings.
- 6.2.3 Remove all the bolts and nuts (572, 581) holding the upper half casing & lower half casing. Take out upper half casing (122) slowly by tightening the release bolts and after removing taper pins.

Upper half casing should be removed slowly so that impellers and other parts are not damaged. By removing upper half casing, the complete rotating unit is exposed for inspection and repairs.

- 6.2.4 Loosen the bolts and nuts (573) holding the bearing cap to the lower half casing (122). Remove the bearing caps.
- 6.2.5 Lift the rotating unit slowly after slinging it in correct fashion so that none of the parts are damaged. Keep the rotating unit in clean dry place for further dismantling.
- 6.2.6 Now start dismantling from driving end side. Loosen the coupling nut (332) if provided.
- 6.2.7 Take out flexible coupling, pump half (390) with help of a puller. Remove the coupling key (321).
- 6.2.8 Take out coupling spacer (195) if provided.
- 6.2.9 Loosen the bolts (631) holding bearing cover (270) to the bearing cartridge (241).
- 6.2.10 Remove the bearing cartridge driving end (241) pull out the bearing driving end (260.1) with the help of puller.
- 6.2.11 Remove bearing cover (270) and water deflector (236).
- 6.2.12 Take out gland (223). Remove the st. box packing.
- 6.2.13 Remove the st. box bush (350) if provided. Also take out casing ring (190).
- 6.2.14 Take out the shaft sleeve DE (317.1) (only for 65 DSM-315 M, DSM-5, DSM-6 and DSM 150-45 pumps). Remove the 'O' ring (522).
- 6.2.15 Remove the shaft sleeve under st. box (310).

6.3 Start dismantling from non-driving end

- 6.3.1 Remove the bearing cartridge (253) NDE.
- 6.3.2 Loosen the bearing lock nut (336) bearing nut (335).
- 6.3.3 Remove bolts (631) for bearing cover (271) and take out the ver.

- 6.3.4 Remove the casing ring NDE (191). Water deflector (236), Glands (229) and lantern ring (227).
- 6.3.5 Take out open shaft sleeve (317.2) and 'O' ring in case of 65 DSM 315M, DSM-5, DSM-6 & DSM 150-45 unscrew or remove the shaft sleeve NDE side (311).
- 6.3.6 Take out impellers (157) and (158). Before removing the impellers put the mark of first stage and second stage impellers so that while re-assembling the impellers may not be interchanged.
- 6.3.7 Remove the impeller key (320). Take out the interstage rin (204). In case of (DSM-5B, DSM-6 & DSM 150-45, remove interstage diaphragm (462) alongwith interstage bush).

6.4 Reassembling

Before reassembling, all parts are to be cleaned including upper half & lower half casings. Bearings are to be cleaned with Kerosene. Change packing and 'O' rings, if any.

- 6.4.1 Put the impeller key (320) in the keyways provided on the shaft. Fix the impellers on the shaft with interstage ring (204/462) in between them. First stage impeller should come towards non-driving end.
- 6.4.2 Put the shaft sleeves (310, 311) and (317.1 & 317.2) with 'O' rings for 65 DSM-315M, DSM-5B, DSM-6 and DSM 150-45.
- 6.4.3 Start the reassembly for non-driving end.
 - Insert the casing ring, NDE (191).
 - Insert the gland NDE (223) if non-split type (in case of DSM-4RM).
 - Put the water deflector, NDE (236).
 - Insert the bearing cover, NDE (271).
 - Press the NDE bearing on the shaft.
 - Tighten the bearing nuts. Put appropriate quantity of grease to the bearings.
 - Fix the cartridge NDE (Except DSM 150-45). The bearing should touch the shoulder provided on the cartridge.
 - Fix the bearing cover to the cartridge by tightening the screws (631).
- 6.4.4 Now start assembling from driving end.
 - Insert the casing ring DE (190).
 - Insert the gland DE (223) if non-split type (DSM-4RM)
 - Fit the water deflector (236).
 - Insert the bearing cover (270).
 - Press fit the DE bearing on the shaft.

- Fix the bearing cartridge DE (241). The outer face of the bearing should touch the shoulder provided in the cartridge.
- Fix the bearing cover DE to the cartridge by tightening the bolts (631).
- Insert coupling spacer in case of DSM-3, DSM-1E, 2E, 3ME, 65 DSM-315-M, DSM-5B and DSM-6.
- Fit coupling key (321) on the shaft.
- Fix pump coupling half (390) on the shaft and tighten the same by coupling nut (332) in case of DSM-3, DSM-1E, 2E, 3ME, 65 DSM-315-M, DSM-5 and DSM-6 pumps.

In case of DSM 150-45 pump, bearing cartridges are put on the shaft prior to mounting of bearings.

This completes the assembly of rotating unit.

- 6.4.5 Now lift the above rotating unit and fit it properly in the lower half casing so that pins (611, 610.1) take their proper seating.
- 6.4.6 Fit the two bearing caps by means of bolts. Rotate the whole unit and see that there is no friction between rotating and stationery parts.
- 6.4.7 Cut the paper packing to match the profile at the upper and lower half casing. Put the paper packing (dipped in linseed oil) on the lower half casing. Keep the upper half casing gently and neatly without disturbing the impellers or packing etc. Insert the taper pins so that the two halves of the casings will take their proper seat.
- 6.4.8 Now insert the bolts and nuts for upper half and lower half casing and tighten them. While tightening the nuts, take care to tighten the diagonally opposite bolts. Rotate the impeller by rotating coupling and see that there is no friction between the rotating unit and stationery parts.
- 6.4.9 Insert the eye bolts in their positions and fix them by tightening the bolts (593, 581). Insert the stuffing box packing staggering the joints in 180 and push each ring inside as far as possible.
- 6.4.10 Insert the lantern ring at non-driving end side at a position indicated in technical data (e.g. $2 + L + 3$).
- 6.4.11 Fix gland (split type) (223) on the shaft. Tighten the stuffing box packing by tightening the gland nuts (300).

While tightening the glands, please see that the unit can be rotated by hand.

- 6.4.12 Connect the copper pipes for sealing connection (562). Fix air vents, priming funnel and grease cups. Fix the nameplate (670) on NDE cartridge.

This completes the re-assembly.

While ordering spares, specify nameplate details, particularly machine numbers given in enclosed spare parts list. Also specify quantity required.

7.

SPARE PART LIST

Old Part Nos.	New Part Nos.	Description pieces reqd. per	No. of pump
1D	122	Casing half upper	1
1E	123	Casing half lower	1
2D*	157*	Impeller, 1 st stage	1
2E*	158*	Impeller, 2 nd stage	1
3A*	180*	Pump shaft direct drive	2
4A*	190*	Wear ring	1
4E*	204*	Interstage ring	1
8A	241	Cartridge for bearing, DE	1
8B	253	Cartridge for bearing, NDE	1
9A*	260.1*	Ball bearing, DE	1
9B*	260.2*	Ball bearing, NDE	1
10A1	270	Bearing cover, DE	1
10B1	271	Bearing cover, NDE	1
10E	274	Bearing COP	2
12A*	310*	Shaft sleeve, DE	1
12B*	311*	Shaft sleeve, non-driving end	1
12C/	317.1/	Shaft sleeve open DE/NDE	2
12D	317.2	For DSM-5B & DSM-6 only	2
13A*	223*	Gland (Non-split) for DSM-1E & DSM-2E	2
13B*	229*	Split gland, DE/NDE	2
14B*	227*	Lantern ring (except DSM-3, DSM-3ME)	2
17B*	350*	St. box bush for DSM-3, DSM-3ME, DSM-5B and DSM-6 only	2
18A	195	Coupling spacer (except DSM-4M)	1
19A	390	Flexible coupling (pump half)	1
19B	391	Flexible coupling (motor half)	1
20A*	400*	Rubber bushes	N
24A* &			
24B*	236*	Water deflector, DE/NDE	1
25	450	Air vent	2
34A	320	Impeller key	2
34B	321	Coupling key	1

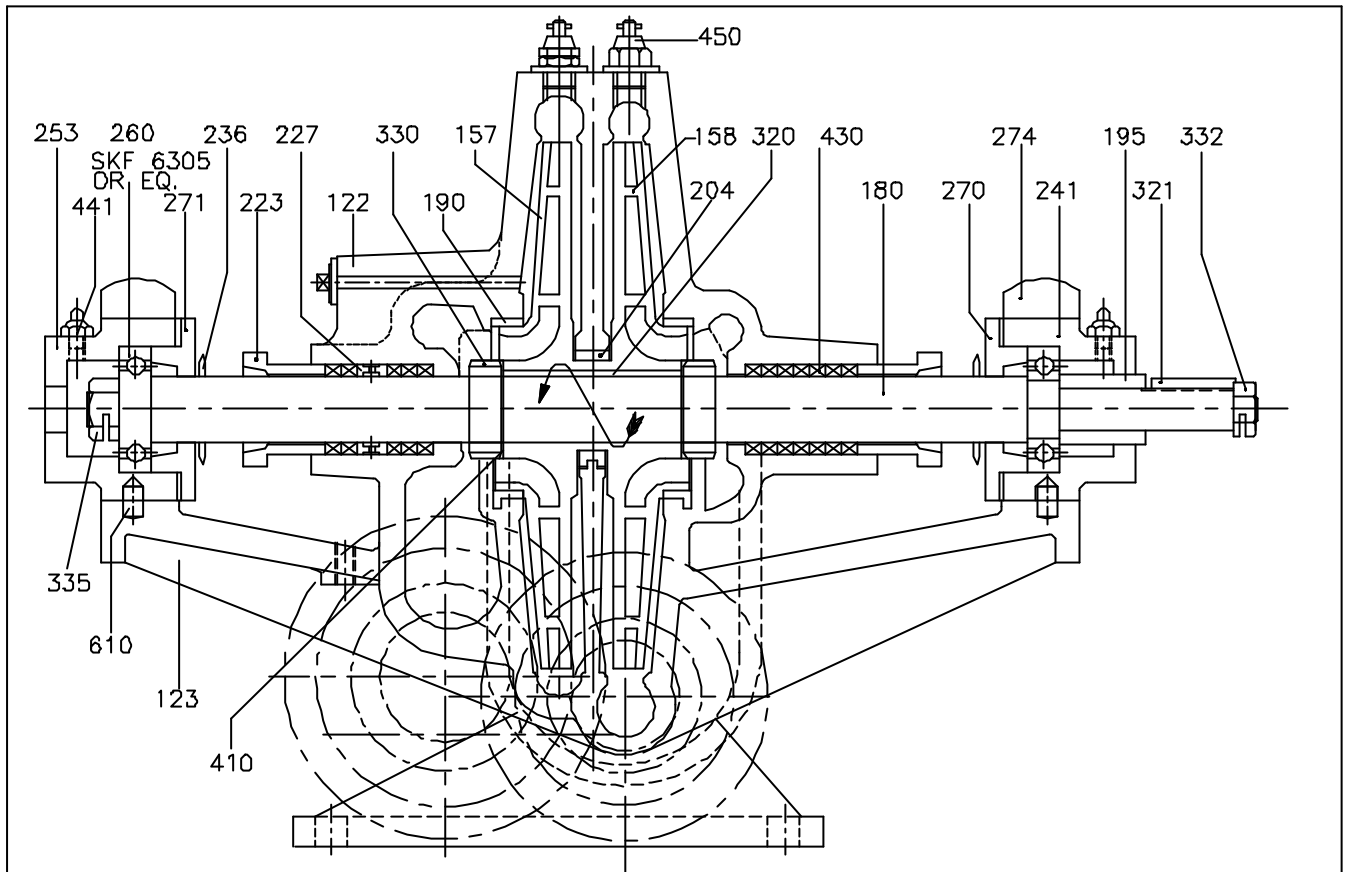
Old Part Nos.	New Part Nos.	Description pieces reqd. per	No. of pump
35B	332	Coupling nut (except DSM-4RM & 6 & DSM-150-45)	1
35F	335	Bearing nut	1
37G	586	Bolts with nuts for 274	4
37H	572	Bolts with nuts for upper and	-
	581	Lower half casing	
37S	582	Eye bolts with nuts & washer for gland	4
37K	574	Hex screw for 300	4
38AP	631	Hex screw for bearing cover	8
41A	611	Taper pin with washes * & nuts for lower and upper half casing	2
41B	610.1**	Pin for casing ring	2
41D	610.2**	Pin for st. box bush	2
41E	610	Pin for cartridge	2
41K	610.3	Pin for interstage diaphragm	1
42A	601	Drain plug for casing	2
42H	600	Plug for Suc. & Del. Pressure gauge connections	2
	602	Plug for sealing	1
42P	604	Plug for st. box leakage water	2
43A*	430*	St. box packing	1set
44C	519	Paper packing between 122 & 123	1
45A*	522*	'O' ring for shaft sleeve only for DSM-4RM DSM-5B & DSM-6	
47C	410	Lock washer for impeller nut	2
47P1	622	Washer for 332 only for DSM	1
51A	441	Grease nipple for lubrication	2
54C1	559.1	Adapter for copper tube	1
54C2	559.2	Adapter for copper tube connection	1
62B	560	Copper tube for sealing connection with nuts	1
67A	670	Duty name plate	1
	224	Clamping plate	2
	228	Collar for st. box only for DSM 150-45	2
	263*	Ball bearing, SKF 7310 BG or equiv.	2

Old Part Nos.	New Part Nos.	Description pieces reqd. per	No. of pump
	264*	Roller bearing, SKF N 310 or equiv.	1
263*	263*	Double row angular contact ball bearing SKF 3309 or equivalent (For DSM-5B only)	1
	261	Spherical roller bearing SKF 21309 cc	1
	336	Brg. lock nut, DE/NDE	2
	404*	Coupling pin	N
	408*	Nut for coupling pin	N
	409	Washer for coupling pin	N
	462	Interstage diaphragm	1
	515*	Gasket for shaft sleeve & impeller	3
	518*	Gasket for adaptor piece	-
	530	Pipe for sealing	1
	534	Pipe for priming only for DSM-6 & DSM- 150-45	1
	540	Socket for sealing connection only for DSM-150-45	2
	550	Wheel cock	1
	557	Three way piece for sealing only for DSM- 150-45	1
	558	Sealing nut	2

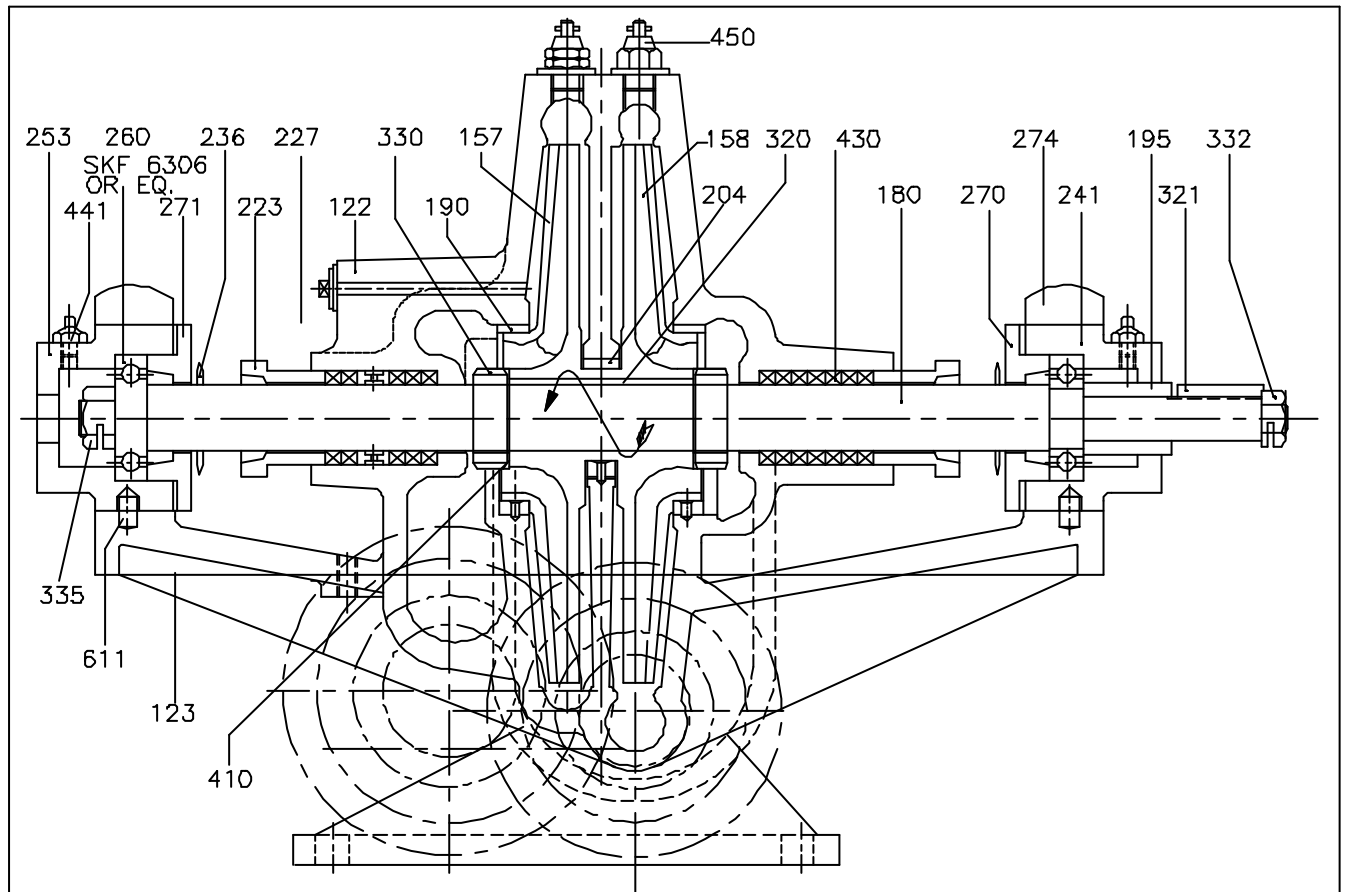
* Parts for two years normal working of the pumps.

** These parts should be included in the order, while ordering top and bottom casing.

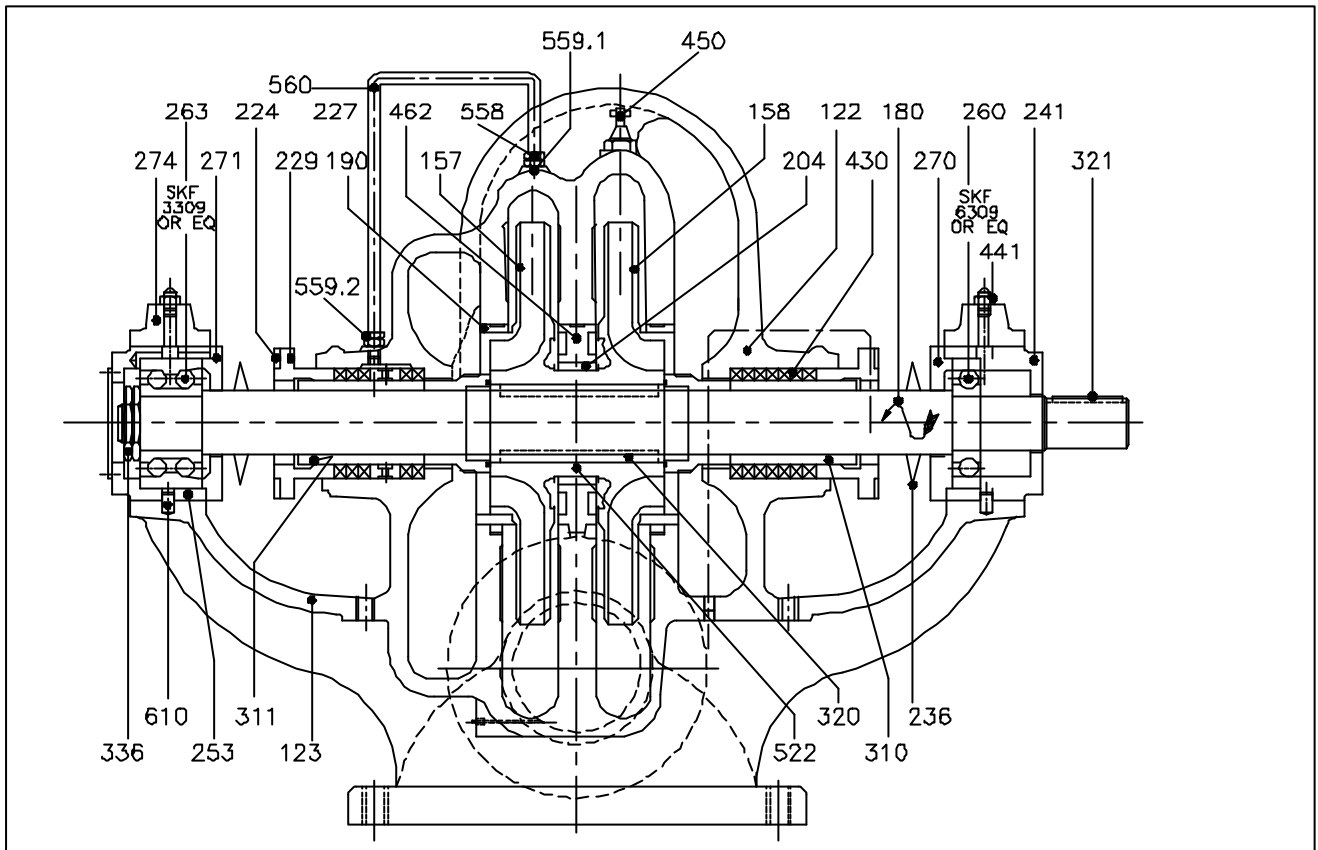
N Quantity depends upon pump type.



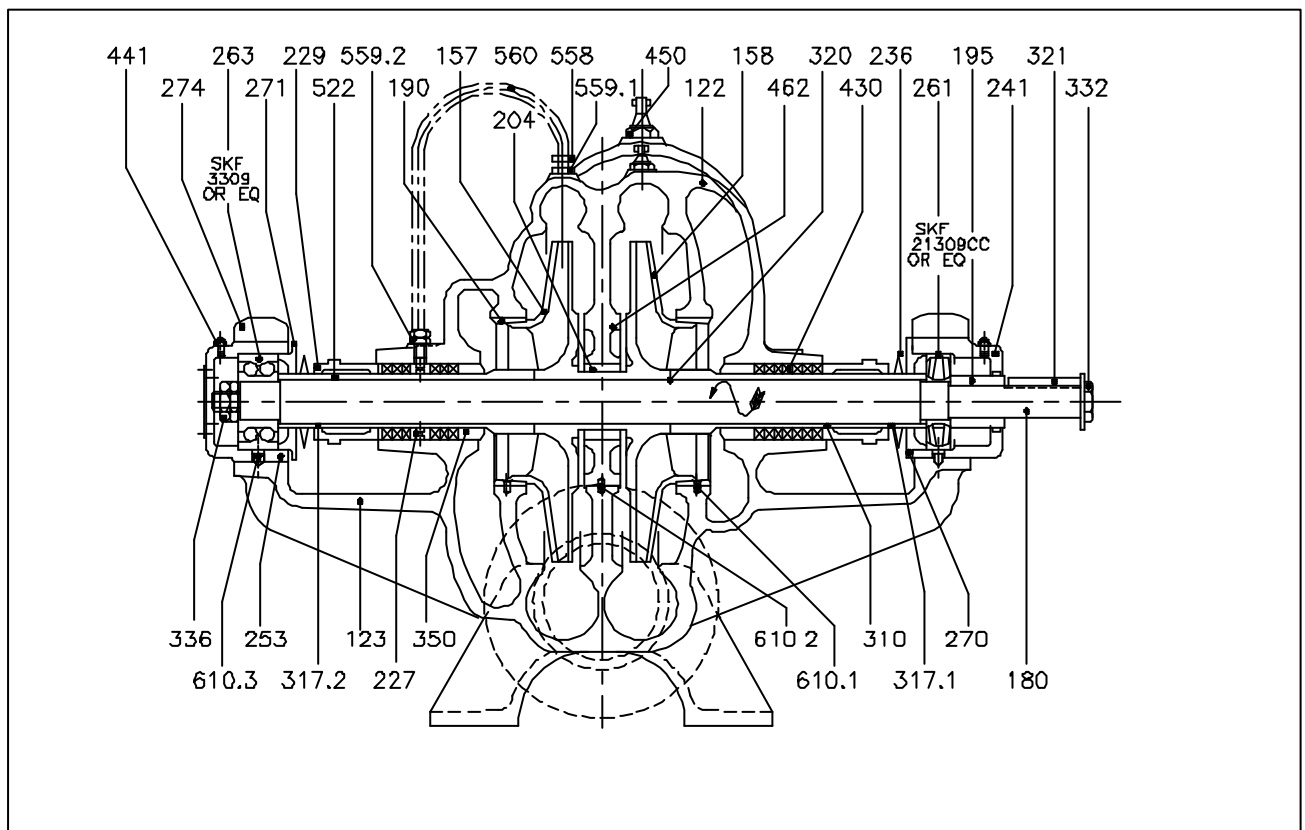
CROSS SECTION ASSEMBLY OF DSM 1E (CCW)



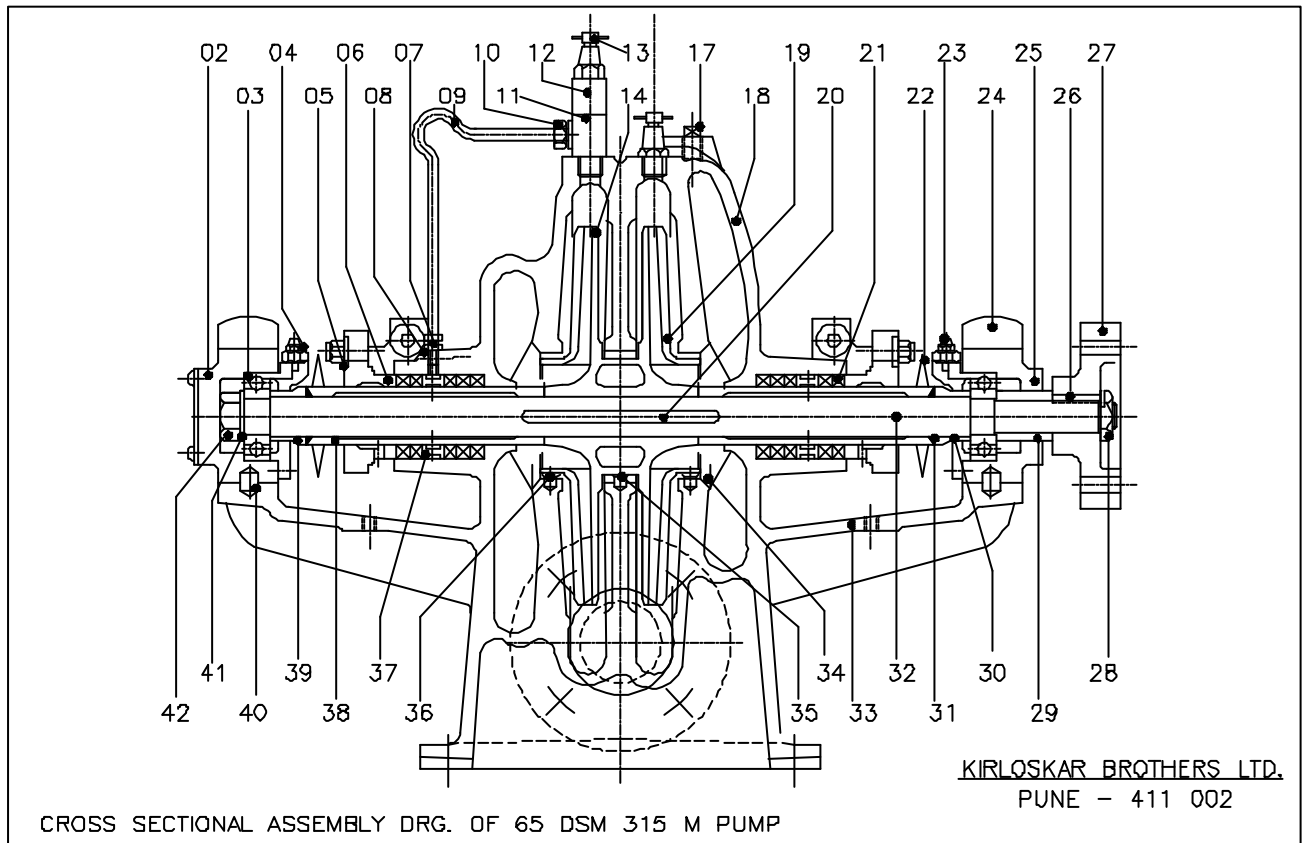
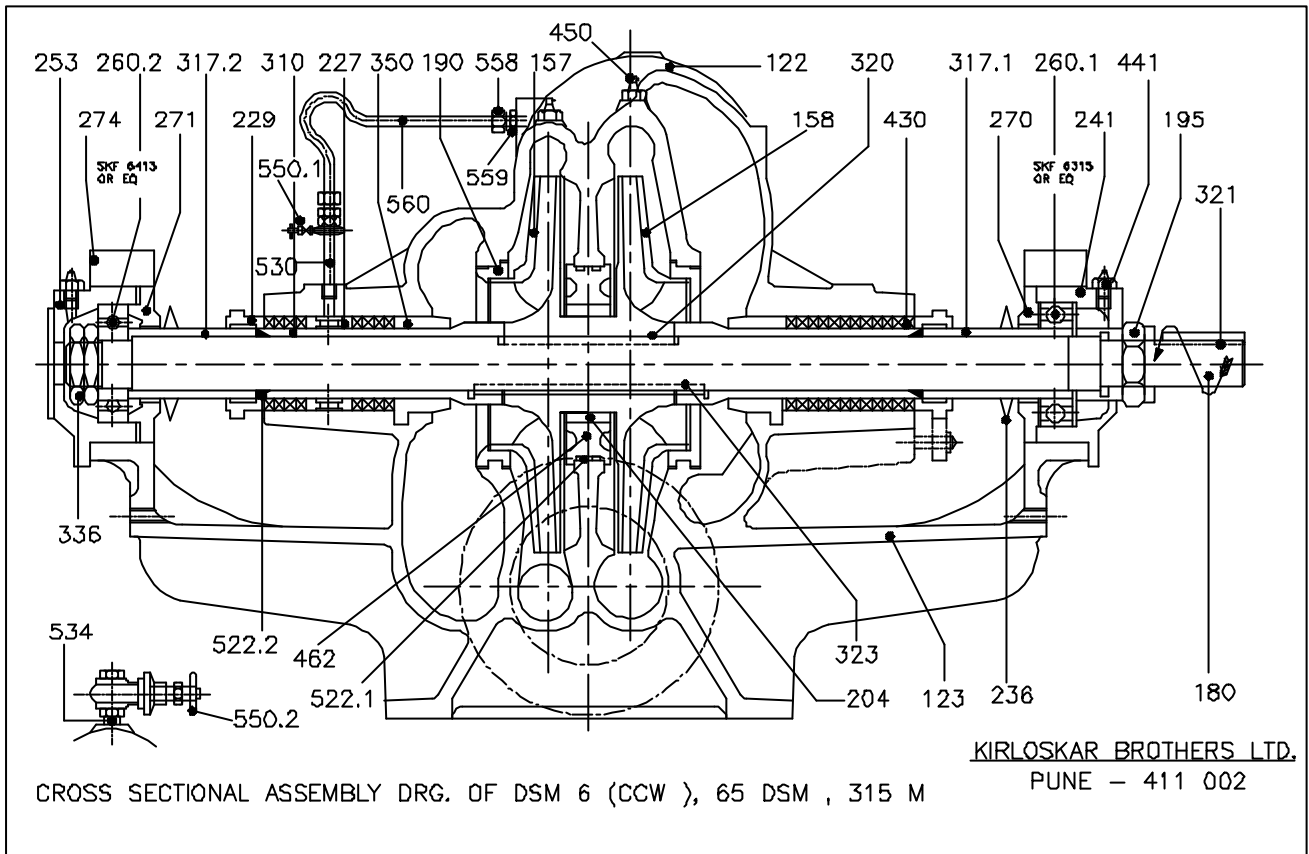
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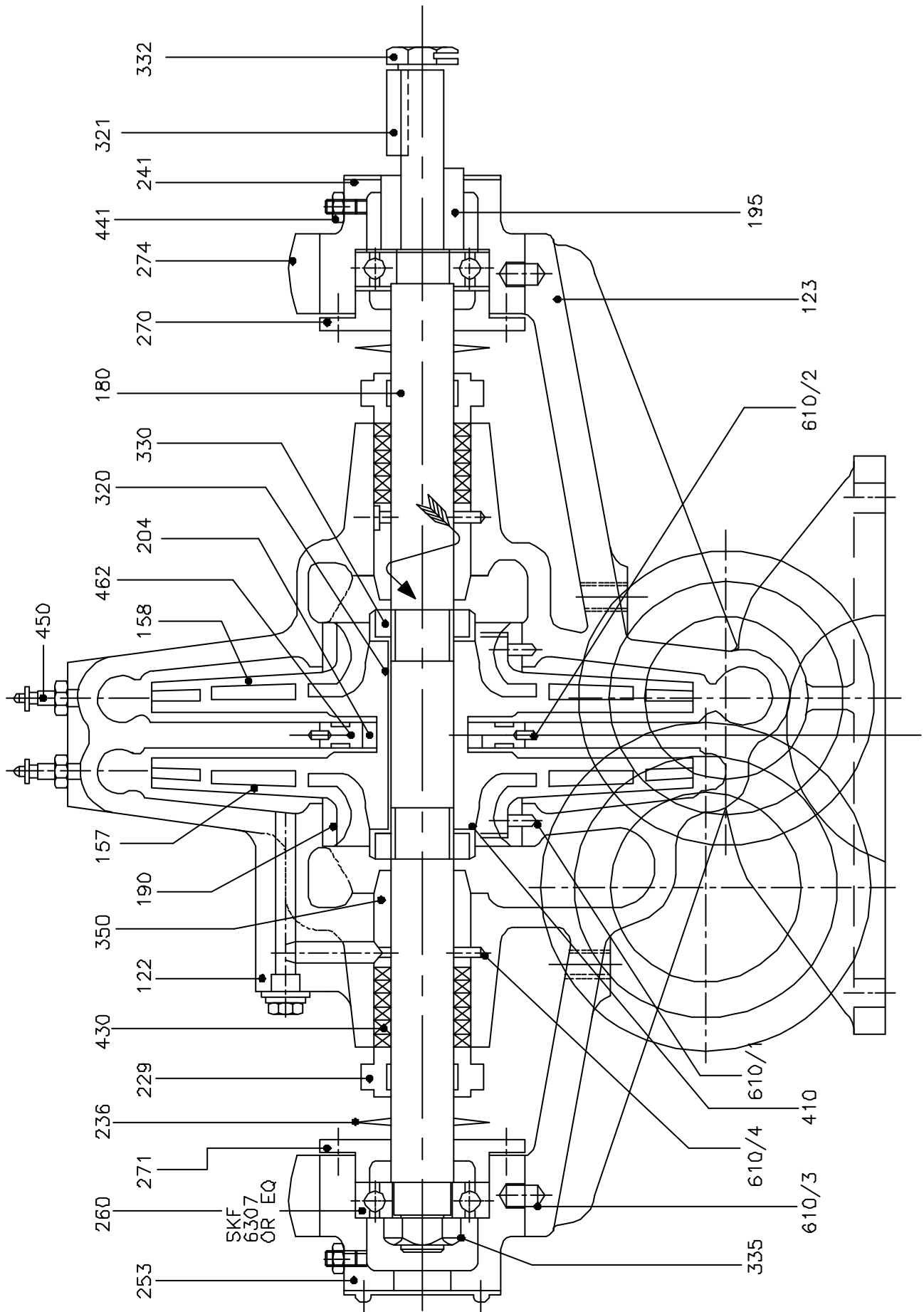


CROSS SECTION ASSEMBLY OF DSM 4 RM
NOTE : ALSO FOR DSM 4 RN, DSM 4 RR (CCW)



CROSS SECTION ASSEMBLY OF DSM 5 B (CCW)
DSM 5 B (F). DSM 5 B (MODIFIED)





CROSS SECTIONAL ASSEMBLY OF DSM 3ME (CCW)
NOTE ALSO FOR DSM 3/3 ME

GENERAL INFORMATION & SAFETY REQUIREMENTS

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

A Pump Duty Nameplate is fitted to each unit and must not be removed. Loss of this plate could make identification impossible. This in turn could affect safety and cause difficulty in obtaining spare parts. If accidental loss or damage occur, contact KBL immediately.
- 1.2 Access to the equipment should be restricted to the personnel responsible for installation, operation and maintenance and they must be trained, adequately qualified and supplied with appropriate tools for their respective tasks.
- 1.3 KBL requires that, all personnel that are responsible for installation, operation or maintenance of the equipment, have access to and study the product instruction manual **BEFORE** any work is done and that they will comply with all local and industry based safety instructions and regulations.
- 1.4 Ear defenders should be worn where the specified equipment noise level exceeds locally defined safe levels. Safety glasses or goggles should be worn where working with pressurised systems and hazardous substances. Other personnel protection equipment must be worn where local rules apply.
- 1.5 Do not wear loose clothing or jewellery which could catch on the controls or become trapped in the equipment.
- 1.6 Read the instruction manual before installation, operation and maintenance of the equipment. Check and confirm that the manual is relevant copy by comparing pump type on the nameplate and with that on the manual.
- 1.7 Note the 'Limits of product application – permissible use' specified in the manual. Operation of the equipment beyond these limits will increase the risk from hazards noted below and may lead to premature and hazardous pump failure.
- 1.8 Clear and easy access to all controls, gauges and dials etc. must be maintained at all times. Hazardous or flammable materials must not be stored in pump rooms unless safe areas or racking and suitable containers have been provided.
- 1.9 **IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF THIS KBL PRODUCT COULD RESULT IN INJURY OR DEATH.**

2.0 SAFETY INSTRUCTIONS WHILE HANDLING AND STORAGE

When lifting the pump, use the lifting points specified on general arrangement drawing. Use lifting equipment having a safe working load rating suitable for the weight specified. Use suitable slings for lifting pump which is not provided with lifting points. The use of fork-lift truck and chain crane sling equipment is recommended but locally approved equipment of suitable rating may be used.

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

3.0 SAFETY INSTRUCTIONS WHILE ASSEMBLY & INSTALLATION

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

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

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

Failure to support suction and delivery pipework may result in distortion of the pump casing, with the possibility of early pump failure.

4.0 SAFETY INSTRUCTIONS WHILE COMMISSIONING & OPERATION.

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

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

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

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

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

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

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

5.0 SAFETY INSTRUCTIONS WHILE MAINTENANCE & SERVICING

Before attempting any maintenance on a pump particularly if it has been handling any form of hazardous liquid, it should be ensured that the unit is safe to work on. The pump must be flushed thoroughly with suitable cleaner to purge away any of the product left in the pump components. This should be carried out by the plant operator and a certificate of cleanliness obtained before starting work. To avoid any risk to health it is also advisable to wear protective clothing as recommended by the site safety officer especially when removing old packing which may be contaminated.

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

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

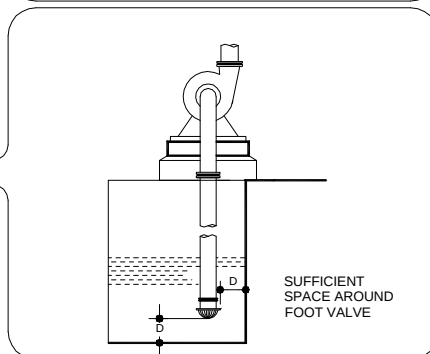
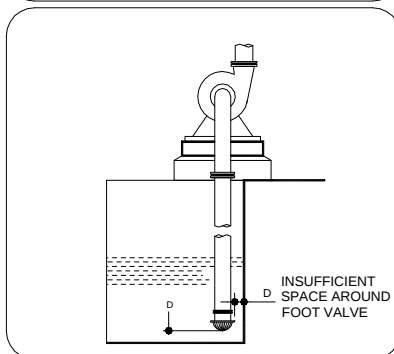
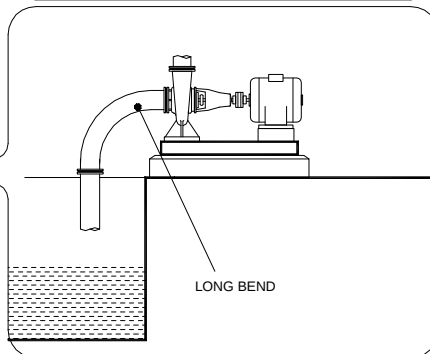
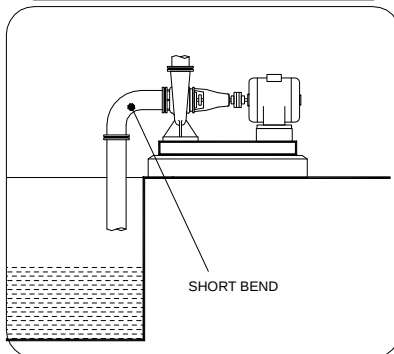
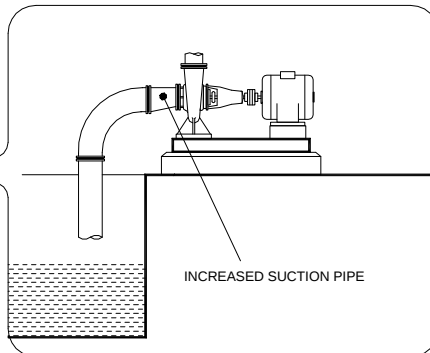
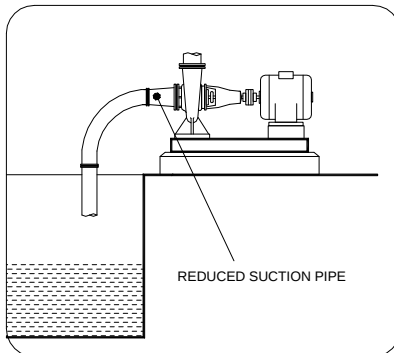
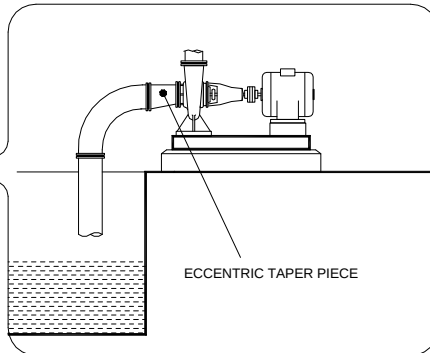
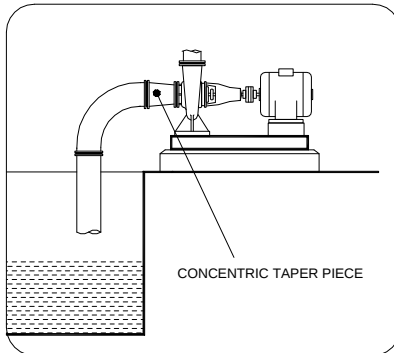
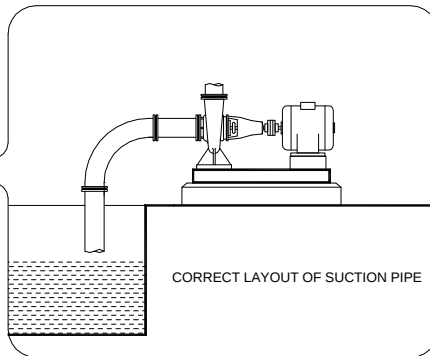
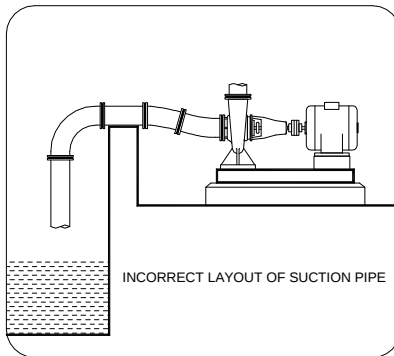
Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation of noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.

Isolate the equipment before any maintenance work is done. Switch off the mains supply, remove fuses, apply lock-outs where applicable and affix suitable isolation warning signs to prevent inadvertent reconnection. In order to avoid the possibility of maintenance personnel inhaling dangerous fumes or vapours, it is recommended that the maintenance work be carried out away from the pump locations by removal of bearing housing and shaft assembly to a suitable maintenance area.

Ref: Proposed draft standard prEN 800:
Pumps and pump units for liquids;
General safety requirements

INCORRECT

CORRECT



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

GENERAL INSTRUCTIONS FOR INSTALLATION OPERATION & MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS

**GENERAL INSTRUCTIONS
FOR INSTALLATION, OPERATION
& MAINTENANCE OF**

KIRLOSKAR CENTRIFUGAL PUMPS

WARNING

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

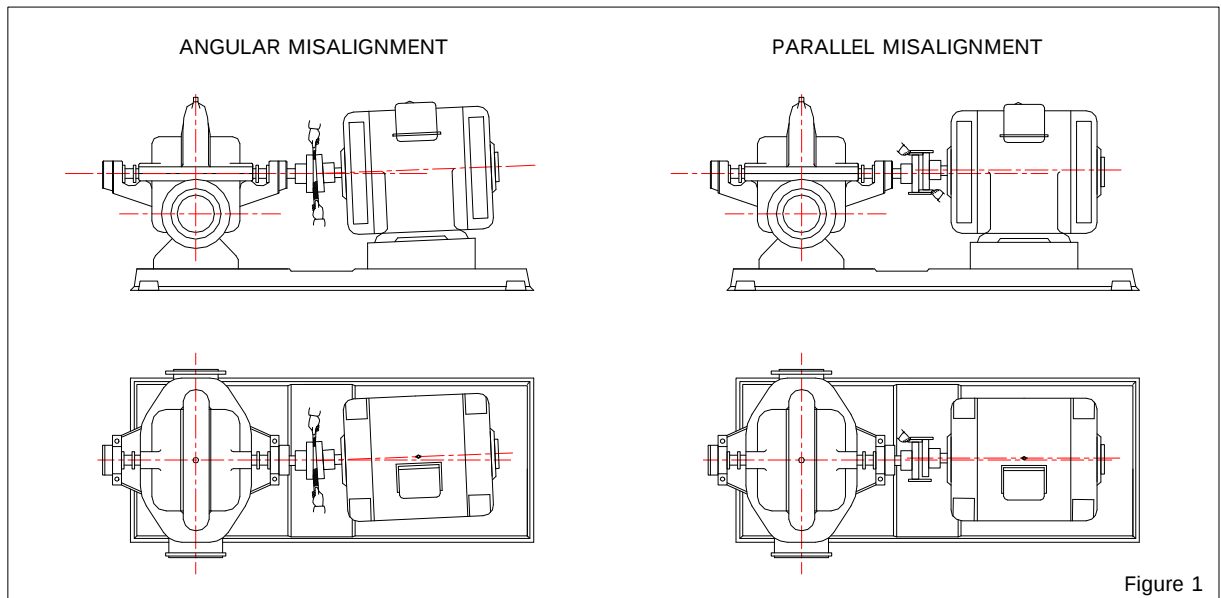


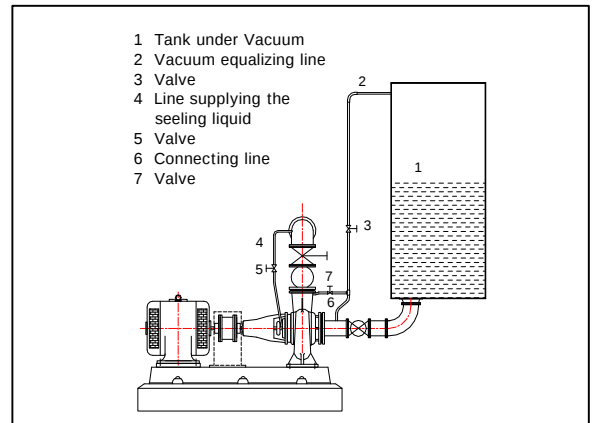
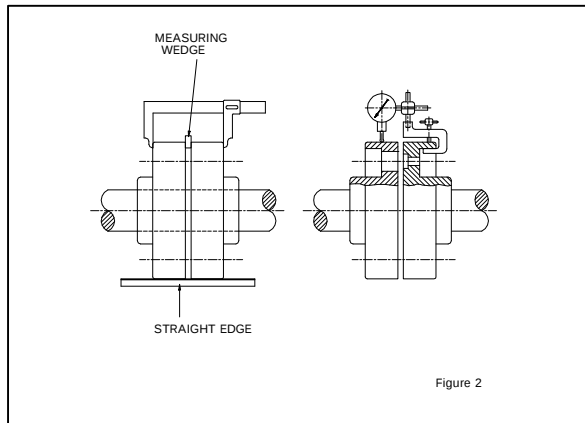
Figure 1

LEVELLING THE UNIT

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

FLEXIBLE COUPLING ALIGNMENT (SEE 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.



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

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

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

GROUTING

When the alignment is correct, the foundation bolts should be tightened evenly but not too firmly. The unit can then be grouted by working soft concrete under the edges. Foundation bolts should not be fully tightened until the grout is hardened, usually 48 hours after 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 along radius wherever possible. The pipe lines should be free from scales, welding residuals etc., and have to be mounted in such a way that they can be connected to suction and delivery flanges without any stress on the pump. Adequate supports should be given to pipe lines so that weight of the pipe lines does not fall on the pump. The use of minimum number of the bends and other fittings will minimise the frictional losses.

SUCTION PIPE

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

The end of the suction pipe must be well submerged to avoid whirlpools and ingress of air but must be kept clear of 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 EQUALISING LINE (AND LIQUID LINE) (SEE FIGURE 3)

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

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

FOOT VALVE

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

STUFFING BOXES AND PACKING

Stuffing boxes should be carefully cleaned and the packing placed in them. Be sure that sufficient packing is placed at the back of the water seal cage. If the water to be pumped is dirty or gritty, sealing water should be piped to the stuffing boxes from clean outside source of supply in order to prevent damage to the packing and shaft. In placing the packing, each packing ring should be cut to the proper length so that ends come together but do not overlap. The succeeding rings of packing should not be pressed too tight as it may result in burning the packing and cutting the shaft. If stuffing box is not properly packed, friction in stuffing box prevents turning the rotor by hand. On starting the pump it is well to have the packing slightly loose without causing an air leak, and if it seems to leak, instead of putting too much pressure on the gland, put some heavy oil in the stuffing box until the pump works properly and then gradually tighten up the gland. The packing should be occasionally changed.

BALL BEARINGS

Correct maintenance of ball bearings is essential. The bearing manufacturers give the following as a guide to relubrication periods under normal conditions.

Three monthly when on continuous duty.

Six monthly when on eight-hour per duty.

The bearings and housings should be completely cleaned and recharged with fresh grease after 2500 hours or the nearest pump overhaul time.

PRIMING

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

(1) Liquid level above pump level

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

(2) Priming with foot valve

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

(b) When there is liquid under some pressure in the discharge pipe, priming can be effected by 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 pumps as stamped on the name plate.

PUMP TROUBLE

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

BREAK DOWN-CAUSE-CHECK POINTS

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

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

CHECK POINTS

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



ENRICHING LIVES

**INSTRUCTION ON
INSTALLATION OPERATION
AND
MAINTAINANCE
FOR**

**KIRLOSKAR SPLIT CASE PUMP
DSM 100/36 & DSM125/40
(NON THRU BORE)**

KIRLOSKAR BROTHERS LIMITED

Regd. & Corporate Office: Udyog Bhavan, Tilak Road, Pune 411 002 (India)

Works : Kirloskarvadi 416 308. Dist. Sangli (Maharashtra)

KIRLOSKAR BROTHERS LIMITED

Udyog Bhavan, Tilak Road, Pune 411 002 (India)

WARRANTY

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

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

KIRLOSKAR BROTHERS LIMITED

CONTENTS

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 the parts, part nos. And material of construction while ordering spare parts for the pumps.

CAUTION

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

1. GENERAL

1.1 The booklet covers instructions for the Non Thru Bore Pump.

1.2 It is Horizontal split Casing type, two stage pump. This construction enables to remove the rotating unit without disturbing pipe connections and alignment.

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

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

2. INSTALLATIONS:

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 with this booklet -must be followed carefully.

2.1 The sealing connection piping to the pump stuffing box must be made after installing and before commissioning the pump.

2.2 Put gland packing and lantern ring, if it is sent separately along with the pump.

3. OPERATION:

3.1 Before starting the pump check the following:

- 3.1.1. The pump rotates freely by hand.
- 3.1.2. Sealing/flushing connection provided is properly tightened and adjusted.
- 3.1.3. Fill in the grease for bearings, if not done earlier.
- 3.1.4. The direction of rotation of motor corresponds to the direction of rotation of the pump.
- 3.1.5. The pump and the 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 properly.
- 3.1.8. The cock for the 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

- 3.3.1 The pump is running smoothly.
- 3.3.2 The flow of sealing water is uninterrupted.
- 3.3.3 Leakage through stuffing box is normal. There should be leakage is 60 to 80 drops/ min. (if pump is with gland packing arrangement, in mechanical seal Pump there will not be any leakage)
- 3.3.4 The bearings are not getting heated up excessively.
- 3.3.5 Head and capacity developed by the pump is as specified.
- 3.3.6 Power consumption is within limit.
- 3.3.7 Ensure that there is no mechanical friction in the pump.
- 3.3.8 Stop the pump immediately, if any defects are noticed. Do not start the pump unless the defects are rectified. Report immediately to the supplier, if it is not possible to rectify the defects.

3.4 During stopping the pump:

3.4.1 Close the valve on delivery side.

3.4.2 Stop the motor.

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

4. TECHNICAL DATA:

4.1 Direction of rotation

The standard direction of rotation is clockwise when viewed from driving end. The pump suitable for anticlockwise rotation can also be supplied against specific requirements.

4.2 pumps are supplied suitable for speed of 1450 rpm. Please contact supplier if the pump is to be used for higher speeds.

4.3 Bearings

The shaft is supplied with below bearings

6.2 BEARING DETAILS :

Sr. No.	PUMP TYPE	BEARING No. (SKF OR EQUIVALENT)	
		DE	NDE
01	DSM 100-36	6307	3307
02	DSM 125-40	6309	3309

Designations of bearings are as per SKF catalogue. However, equivalent bearings in type, capacity and dimensions are also used.

4.4 Lubrication

4.4.1 Type of lubricant – The bearings is grease lubricated.

4.4.2 Quantity of grease – 200 gm

4.4.3 Refilling period – After 1000 hours of running.

4.4.4 Bearing temperature – The permissible bearing temperature rise is 40°C above ambient temperature

4.4.5 Grades of recommended grease-

Following grades of grease of their equivalents available in the market are suitable for bearing lubrication.

INDIAN OIL

SERVOGEM- 3

HINDUSTAN PETROLEUM

NATRA- 3 OR LITHON – 3

CALTEX

STARFAK- 3

4.5 Stuffing box

4.5.1 Stuffing box – The stuffing boxes are extra deep to reduce the leakage.

4.5.2 Stuffing box sealing – Lantern ring provided for sealing purpose is used only in first stage stuffing box. Normally clear cold self liquid only is used for sealing. Grease Sealing/ External sealing can be provided against specific request.

4.5.3 Stuffing box packing (for gland packed pumps)

Champion Style–3116–Non-asbestos packing is used in the pump as a standard supply. However, stuffing box packing suitable for liquid handled is supplied against specific requirements. The packing and lantern ring are sent separately alongwith the pump.

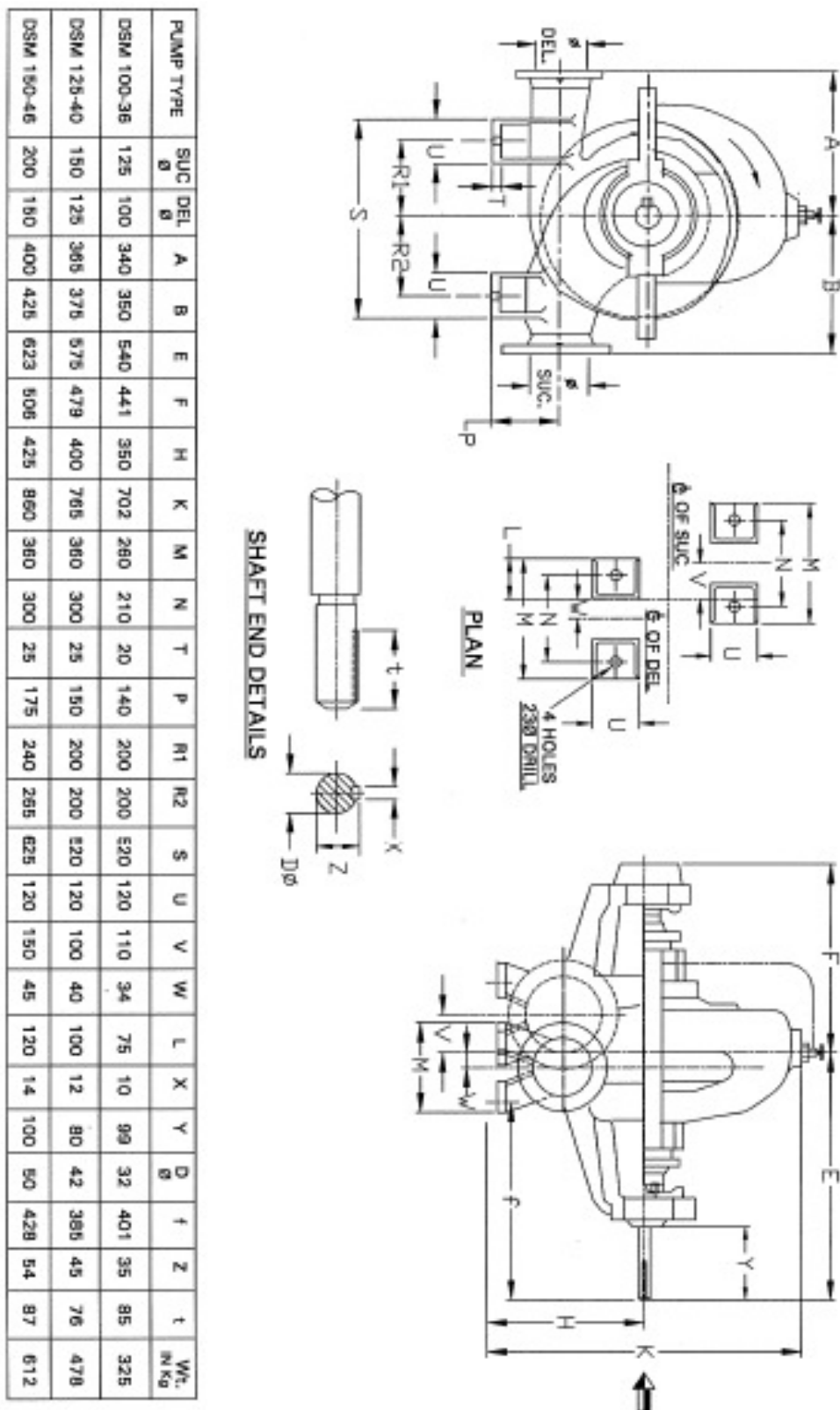
4.5.4 Stuffing box packing size – Please refer Technical Data Chart.

4.5.5 Flexible couplings – The pumps are supplied with LOVE-JOY type & pin bush type flexible couplings.

4.5.6 packing between upper and lower half casing-Dalmia Duplex board packing paper to be used of 1 mm thickness

4.5.7 Technical data chart.

- Position of lantern ring from Impeller side(NDE side): $2 + L + 3$ (for gland packing pumps)



NOTES:-

- ALL DIMENSIONS ARE IN mm
- FLANGES DRILLED TO BS 4504 PN 16 (FF)
- STANDARD DIRECTION OF ROTATION CLOCKWISE VIEWED FROM DRIVING END.

5. MAINTENANCE:

Preventive maintenance schedule is the periodical checks and precautions by which failures and breakdowns 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.

5.2 Periodical Maintenance

- 5.2.1 Replenish the grease.
- 5.2.2 Check the alignment of the pumpset.
- 5.2.3 Calibrate the measuring instruments.
- 5.2.4 Check the sealing and cooling connections for leakage etc.

6. OVERHAULING:

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

6.1 Dismantling Procedure for gland packed pumps.

- 6.1.1 Drain the pump by opening air vent valve & drain plugs.
- 6.1.2 Remove all the screws of bearing cap (274) tightened with lowers half casing.
- 6.1.3 Remove all the nuts and bolts (577, 581) and locating pin (611) of the upper and lower casing flange.
- 6.1.4 Insert a screw driver or peg bar into the slot between the two halves and separate two halves, lifting of the upper half casing
- 6.1.5 Lift the rotating unit out of the lower half casing.
- 6.1.6 Remove all the screws of bearing cartridge (241,253) tightened with casing & bearing cover (271) and dismantle the bearing cartridge.

6.1.7 Remove the bearing lock nut (336) and lock washer (415) from the NDE side of the shaft. By using bearing puller remove the bearings from the shaft. Remove the driving end bearing in the same manner.

6.1.8 Remove shoulder rings & bearing cover (271) in the same manner. Remove the liquid deflectors (236).

6.1.9 Take out gland (229) and remove the stuffing box packing. Remove fasteners used for tightening gland with pump casing.

6.1.10 Remove the sleeve lock nut, sleeve.

6.1.11 Remove impellers with impeller ring from shaft. Before removing impellers, put the marks of the first & second stage on the impellers.

6.1.12 Remove the impeller key (320). Take out interstage ring (204)

6.2 Assembly Procedure for gland packed pumps

6.2.1 Check the "O" rings of impellers for cut or flows, discard if faulty, lubricate and roll the "O" ring in groove.

6.2.2 Wipe over the shaft (180) with clean light oil.

6.2.3 Place the impeller key (320) into the keyway and interstage ring (204).

6.2.4 Check the 1st & 2nd stage impeller for correct rotation and slide onto the shaft from DE and NDE.

6.2.5 Place the sleeves (310) onto the shaft DE and NDE and using the DE sleeve lock nut (334) tight the DE sleeves against the impeller hub. After fixing the DE sleeve locate the NDE sleeve with sleeve nut. Slide the casing rings (190) onto the impellers. Insert the gland (229) from DE & NDE side of shaft.

6.2.6 Heat the bearing (260 & 263) to approximately 100 deg. C. (212 deg. F) using bearing oil bath.

6.2.7 Slide the heated bearing onto the shaft to about shoulder ring (199) non driving end. Place the locking washer (415) onto the shaft and screw the bearing lock nut (336) using spanner Lock up tightly against the bearing. Bend the washer in slot of bearing lock nut.

6.2.8 Cool the bearing to room temperature and coat both the slides with 200 grams of recommended grease. Tighten the bearing cover (271) with bearing cartridge.

- 6.2.9 Place the bearing cartridge over the bearings and tighten up with the lower half casing (123). Apply same procedure to the DE end side.
- 6.2.10 Place the cylindrical pins (used to locate the wear ring) in their respective holes. Install casing gasket (519) with a light coat grease on both gasket surfaces. Carefully align the inner edge of the gasket with the insert "O" rings. Lower the casing half upper (122) onto place and engage casing joint nuts loosely.
- 6.2.11 Lift the rotating unit by means of crane. Place it in lower half casing such that DE insert takes guide on lower half casing, casing rings should take guide in groove provided in lower half casing.
- 6.2.12 Place gland packing (430), lantern ring (227) in insert as per Cross sectional drawing.
- 6.2.13 Fit the shoulder ring (199) onto shaft. Ensure that no foreign particle should enter in bearing assembly. See the cross-sectional drawing.
- 6.2.14 Check whether both Impellers are centrally placed in volute. If it did not, adjust NDE sleeve.

NOTE- WHEN INSTALLING CASING HALF UPPER MAKES SURE THAT THE "O" RINGS ARE NOT CUT OR PUNCHED AND THE GASKET IS HARD AGAINST THE "O" RINGS.

- 6.2.15 Insert the locating pin (610) and drive them home.
- 6.2.16 Tighten the bearing cartridge with both upper and lower half casing.
- 6.2.17 Loosen the Cartridge seal clamps & tighten the cartridge seal allen screws with the shaft sleeve.
- 6.2.18 Install the stuffing box flushing piping.
- 6.2.19 Rotate the shaft by hand to assure smooth turning and that is free from rubbing or binding.

6.3 Dismantling Procedure for mechanical seal pumps.

6.3.1 Drain the pump by opening air vent valve & drain plugs.

6.3.2 Remove all the screws of bearing cap (274) tightened with lower half casing (123).

6.3.3 Loose the DE & NDE side mechanical seal cover (204) which are tightened with Lower & upper half casing with studs & nuts.

6.3.4 Remove all the nuts and bolts and locating pin of the upper and lower casing flange.

6.3.5 Insert a screw driver or peg bar into the slot between the two halves and separate two halves, lifting of the upper half casing (122).

6.3.6 Remove the rotating unit assembly from lower half casing (123) in such a way that impeller should not be damage.

6.1.7 Remove all the screws of bearing cartridge (241,253) tightened with casing & bearing cover (271) and dismantle the bearing cartridge.

6.1.8 Remove the bearing lock nut (336) and lock washer (415) from the NDE side of the shaft. By using bearing puller remove the bearings from the shaft. Remove the driving end bearing in the same manner.

6.1.9 Remove shoulder rings (199) & bearing cover (271) in the same manner. Remove the liquid deflectors (236). Then remove shaft sleeve nut (334), wear ring (190), shaft sleeve (310).

6.3.10 Remove mechanical seal cover (231) & its spring & rotary face very carefully.

Loose the grub screws of backing collar of mechanical seal & remove it from shaft sleeve (310).

6.3.11 Remove the 1st stage & 2nd stage impeller (158), impeller key (320) & interstage (204) ring.

6.4 Assembly Procedure for mechanical seal pumps

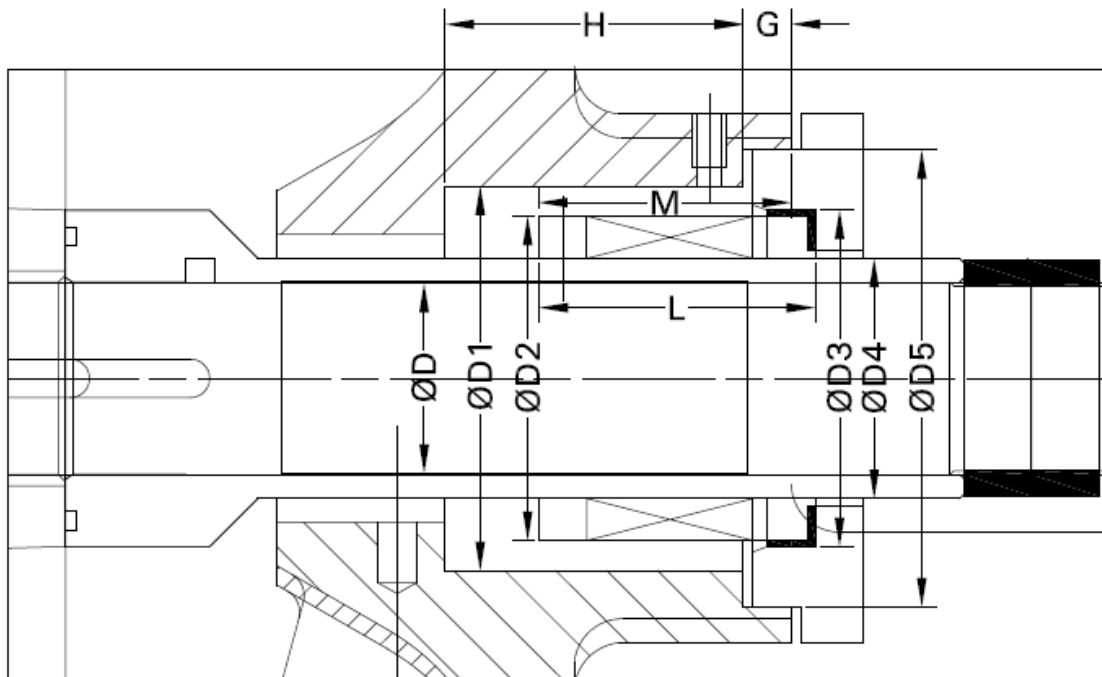
6.4.1 Check the "O" rings of impeller's for cut or flows, discard if faulty, lubricate and roll the "O" ring in groove.

6.4.2 Wipe over the shaft (180) with clean light oil.

6.4.3 Place the impeller key (320) into the keyway and interstage ring (204).

6.4.4 Check the 1st & 2nd stage impeller for correct rotation and slide onto the shaft from DE and NDE.

TABLE A - STUFFING BOX DETAILS: (FOR MECHANICAL SEAL)



SR NO	Pump Type	Diameters in mm						SEAL LENGTH 'L' mm	M mm	H mm	G mm
		D	D1	D2	D3	D4	D5				
1	DSM 100/36	40	80	67.4	70	50	95	57.5	52.5	62	10
2	DSM 125/40	50	95	85.7	92	70	110	60	53	77	10

6.4.5 Place the sleeves (310) onto the shaft DE and NDE and using the DE sleeve lock nut (334) tight the DE sleeves against the impeller hub. After fixing the DE sleeve locate the NDE sleeve with sleeve nut (334). Slide the casing rings (190) onto the impellers.

6.4.6 Place the mechanical seal's backing cover & its rotary assembly on shaft. Then place the mechanical seal cover (231), liquid deflector (236), and bearing cover (270) on shaft. Refer the cross-sectional drawing

6.4.7 Heat the bearing (260 & 263) to approximately 100 deg. C. (212 deg. F) using bearing oil bath.

6.4.8 Slide the heated bearing onto the shaft to about shoulder ring (199) non driving end. Place the locking washer onto the shaft and screw the bearing lock nut (336) using spanner. Lock up tightly against the bearing. Bend the washer in slot of bearing lock nut.

6.4.9 Cool the bearing to room temperature and coat both the slides with 200 grams of recommended grease.

6.4.10 Place the bearing cartridge over the bearings and tighten up with the pump casing. .

6.4.11 Tighten the bearing cover (271) with bearing cartridge.

6.4.12 Apply same procedure to the DE end side.

6.4.13 Lift the rotating unit by means of crane. Place it in lower half casing such that DE insert takes guide on lower half casing, casing rings should takes guide in groove provided in lower half casing.

6.4.14 Check whether both Impellers are centrally placed in volute. If it did not, adjust NDE sleeve.

6.4.15 Place the cylindrical pins (used to locate the wear ring) in their respective holes. Install casing gasket (519) with a light coat grease on both gasket surfaces.

6.4.16 Insert the locating pin (611) and drive them home.

6.4.17 as per above TABLE (A) mark the distance & tight the mechanical seal's backing cover with grub screw. Tight the mechanical seal cover (231) to lower & upper half casing with studs & nuts. Refer the cross-sectional drawing.

6.4.18 Lower the casing half upper (122) onto place and engage casing joint nuts loosely.

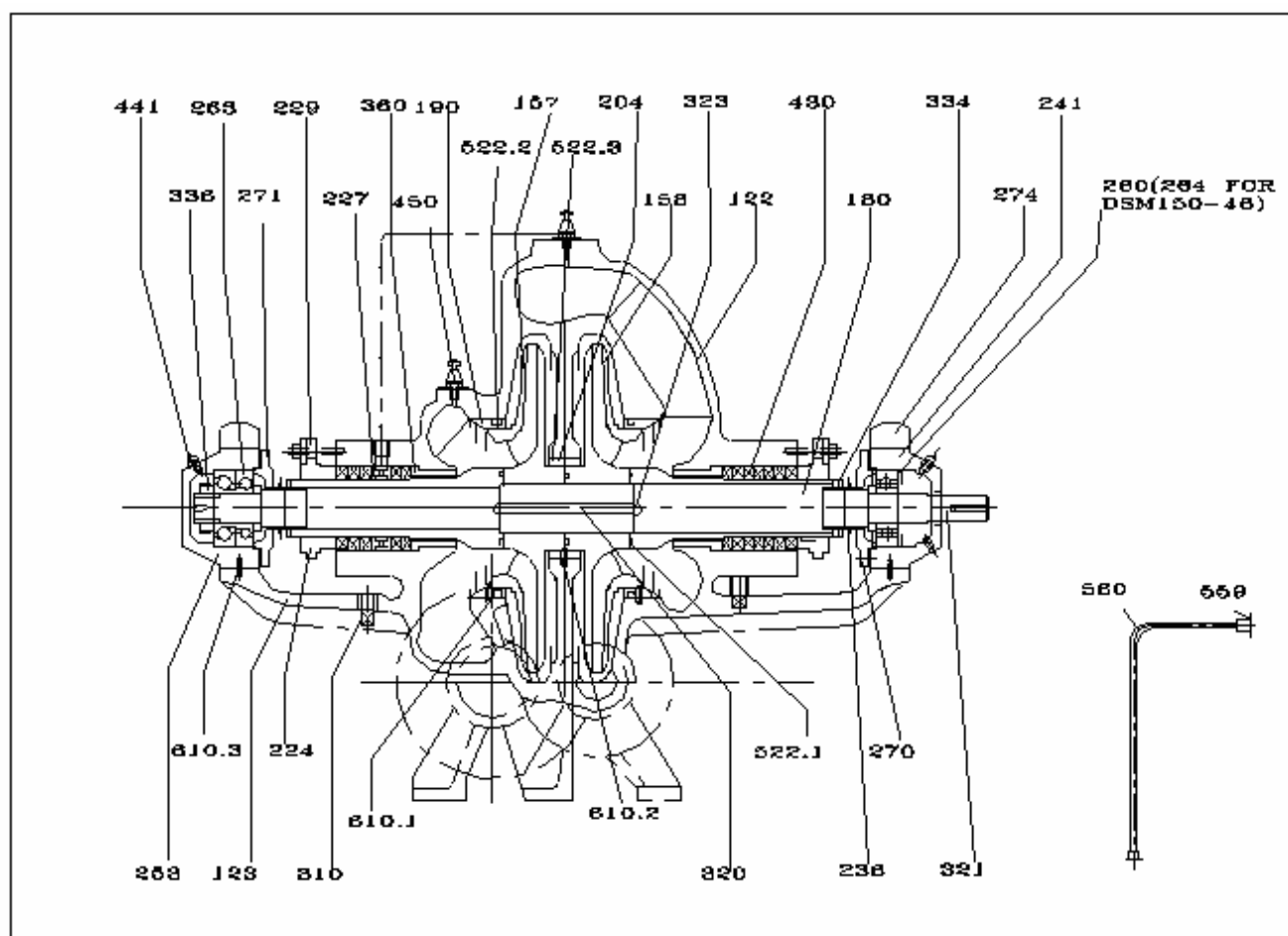
NOTE- WHEN INSTALLING CASING HALF UPPER MAKES SURE THAT THE "O" RINGS ARE NOT CUT OR PUNCHED AND THE GASKET IS HARD AGAINST THE "O" RINGS.

6.4.19 Tighten the bearing cartridge with both upper and lowers half casing.

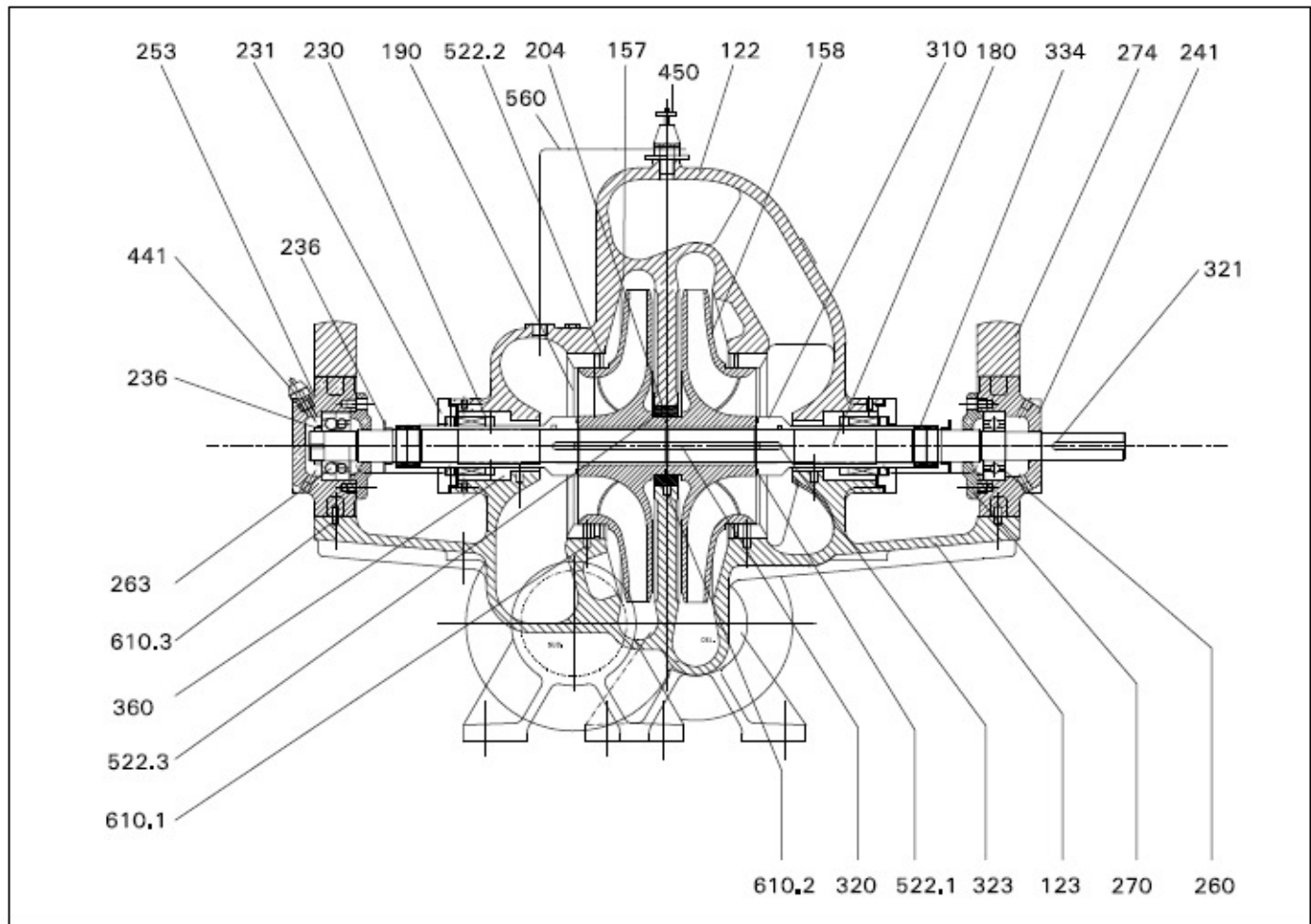
6.4.20 Rotate the shaft by hand to assure smooth turning and that is free from rubbing or binding.

7 CROSS SECTIONAL DRAWINGS :

7.2.1 NON THRU BORE TYPE PUMP (Gland packing type):



7.1.2 NON THRU BORE TYPE PUMP (Mechanical seal type):



7.1.3. SPARE PART LIST

7.1.3.1 Common components for gland packed pumps & mechanical seal pump

PART NO	DESCRIPTION	QTY
122	CASING HALF UPPER	1
123	CASING HALF LOWER	1
157*	IMPELLER I STAGE	1
158*	IMPELLER II STAGE	1
180*	PUMP SHAFT	1
190*	WEAR RING	2
199	SHOULDER RING	2
204	INTERSTAGE RING	1
236*	LIQUID DEFLECTOR	2
241	BEARING HOUSING DE	1
253	BEARING HOUSING NDE	1
260*	DEEP GROOVE BRG	1
263*	CYLINDRICAL ROLLER BRG N314	1
270	BEARING COVER DE & NDE	1
274	BEARING CAP	2
303	LIFTING EYE BOLT	2
320	KEY FOR IMPELLER	1
321	KEY FOR COUPLING	1
323	KEY FOR SLEEVE	1
334	SHAFT SLEEVE NUT	4
336	ROUND LOCK NUT	2
415	LOCK WASHER FOR BEARING	2
441	GREASE NIPPLE FOR BEARING	2
450	VENT VALVE	2
519	GASKET FOR CASING	1
522*	O RING FOR SHAFT SLEEVE	2
522.1	O RING FOR INSERT	3
522.2	O RING FOR WEAR RING.	2
530	PIPE NIPPLE FOR SELF SEALING	1
550	WHEEL COCK FOR SEALING	1
559	STUD COUPLING FOR SEALING	2
560	SEALING TUBE	1
577	HEX SCREW FOR BEARING HOUSING	8
577.1	HEX SCRW FOR BEARING HOUSING & CASING	24
577.2	HEX SCREW FOR BEARING HOUSING & INSERT	8
581	HEX NUT FOR T/B CASING	24
582	HEX NUT FOR SPLIT GLAND	4
590	STUD FOR T/B CASING	26
600	PIPE PLUG FOR SUCTION AND DELIVERY	2
601	PIPE PLUG FOR DRAIN	2

PART NO	DESCRIPTION	QTY
602	PIPE PLUG FOR SEALING	1
604	PIPE PLUG FOR STUFFING BOX	2
610.2*	CYLINDRICAL PIN FOR INTER STG DIAPHRAGM	1
610.1*	CYLINDRICAL PIN FOR WEARING RING.	2
611	TAPER PIN FOR T/B CASING	2
640	RIVET TB NAME PLATE.	4
668	HEX.SOCKET GRUB SCREW	1
670	DUTY NAME PLATE	1
731	STUD FOR SPLIT OR NON-SPLIT GLAND	4

7.1.3.2 Component for Gland packed pumps

PART NO	DESCRIPTION	QTY
229*	GLAND	2
224*	CLAMPING PLATE FOR SPLIT GLAND	2
227.1*	SPLIT LANTEN RING	1
228	STUFFING BOX BUSH	2
310*	SHAFT SLEEVE	2
430*	GLAND PACKING	2 Set

7.1.3.2 Component for Mechanical seal pump

PART NO	DESCRIPTION	QTY
310*	SHAFT SLEEVE FOR MECHANICAL SEAL	2
230*	MECHANICAL SEAL	2
231*	MECHANICAL SEAL COVER	2

* Parts for two years normal working of the pumps.

** These parts should be included in the order, while ordering top and bottom casing.

N Quantity depends upon pump type.

GENERAL INFORMATION & SAFETY REQUIREMENTS

- 1.0 The products supplied by KBL have been designed with safety in mind. Where hazards cannot be eliminated, the risk has been minimised by the use of guards and other design features. Some hazards cannot be guarded against and the instructions below **MUST BE COMPLIED WITH** for safe operation. These instructions cannot cover all circumstances; **YOU** are responsible for using safe working practices at all times.
- 1.1 KBL products are designed for installation in designated area, which are to be kept clean and free of obstructions that may restrict safe access to the controls and maintenance access points.
- A Pump Duty Nameplate is fitted to each unit and must not be removed. Loss of this plate could make identification impossible. This in turn could affect safety and cause difficulty in obtaining spare parts. If accidental loss or damage occur, contact KBL immediately.
- 1.2 Access to the equipment should be restricted to the personnel responsible for installation, operation and maintenance and they must be trained, adequately qualified and supplied with appropriate tools for their respective tasks.
- 1.3 KBL requires that, all personnel that are responsible for installation, operation or maintenance of the equipment, have access to and study the product instruction manual **BEFORE** any work is done and that they will comply with all local and industry based safety instructions and regulations.
- 1.4 Ear defenders should be worn where the specified equipment noise level exceeds locally defined safe levels. Safety glasses or goggles should be worn where working with pressurised systems and hazardous substances. Other personnel protection equipment must be worn where local rules apply.
- 1.5 Do not wear loose clothing or jewellery which could catch on the controls or become trapped in the equipment.
- 1.6 Read the instruction manual before installation, operation and maintenance of the equipment. Check and confirm that the manual is relevant copy by comparing pump type on the nameplate and with that on the manual.
- 1.7 Note the 'Limits of product application – permissible use' specified in the manual. Operation of the equipment beyond these limits will increase the risk from hazards noted below and may lead to premature and hazardous pump failure.
- 1.8 Clear and easy access to all controls, gauges and dials etc. must be maintained at all times. Hazardous or flammable materials must not be stored in pump rooms unless safe areas or racking and suitable containers have been provided.
- 1.9 **IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF THIS KBL PRODUCT COULD RESULT IN INJURY OR DEATH.**

2.0 SAFETY INSTRUCTIONS WHILE HANDLING AND STORAGE

When lifting the pump, use the lifting points specified on general arrangement drawing. Use lifting equipment having a safe working load rating suitable for the weight specified. Use suitable slings for lifting pump which is not provided with lifting points. The use of fork-lift truck and chain crane sling equipment is recommended but locally approved equipment of suitable rating may be used.

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

3.0 SAFETY INSTRUCTIONS WHILE ASSEMBLY & INSTALLATION

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

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

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

Failure to support suction and delivery pipework may result in distortion of the pump casing, with the possibility of early pump failure.

4.0 SAFETY INSTRUCTIONS WHILE COMMISSIONING & OPERATION.

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

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

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

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

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

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

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

5.0 SAFETY INSTRUCTIONS WHILE MAINTENANCE & SERVICING

Before attempting any maintenance on a pump particularly if it has been handling any form of hazardous liquid, it should be ensured that the unit is safe to work on. The pump must be flushed thoroughly with suitable cleaner to purge away any of the product left in the pump components. This should be carried out by the plant operator and a certificate of cleanliness obtained before starting work. To avoid any risk to health it is also advisable to wear protective clothing as recommended by the site safety officer especially when removing old packing which may be contaminated.

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

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

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

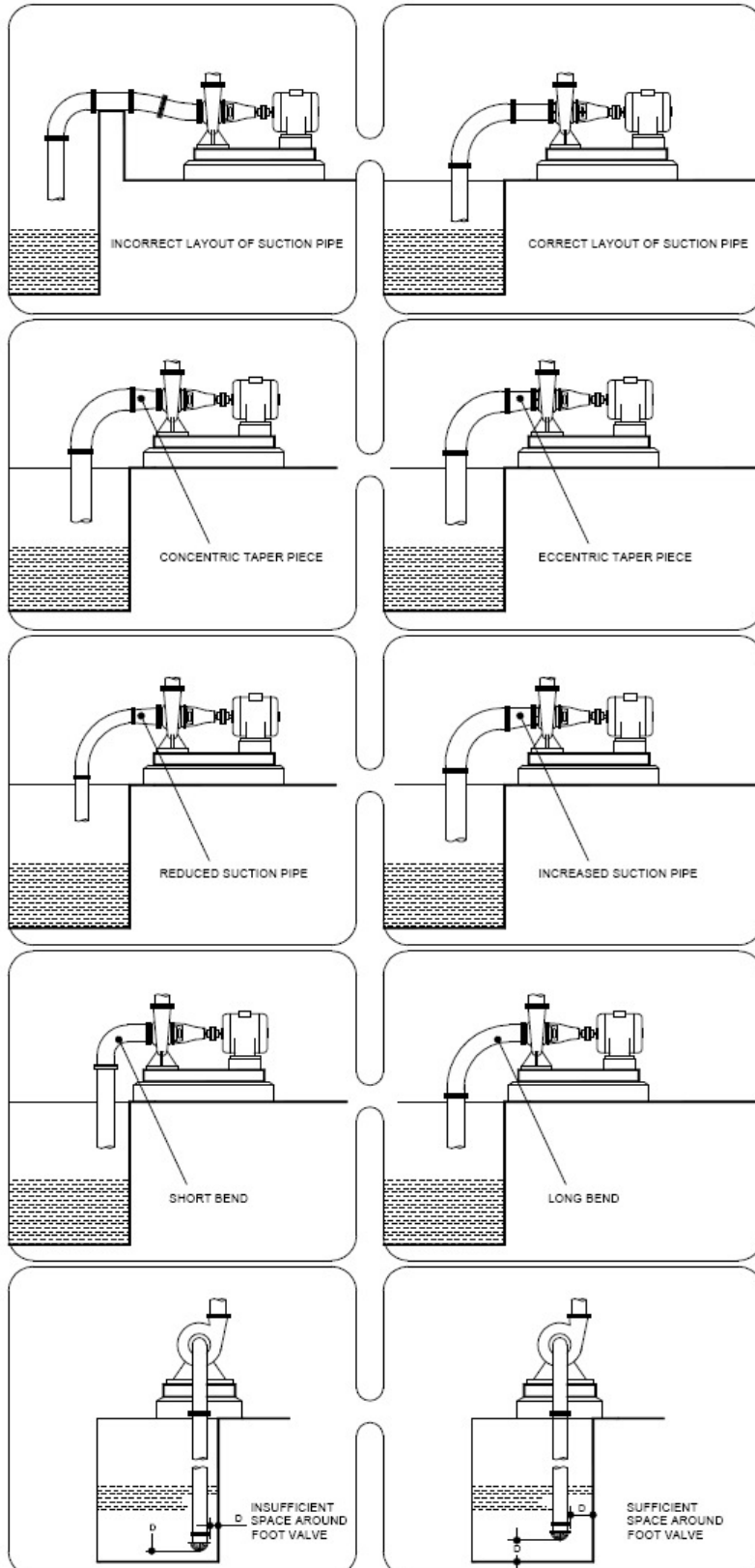
Isolate the equipment before any maintenance work is done. Switch off the mains supply, remove fuses, apply lock-outs where applicable and affix suitable isolation warning signs to prevent inadvertent reconnection. In order to avoid the possibility of maintenance personnel inhaling dangerous fumes or vapours, it is recommended that the maintenance work be carried out away from the pump locations by removal of bearing housing and shaft assembly to a suitable maintenance area.

Ref: Proposed draft standard prEN 800:
Pumps and pump units for liquids;
General safety requirements



INCORRECT

CORRECT



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

GENERAL INSTRUCTIONS FOR INSTALLATION OPERATION & MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS

**GENERAL INSTRUCTIONS
FOR INSTALLATION, OPERATION
& MAINTENANCE OF**

KIRLOSKAR CENTRIFUGAL PUMPS

WARNING

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

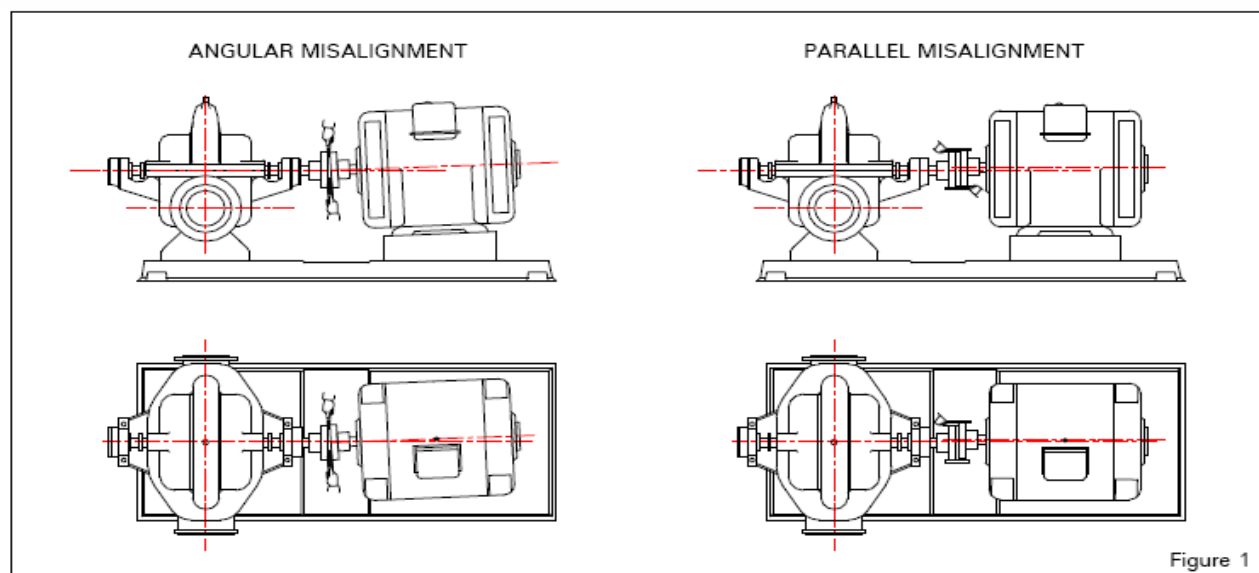


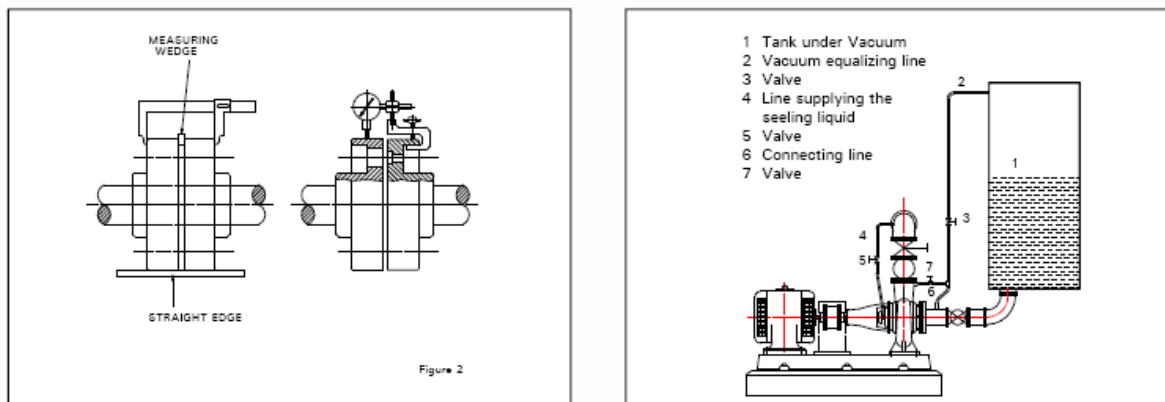
Figure 1

LEVELLING THE UNIT

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

FLEXIBLE COUPLING ALIGNMENT (SEE 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 an outside caliper.



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

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

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

GROUTING

When the alignment is correct, the foundation bolts should be tightened evenly but not too firmly. The unit can then be grouted by working soft concrete under the edges. Foundation bolts should not be fully tightened until the grout is hardened, usually 48 hours after 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 along radius wherever possible. The pipe lines should be free from scales, welding residuals etc., and have to be mounted in such a way that they can be connected to suction and delivery flanges without any stress on the pump. Adequate supports should be given to pipe lines so that weight of the pipe lines does not fall on the pump. The use of minimum number of the bends and other fittings will minimise the frictional losses.

SUCTION PIPE

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

The end of the suction pipe must be well submerged to avoid whirlpools and ingress of air but must be kept clear of any deposits of mud, silt, grit etc. The pipe must be clear of 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 EQUALISING LINE (AND LIQUID LINE) (SEE FIGURE 3)

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

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

FOOT VALVE

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

STUFFING BOXES AND PACKING

Stuffing boxes should be carefully cleaned and the packing placed in them. Be sure that sufficient packing is placed at the back of the water seal cage. If the water to be pumped is dirty or gritty, sealing water should be piped to the stuffing boxes from clean outside source of supply in order to prevent damage to the packing and shaft. In placing the packing, each packing ring should be cut to the proper length so that ends come together but do not overlap. The succeeding rings of packing should not be pressed too tight as it may result in burning the packing and cutting the shaft. If stuffing box is not properly packed, friction in stuffing box prevents turning the rotor by hand. On starting the pump it is well to have the packing slightly loose without causing an air leak, and if it seems to leak, instead of putting too much pressure on the gland, put some heavy oil in the stuffing box until the pump works properly and then gradually tighten up the gland. The packing should be occasionally changed.

BALL BEARINGS

Correct maintenance of ball bearings is essential. The bearing manufacturers give the following as a guide to relubrication periods under normal conditions.

Three monthly when on continuous duty.

Six monthly when on eight-hour per duty.

The bearings and housings should be completely cleaned and recharged with fresh grease after 2500 hours or the nearest pump overhaul time.

PRIMING

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

(1) Liquid level above pump level

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

(2) Priming with foot valve

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

(b) When there is liquid under some pressure in the discharge pipe, priming can be effected by 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 pumps as stamped on the name plate.

PUMP TROUBLE

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

BREAK DOWN-CAUSE-CHECK POINTS

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

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

CHECK POINTS

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



Enriching Lives

INSTRUCTIONS ON INSTALLATION OPERATION AND MAINTENANCE FOR

KIRLOSKAR MULTISTAGE PUMP TYPE DSM (THRU BORE)

DSM 50/20

DSM 65/20

DSM 50/28

DSM 65/32 A/B

DSM 80/36

KIRLOSKAR BROTHERS LIMITED

UDYOG BHAVAN, TILAK ROAD, PUNE - 411 002

KIRLOSKAR BROTHERS LIMITED
Udyog Bhavan, Tilak Road, Pune 411 002 (India)

WARRANTY

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

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

KIRLOSKAR BROTHERS LIMITED

CONTENTS

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 the parts, part nos. And material of construction while ordering spare parts for the pumps.

CAUTION

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

1. GENERAL:

- 1.1 The booklet covers instructions for the following type of “DSM” pumps.
- DSM 50/20
- DSM 65/20
- DSM 50/28
- DSM 65/32 A/B
- DSM 80/36
- 1.2 These are Horizontal split Casing type, two stage pumps. This construction enables to remove the rotating unit without disturbing pipe connections and alignment.
- 1.3 Pumps when properly installed and given due care in operation and maintenance should operate satisfactorily for a long period.
- 1.4 When the pump is received, sometime before the actual use of pump, it should be inspected and stored in a dry place. The coupling should be rotated at least once in a month to prevent pitting of bearing surfaces.

2 INSTALLATION :

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 with this booklet -must be followed carefully.

- 2.1 The sealing connection piping to the pump stuffing box must be made after installing and before commissioning the pump.
- 2.2 Put the gland packing and lantern ring, if it is sent separately along with the pump as per given procedure.

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 provided is properly tightened and adjusted.
- 3.1.3. Fill in the grease for bearings, if not done earlier.
- 3.1.4. The direction of rotation of motor corresponds to the direction of rotation of the pump.
- 3.1.5. The pump and the 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 the 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

3.3.1 The pump is running smoothly.

3.3.2 The flow of sealing water is uninterrupted.

3.3.3 Leakage through stuffing box is normal. This is required for cooling of Stuffing box/ Gland packing.

3.3.4 The bearings are not getting heated up excessively.

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

3.3.6 Power consumption is within limit.

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

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

3.4 During stopping the pump:

3.4.1 Close the valve on delivery side.

3.4.2 Stop the motor.

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

4. TECHNICAL DATA:

4.1 Direction of rotation

The standard direction of rotation is clockwise when viewed from driving end. The pump suitable for anticlockwise rotation can also be supplied against specific requirements.

4.2 Normally the pumps are supplied suitable for speed of 1450 rpm. Please contact supplier if the pump is to be used for higher speeds.

4.3 Bearings

The shaft is supplied with antifriction bearings at driving end and non- driving end. The details of the bearings are given in the technical data chart (4.5.7). The designations of bearings are as per SKF catalogue. However, equivalent bearings in type, capacity and dimensions are also used.

4.4 Lubrication

- 4.4.1 Type of lubricant – The bearings are grease lubricated.
- 4.4.2 Quantity of grease – Please refer to Technical Data chart. (4.5.7)
- 4.4.3 Refilling period – After 1000 hours of running.
- 4.4.4 Bearing temperature – The permissible bearing temperature rise is 40°C above ambient temperature
- 4.4.5 Grades of recommended grease-

Following grades of grease of their equivalents available in the market are suitable for bearing lubrication.

	2900 RPM	1450 RPM
INDIAN OIL	SERVOGEM- 2	SERVOGEM- 3
HINDUSTAN PETROLEUM		NATRA- 3 OR LITHON – 3
CALTEX		STARFAK- 3

4.5 Stuffing box

- 4.5.1 Stuffing box – The stuffing boxes are extra deep to reduce the leakage.
- 4.5.2 Stuffing box sealing – Lantern ring provided for sealing purpose is used only in first stage stuffing box. Normally clear cold self liquid only is used for sealing. Grease Sealing/ External sealing can be provided against specific request.
- 4.5.3 Stuffing box packing
- Champion Style–3116–Graphited Cotton Grease packing is used in the pump as a standard supply. However, stuffing box packing suitable for liquid handled is supplied against specific requirements.
- 4.5.4 Stuffing box packing size
- Please refer Technical Data Chart. (4.5.7)
- 4.5.5 Flexible couplings
- The pumps are supplied with flexible couplings. Details are given in Technical Data Chart.
- 4.5.6 Packings between upper and lower half casing

Dalmia Duplex board packing paper to be used of following thickness.

PUMP TYPE	PACKING THICKNESS IN MM.
DSM 100/36	0.4
DSM 65/20	0.4
DSM 50/28	0.4
DSM 65/32 A/B	0.4
DSM 80/36	0.4

4.5.7 Technical data Chart

PUMP TYPE "DSM" ----- >	DSM 50/20	DSM 65/20	DSM 50/28	DSM 65/32 A/B	DSM 80/36
FLANGE SIZE IN MM DEL. x SUC.	50 x 80	65 x 100	50 x 65	65 x 80	80 x 100
BALL BEARING NO. SKF OR EQUIV.					
DRIVING END	6307	6309	6306	6306	6307
NON DRIVING END	6307	6408	6306	6306	6307
QTY. OF GREASE PER BRG. Gms	100	100	100	100	100
ST. BOX PACKING SIZE IN MM.					
SIZE x LENGTH	10 SQ x 1660	10 SQ x 2010	10 SQ x 1560	10 SQ x 1560	10 SQ x 1650
POSITION OF LANTERN RING (L) FROM IMPELLER SIDE (NDE SIDE)	2 + L + 3	2 + L + 3	2 + L + 2	2 + L + 3	2 + L + 2
NO. OF PACKING RINGS					
DE (Lantern ring is not required of DE side)	6	6	5	6	6
NDE(Lantern ring is not required of DE side)	5	5	4	5	4
COUPLING: FLEXIBLE JOY TYPE	KWS 150	KWS 225	KWS 110	KWS 190	KWC 226

5. MAINTENANCE:

Preventive maintenance schedule is the periodical checks and precautions by which failures and breakdowns 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.

5.2 Periodical Maintenance

- 5.2.1 Replenish the grease.
- 5.2.2 Check 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 and cooling connections for leakage etc.

6. OVERHAULING:

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

6.1 Dismantling Procedure

- 6.1.1 Drain the pump by opening air vent valve (450).
- 6.1.2 Remove all the nuts and bolts (572, 581) and locating pin (611) of the upper and lower casing flange.
- 6.1.3 Loosen all the insert joint nuts (586) at both the ends.
- 6.1.4 Insert a screw driver or peg bar into the slot between the two halves and separate two halves, lifting of the upper half casing
- 6.1.5 Tap the inserts (979.1 and 979.2) with a soft hammer to break the seat between the insert and lower half casing and lift the rotating unit out of the lower half casing.
- 6.1.6 Remove four hex. nuts (586) from each bearing housing (240.1 and 240.2) and remove the bearing housing from bearings.
- 6.1.7 Remove the bearing lock nut (335) and lock washer (415) from the NDE side of the shaft and using by bearing puller. Remove the bearing (260) from the shaft. Remove the driving end bearing in the same manner.
- 6.1.8 Remove the oil seals (500) from the insert. Remove shoulder rings (199) from the shaft by using puller. Remove the liquid deflectors (236).

- 6.1.9 Remove gland nuts (582) and washers (624) from each gland, slide the inserts (979.1 and 979.2) off the shaft.
- 6.1.10 Remove the gland packings (430) and the lantern ring 9227) from the NDE side insert.
- 6.1.11 Remove the two casing rings (190) from the impellers (157 and 158).
- 6.1.12 First unscrew the impeller nuts (586). Remove the lock washers (410) and distance sleeves (201).
- 6.1.13 Take out the impellers (157 and 158). Before removing the impellers put the mark of first stage and second stage impellers so that while reassembling, the impellers may not be interchanged.
- 6.1.14 Remove the impeller key (320). Take out interstage ring (227) alongwith the interstage diaphragm (462).

6.2 Assembly Procedure

- 6.2.1 Check the "O" rings (522.2) for cut or flows, discard if faulty, lubricate and roll the "O" ring in groove.
- 6.2.2 Wipe over the shaft (180) with clean light oil.
- 6.2.3 Place the impeller key (320) into the keyway and interstage ring (204) alongwith interstage diaphragm (462).
- 6.2.4 Check the 1st & 2nd stage impeller for correct rotation and slide onto the shaft from DE and NDE.
- 6.2.5 Place the distance sleeves (201) onto the shaft DE and NDE and using the impeller nut (300) and lock washer (410) tight against the impeller hub. Slide the casing rings (199) onto the impellers.
- 6.2.6 Check the "O" rings (522.1) for cuts or flaws, discard if faulty. Lubricate and roll the "O" ring (522.1) into the groove in each insert (979.1 and 979.2).
- 6.2.7 Slide insert (979.1 and 979.2), glands (223) and liquid deflectors (236) simultaneously over the shaft with guide vane at proper position.
- 6.2.8 Fit the shoulder ring (227) onto shaft then press oil seal (500) into the insert. Ensure that no foreign particle should enter in bearing assembly. See the cross-sectional drawing.
- 6.2.9 Heat the ball bearing (260) to approximately 100 deg. C. (212 deg. F) using bearing oil bath.

NOTE: DO NOT EXCEED 120 DEG.C (250 DEG. F)

- 6.2.10 Slide the heated bearing onto the shaft to abut shoulder ring (227) nondriving end. Place the locking washer (415) onto the shaft and screw the bearing lock nut (335) using spanner* Lock up tightly against the bearing. Bend the washer in slot of bearing lock nut.
- 6.2.11 Cool the bearing to room temperature and coat both the slides with 40 grams of recommended grease.
- 6.2.12 Apply grease on bearing housing (240.2) OD and slide into the place over bearing. Secure bearing housings to insert with four hex. nuts (586) and studs (593).

- 6.2.13 At the coupling end heat the bearing (260) to approximately 100°C (212° F) using the bearing oil bath.
- 6.2.14 Slide the heated bearing onto the shaft to abut shoulder ring (199) coupling end.
- 6.2.15 Cool the bearing to room temperature and coat both sides with about 40 grams of recommended grease.
- 6.2.16 Coat the inside of the bearing housing (240.1) with grease and slide into place over bearing. Secure the bearing housing to the insert with four hex. nuts (586) and studs (593).
- 6.2.17 Place the cylindrical pins (610) in their respective holes. Set the rotating unit in the casing half lower. Locate both the insert tongues. Correct any excessive "O" ring buckling. Check that the impeller is centralised in the casing +/- 2mm and that there are no rubs.
- 6.2.18 Install casing gasket (519) with a light coat grease on both gasket surfaces. Carefully align the inner edge of the gasket with the insert "O" rings.
- 6.2.19 Lower the casing half upper (122) onto place and engage casing joint nuts loosely.
- NOTE- WHEN INSTALLING CASING HALF UPPER MAKE SURE THAT THE "O" RINGS (522.1) ARE NOT CUT OR PUNCHED AND THE GASKET IS HARD AGAINST THE "O" RINGS.**
- 6.2.20 Insert the locating pin (611) and drive them home. Tighten the joint nuts (581).
- 6.2.21 Install the stuffing box flushing piping.
- 6.2.22 Rotate the shaft by hand to assure smooth turning and that is free from rubbing or binding.

7. SPARE PART LIST

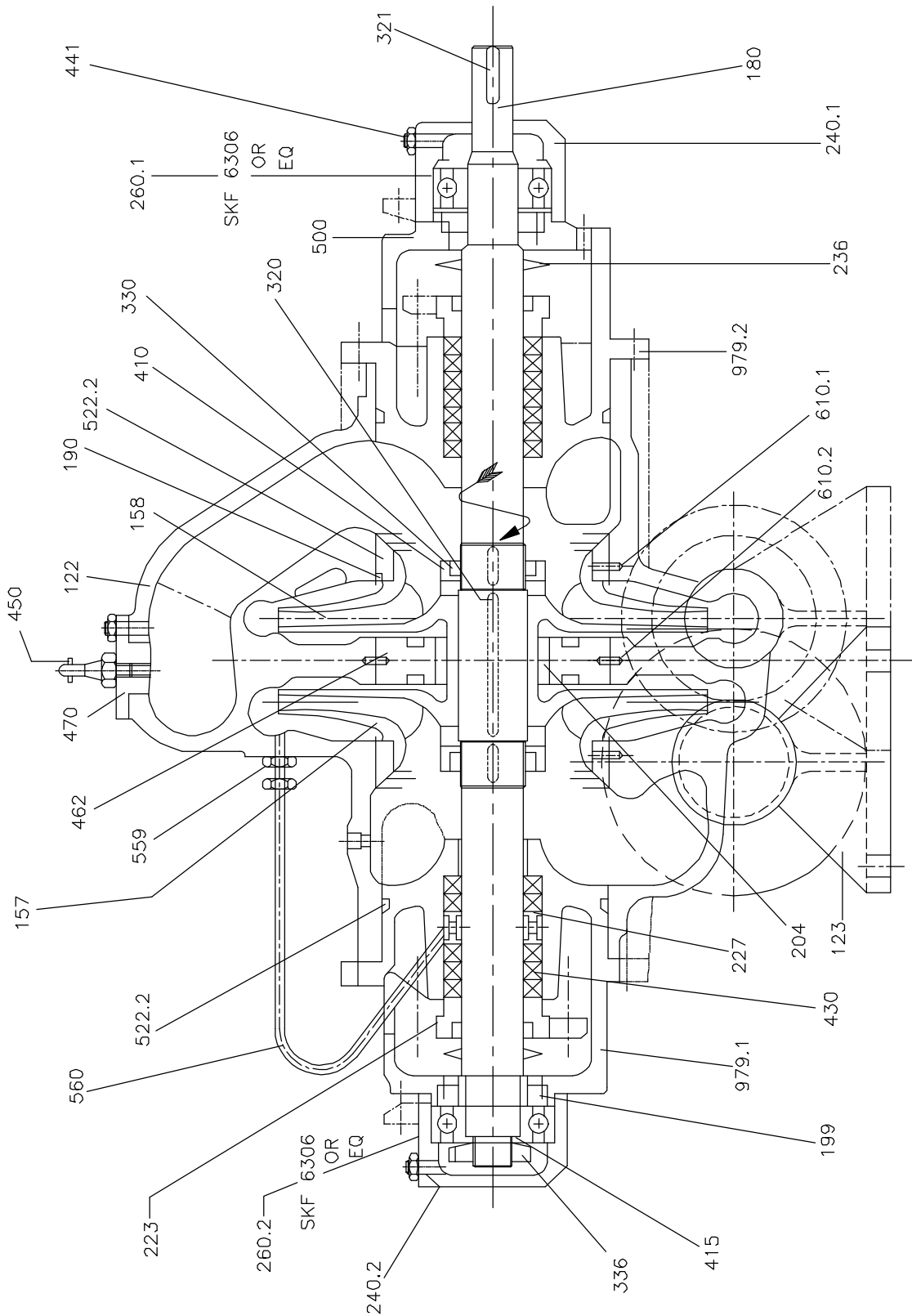
PART NOS.	DESCRIPTION	NO. OF PUMP
122	Casing half upper	1
123	Casing half lower	1
157 *	Impeller, 1 st stage	1
158 *	Impeller, 2 nd stage	1
180 *	Pump shaft	1
190 *	Wear ring	2
204 *	Interstage ring	1
260 *	Ball bearing	1
274	Bearing Cap	2
310 *	Shaft sleeve, DE/NDE	1
227 *	Lantern ring	2
350 *	stuffing box bush	2
236 *	Water Deflector DE/NDE	1
450	Air vent	2
320 *	Impeller key	2
321 *	Coupling key	1
335 *	Bearing nut	1

PART NOS.	DESCRIPTION	NO. OF PUMP
586	Bolts with nuts for 274	4
572	Bolts for upper and lower half casing	1 set
581	Nuts for Lower half casing	1 set
631	Hex screw for bearing cover	8
611*	Taper pin with washes and nuts for lower and upper half casing	2
610*	Cylindrical pin	2
601	Drain plug for casing	2
600	Plug for Suc. & Del. Pressure gauge connections	2
602	Plug for sealing	1
604	Plug for st. box leakage water	2
430	Gland packing	1set
519*	Paper packing between 122 & 123	1
522*	'O' ring for shaft sleeve	2
441	Grease nipple for lubrication	2
560	Nylon tube for sealing	1
670	Duty name plate	1
264*	Cylindrical roller bearing SKF N 311 or equivalent	1
263*	Double row angular contact ball bearing SKF:7310 BG or equivalent	1
336*	Bearing lock nut ND/NDE	2
550	Wheel cock	1
223*	Gland (non split)	2
979.1	Insert DE	1
979.2	Insert NDE	1
240.1	Bearing Housing DE	1
240.2	Bearing housing NDE	1
415*	Lock Washer	2
500*	Oil Seal	2
199*	Shoulder Ring	2
582	Gland Nut	4
624	Washer	4
223*	Gland	2
330*	Impeller nut	2
410*	Lock washer	2
201*	Distance Sleeve	2
204*	Inter stage ring	1

* Recommended spares.

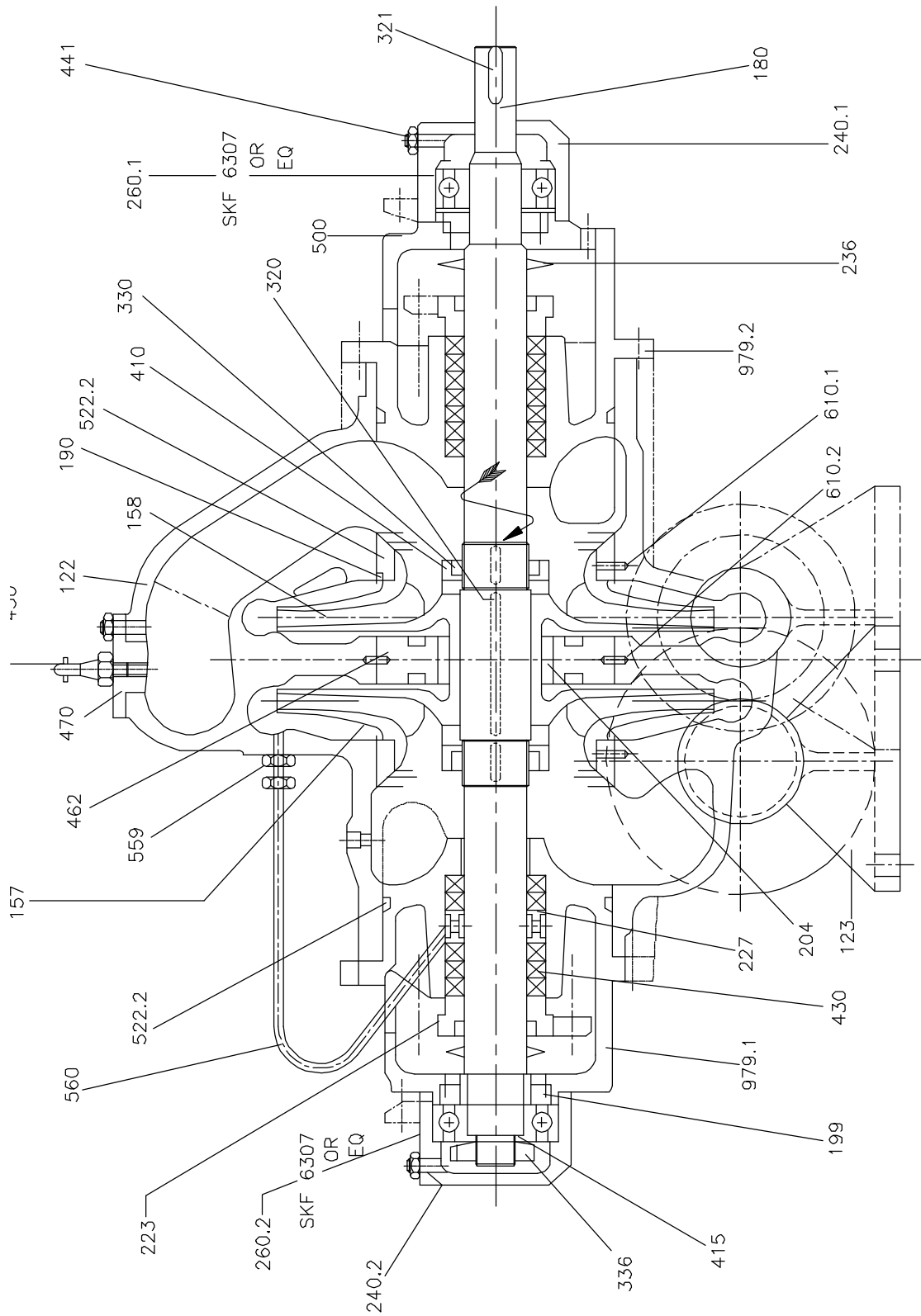
**CROSS SECTIONAL ASSEMBLY OF DSM 50-28 PUMP CW
(THRU BORE TYPE PUMP) DSM 65 32A/B**

DRG.NO.
TC 172-90-003-0



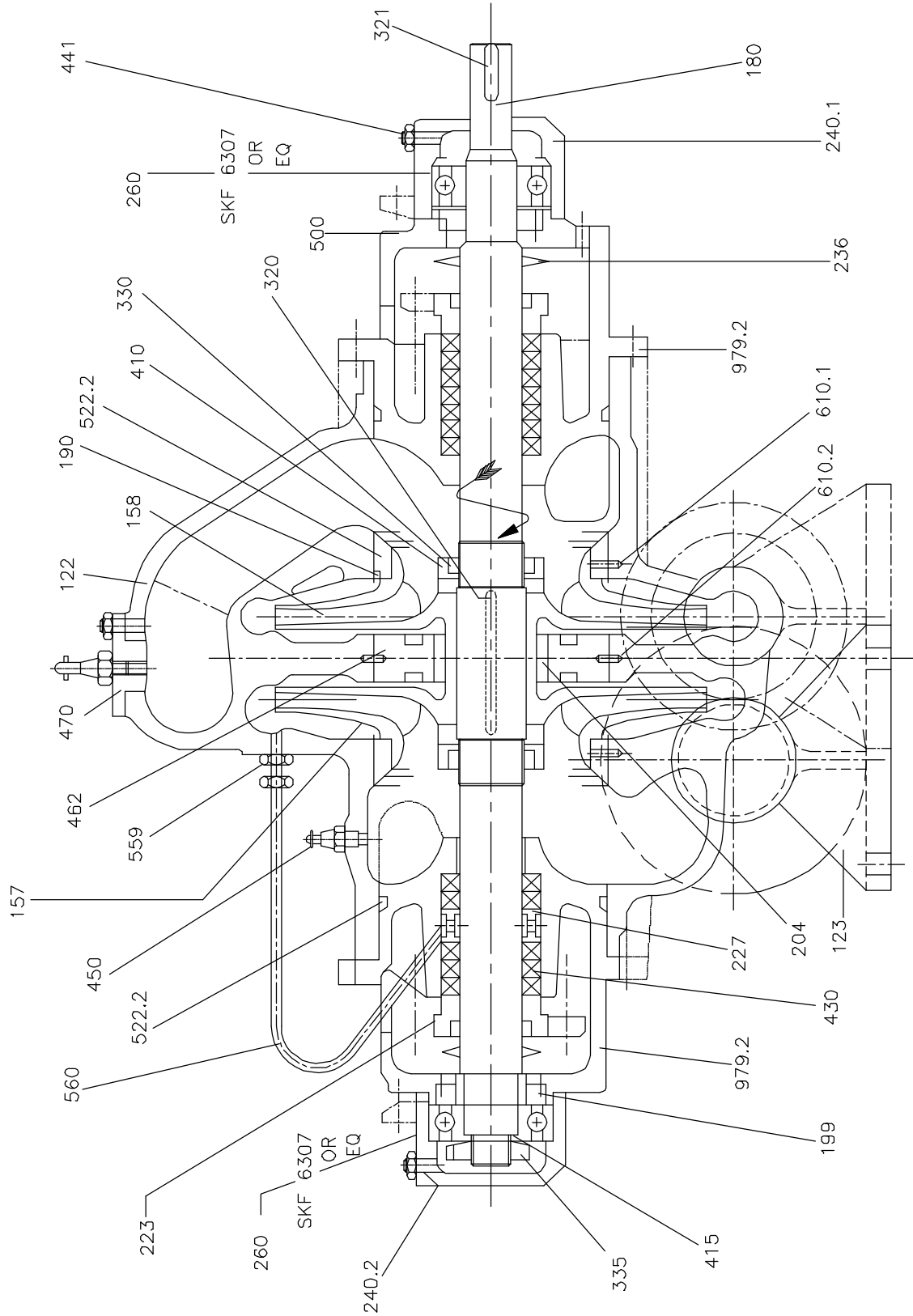
**CROSS SECTIONAL ASSEMBLY OF DSM 80-36 PUMP CW
(THRU BORE TYPE PUMP)**

DRG.NO.
TC 172-90005.0



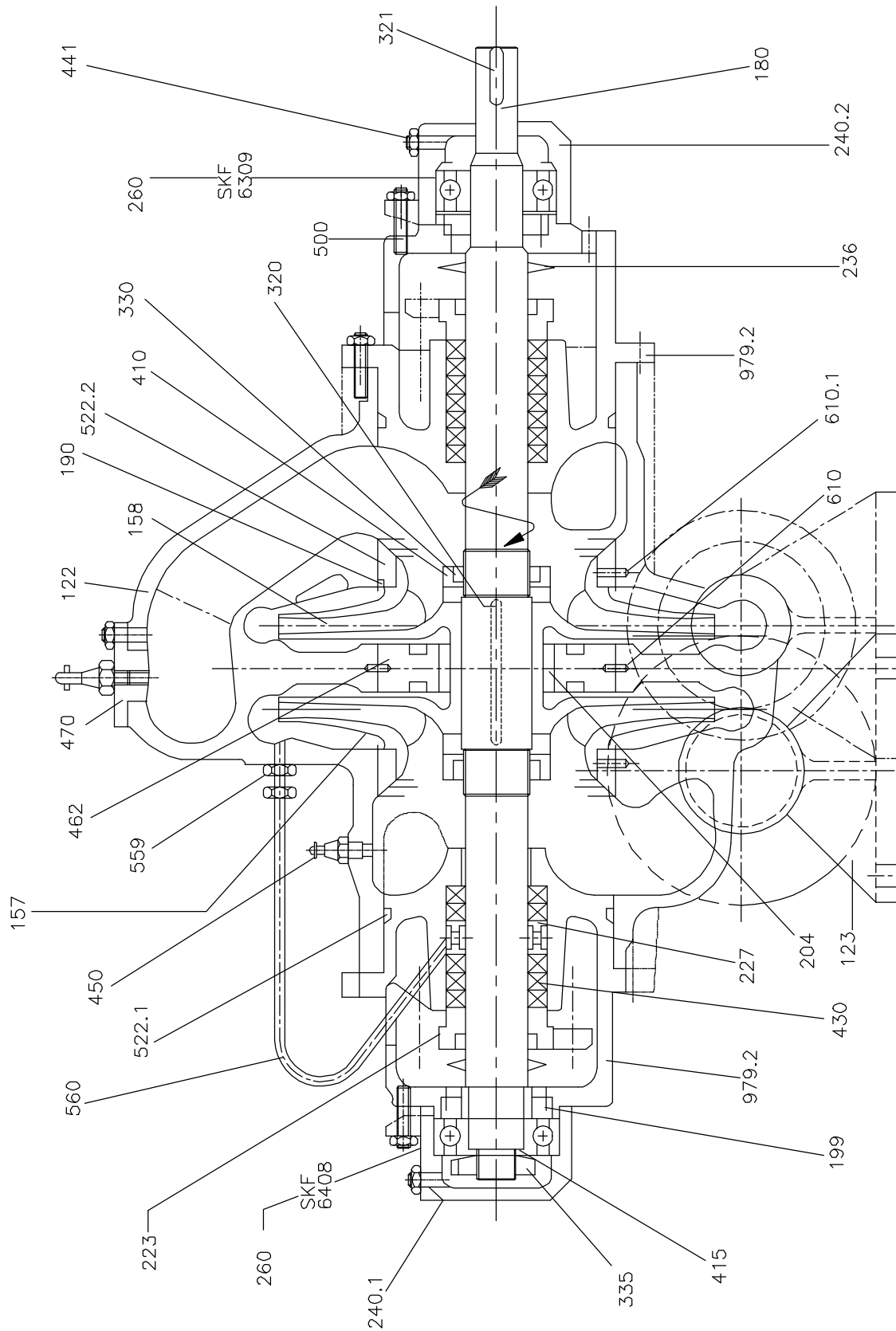
**CROSS SECTIONAL ASSEMBLY OF DSM 50-20 PUMP CW
(THRU BORE TYPE PUMP)**

DRG.NO.
TC 172-86 024 0



CROSS SECTIONAL ASSEMBLY OF DSM 65-20 PUMP CW

DRG.NO.
TC 172-86-025-1



GENERAL INFORMATION & SAFETY REQUIREMENTS

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

A Pump Duty Nameplate is fitted to each unit and must not be removed. Loss of this plate could make identification impossible. This in turn could affect safety and cause difficulty in obtaining spare parts. If accidental loss or damage occur, contact KBL immediately.
- 1.2 Access to the equipment should be restricted to the personnel responsible for installation, operation and maintenance and they must be trained, adequately qualified and supplied with appropriate tools for their respective tasks.
- 1.3 KBL requires that, all personnel that are responsible for installation, operation or maintenance of the equipment, have access to and study the product instruction manual **BEFORE** any work is done and that they will comply with all local and industry based safety instructions and regulations.
- 1.4 Ear defenders should be worn where the specified equipment noise level exceeds locally defined safe levels. Safety glasses or goggles should be worn where working with pressurised systems and hazardous substances. Other personnel protection equipment must be worn where local rules apply.
- 1.5 Do not wear loose clothing or jewellery which could catch on the controls or become trapped in the equipment.
- 1.6 Read the instruction manual before installation, operation and maintenance of the equipment. Check and confirm that the manual is relevant copy by comparing pump type on the nameplate and with that on the manual.
- 1.7 Note the 'Limits of product application – permissible use' specified in the manual. Operation of the equipment beyond these limits will increase the risk from hazards noted below and may lead to premature and hazardous pump failure.
- 1.8 Clear and easy access to all controls, gauges and dials etc. must be maintained at all times. Hazardous or flammable materials must not be stored in pump rooms unless safe areas or racking and suitable containers have been provided.
- 1.9 **IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF THIS KBL PRODUCT COULD RESULT IN INJURY OR DEATH.**

2.0 SAFETY INSTRUCTIONS WHILE HANDLING AND STORAGE

When lifting the pump, use the lifting points specified on general arrangement drawing. Use lifting equipment having a safe working load rating suitable for the weight specified. Use suitable slings for lifting pump which is not provided with lifting points. The use of fork-lift truck and chain crane sling equipment is recommended but locally approved equipment of suitable rating may be used.

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

3.0 SAFETY INSTRUCTIONS WHILE ASSEMBLY & INSTALLATION

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

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

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

Failure to support suction and delivery pipework may result in distortion of the pump casing, with the possibility of early pump failure.

4.0 SAFETY INSTRUCTIONS WHILE COMMISSIONING & OPERATION.

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

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

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

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

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

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

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

5.0 SAFETY INSTRUCTIONS WHILE MAINTENANCE & SERVICING

Before attempting any maintenance on a pump particularly if it has been handling any form of hazardous liquid, it should be ensured that the unit is safe to work on. The pump must be flushed thoroughly with suitable cleaner to purge away any of the product left in the pump components. This should be carried out by the plant operator and a certificate of cleanliness obtained before starting work. To avoid any risk to health it is also advisable to wear protective clothing as recommended by the site safety officer especially when removing old packing which may be contaminated.

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

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

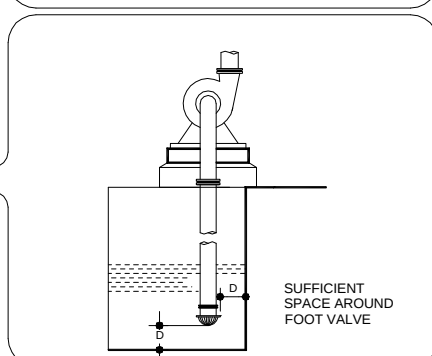
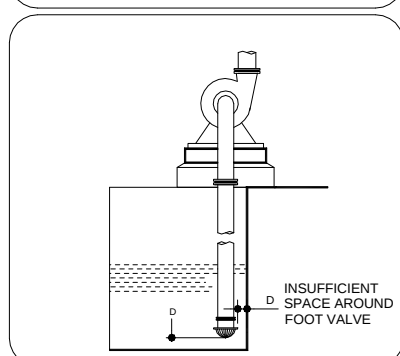
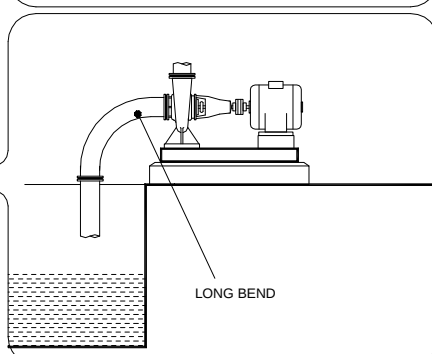
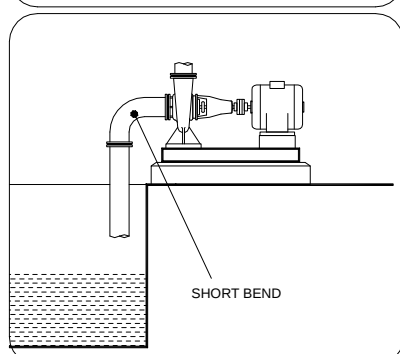
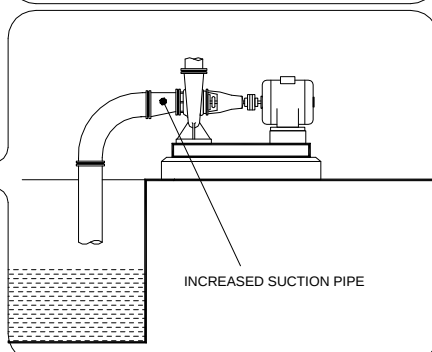
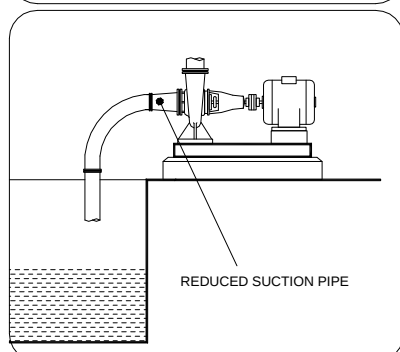
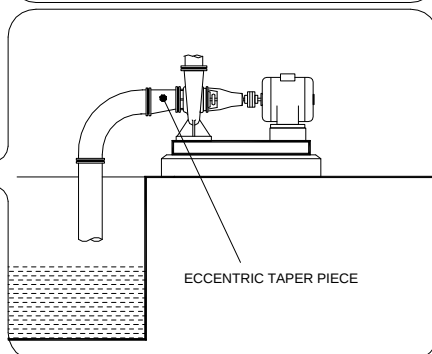
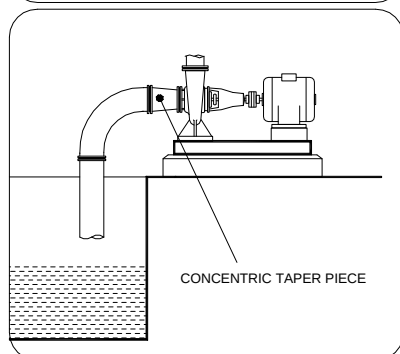
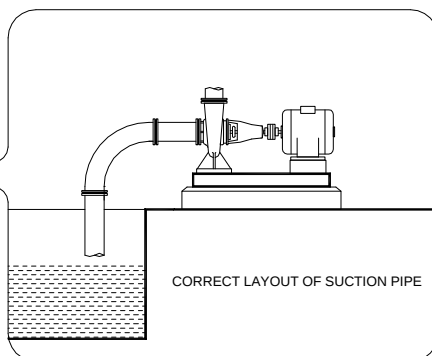
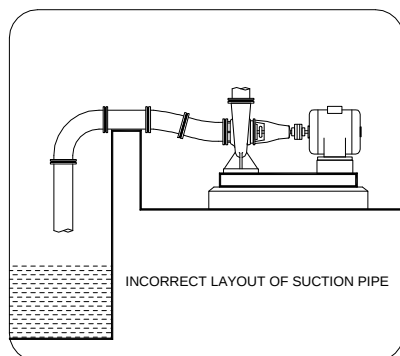
Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation of noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.

Isolate the equipment before any maintenance work is done. Switch off the mains supply, remove fuses, apply lock-outs where applicable and affix suitable isolation warning signs to prevent inadvertent reconnection. In order to avoid the possibility of maintenance personnel inhaling dangerous fumes or vapours, it is recommended that the maintenance work be carried out away from the pump locations by removal of bearing housing and shaft assembly to a suitable maintenance area.

Ref: Proposed draft standard prEN 800:
 Pumps and pump units for liquids;
 General safety requirements

INCORRECT

CORRECT



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

GENERAL INSTRUCTIONS FOR INSTALLATION OPERATION & MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS

**GENERAL INSTRUCTIONS
FOR INSTALLATION, OPERATION
& MAINTENANCE OF**

KIRLOSKAR CENTRIFUGAL PUMPS

WARNING

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

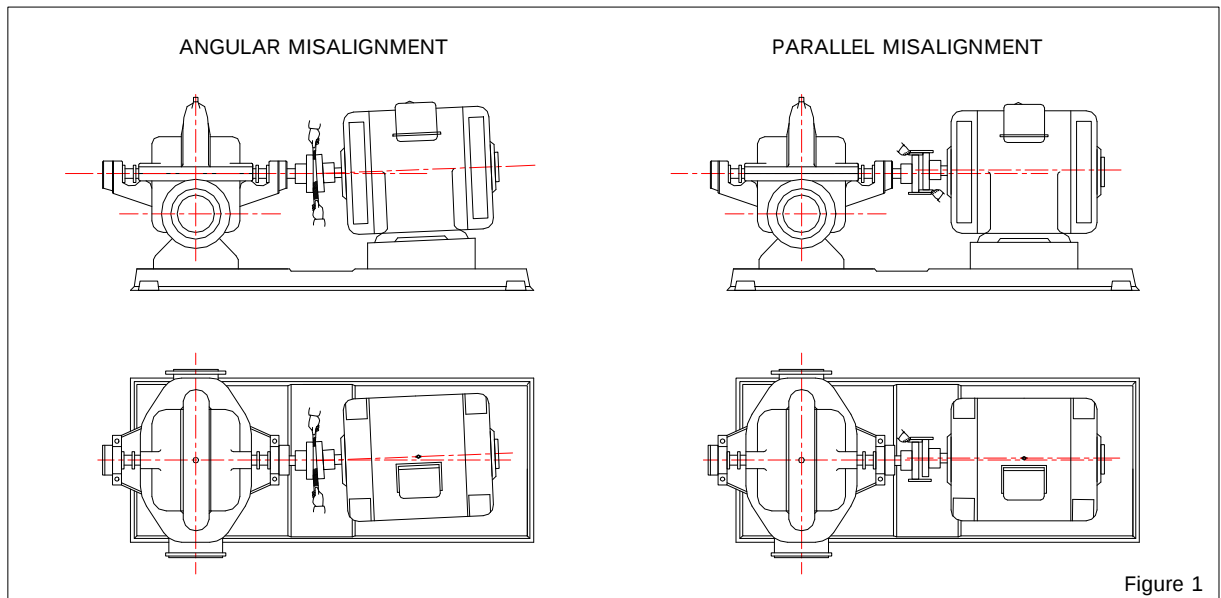
FLEXIBLE COUPLING

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.

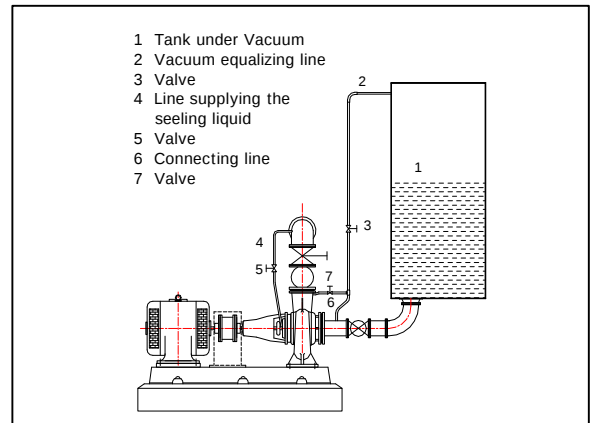
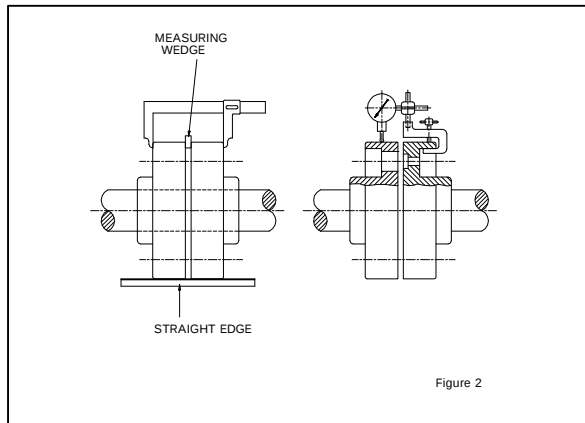


LEVELLING THE UNIT

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.



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

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

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

GROUTING

When the alignment is correct, the foundation bolts should be tightened evenly but not too firmly. The unit can then be grouted by working soft concrete under the edges. Foundation bolts should not be fully tightened until the grout is hardened, usually 48 hours after 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 along radius wherever possible. The pipe lines should be free from scales, welding residuals etc., and have to be mounted in such a way that they can be connected to suction and delivery flanges without any stress on the pump. Adequate supports should be given to pipe lines so that weight of the pipe lines does not fall on the pump. The use of minimum number of the bends and other fittings will minimise the frictional losses.

SUCTION PIPE

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

The end of the suction pipe must be well submerged to avoid whirlpools and ingress of air but must be kept clear of 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 EQUALISING LINE (AND LIQUID LINE) (SEE FIGURE 3)

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

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

FOOT VALVE

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

STUFFING BOXES AND PACKING

Stuffing boxes should be carefully cleaned and the packing placed in them. Be sure that sufficient packing is placed at the back of the water seal cage. If the water to be pumped is dirty or gritty, sealing water should be piped to the stuffing boxes from clean outside source of supply in order to prevent damage to the packing and shaft. In placing the packing, each packing ring should be cut to the proper length so that ends come together but do not overlap. The succeeding rings of packing should not be pressed too tight as it may result in burning the packing and cutting the shaft. If stuffing box is not properly packed, friction in stuffing box prevents turning the rotor by hand. On starting the pump it is well to have the packing slightly loose without causing an air leak, and if it seems to leak, instead of putting too much pressure on the gland, put some heavy oil in the stuffing box until the pump works properly and then gradually tighten up the gland. The packing should be occasionally changed.

BALL BEARINGS

Correct maintenance of ball bearings is essential. The bearing manufacturers give the following as a guide to relubrication periods under normal conditions.

Three monthly when on continuous duty.

Six monthly when on eight-hour per duty.

The bearings and housings should be completely cleaned and recharged with fresh grease after 2500 hours or the nearest pump overhaul time.

PRIMING

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

(1) Liquid level above pump level

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

(2) Priming with foot valve

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

(b) When there is liquid under some pressure in the discharge pipe, priming can be effected by 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 pumps as stamped on the name plate.

PUMP TROUBLE

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

BREAK DOWN-CAUSE-CHECK POINTS

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

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

CHECK POINTS

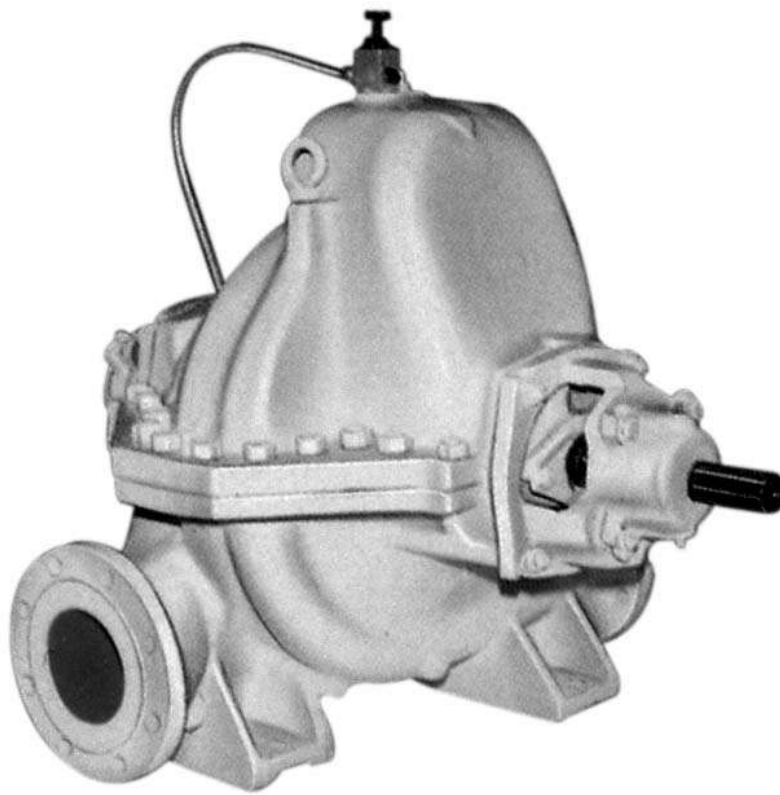
1. Suction pipe, foot valve choked.
2. Nominal diameter of suction line too small.
3. Suction pipe not sufficiently submerged.
4. Too many bends in the suction line.
5. Clearance around suction inlet not sufficient.
6. Shut off valve in the suction line in unfavourable position.
7. Incorrect layout of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

INSTRUCTIONS ON INSTALLATION OPERATION AND MAINTENANCE FOR KIRLOSKAR PUMP **TYPE DSM (THRU BORE)**

DSM 100-36/DSM 125-40/DSM 150-46



Enriching Lives



KIRLOSKAR BROTHERS LIMITED

UDYOG BHAVAN, TILAK ROAD, PUNE - 411 002

KIRLOSKAR BROTHERS LIMITED
Udyog Bhavan, Tilak Road, Pune 411 002 (India)

WARRANTY

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

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

KIRLOSKAR BROTHERS LIMITED

CONTENTS

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 the parts, part nos. And material of construction while ordering spare parts for the pumps.

CAUTION

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

1. GENERAL:

- 1.1 The booklet covers instructions for following type of “DSM” pumps.
DSM 100/36
DSM 125/40
DSM 150/46
- 1.2 These are Horizontal split Casing type, two stage pumps. This construction enables to remove the rotating unit without disturbing pipe connections and alignment.
- 1.3 Pumps when properly installed and given due care in operation and maintenance should operate satisfactorily for a long period.
- 1.4 When the pump is received, sometime before the actual use of pump, it should be inspected and stored in a dry place. The coupling should be rotated at least once in a month to prevent pitting of bearing surfaces.

2 INSTALLATION :

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 alongwith this booklet must be followed carefully.

- 2.1 The sealing connection piping to the pump stuffing box must be made after installing and before commissioning the pump.
- 2.2 Put gland packing and lantern ring, if it is sent separately alongwith the pump.

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 provided is properly tightened and adjusted.
- 3.1.3. Fill in the grease for bearings, if not done earlier.
- 3.1.4. The direction of rotation of motor corresponds to the direction of rotation of the pump.
- 3.1.5. The pump and the 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 the 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

- 3.3.1 The pump is running smoothly.
- 3.3.2 The flow of sealing water is uninterrupted.
- 3.3.3 Leakage through stuffing box is normal. This is required for cooling of Stuffing box/ Gland packing.
- 3.3.4 The bearings are not getting heated up excessively.
- 3.3.5 Head and capacity developed by the pump is as specified.
- 3.3.6 Power consumption is within limit.
- 3.3.7 Ensure that there is no mechanical friction in the pump.
- 3.3.8 Stop the pump immediately, if any defects are noticed. Do not start the pump unless the defects are rectified. Report immediately to the supplier, if it is not possible to rectify the defects.

3.4 During stopping the pump:

- 3.4.1 Close the valve on delivery side.
- 3.4.2 Stop the motor.
- 3.4.3 If the pump is not required to be operated for a long time, then drain the casing completely.

4. TECHNICAL DATA:

4.1 Direction of rotation

The standard direction of rotation is clockwise when viewed from driving end. The pump suitable for anticlockwise rotation can also be supplied against specific requirements.

4.2 Rotational speed

Normally the pumps are supplied suitable for speed of 1450 rpm. Please contact supplier if the pump is to be used for higher speeds.

4.3 Bearings

The shaft is supplied with antifriction bearings at driving end and non- driving end. The details of the bearings are given in the technical data chart (4.5.7). The designations of bearings are as per SKF catalogue. However, equivalent bearings in type, capacity and dimensions are also used.

4.4 Lubrication

- 4.4.1 Type of lubricant – The bearings are grease lubricated.
- 4.4.2 Quantity of grease – Please refer to Technical Data chart. (4.5.7)
- 4.4.3 Refilling period – After 1000 hours of running.
- 4.4.4 Bearing temperature – The permissible bearing temperature rise is 40°C above ambient temperature

4.4.5 Grades of recommended grease-

Following grades of grease of their equivalents available in the market are suitable for bearing lubrication.

INDIAN OIL - SERVOGEM- 3

HINDUSTAN PETROLEUM - NATRA- 3 OR LITHON – 3

CALTEX - STARFAK- 3

4.5 Stuffing box

4.5.1 Stuffing box – The stuffing boxes are extra deep to reduce the leakage.

4.5.2 Stuffing box sealing – Lantern ring provided for sealing purpose is used only in first stage stuffing box. Normally clear cold self liquid only is used for sealing. Grease Sealing/ External sealing can be provided against specific request.

4.5.3 Stuffing box packing

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

4.5.4 Stuffing box packing size

Please refer Technical Data Chart. (4.5.7)

4.5.5 Flexible couplings

The pumps are supplied with flexible couplings. Details are given in Technical Data Chart. (4.5.7)

4.5.6 Packings between upper and lower half casing

Dalmia Duplex board packing paper to be used of following thickness.

PUMP TYPE	PACKING THICKNESS IN MM.
DSM 100/36	0.8
DSM 125/40	0.8
DSM 150/46	0.8

4.5.7 Technical data Chart

PUMP TYPE "DSM" ----- >	100/36	125/40	150/46
FLANGE SIZE IN MM DEL. x SUC.	100 x 125	125 x 150	150 x 200
BALL BEARING NO. SKF OR EQUIV.	6307	6309	N311
DRIVING END			
NON DRIVING END	3307	3309	2 x 7310 BG
QTY. OF GREASE PER BRG. Cms	100	100	200
ST. BOX PACKING SIZE IN MM.			
SIZE x LENGTH	10 SQ x 2250	12 SQ x 2850	12 SQ x 3200
POSITION OF LANTERN RING (L) FROM IMPELLER SIDE (NDE SIDE)	2 + L + 3	2 + L + 3	2 + L + 3
NO. OF PACKING RINGS			
DE (Lantern ring is not required of DE side)	6	6	6
NDE	5	5	5
COUPLING TYPE	FLEXIBLE JOY TYPE KC 276	PIN BUSH TYPE S 260	PIN BUSH TYPE S 290

5. MAINTENANCE:

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

5.2 Periodical Maintenance

- 5.2.1 Replenish the grease.
- 5.2.2 Check 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 and cooling connections for leakage etc.

6. OVERHAULING:

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

6.1 Dismantling and Assembling procedure

All DSM pumps are similar in construction (except some minor changes in the parts). Please refer to the cross sectional drawings and spare parts list given in this booklet while dismantling and dismantling.

6.2 Dismantling

- 6.2.1 Uncouple the pump from the prime mover by removing coupling bolts, nuts and rubber bushes.
- 6.2.2 Remove –
 - Sealing Connections
 - Air vent
 - Grease nipples and other fittings.
- 6.2.3 Remove all the bolts and nuts (572, 581) holding the upper half casing and lower half casing. Take out upper half casing (122) slowly by tightening the release bolts and after removing taper pins.

Upper half casing should be removed slowly so that impellers and other parts are not damaged. By removing upper half casing, the complete rotating unit is exposed for inspection and repairs.

- 6.2.4 Loosen the bolts and nuts (573) holding the bearing cap to the lower half casing (122). Remove the bearing caps.
- 6.2.5 Lift the rotating unit slowly after slinging it in correct fashion so that none of the parts are damaged. Keep the rotating unit in clean dry place for further dismantling.
- 6.2.6 Now start dismantling from driving end side.
- 6.2.7 Take out flexible coupling, (pump half) with help of a puller. Remove the coupling key (321).
- 6.2.8 Loosen the bolts (631) holding bearing cover (270) to the bearing cartridge (241).
- 6.2.9 Remove the bearing cartridge driving end (241) pull out the bearing driving end (260) with the help of puller.
- 6.2.10 Remove bearing cover (270) and water deflector (236).
- 6.2.11 Take out gland (229). Remove the stuffing box packing.
- 6.2.12 Remove the stuffing box bush (360). Also take out casing ring (190).
- 6.2.13 Take out the shaft sleeve DE (310). Remove the 'O' ring (522).

6.3 Start dismantling from non-driving end

- 6.3.1 Remove the bearing cartridge (253) NDE.
- 6.3.2 Loosen the bearing lock nut (336) bearing nut (335).
- 6.3.3 Remove bolts (631) for bearing cover (271) and take out the cover.
- 6.3.4 Remove the casing ring NDE side (190). Water deflector (236), Gland (229) and lantern ring (227).
- 6.3.5 Take out shaft sleeve (310) and "O" ring.
- 6.3.6 Take out impellers (157) and (158). Before removing the impellers put the mark of first stage and second stage impellers so that while re-assembling the impellers may not be interchanged.
- 6.3.7 Remove the impeller key (320). Take out the interstage ring (204).

6.4 Re-assembling

Before reassembling, all parts are to be cleaned including upper half and lower half casings. Bearings are to be cleaned with Kerosene. Change packing and "O" rings, if any.

- 6.4.1 Put the impeller key (320) in the keyways provided on the shaft. Fix the impellers on the shaft with interstage ring (204) in between them. First stage impeller should come towards non-driving end.

6.4.2 Start the reassembly for non-driving end.

- Insert the casing ring, NDE (190).
- Insert the shaft sleeve (310).
- Insert the bearing cover, NDE (271).
- Press the NDE bearing on the shaft.
- Tighten the bearing nuts. Put appropriate quantity of grease to the bearings.
- Fix the cartridge NDE. The bearing should touch the shoulder provided on the cartridge.
- Fix the bearing cover to the cartridge by tightening the screws (631).

6.4.3 Now start assembling from driving end.

- Insert the casing ring DE (190).
- Insert the shaft sleeve (310)
- Fit the water deflector (236).
- Insert the bearing cover (270).
- Press fit the DE bearing on the shaft.
- Fix the bearing cartridge DE (241). The outer face of the bearing should touch the shoulder provided in the cartridge.
- Fix the bearing cover DE to the cartridge by tightening the bolts (631).
- Fit coupling key (321) on the shaft.

This completes the assembly of rotating unit.

6.4.4 Now lift the above rotating unit and fit it properly in the lower half casing so that pins (610.1, 610.2) take their proper seating.

6.4.5 Fit the two bearing caps by means of bolts. Rotate the whole unit and see that there is no friction between rotating and stationery parts.

6.4.6 Cut the paper packing to match the profile at the upper and lower half casing. Put the paper packing (dipped in linseed oil) on the lower half casing. Keep the upper half casing gently and neatly without disturbing the impellers or packing etc. Insert the taper pins so that the two halves of the casings will take their proper seat.

6.4.7 Now insert the bolts and nuts for upper half and lower half casing and tighten them. While tightening the nuts, take care to tighten the diagonally opposite bolts. Rotate the impeller by rotating driving end of shaft and see that there is no friction between the rotating unit and stationery parts.

6.4.8 Insert the stuffing box packing staggering the joints in 180° and push each ring inside as far as possible.

- 6.4.9 Insert the lantern ring at non-driving end side at a position indicated in technical data chart (e.g. 2 + L + 3).
- 6.4.10 Fix gland (229) on the shaft. Tighten the stuffing box packing by tightening the gland nuts (300).

While tightening the glands, please see that the unit can be rotated by hand.

- 6.4.11 Connect the Nylon pipes for sealing connection. Fix air vents, priming funnel and grease nipples. Fix the nameplate (670) on NDE cartridge.

This completes the re-assembly.

While ordering spares, specify nameplate details, particularly machine numbers given in enclosed spare parts list. Also specify quantity required.

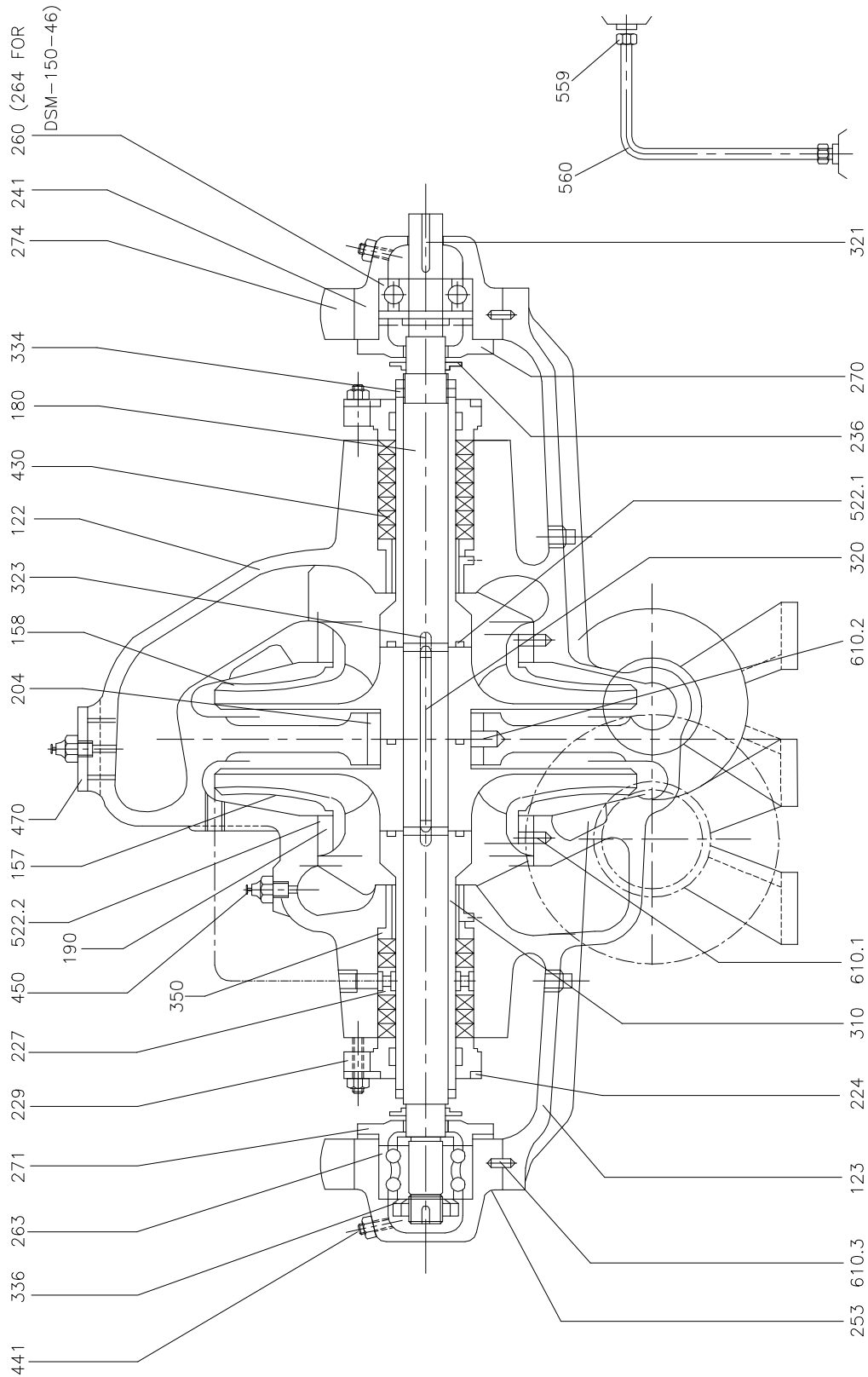
7. SPARE PART LIST

PART NOS.	DESCRIPTION	NO. OF PUMP
122	Casing half upper	1
123	Casing half lower	1
157*	Impeller, 1 st stage	1
158*	Impeller, 2 nd stage	1
180*	Pump shaft	1
190*	Wear ring	2
204*	Interstage ring	1
241	Cartridge for bearing, DE	1
253	Cartridge for bearing, NDE	1
260*	Ball bearing, DE	1
270	Bearing cover, DE	1
271	Bearing cover, NDE	1
274	Bearing Cap	2
310*	Shaft sleeve, DE/NDE	1
229*	Gland, DE/NDE	2
227*	Lantern ring	2
350*	stuffing box bush	2
236	Water Deflector DE/NDE	1
450	Air vent	2
320 *	Impeller key	1
321*	Coupling key	1
335*	Bearing nut	1

PART NOS.	DESCRIPTION	NO. OF PUMP
586	Bolts with nuts for 274	4
572	Bolts with nuts for upper and	-
&581	Lower half casing	
631	Hex screw for bearing cover	8
611	Taper pin with washes and nuts for lower and upper half casing	2
610	Cylindrical pin	2
601	Drain plug for casing	2
600	Plug for Suc. & Del. Pressure gauge connections	2
602	Plug for sealing	1
604	Plug for st. box leakage water	2
430*	St. box packing	1set
519*	Paper packing between 122 & 123	1
522*	'O' ring for shaft sleeve	
441	Grease nipple for lubrication	2
560	Nylon tube for sealing	1
670	Duty name plate	1
264*	Cylindrical roller bearing SKF N 311 or equivalent	1
263*	Double row angular contact ball Bearing SKF:7310 BG or equivalent	1
336*	Bearing lock nut ND/NDE	2
550	Wheel cock	1
573	Hex bolt for Bearing cap	
300	Eye bolt for gland	
610.1	Cylindrical Pin for wear ring	
610.2	Cylindrical Pin for interstage diaphragm	

* Recommended spares.

NON THRU BORE PUMP DSM 100-36, DSM 125-40, DSM 150-46



GENERAL INFORMATION & SAFETY REQUIREMENTS

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

A Pump Duty Nameplate is fitted to each unit and must not be removed. Loss of this plate could make identification impossible. This in turn could affect safety and cause difficulty in obtaining spare parts. If accidental loss or damage occur, contact KBL immediately.
- 1.2 Access to the equipment should be restricted to the personnel responsible for installation, operation and maintenance and they must be trained, adequately qualified and supplied with appropriate tools for their respective tasks.
- 1.3 KBL requires that, all personnel that are responsible for installation, operation or maintenance of the equipment, have access to and study the product instruction manual **BEFORE** any work is done and that they will comply with all local and industry based safety instructions and regulations.
- 1.4 Ear defenders should be worn where the specified equipment noise level exceeds locally defined safe levels. Safety glasses or goggles should be worn where working with pressurised systems and hazardous substances. Other personnel protection equipment must be worn where local rules apply.
- 1.5 Do not wear loose clothing or jewellery which could catch on the controls or become trapped in the equipment.
- 1.6 Read the instruction manual before installation, operation and maintenance of the equipment. Check and confirm that the manual is relevant copy by comparing pump type on the nameplate and with that on the manual.
- 1.7 Note the 'Limits of product application – permissible use' specified in the manual. Operation of the equipment beyond these limits will increase the risk from hazards noted below and may lead to premature and hazardous pump failure.
- 1.8 Clear and easy access to all controls, gauges and dials etc. must be maintained at all times. Hazardous or flammable materials must not be stored in pump rooms unless safe areas or racking and suitable containers have been provided.
- 1.9 **IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF THIS KBL PRODUCT COULD RESULT IN INJURY OR DEATH.**

2.0 SAFETY INSTRUCTIONS WHILE HANDLING AND STORAGE

When lifting the pump, use the lifting points specified on general arrangement drawing. Use lifting equipment having a safe working load rating suitable for the weight specified. Use suitable slings for lifting pump which is not provided with lifting points. The use of fork-lift truck and chain crane sling equipment is recommended but locally approved equipment of suitable rating may be used.

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

3.0 SAFETY INSTRUCTIONS WHILE ASSEMBLY & INSTALLATION

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

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

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

Failure to support suction and delivery pipework may result in distortion of the pump casing, with the possibility of early pump failure.

4.0 SAFETY INSTRUCTIONS WHILE COMMISSIONING & OPERATION.

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

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

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

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

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

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

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

5.0 SAFETY INSTRUCTIONS WHILE MAINTENANCE & SERVICING

Before attempting any maintenance on a pump particularly if it has been handling any form of hazardous liquid, it should be ensured that the unit is safe to work on. The pump must be flushed thoroughly with suitable cleaner to purge away any of the product left in the pump components. This should be carried out by the plant operator and a certificate of cleanliness obtained before starting work. To avoid any risk to health it is also advisable to wear protective clothing as recommended by the site safety officer especially when removing old packing which may be contaminated.

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

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

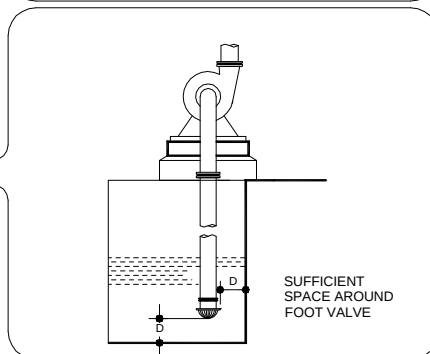
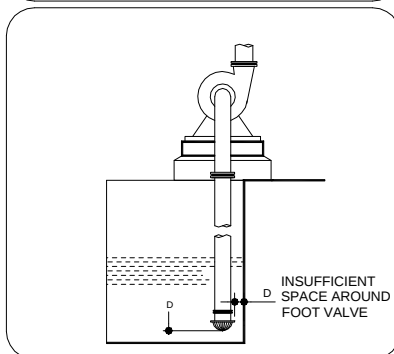
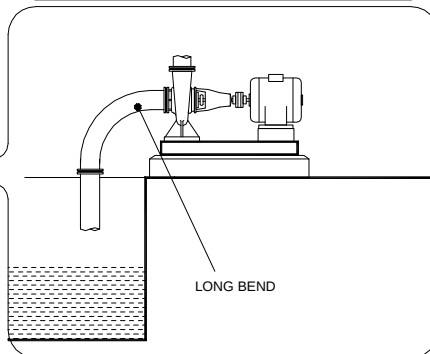
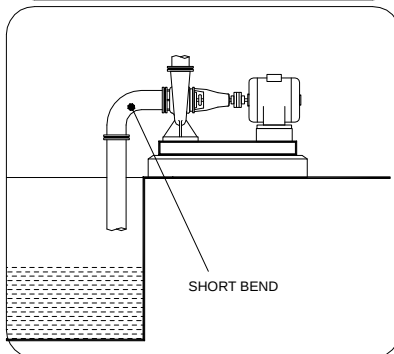
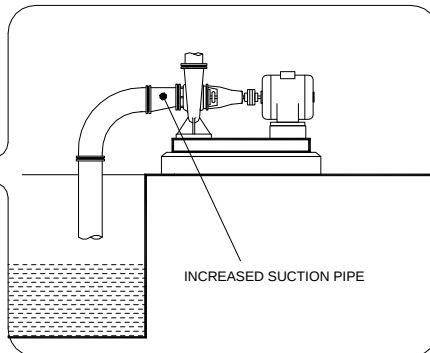
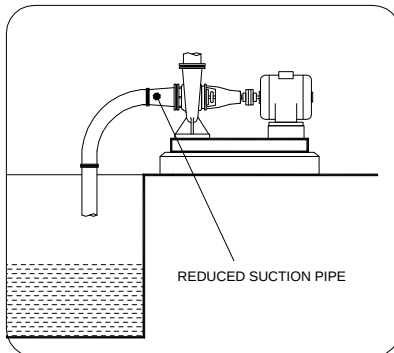
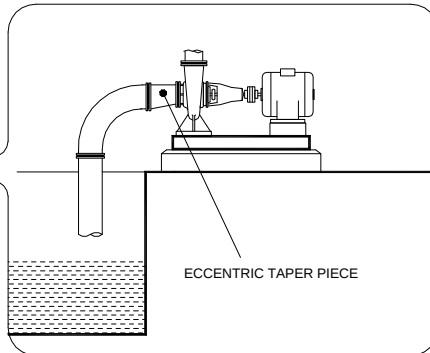
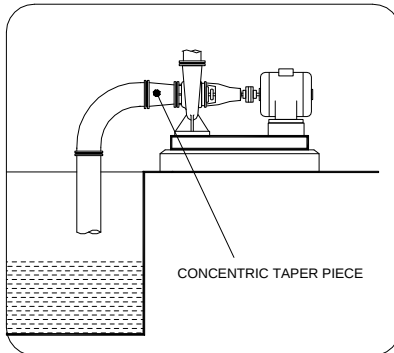
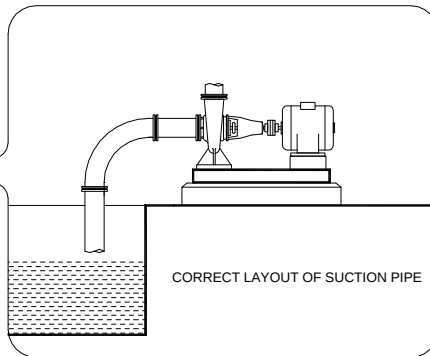
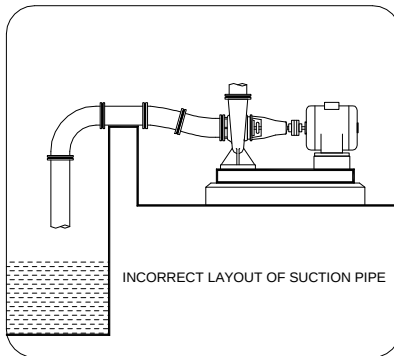
Be aware of the hazards relating to the pumped fluid, especially the danger from inhalation of noxious and toxic gases, skin and eye contact or penetration. Obtain and understand the hazardous substance data sheets relating to the pumped fluid and note the recommended emergency and first aid procedures.

Isolate the equipment before any maintenance work is done. Switch off the mains supply, remove fuses, apply lock-outs where applicable and affix suitable isolation warning signs to prevent inadvertent reconnection. In order to avoid the possibility of maintenance personnel inhaling dangerous fumes or vapours, it is recommended that the maintenance work be carried out away from the pump locations by removal of bearing housing and shaft assembly to a suitable maintenance area.

Ref: Proposed draft standard prEN 800:
Pumps and pump units for liquids;
General safety requirements

INCORRECT

CORRECT



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

GENERAL INSTRUCTIONS FOR INSTALLATION OPERATION & MAINTENANCE OF KIRLOSKAR CENTRIFUGAL PUMPS

**GENERAL INSTRUCTIONS
FOR INSTALLATION, OPERATION
& MAINTENANCE OF**

KIRLOSKAR CENTRIFUGAL PUMPS

WARNING

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

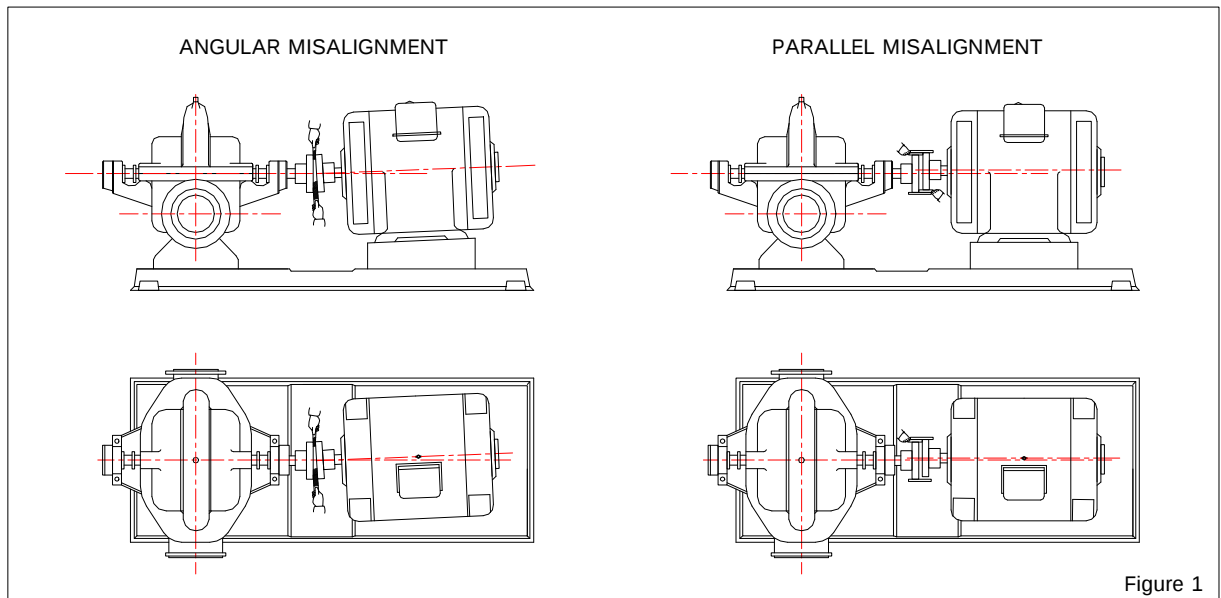


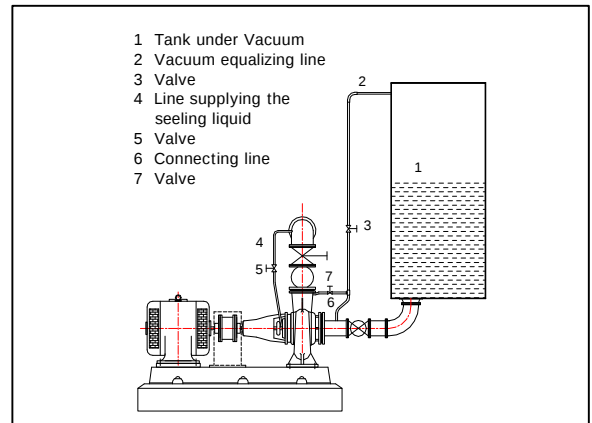
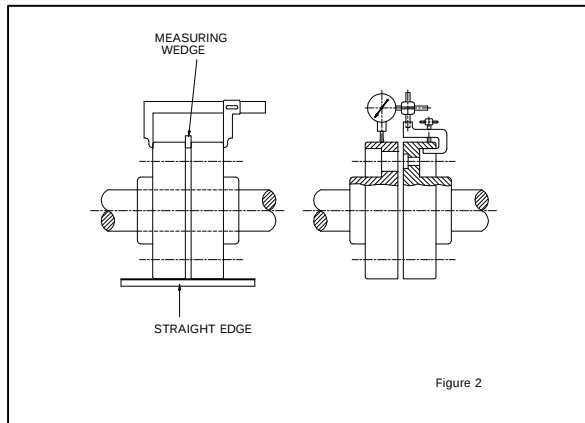
Figure 1

LEVELLING THE UNIT

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

FLEXIBLE COUPLING ALIGNMENT (SEE 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.



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

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

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

GROUTING

When the alignment is correct, the foundation bolts should be tightened evenly but not too firmly. The unit can then be grouted by working soft concrete under the edges. Foundation bolts should not be fully tightened until the grout is hardened, usually 48 hours after 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 along radius wherever possible. The pipe lines should be free from scales, welding residuals etc., and have to be mounted in such a way that they can be connected to suction and delivery flanges without any stress on the pump. Adequate supports should be given to pipe lines so that weight of the pipe lines does not fall on the pump. The use of minimum number of the bends and other fittings will minimise the frictional losses.

SUCTION PIPE

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

The end of the suction pipe must be well submerged to avoid whirlpools and ingress of air but must be kept clear of 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 EQUALISING LINE (AND LIQUID LINE) (SEE FIGURE 3)

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

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

FOOT VALVE

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

STUFFING BOXES AND PACKING

Stuffing boxes should be carefully cleaned and the packing placed in them. Be sure that sufficient packing is placed at the back of the water seal cage. If the water to be pumped is dirty or gritty, sealing water should be piped to the stuffing boxes from clean outside source of supply in order to prevent damage to the packing and shaft. In placing the packing, each packing ring should be cut to the proper length so that ends come together but do not overlap. The succeeding rings of packing should not be pressed too tight as it may result in burning the packing and cutting the shaft. If stuffing box is not properly packed, friction in stuffing box prevents turning the rotor by hand. On starting the pump it is well to have the packing slightly loose without causing an air leak, and if it seems to leak, instead of putting too much pressure on the gland, put some heavy oil in the stuffing box until the pump works properly and then gradually tighten up the gland. The packing should be occasionally changed.

BALL BEARINGS

Correct maintenance of ball bearings is essential. The bearing manufacturers give the following as a guide to relubrication periods under normal conditions.

Three monthly when on continuous duty.

Six monthly when on eight-hour per duty.

The bearings and housings should be completely cleaned and recharged with fresh grease after 2500 hours or the nearest pump overhaul time.

PRIMING

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

(1) Liquid level above pump level

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

(2) Priming with foot valve

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

(b) When there is liquid under some pressure in the discharge pipe, priming can be effected by 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 pumps as stamped on the name plate.

PUMP TROUBLE

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

BREAK DOWN-CAUSE-CHECK POINTS

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

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

CHECK POINTS

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



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