INSTRUCTIONS ON INSTALLATION, OPERATION AND MAINTENANACE FOR SAM TURBO PUMP TYPE "MF"

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SAM TURBO INDUSTRY LIMITED

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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.

We warrant the materials for the chemical composition and mechanical properties of the relevant standard only and not for corrosion and erosion.

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

SAM TURBO INDUSTRY LIMITED

CONTENT

PLEASE FURNISH COMPLETE NAMEPLATE DETAILS, NAME OF THE PARTS, PART NOS AND MATERIAL OF CONSTRUCTION WHILE ORDER SPARE PARTS FOR THE PUMPS

1. FORWARD AND GUARANTEE

This erection and operating manual should in all cases be read by your fitters before erection and start-up.

We are not liable for damage incurred through failure to observe the instructions for erection and operation. In this connection we refer to our General Terms of delivery for centrifugal pumps.

During the period of guarantee, repair work and modification shall be carried out by our fitters only, or following our approval in writing, it may be done by you. If contrary to our Acknowledgement of Order, you wish to use the pump for a different service please ask for our acceptance. Otherwise the guarantee given for this pump will not be valid.

2. DESCRIPTION OF PUMP

2.1 Pump Nameplate/Ordering Spare Parts/ Spare Parts List

Every pump has a name plate giving following details:

Pump type

Serial Number

Duty conditions (Head, Capacity)

Motor details etc.,

While you correspond with us for your requirements of spare parts or for any technical information, please always quote the above details in your letter.

2.2 Constructional Details:

Mixed flow pumps are single volute casing pumps with axial suction branch and top centre line delivery branch. All Pumps are supported by integrally cast foot in the casing.

Bearings are cooled when liquids are handled at temperatures above 200^0 C.

2.3 Direction of Rotation:

Clockwise, pump viewed from driven end.

3. ERECTING THE PUMP

3.1 Assembling the set on the Base plate:

3.1.1. If the assembly of the pump with the driver on a common base plate is done in our works, the whole set will be carefully mounted and aligned. It is necessary to check once more the alignment of the coupling before putting the pump into operation.

The eye bolts which may be fitted to the driver must never be used to lift the complete set as they are meant to carry the weight of the driver only.

3.1.2. If you furnish the driver yourselves, the. Clearance between the motor and pump coupling halves as shown on the arrangement drawing must be strictly observed.

Difference in level between the shaft centre lines of pump and driver must be equalized by suitable packing (plane parallel Shims). When the pump and motor holding-down bolts are finally secured, care must be taken to avoid distortion.

3.2 Leveling the Base plate, aligning the Coupling:

To check whether pump and motor shafts are in perfect alignment, proceed as follows:

3.2.1. Level accurately the base plate which carries the complete set with the aid of a spirit level. Place metallic packing between the base plate and foundation close to the foundation bolt holes. To prevent sagging of the base plate, place metallic packing if required - also between the foundation bolt holes. After leveling the base plate fill up the foundation bolt holes-with the bolts inserted with a quick setting cement compound. After the grout has set, tighten nuts crosswise. Check once again the alignment with a spirit level.

3.2.2. After leveling the pump set, measure the axial clearance between the two coupling halves. Axial clearance between two corresponding points should remain same when both couplings are turned through an angle. Maximum permissible tolerance is 0.05mm.

The radial alignment is achieved by means of a bevelled straight edge, the permissible tolerance being 0.05mm provided that the type of coupling is such as to allow this check figure 1 (a). Otherwise a coupling aligner must be used, permissible tolerance 0.05 mm figure 1 (b).

3.2.3 At every check take care that the axial float of the rotor is taken into account, i.e., when measuring the rotor **and the driver shaft must always be brought to bear in the same direction.**

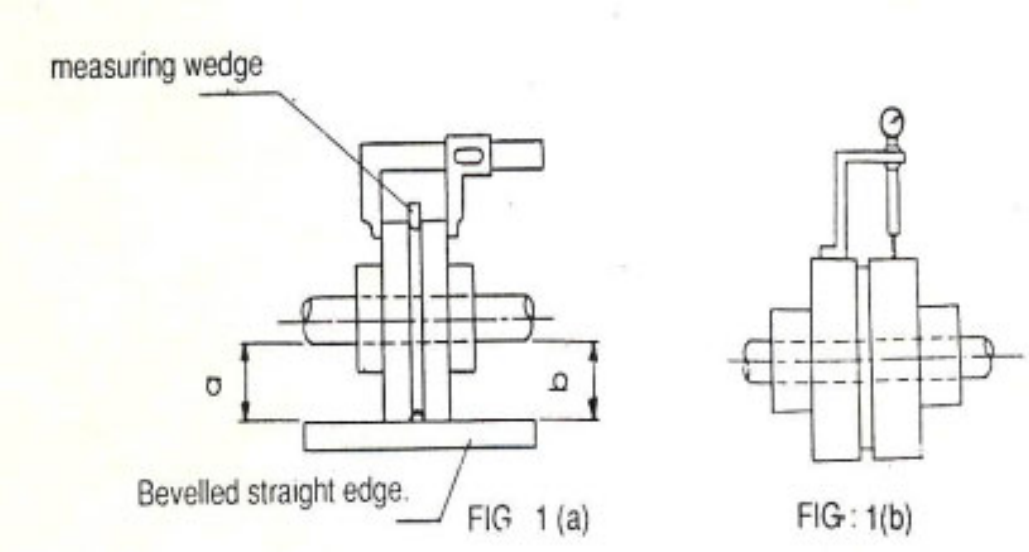


FIG 1 (a)

FIG : 1(b)

3.3 Grouting the baseplate

Grout base plate fully with concrete through the grouting holes provided for this purpose, leaving no cavities. After the grout has set, recheck the alignment of the coupling.

4. LAYING THE CONNECTING PIPINGS

4.1 General

After grouting the base plate, the pipe work may be connected. The diameters of the piping are not determined by those of the pump and suction branches.

On short delivery runs the diameter should be such that the pipe resistance constitutes but a small portion of the delivery head for long pipe runs the most economic pipe diameter must be assessed in each particular case.

The flow velocity in the suction piping should be 1.5 to 2.5 metres/sec., for normal cases, but should not exceed 3 metres/sec.

Unfavourably installed pipe runs, especially on the suction side (i.e. bends in various planes immediately before the suction branch) can affect performance of the pump.

AS THE PUMP BRANCHES SHOULD NOT ABSORB PIPE FORCES AND MOMENTS, THE PUMP MUST NOT BE USED AS A LOCATING POINT OF THE PIPEWORK.

Once the flange bolts have been loosened, the flanges must not yield more than the amount corresponding to the gasket thickness, nor must they be out of the parallel nor near against each other under stress. See that the flange gaskets do not extend into the bore of the piping. Clean carefully all pipe parts, valves and fittings, and pump branches prior to assembly.

Attention

After connecting up the piping, the coupling alignment must be rechecked. It must be possible to turn the rotor easily by hand. In case of inadequate alignment, bearings, coupling, shaft seal, and impeller wearing may get damaged prematurely. In accordance with safety prescriptions the coupling must be protected with a guard against contact.

Piping

The piping should be installed with the following considerations:

Select pipe diameter according to the allowed flow velocities.

Crooked or twisted flanges should not be forced together with bolts. The suction piping should be tight and free of air pockets.

Support the pipes so that weight of piping and contained fluid will not rest on the pump. When placing the supports, make a provision for heat expansion.

ONCE THE PIPING AND SUPPORTS ARE IN PLACE, RE-CHECK THE COUPLING ALIGNMENT AS IN THE INSTALLATION WORK MAY HAVE THROWN IT OUT.

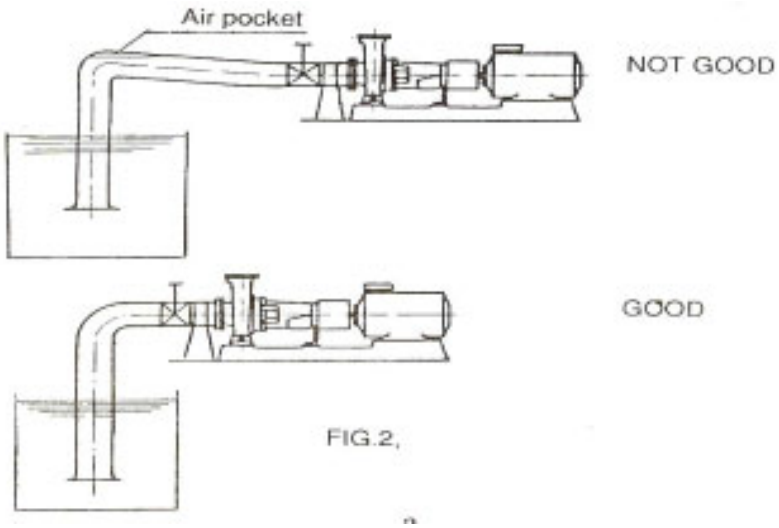
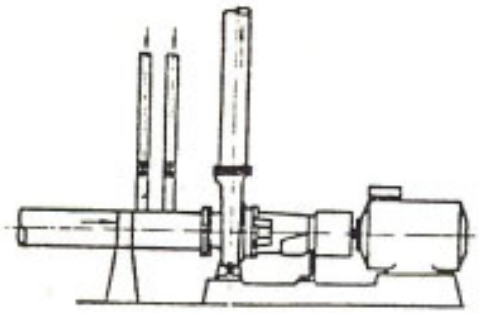


FIG.2,



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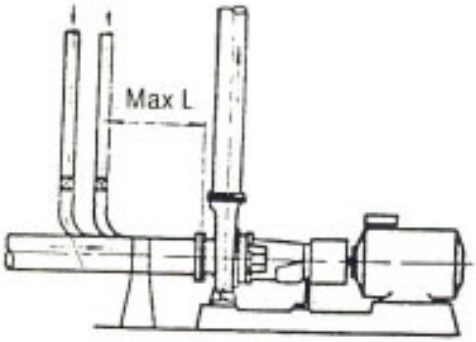

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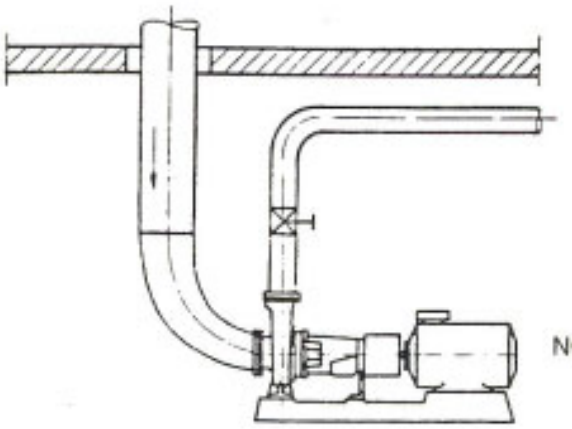
FIG.3



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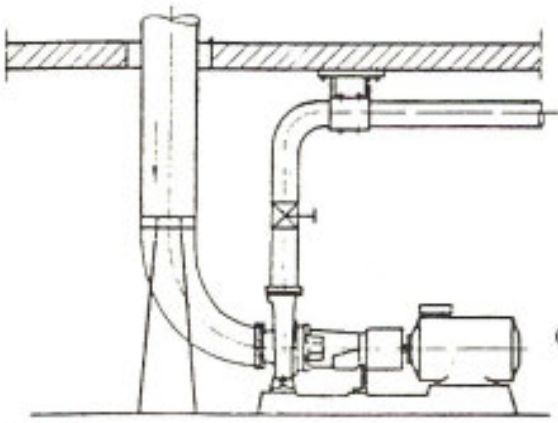

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FIG.4

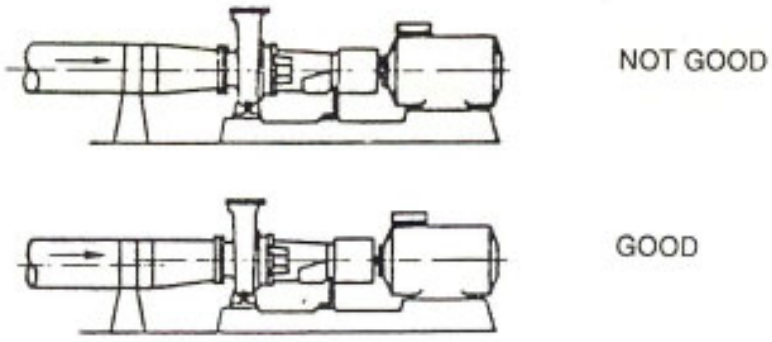


FIG: 5

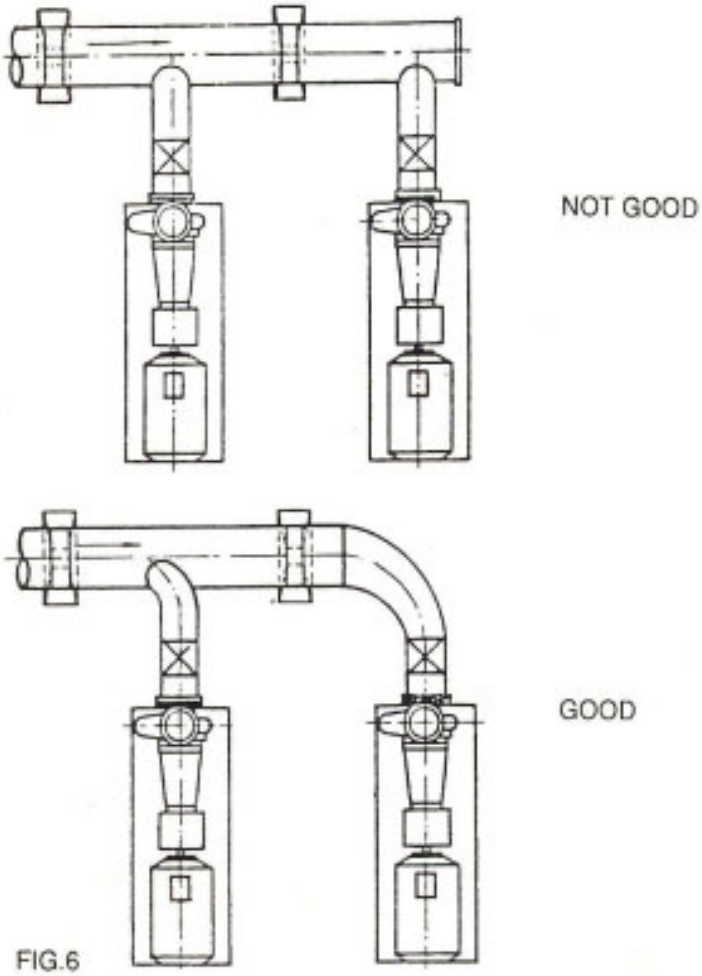


FIG.6

Cleaning the Piping and Suction Pit

After the piping has been installed, it should be cleaned and emptied of welding waste, welding rod ends and other foreign material. Likewise, the suction pit should be thoroughly cleaned of all loose rubbish.

5. STARTING AND STOPPING

5.1 Checks

Before initial starting, check the rotation of the motor. This should always be done with the coupling spacer detached because if the rotation direction is not correct, the pump may be seriously damaged. Never run the pump if it is not filled with liquid because even a shortest dry run, e.g. checking rotation, will damage the seals. Direction of rotation must be as shown by the arrow on the pump. Before installing the spacer, rotate the coupling by hand to see that the pump runs easily. Also check that the bearings have been lubricated (SEE LUBRICATION).

5.2 Starting the Pump

1. Open the valves in the sealing liquid and cooling water pipes (if applicable).
2. If the suction side has a shut-off valve, this should be fully open during starting and operation.
3. Make sure that the pump is filled with liquid before starting. E.g.:
   - Introduce liquid through the priming port (the suction side should have a bottom valve)
   - Suck the air out of the upper section with air exhauster (the discharge valve should be closed)
   - Let the air out through the discharge valve (there is overpressure on the suction side.)
4. Start the pump with the discharge valve closed, but let it run for just a short time under this Condition.

5.3 Regulating the Flow

If you have to regulate the flow with a valve, always do this by means of the discharge valve.

5.4 Stopping the Pump

1. If the shut-off valve of your pump is not automatic, close the discharge valve immediately before stopping the motor. This is important if the discharge pipe is a along one because liquid, when flowing back, will unnecessarily strain the shaft seals and bottom valve or check valve (if there is such in the discharge piping.
2. Stop the motor.
3. Close the suction valve.
4. Release the pressure.
5. Then shut off the cooling water.
6. The pump, if filled with liquid, should be supplied with seal water during shutdowns, too.

5.5 In-service Control

Your Pump will have a longer life if it regularly checked and serviced.

Check every few days for stuffing box leakage; bearing temperature and running of the pump (see LUBRICATION and STUFFING BOX). If your pump has a mechanical seal, follow the instructions by the seal manufacturer

5.6 Controls during Shutdown Periods

During longer shutdowns, periodically inspect the pump and turn the shaft by hand through a couple of revolutions. If the pumped liquid is liable to congeal or the pump exposed to freezing, drain the pump and suction piping for shutdown periods.

6. LUBRICATION

Your pump is furnished with two taper roller bearings (Table 1.)

Grease lubrication

The grease-lubricated bearings have been lubricated before shipment. For these bearings following roller bearing greases are recommended which are available in the market.

GREASE SPECIFICATIONS

Name of the firm	Speed 1450 rpm	Speed 2900/3600 rpm
INDIAN OIL	SERVOGEM 3	SERVOGEM 2
CALTEX	STARFAK 3	STARFAK 2
HINDUSTAN PETROLEUM	NATRA 3 or	NATRA 2 or
	LITHON 3	LITHON 2

Pump Type	Bearings (2 nos)	Speed (rpm)	Lubr. Interval (oper.hrs)	Qty of grease for re-lubr. of each bearing (g)	(oz)
200/320	32214	1000/1200 1500/1800	1500 900	20 20	0.70 0.70
300/320	32214	1000/1200 1500/1800	1500 900	20 20	0.70 0.70
300/400 M	32220	1000/1200 1500/1800	1100 600	40 40	1.40 1.40

TABLE – 1

- The lubrication intervals in Table-1 apply if the temperature is below 70° C (158° F)
- Each temperature rise of 15° C *(59^0* F) will reduce the lubrication interval to a half

7 STUFFING BOX

7.1 Maintenance and Re-packing

When a new pump is being put into service or the stuffing box has just been re-packed, watch the packing performance more closely than normal. For the checking, shut off the cooling water to the gland (if applicable).

During the first hours, the stuffing box is allowed to leak quite a good deal, about 100 drops a minute. If the leakage decreases, slacken the packing gland. If you want to reduce the leakage, tighten the packing stepwise at intervals of about 10 minutes and continue until the packing performance is satisfactory. A small leakage of single drops should be allowed from the stuffing box for ascertainment of lubrication and of the correct packing tightness. A suitable leakage is 5-30 drops a minute. If the packing cannot be made to seal without intense tightening, it is best to re-pack. When re-packing removes all the old packing rings and clean the stuffing box thoroughly. At the same time check to see that the water channels are clear and the shaft is free of warpage and score marks.

When selecting the packing type, observe the quality and temperature of the liquid being pumped and the shaft sleeve material.

Carefully form the packing into the right ring shape over the shaft sleeve. First insert the cut ends into the stuffing box and then push the whole ring to the bottom of the stuffing box. Put the rings one by one in the stuffing box, with the cut ends spaced 90 degrees apart. Note the location of the lantern ring (table II)

Stuffing Box Construction of 'MF' Pumps When Using Lantern Ring

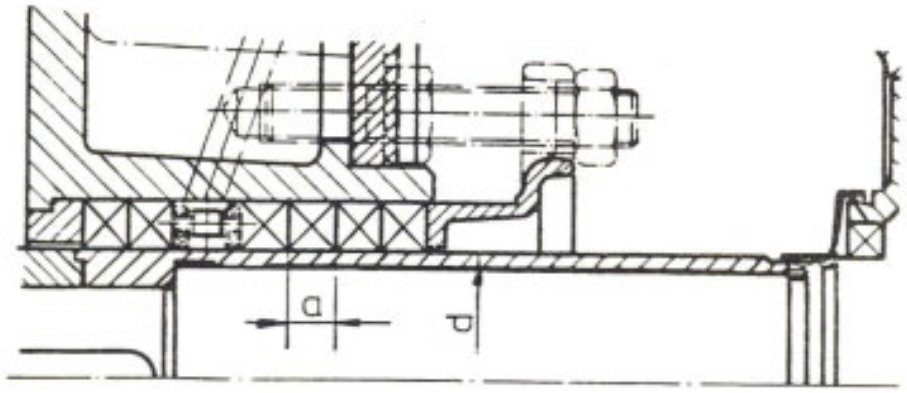


FIG : 7

PACKING OF STUFFING BOX

Pump type	Packing ring a x d x length (mm) (1)	Number of Rings Rings.	Size mm.sq	Total length of packing (mm)
200/320 300/320	12.5x70x260	6(2-L-4)	12.5	1570
300/400 M	16x100x370	5(2-L-3)	16	1840

TABLE-II

1) Ready ring-shaped packing

The First Figure in the bracket shows the number of Packing Rings between the bottom Ring and lantern Ring. If the stuffing box has no Lantern Ring, use one extra Packing Ring.

8 O-RINGS AND OIL SEALS

Because of design and manufacturing tolerances it is recommended to use metric o-rings and Oilseals according to the following tables.

O-Rings: Material: NEOPRINE RUBBER Temp.Range:-40 ... +100°C

Oilseals – For Bearing covers on Grease lubricated bearings. Refer TABLE – III.

'O' Rings and oil seals.

DESCRIPTION	Pump Type		
	200/320	300/320	300/400 M
'O' Ring (42.3) For bearing cover	1D 162xØ5	1D 162xØ5	1D 221XØ6
'O' Ring (42.5) For Deflector	1D 58xØ6	1D 58xØ6	1D 70xØ6
'O' Ring (42.6) For dismantling sleeve	1D 70xØ3	1D 70xØ3	1D99xØ3
'O' Ring (42.4) For wear plate	1D 249.3xØ6	1D 299.3xØ6	1D 339.3xØ6
Oil Seal (43.13) Impeller end	70x90x10	70x90x10	100x120x12
Oil Seal (43.3) Coupling end	65x90x10	65x90x10	90x120x12

TABLE - III

9. SERVICING REPAIRS (follow the assembly drawing)

9.1. Preparations

1.1 Make sure that the motor cannot be started.
1.2 Close the suction and discharge valves open the bottom tap of the casing.
1.3 Disconnect the seal water and cooling water pipes.
1.4 Detach the coupling guard.
1.5 Remove the spacer of the coupling (spacer coupling).

9.2. Detaching the Exchange Unit

2.1 Loosen the screws fixing the stuffing box cover to the casing.
2.2 Support the exchange unit underneath the bearing housing or with hoist.
2.3 Remove the screws fixing the support foot from the base plate
2.4 Pull the exchange unit out by means of the detaching screws of the stuffing box cover.

9.3. Installing the exchange Unit into Casing

3.1 Clean the casing (11.4) and inspect the seal surfaces and gasket (41.2)
3.2 Inspect the casing wear ring (51.4) or wear plate (14.7) replace if necessary.
3.3 Install the new exchange unit into the casing.
3.4 Take the support foot (19.5) and coupling flange (if needed) from the old exchange unit to the new one.
3.5 Adjust for correct distance (0.5 mm =0.020 in) between the impeller and wear plate by moving the rotor assembly.

To adjust the gap between the impeller and wear plate move the impeller until it contacts the wear plate and then move the rotor assembly back as. long as required (0.5 mm= 0.020 in).Make the adjustment by loosening the fixing screws of the bearing housing covers and by tightening the screws of the opposite cover.

If your pump has a mechanical seal, do not move the rotor assembly, but the manufacturer should be consulted for advice to adjust the gap.

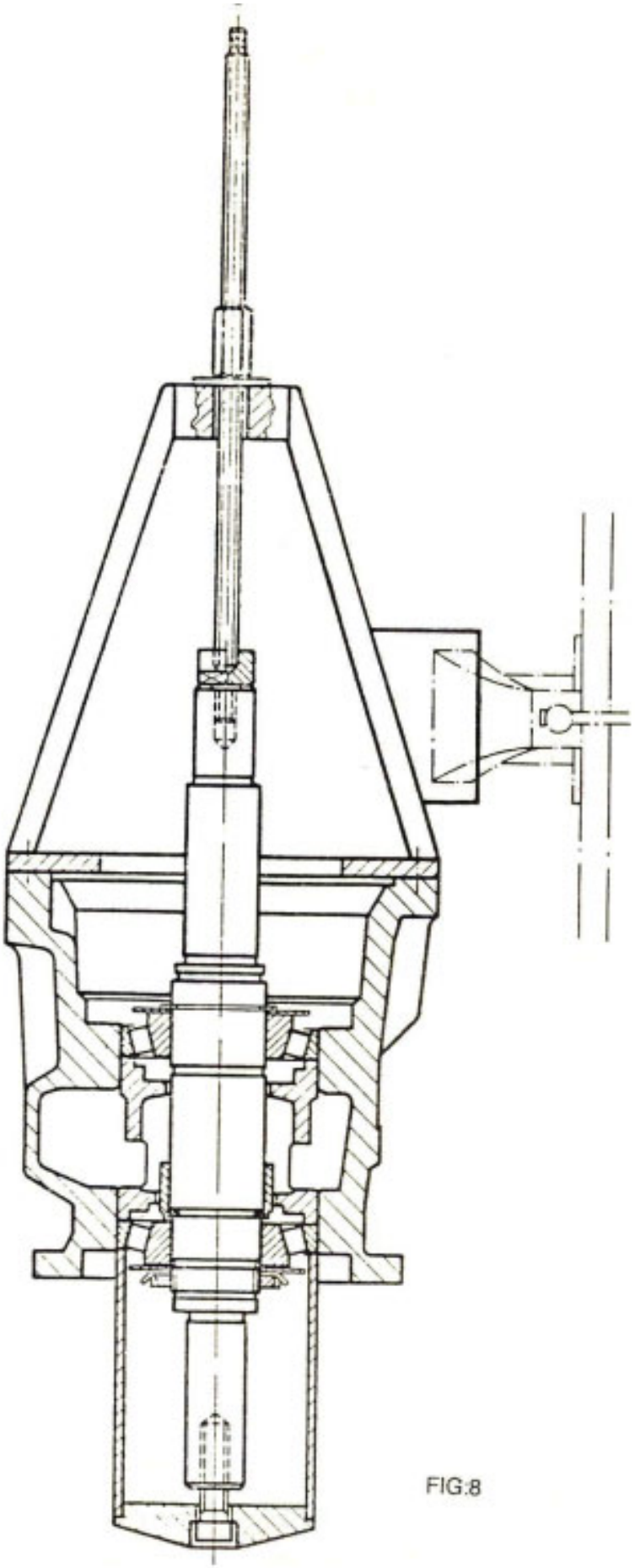


FIG:8

10. DISMANTLING AND ASSEMBLING

10.1 Dismantling the Bearing Housing

Stage 1

TOOLS:
-vise
-puller
-dismantling sleeve
-working nut
-wrenches
-hex. Screw M12 x 70 (4 pcs)
(Fully threaded)
-hex, nut M.12

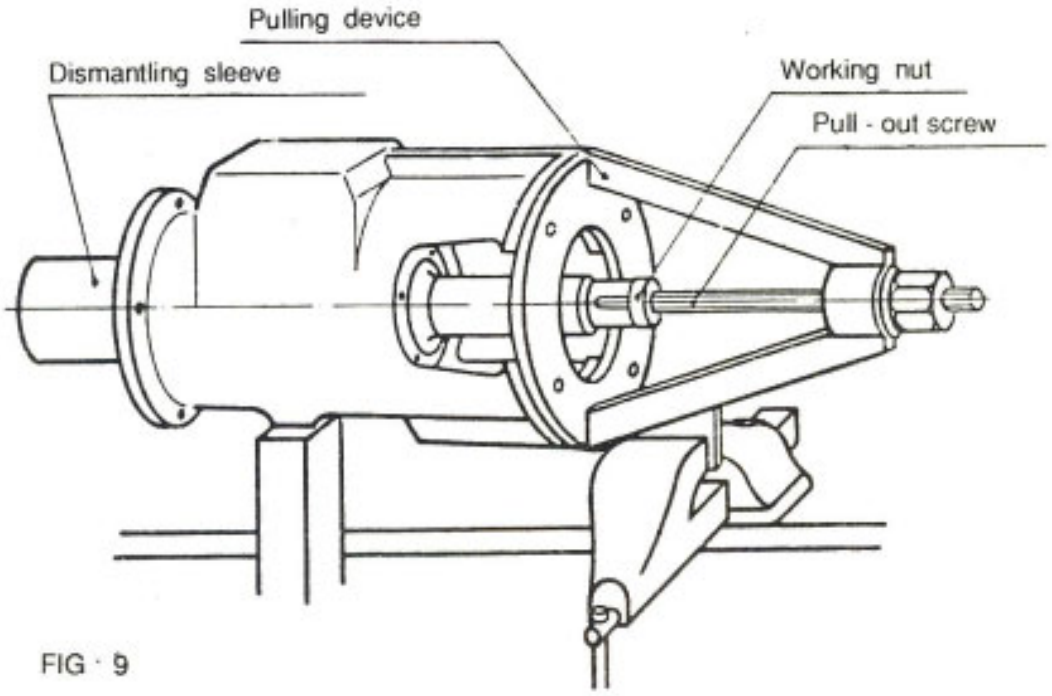


FIG · 9

0.1 Remove the screws fixing the bearing covers and detach the coupling end cover (37.3) by levering at the heads of the pull - out screws.

0.2 Place the puller, at its fixing point, in the vise as shown in Fig: 9; tighten firmly,

0.3 Fix the bearing cover with 4 Nos of M .12x 70 hex screws and nuts to the puller and screw the working nut and pull-out screw in place. If necessary, support the bearing housing to the floor.

0.4 Fix the dismantling sleeve, with the screw provided, to the drive end of the shaft. Center the sleeve with the outer ring of the bearing and tighten reasonably.

0.5 Pull the shaft (22.3), with the bearings, out of the housing by means of the pull-out nut. The bearing cover (37.2) will come along.

0.6 Unscrew the working nut from the shaft and detach the bearing housing from the puller while supporting the shaft.

0.7 Pull the shaft out of the bearing housing and remove the dismantling sleeve.

Stage 2

0.8 Fix the shaft assembly in the vise. Remove the locknut 93.5, lock washer 94.3 and Oil flinger 56.3.

0.9 Place the two-pronged extractor on the shaft as shown in fig: 10 pull the bearing (33.2) out. Remove the loosened parts from the shaft

Tools

-vise
-two-pronged extractor
-hooked wrench
-hammer
-punch (2 pcs)
-external snap ring pliers

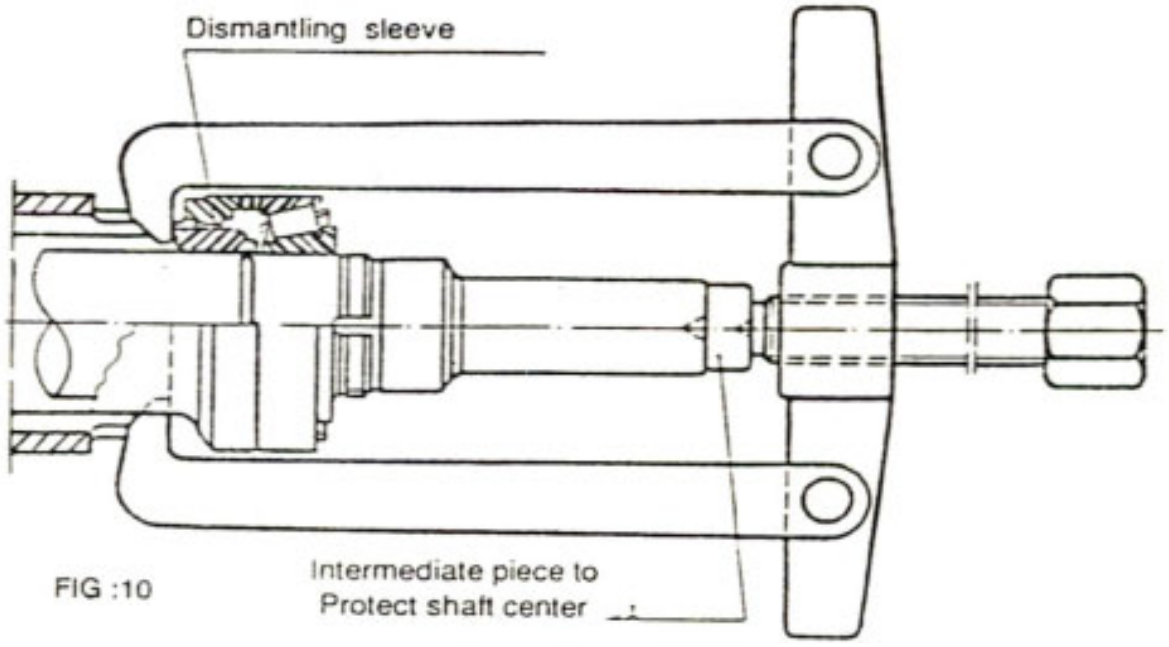


FIG :10

0.10 Give the Oil flinger (56.3) a couple of smart strokes with punch. (fig:11)

0.11 Detach the circlip (94.4) with suitable pliers and remove the Oil flinger 56.3 from the shaft.

0.12 Use a punch, or preferably a pipe punch, to hammer the roller ring out from the shaft with the aid of the working ring (fig: 11)

0.13 Clean and inspect all parts; replace if necessary.

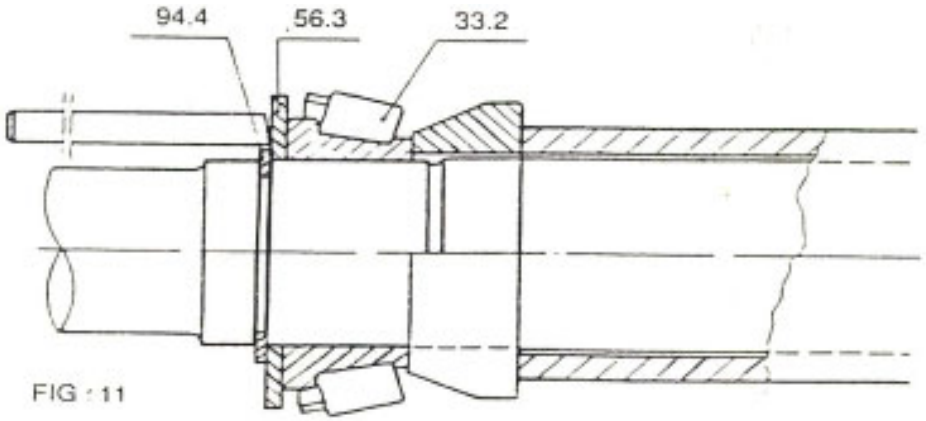


FIG : 11

10.2 Assembling the Bearing Housing

TOOLS:
- vise
- working ring
- external snap ring pliers
- hammer
- punch

Stage 1

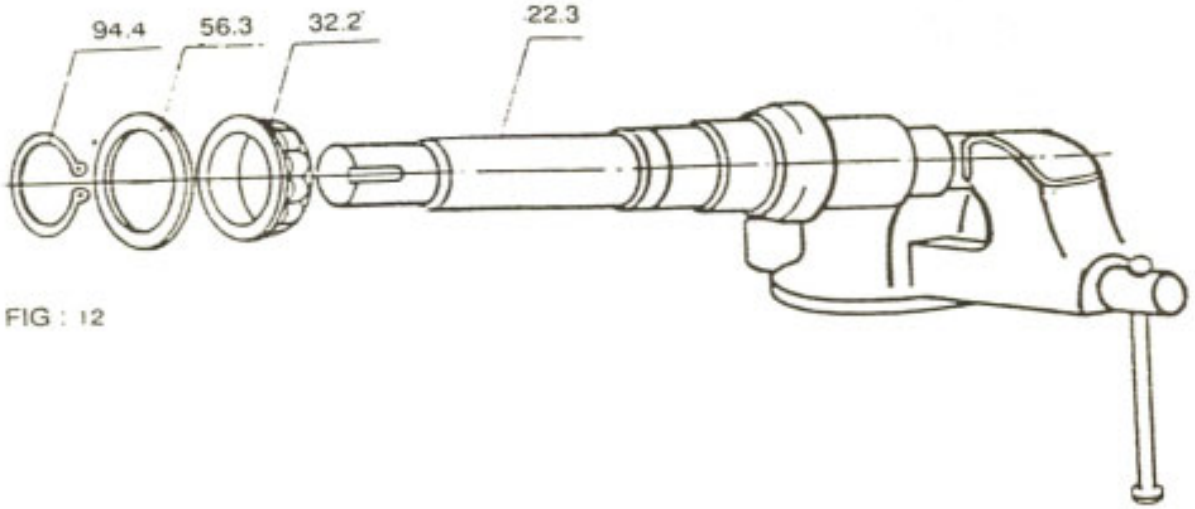


FIG : 12

1.1 Place the shaft (22.3) in the vise as shown in fig: 12

1.2 Place the working ring around the greatest diameter of the shaft.

1.3 Pre-heat the roller ring of the bearing (33.2) in oil bath to 100-110°C (212-230°F)

1.4 Push the roller ring on the shaft against the shoulder.

1.5 Place the protecting ring (56.3) and circlip (94.4) on the shaft. Use snap ring pliers.

1.6 Hammer the parts against the circlip with the aid of the working ring and punch.

DO THE STEPS 1.4 - 1.5 AT A GOOD SPEED BECAUSE THE ROLLER RING, WHEN COOLING DOWN, WILL RAPIDLY SHRINK ON THE SHAFT.

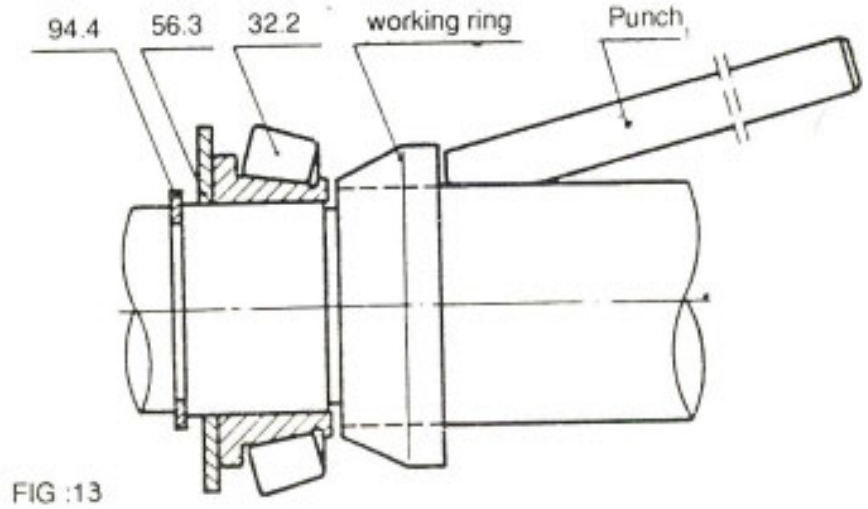


FIG :13

1.7 Place the shaft, partly carried into bearings during stage 1, in the vise as shown in fig : 14

TOOLS:
- vise
- hooked wrench
- hammer

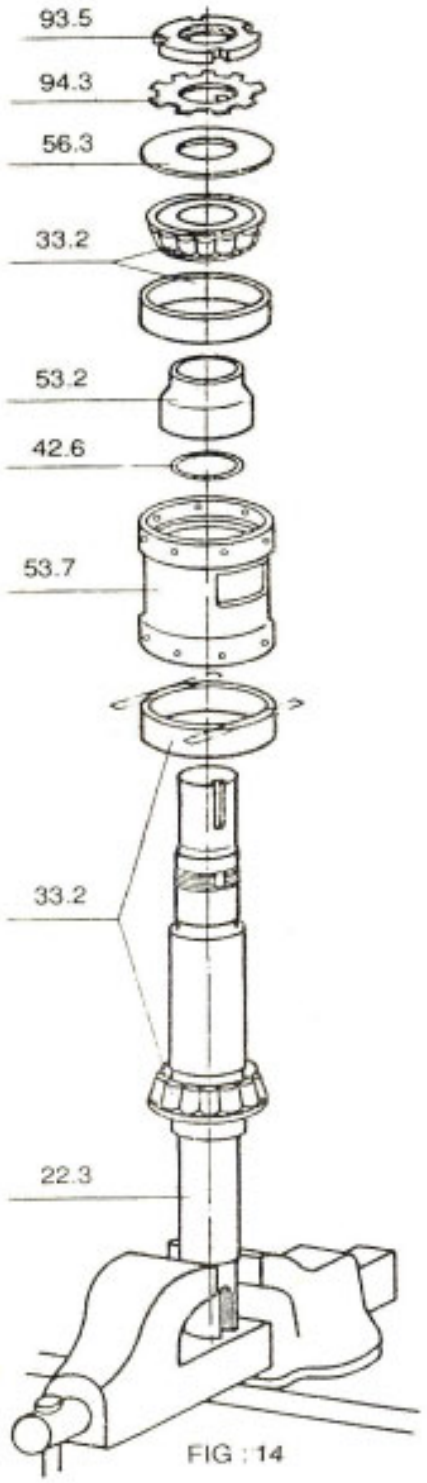


FIG : 14

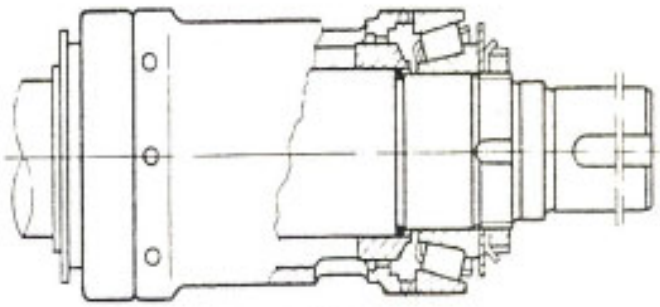


FIG : 15

1.8 Put the outer ring of the bearing (33.2) in place on the roller ring and the support sleeve (53.7) on the outer ring with the larger opening upwards.

1.9 Lightly grease the o-ring (42.6) with vaseline and put it in the groove on the shaft.

1.10 Press the dismantling sleeve (53.2) in place on the o-ring - against the shoulder on the shaft.

1.11 Put the outer ring of the bearing on the support sleeve (53.7)

1.12 Pre-heat the roller ring in oil bath to 100°-110°C (212°-230°F)

1.13 Push the roller ring on the shaft against the shoulder.

1.14 Place the protecting (56.3) and lock washer (94.3) on the shaft and screw the locknut (93.5) into the thread on the shaft in a vertical pump, do not install the coupling end protecting ring (56.3)

1.15 Place 2 or 3 steel plates, thickness 0.10 mm (0.004) between the outer ring of the bearing and support sleeve. Tighten the bearings with the bearing nut until no clearance is present. A couple of strokes with punch on the locknut (93.5) face will make tightening easier. While tightened, the bearing unit should be rolled for several times. Once clearance cannot be felt any more (rolls stiffly), remove the steel plates and bend the claw of the lock washer (94.3) into the nut (93.5) slot. (Fig: 14-15)

Stage 3

TOOLS

- vise
- puller
- dismantling sleeve
- working nut
- wrenches
- grease squirt
- hex screw M12 x 70 (4 pcs)
- hex. nut M12 (4 pcs)

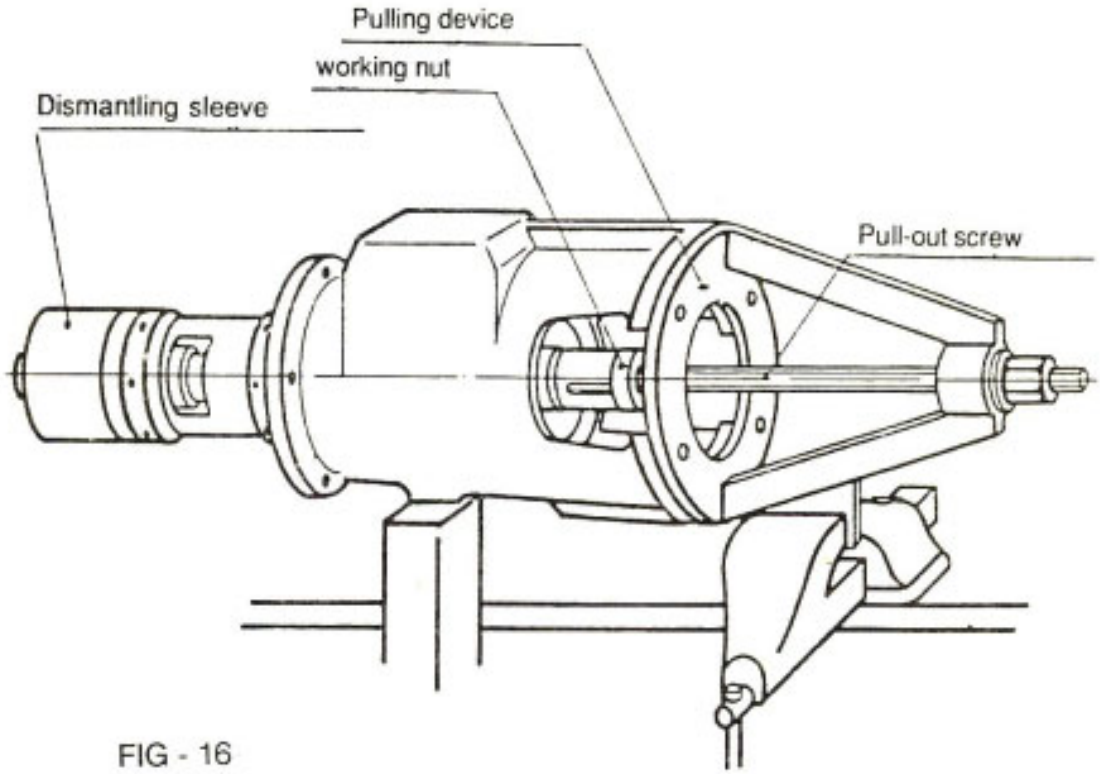


FIG - 16

1.16 Place the puller at its tightening point, in the vise as shown in fig: 18 Tighten firmly

1.17 Fix the bearing housing (34.2) with 4 hex. Screws (M12x70) and nuts to the puller. Support the bearing housing to the floor

1.18 Screw the nut of the pull-out bolt almost up to the screw end so that the screw comes through the puller opening.

1.19 Fix the dismantling sleeve, with the screw provided, to the drive end of the shaft (22.3) Center the sleeve with the outer ring of the bearing tighten reasonably.

1.20 Push the shaft unit into the bearing housing (34.2) and screw the working nut into the shaft end thread

1.21 Tighten the pull-out nut and check to be sure that the shaft is straight when the pulling starts.

1.22 Pull the shaft unit into the bearing housing. When the first bearing has passed through, tighten the nut again and check for alignment. Pull the shaft unit until the outer ring of the front bearing and that of the hindermost bearing are at the same distance form the bearing housing

1.23 Detach the working nut form the shaft and the bearing housing form the puller; remove the dismantling sleeve.

1.24 Lubricate the bearings with grease squirt (if grease lubricated bearings are concerned); fill about 2/3 of the space around the bearings.

1.25 Install the bearing covers (37.2, 37.3) being careful not to damage o-rings and oil seals (43.3, 43.13). In case of oil lubrication, the bearing covers have labyrinth rings; place their oil filling holes downwards.

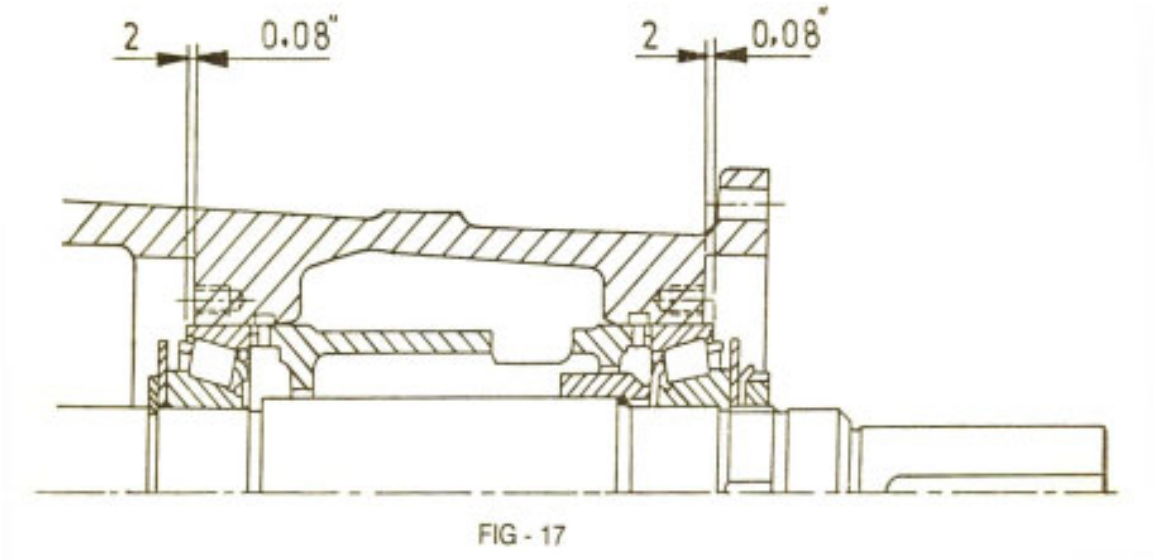


FIG - 17

10.3 Assembling the Exchange Unit

2.1 Put the deflector (51.9) and shaft sleeve (53.6) on the shaft. Note o-ring (42.5) between the shaft sleeve and deflector.

2.2 Put the gland (46.4) and lantern ring (46.10) on the shaft and check to see that the neck bush is in place at the casing cover. Be careful not to damage the surfaces of the shaft and shaft sleeve. If your pump has a mechanical seal, follow the special instructions by the seal manufacturer for seal assembly.

10.4 FIXING THE IMPELLER ON TPS PUMPS.

3.1 Fix the impeller {24.2) on the shaft. Put the gasket (thickness 3.5mm) on the step provided.

3.2 Put the locking cap impeller screw (93.4) in place, with the fixing claw in the slot provided.

3.3 Secure the screw (27.2) by hammering the edge of the locking Cap (93.4) at two points into the slot provided in the screw head. The edge should cut in the slot.

3.4 The Impeller Nut (27.2) secured by hammering the nut shoulder into the slot Provided in the impeller.

3.5 Pack the stuffing box with new packing rings Press the rings in place using the gland. Loosen the tightening screws until "finger tight".

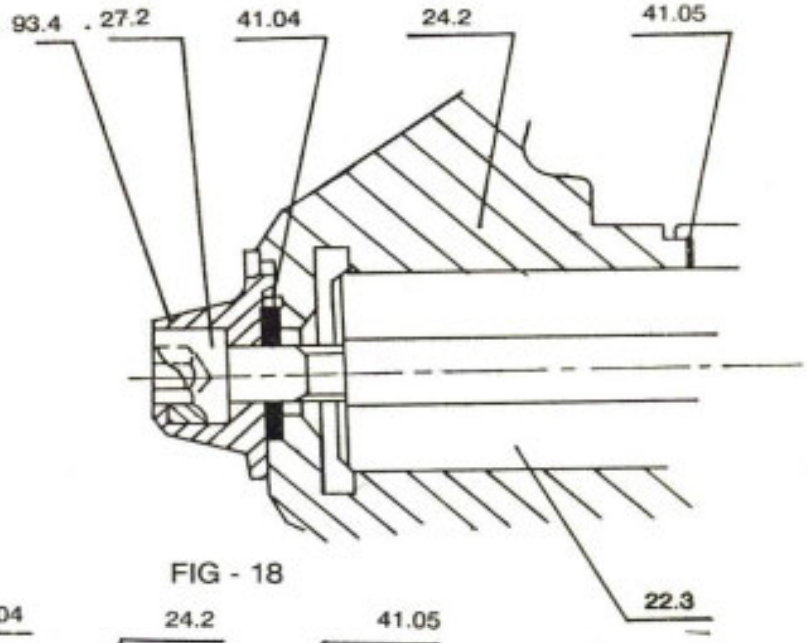


FIG - 18

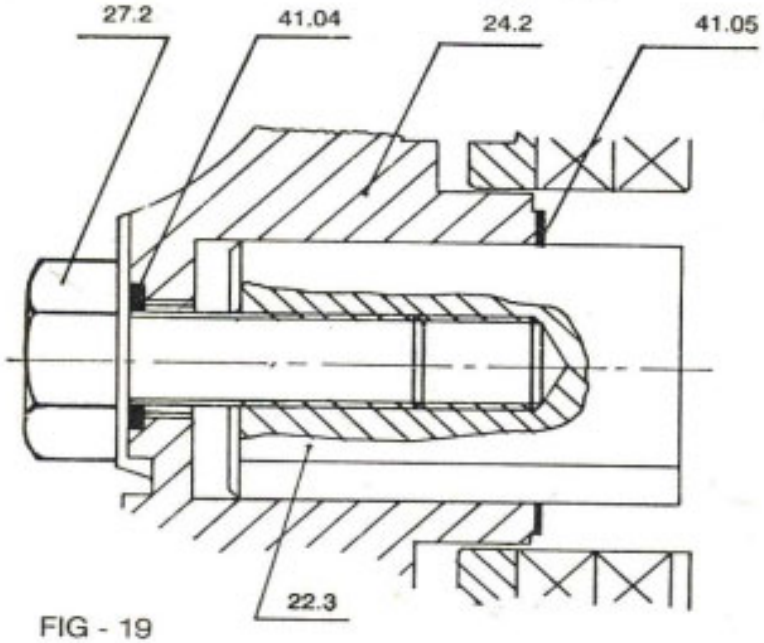


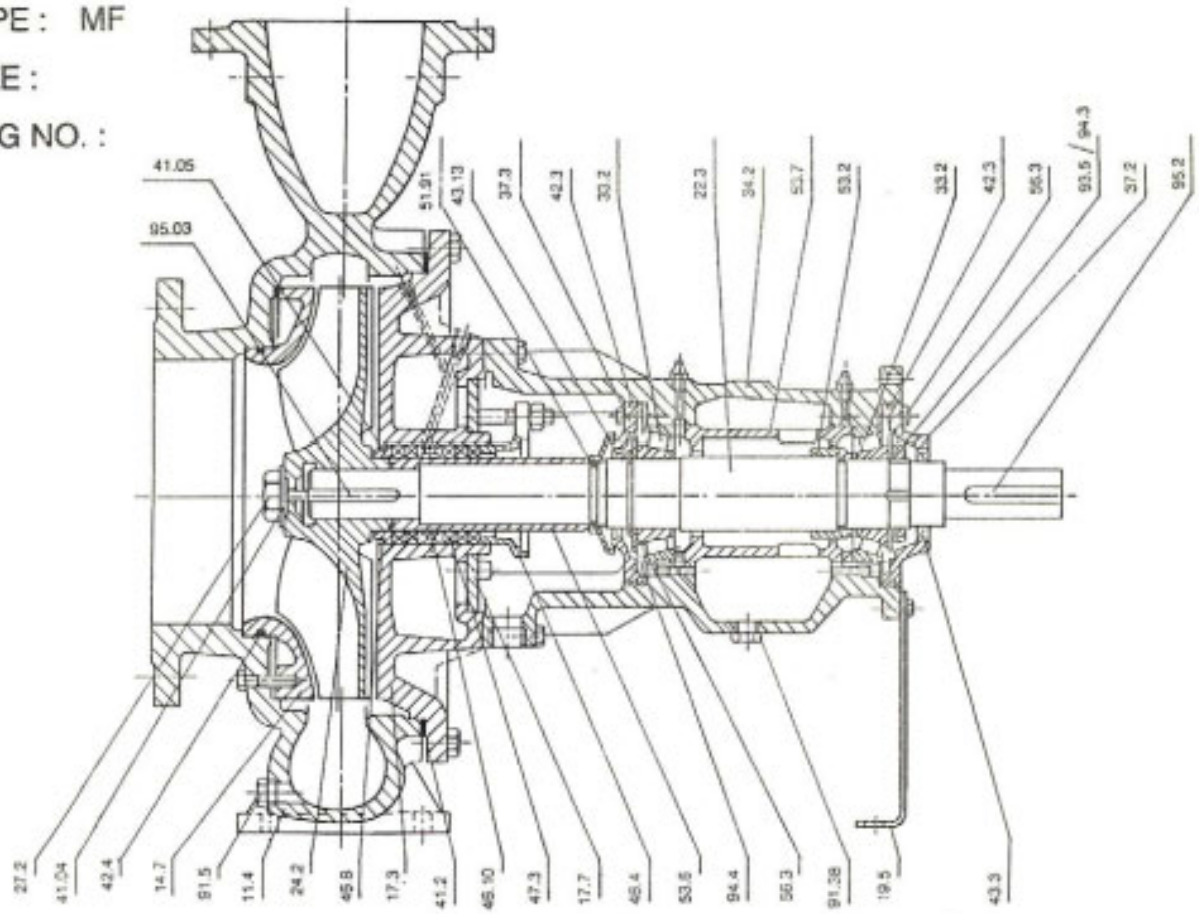
FIG - 19

SECTIONAL DRAWING WITH BILL OF MATERIAL

TYPE : MF

SIZE :

DRG NO. :



CODE NO.	PART NAME	MATERIAL	QTY.
11.4	Volute Casing	IS210FG 200	1
14.7	Wear Plate	IS210FG 200	1
17.3	Casing cover	IS210FG 200	1
17.7	Cover	IS226 C 15	1
19.5	Support Foot	IS226 C 15	1
22.3	Pump Shaft		1
24.2	Impeller		1
27.2	Impeller Screw		1
33.2	Bearings	Steel	2
34.2	Bearing Bed	IS210FG 200	1
37.2	Bearing Cover (Drive)	IS210FG 200	1
37.3	Bearing Cover (Pump)	IS210FG 200	1
41.04	Gasket (Impeller Screw)	CAF 9	1
41.05	Gasket (Impeller/Sleeve)	CAF 9	1
41.2	Gasket (Casing)	CAF 9	1
42.3	'O Ring (Bearing Cover)	Neoprine Rubber	
42.4	'O' Ring (Wear Plate)	Neoprine Rubber	1
43.3	Oil Seal (Drive)	Synthetic Rubber	1
43.13	Oil Seal (Pump)	Synthetic Rubber	1

CODE NO.	PART NAME	MATERIAL	QTY.
46.4	Gland	IS210FG 200	1
46.10	Lantern Ring	AISI 410	1
46.8	Throttle Bush	IS210FG 200	1
47.3	Gland Packing	TIGA	Rings
51.91	Deflector	AISI-304	1
53.2	Dismantling Sleeve	BS 970 En-8	1
53.6	Shaft Sleeve		1
53.7	Support Sleeve	IS210FG 200	1
56.3	Oil Flinger	IS226 C15	1
91.3	Adjusting Screw (Impeller)	MS IS 1363	8
91.38	Plug (Oil Drain)	BS 970 En-8	1
91.5	Plug (Casing Drain)		1
93.5	Lock Nut	BS 970 En-8	1
94.3	Lock Washer	MS	1
94.4	Circlip	Steel	1
95.2	Key (Coupling)		1
95.03	Key (Impeller)		1

11. TROUBLE - CAUSE - REMEDY

In the event of troubles we recommend to locate the cause using the following chart:

Trouble	Cause-Remedy No.								
1.Pump does not deliver	1	7	8	9	10	11	12	15	16
	17	18	19	20	24	26	27	31	68
	69	70							
2.Pump delivers at reduced capacity	1	2	3	4	5	6	7	8	9
	10	11	12	14	15	16	18	19	20
	21	23	68	69	70	74			
3.Delivery performance reduced	1	3	7	9	10	11	12	14	15
	20	21	23	24	59	65	69	74	
4.Pump delivers too much	17	68	69	70					
5.Delivery is interrupted	1	3	6	7	8	9	10	11	12
	13	14	15	16	17	20	23	24	26
	31	68	69	70	74				
6.Pumps runs in reverse direction	64								
7.Very noisy	1	2	5	6	7	8	11	12	14
	16	20	21	23	66	67	68	69	70
	74								
8.Unsteady running of pump	20	21	23	33	34	36	38	39	40
	41	42	43	47	48	49	52	54	55
	56	57	58	63	66	67	70		
9.Pumping casing not leak proof	52	54	59	60					
10.Excessive leakage from stuffing box	21	25	28	29	30	32	33	55	56
	57	65							
11.Fumes from stuffing box	23	24	25	26	27	28	29	32	45
	46	65							
12.Mechanical Seal leaking	21	23	24	31	45	46	55	57	65
	75								
13.Pump rotor blocked in stand still position	23	49	50	52	54	58			
14.Pump is heating up and seizing	23	24	25	26	27	28	30	32	43
	45	46	49	50	54	55	56	57	58
15.Bearing temperature increase	20	21	23	33	34	36	39	40	41
	42	43	44	45	47	48	49	50	52
	54	55	57	63	66	67	70		
16.Motor will not start	15	23	72						
17. Motor is difficult to start	15	17	23	28	29	49	50	54	58
	70	71	72						
18.Motor is running hot burning out	15	17	23	28	29	43	58	68	69
	70	71	72	73					

11.1 CAUSE - REMEDY

1. Suction filter, foot valve clogged.
2. Nominal diameter of suction line too small.
3. Suction does not reach down far enough into the delivery liquid.
4. Ground clearance of suction too narrow.
5. Too many bends in the suction line.
6. Shut-off valve in the feed line in unfavorable position.
7. Incorrect layout of suction line (Formation of air pockets)
8. Valve(s) in the suction and/or feed line not fully open.
9. Screwed joints or flanges in the suction line not leak-proof.
10. Ingress of air via leaking valves and fittings in the suction line (Stuffing box etc).
11. Suction lift too great.
12. Available NPSH too low (difference between pressure at suction branch and vapour pressure too low).
13. Cut-out level for starter too low (In automatic plants).
14. Delivery liquid containing too much gas and/or air.
15. Delivery liquid too viscous.
16. Insufficient venting.
17. Speed too high (number of revolutions of driver higher than nominal number of revolutions of pump).
18. Speed too low (number of revolutions of driver lower than nominal number of revolutions of pump).
19. Incorrect direction of rotation (electric motor, incorrectly connected, leads on the terminal board Interchanged).
20. Impeller clogged.
21. Impeller Damaged.
22. Separation of crystals from the delivery liquid (falling below the temperature limit/equilibrium Temperature).
23. Sealing liquid line/circulation line clogged.
24. Sealing liquid line 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 material not suitable for operating conditions.
30. Mechanical seal blocked; O-ring-rotating seal ring or stationary seal ring damaged.
31. Shaft sleeve/shaft worn in the region of the packing.
32. Bearing worn out.
33. Insufficient lubrication of bearings (also in case of automatic lubrication).
34. Specified oil level not maintained.
35. Oil quality unsuitable.
36. Rolling contact bearings incorrectly fitted.
37. Axial stress on rolling contact bearings (no axial clearance for rotor)
38. Bearings dirty.
39. Bearings rusty (corroded).
40. Axial thrust too great because of worn wearing, obstructed relief holes.
41. Radial shaft seal ring has not much tension (local heating-up of shaft)
42. Insufficient cooling water supply.
43. Sediment in the cooling water chambers.
44. Alignment of coupling faulty or coupling loose.
45. Elastic element of coupling worn.
46. Foundation incorrectly performed.

47. Base plate not rigid enough in the event of erection without foundation.
48. Pump casing under stress.
49. Pipe line under stress.
50. Shaft runs untrue
51. Shaft bent.
52. Rotor insufficiently balanced.
53. Rotor parts touching the casing.
54. Unsuitable casing seal.
55. Casing screws not light enough.
56. Vibration of pipe work:
57. Non return valve gets stuck.
58. Contaminated delivery liquid.
59. Delivery flow too small.
60. Delivery flow too great.
61. Pump unsuitable for parallel operation.
62. Type of pump unsuitable.
63. Incorrect designing of pump for existing operating conditions.
64. Voltage too low/power supply overloaded.
65. Short circuit-in the motor.
66. Setting of circuit-breaker for motor handled too high
67. Temperature of the liquid too high
68. Spring of the mechanical seal damaged.