

# **INSTRUCTIONS ON INSTALLATION, OPERATION AND MAINTENANACE FOR SAM TURBO PUMP TYPE “TCC”**



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**NEELAMBUR, COIMBATORE-641 014. INDIA**

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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

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

## INSTALLATION AND OPERATING INSTRUCTIONS

### General:

This Booklet covers instructions for following **TCC** Model Pumps

BEARING UNIT	PUMP MODELS
15	40/200
	50/160
	50/200
	65/160
18	40/260
	50/260
	50/320
	65/200
	65/260
	80/160
	100/200
22	65/320
	100/260
	100/320
	100/400
	125/260
	125/320
	125/400
30	150/320
	150/400

## **INSTALLATION AND OPERATING INSTRUCTIONS.**

### **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 'SAM' 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:**

SAM CHEMICAL pumps & Process Pumps like TCC are single volute casing pumps with axial suction branch and top centre line delivery branch. All chemical pumps are supported by integrally cast foot in the Casing and all Process pumps are centerline mounted.

Bearings are cooled when liquids are handled at temperatures above 200<sup>0</sup> 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:

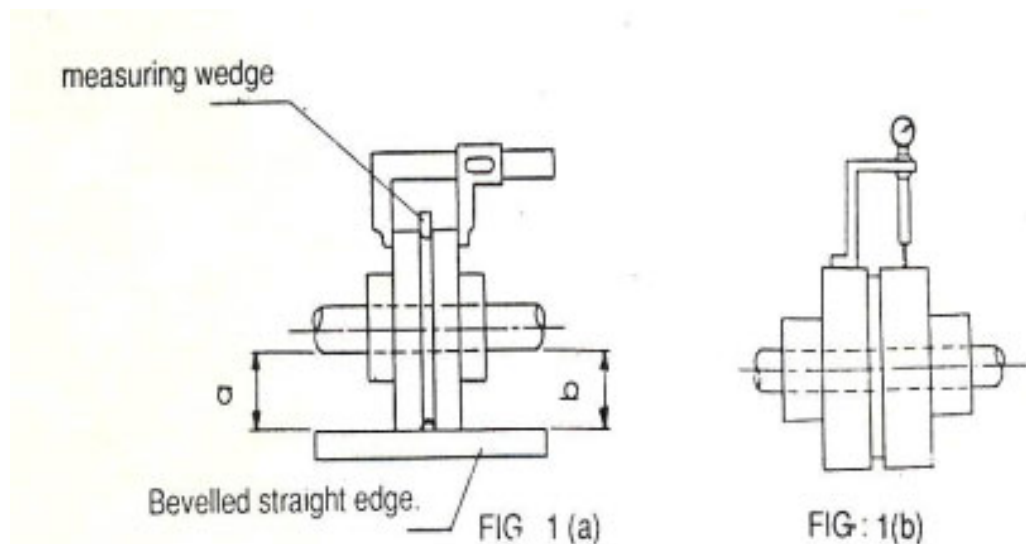
To check whether pump and motor shafts are in perfect alignment, proceed as follows:

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 beveled 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, Le., when measuring the rotor and the driver shaft must always be brought to bear in the same direction.



### 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

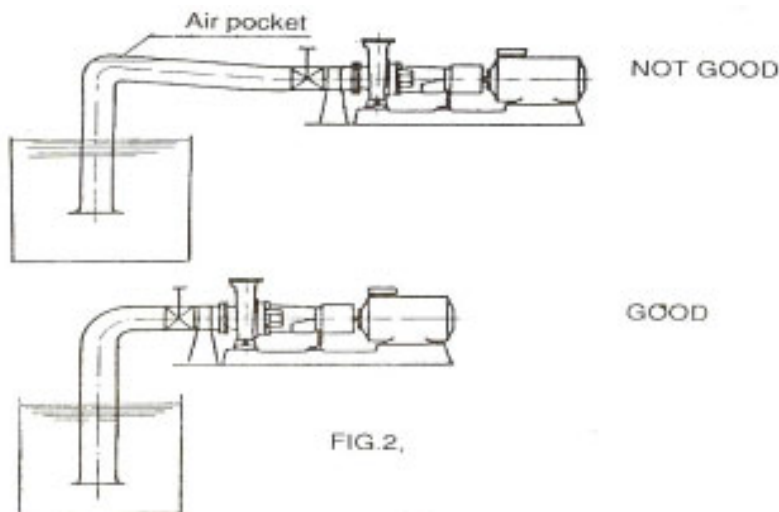
The piping should be installed with the following considerations:

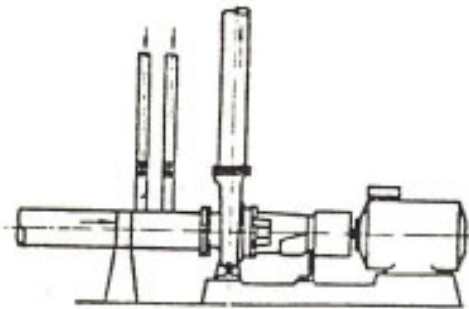
Select pipe diameter according to the allowed flow velocities.

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

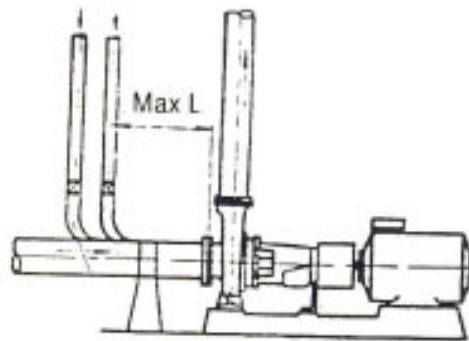
Support the pipes so that weight of piping and contained fluid will not rest on the pump. When placing the supports, make a provision for heat expansion.

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



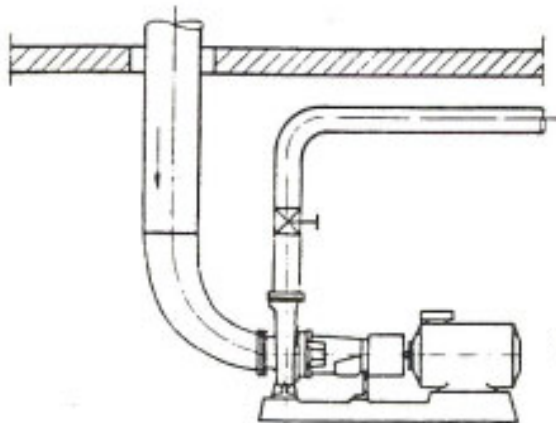


NOT GOOD

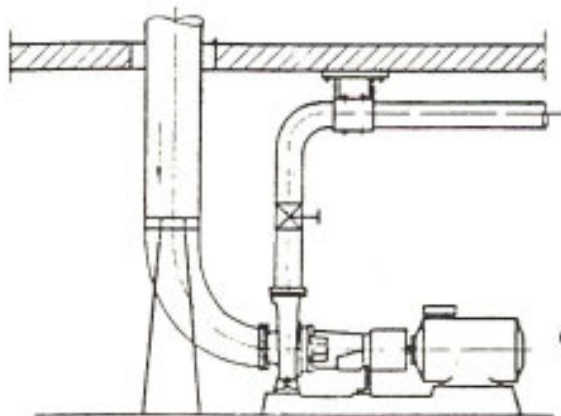


GOOD

FIG.3



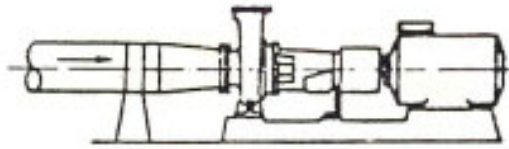
NOT GOOD



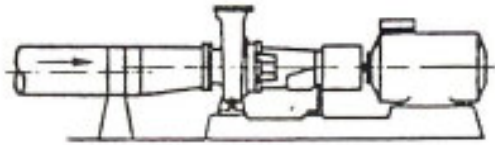
GOOD

FIG.4



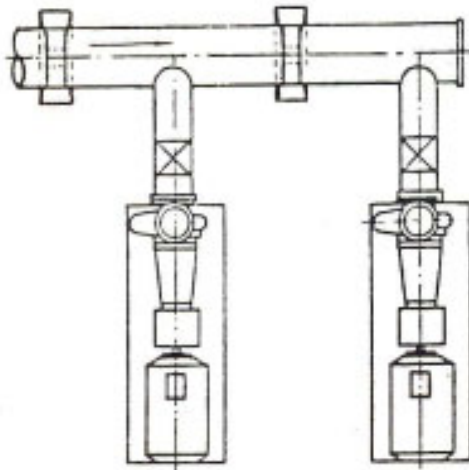


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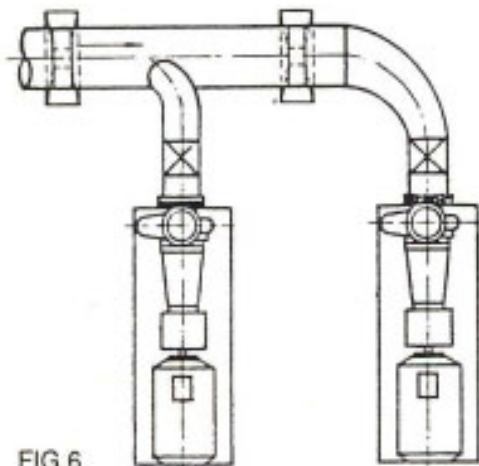


GOOD

FIG: 5



NOT GOOD



GOOD

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**

### **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)

### **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.

### **Regulating the Flow**

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

### **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 long 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.

### **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

### **Control 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 LITHON 3	NATRA 2 or LITHON 2

Bearing Unit	Bearings 2 x (pcs)	Speed (rpm)	Lubr. Interval (oper.hrs)	Qty of grease for re-lubr. of each bearing	
				(g)	(oz)
15	30308*	1500/1800 3000/3600	1500 700	10	0.35
18	30310*	1500/1800 3000	1200 500	15	0.55
22	30312*	1500/1800 3000	1100 400	20	0.70
30	32214*	1000/1200 1500/1800	1500 900	20	0.70
45	32216*	1000/1200 1500/1800	1400 800	25	0.90
60	32220*	1000/1200 1500/1800	1100 600	40	1.4

\* SKF Catalogue Number

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° F) will reduce the lubrication interval to a half

## Oil-Lubricated Bearings

The bearing housing has been emptied of oil prior to shipment and must be refilled before starting,

Pour oil in the bearing housing half way up the sight glass. Also fill the plastic domed cap of the constant level oiler and put it in place.

During operation, the oil level may slightly fall. Refilling during operation should always be done through the cap hole of the constant level oiler. In the plastic cap there must always be oil.

When the pump is put into operation after prolonged shut-down, flush bearings and bearing housing with petrol or benzol in order to remove impurities, during the flushing procedure rotate the shaft slowly.

FIRM	Lubricating oil for temperature up to 80°C	
	Speed up to 1500 rpm	Speed over 1500 rpm
Indian Oil	Servo System 526	Servo System 317
Hindustan Petroleum	ESSTIC 55, TERRESSO 56	ESSTIC 50, TERRESSO 52
Mobil	MOBIL V ACTRA Oil Heavy MOBIL D.T.E. Oil Heavy Vac HLP 49	MOBIL VICTRA Oil Heavy Medium MOBIL D.T.E Oil Heavy Medium Vac HLP 36
Shell	Shell Vitrea Oil 33, Shell Oil 33	Shell Vitrea Oil 31 , Shell Tellus Oil 29

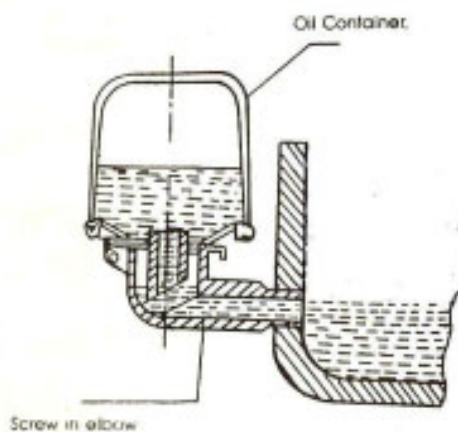


FIG : 7(a)

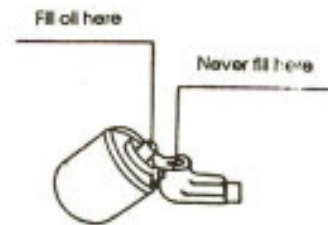


FIG : 7(b)

For lubrication of our machines we recommend the lubricants shown on this lubrication table or equivalent lubricants.

The sequence of the lubricant suppliers is not indicative of the quality rating of their grades. Each of these companies maintains a technical service whose engineers are at all time at your disposal and without Obligation on your part.

Fill the bearing housing through the inlet hole with oil until the oil becomes visible in the screw-in-elbow, the oil container being hinged back. Next fill the oil container and allow it to spring back into position (figure 7(a) and 7(b) now so much oil flows from the container into the bearing housing until the requisite oil level is reached. As long as there is oil in the container, the oil level in the bearing housing has the requisite height.

### Oil Change

It is recommended that for a new pump the oil should be changed after 100 hours of operation for the first time and thereafter at intervals of 6-12 months. Add oil when necessary

### Oil Volume of the Bearing Housing:

Bearing unit	Amount of oil in litres
15	0.5
18	0.9
22	1.0

Bearing unit	Amount of oil in litres
30	1.7
45	2.5
60	3.3

Table: 2

**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 3)

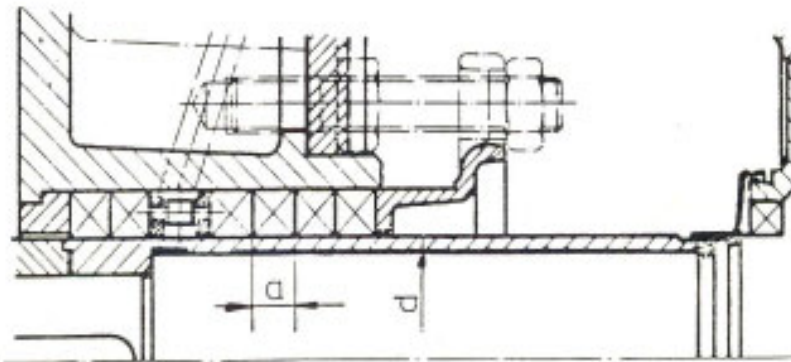
**Stuffing Box Construction of TCC Pumps When Using Lantern Ring**

FIG:8

**PACKING OF STUFFING BOX WHEN USING LANTERN RING:**

Bearing Unit	Packing ring axd/length 1)	Number of packing rings	Size	Total length of packing
	mm		mm	mm
15	10 x 45/175	5 (2-3)	10	900
18	10 x 50/190	6 (2-4)	10	1200
22	12.5 x 63/240	5 (2-3)	12.5	1200
30	12.5 X 70/260	6 (2-4)	12.5	1570
45	16 X 85/320	6 (2-4)	16	1920
60	16 X 100/370	5 (2-3)	16	1840
	Inch		Inch	Inch
15	3/8 x 1.77/6.89	5 (2-3)	3/8	35.5
18	3/8 x 1.97/7.48	6 (2-4)	3/8	45.0
22	1/2 x 2.48/9.45	5 (2-3)	1/2	47.5
30	1/2 x 2.75/10.24	6 (2-4)	1/2	61.5
45	5/8 x 3.35/12.60	6 (2-4)	5/8	63.0
60	5/8 x 3.94/14.57	5 (2-3)	5/8	73.0

Table: 3

**1) Ready ring-shaped packing**

The first figure in the brackets 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.

**Stuffing Box Construction when using LABYRINTH Neck Bush.**

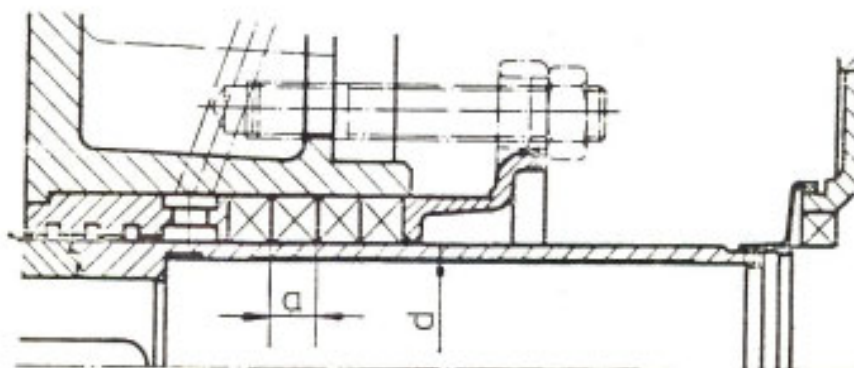


FIG : 9

**PACKING OF STUFFING BOX 'WHEN USING LABYRINTH NECK BUSH:**

Bearing unit	Packing ring axd/length 1)	Number of Packing rings	Size	Total length of packing
	mm		mm	mm
22	12.5 x 63/240	4	12.5	960
30	12.5 x 70/260	4	12.5	1050
45	16 x 85/320	4	16	1280
60	16 x 100/370	4	16	1470
	in		in	in
22	1/2 x 2.48/9.45	4	1/2	40.0
30	1/2 x 2.75/10.24	4	1/2	41.0
45	5/8 x 3.35/12.60	4	5/8	50.5
60	5/8 x 3.94/14.57	4	5/8.	58.5

1) Ready ring-shaped packing

Table: 4

**MECHANICAL SEAL**

**Taking into service:**

Before taking your pump into service, get acquainted with the maintenance instructions for the mechanical seal.

**Installation:**

When installing the mechanical seal, follow the special instructions by the seal manufacturer or pump supplier.

DO NOT AXIALLY MOVE THE ROTOR ASSEMBLY AFTER THE SEAL HAS BEEN INSTALLED

(See "SERVICING REPAIRS")

**8 O-RINGS AND OIL SEALS**

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

**O-Rings:** Material: NEOPRINE RUBBER temp.range:-40 ... +100°C

Table 5

Size of O-Rings			
Bearing unit	O-ring (42.3) for bearing cover	O-ring (42.5) for deflector	O-ring (42.6) for dismantling sleeve
15	125 x 3	30 x 3	38 x 4
18	145 x 3	40 x 3	50 x 3
22	170 x 5	50 x 6	60 x 3
30	162 x 5	58 x 6	70 x 3
45	180 x 6	70 x 6	80 x 3
60	221 x 6	76 x 6/81 x 6	99 x 3

**Oil Seals for Bearing Covers on Grease-Lubricated Bearings.**

std: DIN 3760

Table 7

Bearing unit	Oil seal (43.13), impeller end	Oil seal (43.3), coupling end
15	40 x 52 x 7	35 x 50 x 7
18	50 x 65 x 8	45 x 62 x 8
22	60 x 80 x 8	55 x 72 x 8
30	70 x 90 x 10	65 x 90 x 10
45	80 x 100 x 10	75 x 100 x 10
60	100 x 120 x 12	90 x 120 x 12



## 9. **SERVICING REPAIRS (follow the assembly drawing)**

### 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).

### 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.

### 3.1 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.

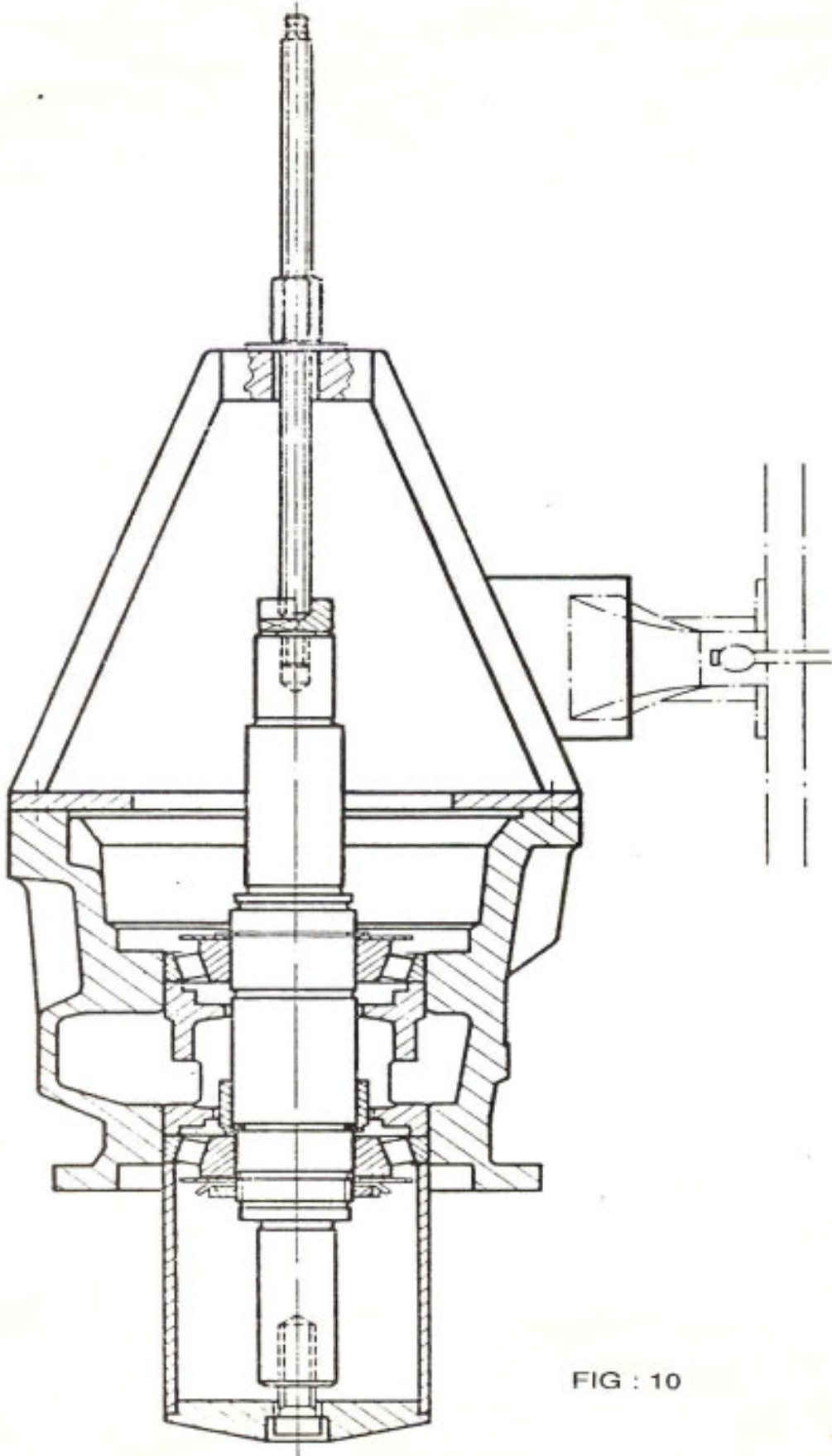
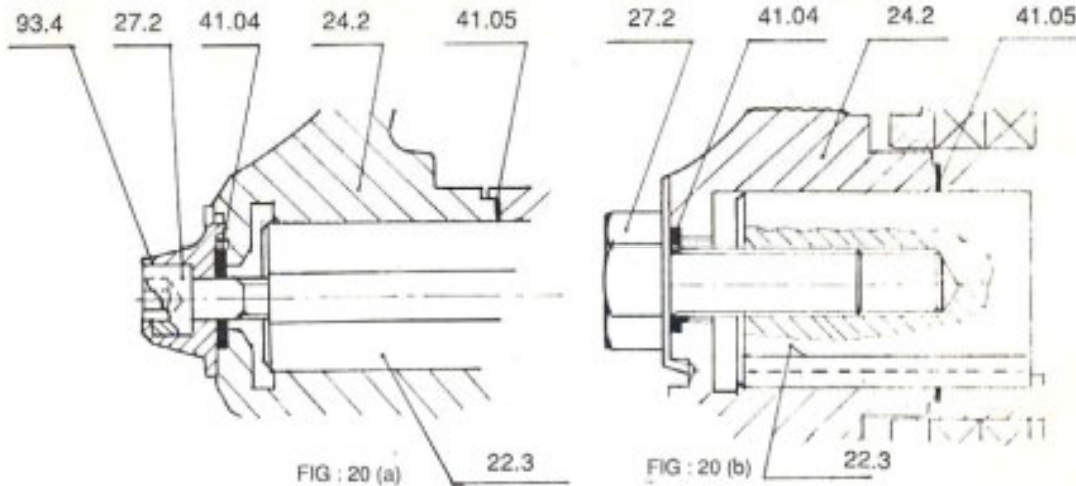
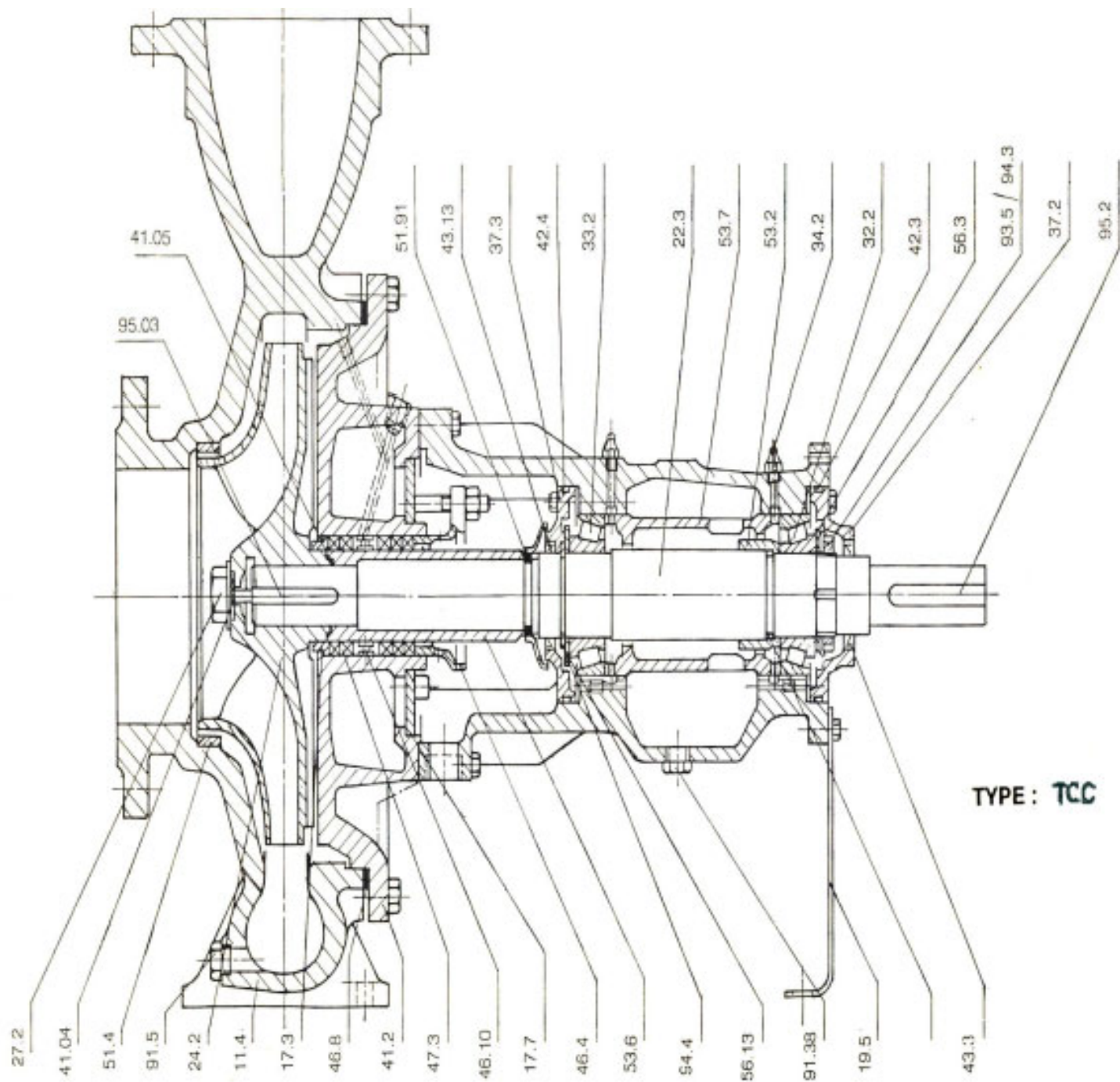


FIG : 10

#### 10.4 FIXING THE IMPELLER ON TPS PUMPS.



- 5.28** Fix the impeller (24.2) on the shaft. Put the gasket (thickness 3.5mm) on the step provided. 5.29 Put the locking cap impeller screw (93.4) in place, with the fixing claw in the slot provided.
- 5.30** 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.
- 5.31** The Impeller Nut (27.2) secured by hammering the nut shoulder into the slot Provided in the impeller. 5.32 Pack the stuffing box with new packing rings Press the rings in place using the gland. Loosen the tightening screws until "finger tight".
- 5.32** Pack the stuffing box with new packing rings Press the rings in place using the gland. Loosen the tightening screws until "finger tight".



TYPE : TCC

## 2. BILLOF MATERIALS

CODE NO	PART NAME
11.4	Casing
* 17.3	S.B.Cover
17.7	Cover
19.5	Support foot
* 22.3	Pump shaft
* 24.2	Impeller
* 27.2	Impeller Screw
* 33.2	Bearings
34.2	Bearing Bed
37.2	Bearing Cover (Drive)
37.3	Bearing Cover (Pump)
* 41.04	Gasket (Impeller Screw)
* 41.2	Gasket (Casing)
* 42.3	'O' ring (Bearing Cover)
* 43.3	Oil Seal (Drive)
* 43.13	Oil Seal (Pump)
46.4	Gland
46.10	Lantern ring
* 46.8	Throttle bush
* 47.3	Gland packing
51.9	Deflector
53.2	Dismantling sleeve
* 53.6	Shaft Sleeve
53.7	Support Sleeve
56.3	Oil Flinger
91.3	Adjusting Screw (Impeller)
91.38	Plug (Oil Drain)
91.5	Plug (Casing Drain)
93.5	Lock Nut
94.3	Lock Washer
94.4	Circlip
* 95.2	Key (Coupling)
* 95.03	Key (Impeller)
* 51.4	Wear ring
* 41.05	Gasket (Sleeve/Impeller)
* 93.4	Locking Cap
51.91	'O' ring (Deflector)

\* Recommended spares for 2 years normal operation.

BEARING LUBRICATION AND  
OIL SEAL DETAILS

TYPE :

SHEET NO :

We recommend Oil depending on the operating temperatures and speed of the pump:

Oil Specification	Operating Temperature of the Bearings upto 80°C		Operating Temperature of the Bearings Above 80°C	Ambient Temperature below 0°C
	Speed Upto 1500 rpm	Speeds Above 1500 rpm		
Kinematic Viscosity at 50°C mm <sup>2</sup> /Sec = CST	49 ± 5	36 ± 4	68 ± 6	25 ± 4
IOC SPECIFICATION	Servo System 46	Servo System 46	Servo System 68	Servo System 32
SAE SPECIFICATION	SAE 30	SAE 30	SAE 40	SAE 20

OIL SEAL SIZE

BEARING UNIT	PUMP SIDE	COUPLING SIDE
C	40/52 x 7	35/50 x 7
F	50/65 x 8	45/62 x 8
H <sup>20</sup>	60/80 x 8	55/72 x 8
L <sup>30</sup>	70/90 x 10	65/90 x 10
P <sup>45</sup>	80/100 x 10	75/100 x 10
R <sup>60</sup>	100/120 x 12	90/120 x 12

**'O' - RINGS :**

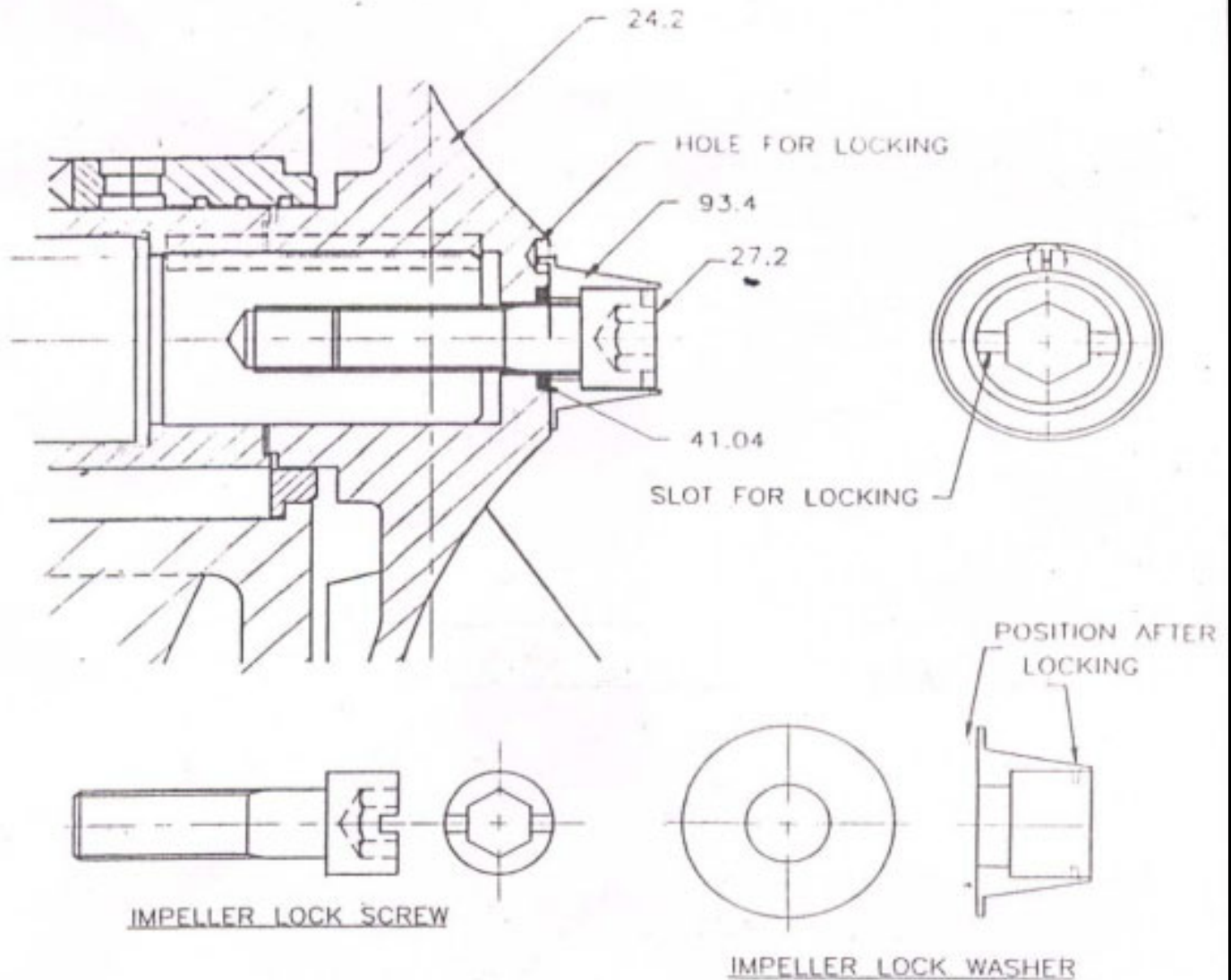
Because of design and manufacturing tolerances, it is recommended to use metric 'O' Rings according to the following tables .

MATERIAL : NEO-PRINE RUBBER, Temp. range : -40 ... + 100°C (-40 ... +212°F)

Bearings Unit	SIZE OF 'O' RINGS		
	For bearing Cover	For deflector	For dismantling Sleeve
22 C	124.5 x 3	29.2 x 3	36.2 x 3
30 F	144.5 x 3	39.2 x 3	44.2 x 3
45 H	169.3 x 5.7	49.2 x 5.7	54.5 x 3
60 L	199.3 x 5.7	59.2 x 5.7	64.5 x 3
65 P	179.3 x 5.7	69.2 x 5.7	74.5 x 3 ⊙
60 R	219.3 x 5.7	84.1 x 5.7	94.5 x 3

'O' RING FOR SIDE PLATE	
Dia of suction opening	Size of 'O' Ring
150	154.3 x 5.7
200	199.3 x 5.7
250	249.3 x 5.7
300	299.3 x 5.7
350	399.3 x 5.7
400	399.3 x 5.7

## TPS IMPELLER LOCK SCREW ARRANGEMENT



### STEP-I

FIX THE IMPELLER (24.2) ON THE SHAFT. PUT THE GASKET (3.5mm) (41.04) ON THE STEP PROVIDED. PUT THE IMPELLER LOCK SCREW (27.2) & IMPELLER LOCK WASHER IN PLACE WITH THE FIXING CLAW IN THE SLOT PROVIDED.

### STEP-II

SECURE THE SCREW (27.2) BY HAMMERING THE EDGE OF THE LOCK WASHER (93.4) AT TWO POINTS INTO THE SLOT PROVIDED IN THE LOCK SCREW HEAD (27.2) THE EDGE SHOULD CUT IN THE SLOT.

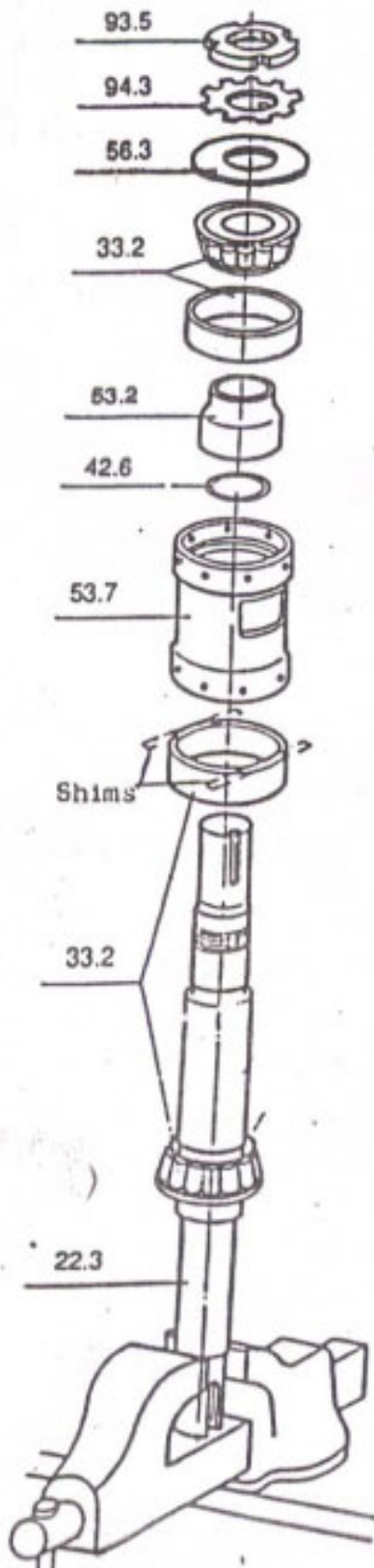
### STEP-III

THE LOCK SCREW (27.2) SECURED BY HAMMERING THE LOCK WASHER SHOULDER INTO THE HOLE PROVIDED IN THE IMPELLER (24.2)



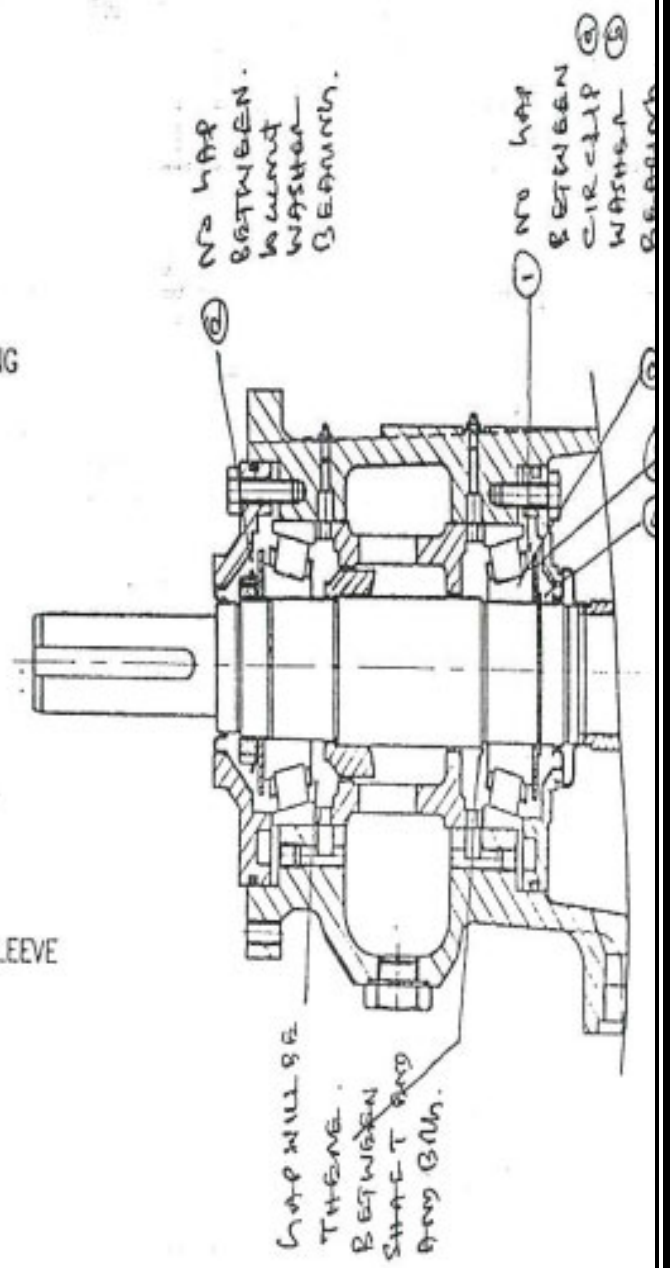
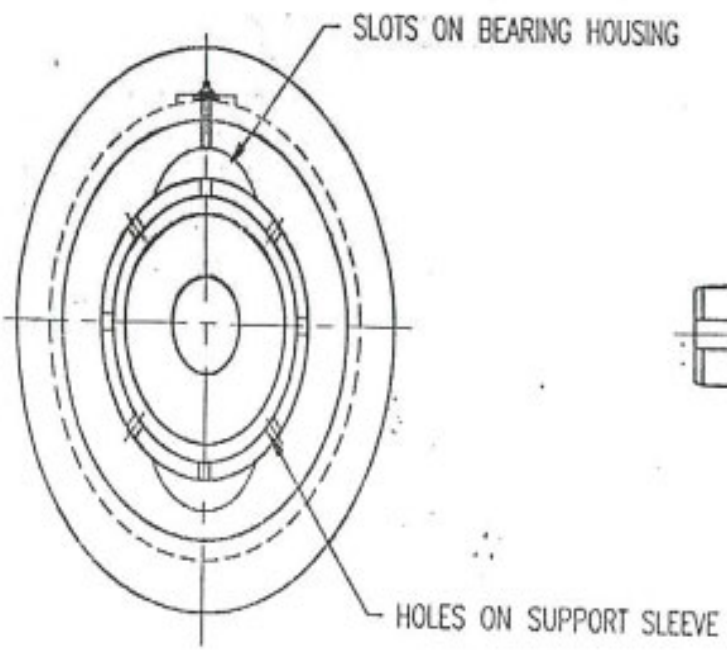


## TPS PUMPS – BEARING ASSEMBLY & CLEARANCE DETAILS



Place 2 or 3 shims, thickness 0.10 mm (0.004") between the outer ring of the bearing and support sleeve (53.7). Tighten the bearings with the bearing lock nut (93.5) 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 shims and bend the claw of the lockwasher (94.3) into the nut (93.5) slot.

# ILLUSTRATION & LUBRICATION PATH - TPS PUMPS



### 13. TROUBLE - CAUSE - REMEDY

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

<b>Trouble</b>	<b>Cause-Remedy No.</b>
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. Pumps 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 30 68 69 70 74
6. Pumps runs in reverse direction	64
7. Very noisy	1 2 5 6 7 8 11 12 14 1 20 21 23 66 67 68 69 70 74
8. Unsteady running of the 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 form Stuffing box	21 25 28 29 30 32 33 55 56 57 65
11. Fumes form 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 47 50 54 55 56 57 58
15. Bearing temperature increase	20 21 23 33 34 36 37 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	68 69 70 71 72 73

## 13.1 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 tight 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.

