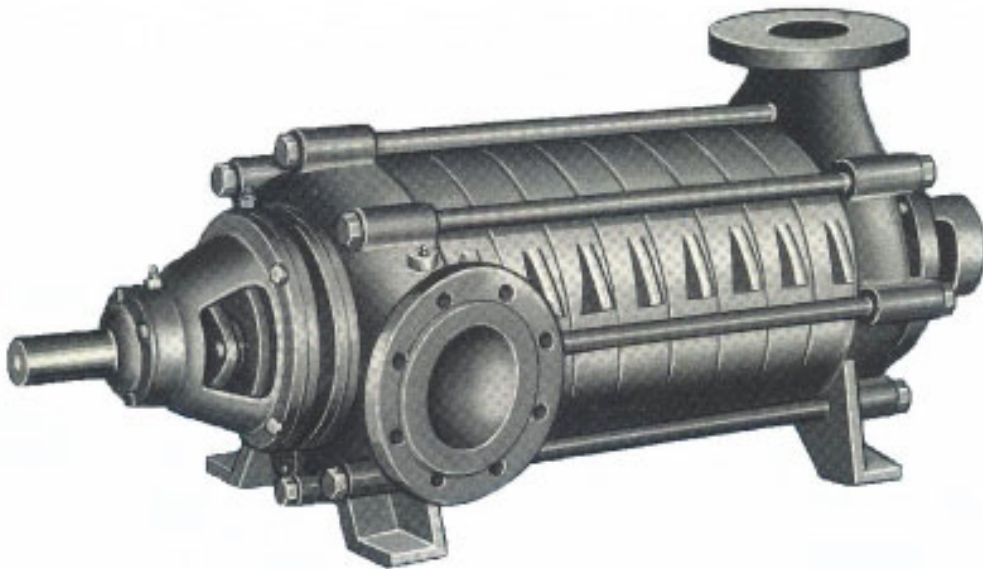


**INSTRUCTIONS ON INSTALLATION,
OPERATION AND MAINTENANACE FOR
SAM TURBO PUMP TYPE “MD”**



SAM TURBO INDUSTRY LIMITED

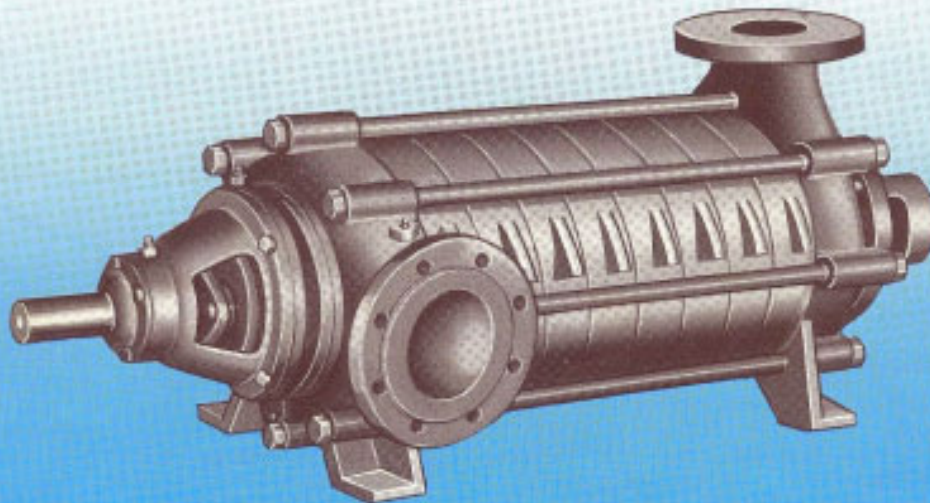
NEELAMBUR, COIMBATORE-641 014. INDIA

PH: 0422-3058899(50 LINES), FAX: 3058000, E-MAIL: mktg@sampumps.com,

WEBSITE: www.sampumps.com

Medium and high-pressure SAM CENTRIFUGAL PUMPS

TYPE "MD"



GENERAL : TYPE "MD" :

SAM type "MD" medium high pressure centrifugal pumps are basically radially split barrel type construction multistage pumps.

The pumps are available for capacity range of 10M³/hr to 550M³/hr. for differential head upto 400 Metres.

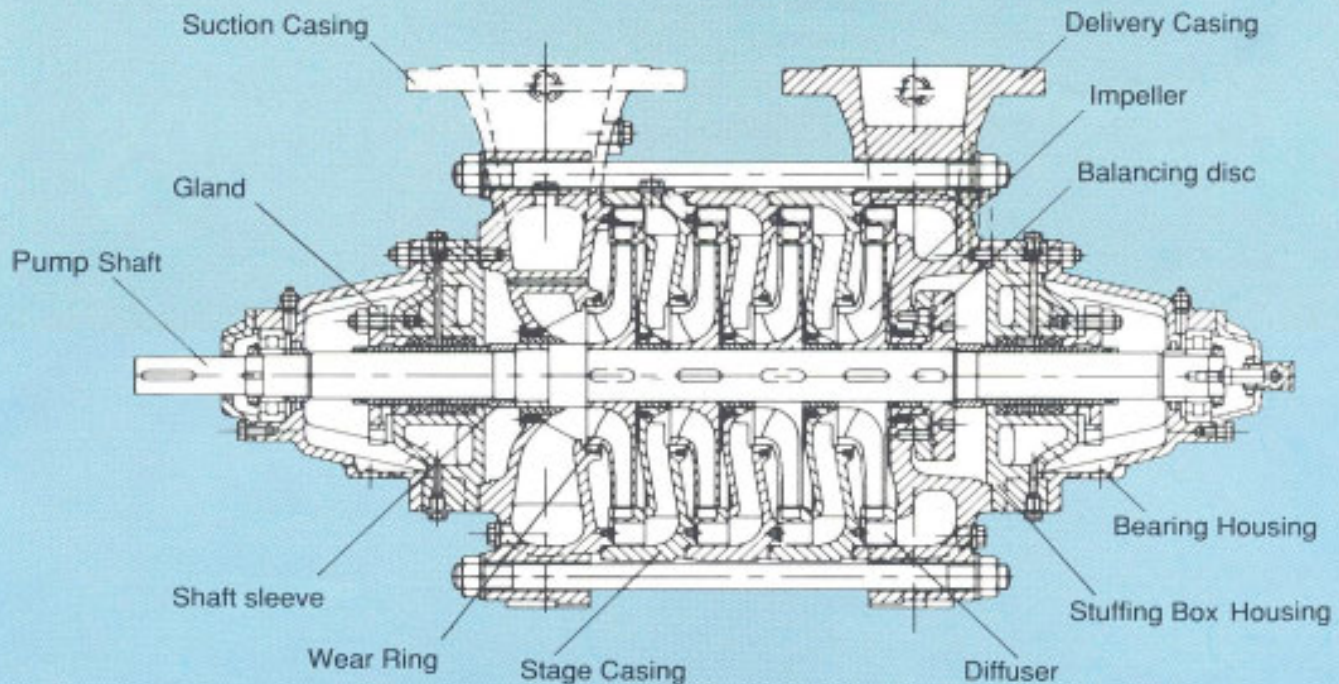
Standard design will be suitable for temperatures upto 105°C and special designs available for temperatures upto 215°C.



SAM INDUSTRY LIMITED,

LEADERSHIP THROUGH INNOVATION

SECTIONAL DRAWING



1. IMPELLERS :

Impellers are closed type and designed to produce a continuously raising curve from the maximum out put to Zero capacity and provided with replaceable wear ring in the suction side. They are both statically and dynamically balanced at high speed.

2. BALANCING CHAMBER :

The axial thrust created by the impellers are well taken care by the balancing disc arrangement as shown. The full pressure from last impeller lifts the disc from its face and adjust itself automatically to maintain the complete hydraulic balance. Suitable pipe connections given for unrestricted out let to balance water.

INDICATION OF THRUST BALANCING DEVICE :

The axial position of the rotor assembly can be checked at regular intervals to study the position of balancing disc, and hence take necessary steps for replacement of the disc, at the right time for satisfactory performance.

Standard vent and drain connections are provided in all the stages.

3. GLAND PACKING SYSTEM :

- For temperatures upto 100°C with suction under flooded conditions standard un-cooled gland packing system will be supplied (not shown in the illustration)
- In case of high temperature application above 100°C and upto 200°C and suction with flooded conditions, Throttle bushing arrangement of gland cooling jacket as optional is also available (not shown in the illustration)
- For suction lift operations and for handling condensate under vacuum etc. extra heavy duty gland packing system with a lantern ring for pressure water connection and also with provision of cooling jacket for stuffing box is also available (as shown in the picture).

BEARING ARRANGEMENT

The Shaft is carried in grease lubricated cylindrical roller bearings. Oil lubricated bush bearing arrangement can be also supplied for sizes above MD 125 onwards.

Manufactured by :

SAM INDUSTRY LIMITED,

Avanashi Road, Neelambur, Coimbatore - 641 014, Tamilnadu, India.

Tel : 3058899(50 Lines) Fax : 0422 - 3058000

E-mail : mktg@sampumps.com Website : <http://www.sampumps.com>

SAM TURBO INDUSTRY LIMITED

NEELAMBUR, COIMBATORE-641 014. 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.

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

| SL.NO | CONTENT |
|-------|----------------------------|
| 1 | GENERAL |
| 2 | DESCRIPTION OF PUMPS |
| 3 | ERECTION OF THE PUMP |
| 4 | OPERATION OF THE PUMP |
| 5 | DISMANTLING AND REASSEMBLY |

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

INSTRUCTIONS FOR THE ERECTION, STARTING AND MAINTENANCE OF HIGH PRESSURE CENTRIFUGAL MULTI-STAGE PUMP – TYPE ‘MD’

1.0 GENERAL

This erection and operating manual should in all cases be made available for your Engineers, before erection start-up.

We are not liable for any damage incurred in case of failure to observe the instructions while erection and operation. Information in this Manual applies to ‘SAM’ Multistage Pump ‘MD’ only and instructions given are issued to assist our customers to install and operate their pumps, to obtain the best results.

2.0 DESCRIPTION OF PUMPS

2.1 Pump Name Plate/Ordering of Spare Parts:

Every ‘SAM’ Pump has a name plate giving the following details:

Pump Type
Serial Number
Performance Data
Motor Details, etc.,

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

2.2 Construction Features:

SAM Type ‘MD’ high pressure Centrifugal Pumps are basically, radially split, barrel type construction Multistage Pumps. The pumps are available for capacity range of 10 M³/Hr to 550 M³/Hr., for differential head up to 400 Metres. Standard design will be suitable for temperature up to 150⁰ C and special design available for temperatures up to 215⁰ C.

2.3 Rotor Assembly:

The Impellers (24.2) are keyed on to the shaft (22.3) and they are maintained in their correct Axial position by providing spacers (53.3, 53.4) which also act as Shaft Protecting Sleeves. The exact position of the Rotor Assembly is maintained by the thrust Balancing Disc (61.3). The special shaft sleeves (53.43, 53.6) are provided to protect the shaft where it passes through the stuffing box packing and screwed on to the shaft with the left hand thread on one side and right hand on other side. The shaft consists of high tensile steel and it is specially adopted to the duty, the Impellers and spacers may be of Cast Iron, Bronze, Plain Steel, Chrome Steel depending on the nature of the fluid being pumped.

2.4 Bearings:

The shaft is carried in Grease Lubricated Cylindrical Roller Bearings. Oil Lubricated bush bearing arrangement can be also supplied for sizes MD 125 and above.

2.5 Shaft Seal:

SAM 'MD' Pump is provided with conventional Gland Packing with Lantern Ring arrangement or a mechanical seal depends on the pressure, temperature and nature of the liquid being pumped. The purpose of the Shaft Seal is to prevent the entry of high pressure liquid through the gap between the shaft and casing or the entry of air if the interior of the pump is at less than atmospheric pressure.

2.6 Stuffing Box:

A conventional Stuffing Box is provided with shaft packing in the form of rings in the Annular space between the Stuffing Box Housing and Shaft Sleeve. We recommend this type of packing for clear water where they should not exceeded 100⁰ C. When the temperature is above 100⁰ C, a specially designed Stuffing Box with the provision of Cooling Jacket is also available.

2.7 Mechanical Seal:

SAM can also supplied High Pressure Pump with Mechanical Seals according to the service. The cooling water and other procedures have to be followed as per the recommendations given by the Seal Manufacturers.

2.8 Couplings:

When the coupling is of SAM standard Pin and Bush type, a gap of 3 mm should be left between the two halves. It is essential that there should be free axial movement between the two halves of the coupling. The coupling driving pins are securely fastened to the pump half coupling and the Rubber Bushes fit loosely into the driving half coupling. The bushes are fitted on the coupling pins and will allow the necessary axial movement, if the alignment is correct.

To meet special conditions it is sometimes necessary to reverse the half-couplings so that the pins are fastened into the driving half coupling. Here again, however, the necessary axial movement is dependent upon correct alignment of the pump and motor.

2.9 Balancing of Multistage Pump:

In Multistage pumps the Impellers are of Single entry type and are arranged on the shaft with all inlet eyes in one direction. This arrangement causes a thrust in the direction towards the suction end. In order to balance this thrust SAM ENGINEERING employ a special device at eh delivery end (Refer figure 4). This consists of Balancing Disc (61.3) secured on the shaft with limited axial movement. This balancing disc rotates with close clearance over the renewable seating (61.4), which is fixed on the delivery casing. The thrust generated by the Impellers tends to force the balancing disc against the seating. At the same time high pressure water blows from the delivery casing through the annular pace between hub of the balancing disc and seat and pass to the collecting chamber. Water collected in the chamber is called balance water and it should be collected through drain or connected with the suction branch of the pump. Strictly there should not be any stock cock or valve or any other type of valve in this pipe line. It is advisable, periodical inspection should be carried out in this pipe line to remove any scale formation or growth, which will restrict the flow in the pipe.

3.0 ERECTION OF THE PUMP:

3.1 Foundation:

The foundation should be sufficiently substantial to absorb 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 should be satisfactory. Foundation bolts of the proper size should be embedded in the concrete located by a drawing or template. A pipe sleeve larger than the bolt should be used to allow movement for final positioning of the bolts. (Refer Figure 2).

3.2 Pipe Work:

It is essential that no strain is put on the pump casing by the pipe work; such strain may be caused by the weight of the pipes or by the tightening up of badly fitting pipes. It is our experience that the alignment can be seriously affected in this way and it is important, therefore, that the alignment should be checked again after the pipes are finally fitted (Refer Figure 5).

3.3 Suction Conditions:

The Suction pipe should be as short as possible and when dealing with cold liquids the total suction lift (including friction) should not normally exceed 15 feet. If the suction lift exceeds 15 feet, the fact should be made clear at the time of enquiry and the particulars should be confirmed with order so that the pump may be designed to meet the condition. An arrangement of suction pipe work which is common to two or more pumps operating on a suction lift is not recommended.

The following precautions should be taken to avoid air pockets.

1. Arrange the suction pipe with as few bends as possible.
2. The suction pipe work should be air tight.
3. There must be a gradual raise in suction pipe work towards the pump.
4. The suction pipe work must be fully supported so that the suction flange should not carry any weight. The typical good and bad alignments are shown in Fig. No.3.

3.4 Foot Valve:

The suction pipe should lie at the lowest possible water level and fitted with foot valve and strainer. The foot valve should be of free opening type preferably of hinged flat design, opening horizontally or vertically. The inlet velocity of the foot valve should be limited to 6 ft/sec. up to 6" valves. For the valves between 6" and 14" the permissible velocity is 7 ft/sec. For the valves above 14" the velocity should be limited below 8 ft/sec.

The strainer should be of strong construction. For clear liquid the total areas of the holes provided in the strainer should be twice the time of suction bore area.

If the pump is fitted to work against the suction head, the foot valve is not necessary, but a sluice valve is required for the purpose of isolating the suction.

3.5 Delivery Pipe:

Suitable type of valve should be fitted in the delivery pipe very nearer to the pump delivery flange. If the pump is working against a low quantity of liquid, also at a low head non return valve is not necessary. Otherwise, non return valve and sluice valve should be provided in the delivery flange.

3.6 Relief Check Valve:

The power requirement of the pump do not decrease lineially with fall in the rate of flow, and even relatively high when Q is zero. In this case whatever the power absorbed with converted into heat energy, which will lead to vapourisation of the liquid in the pump, particularly when the temperature of the liquid is so high and also when the flow is very small amount or zero. In order to prevent vapourisation which will tend to damage of the pump, provision must be made to allow some amount of liquid as a flow to dissipate the heat energy. For this purpose a special relief check valve is provided into a delivery branch. The valve automatically opens when the flow is reduced to a safety minimum.

4.0 OPERATION OF THE PUMP

4.1 General Instructions:

As soon as the packing is received at the site, check up whether all the parts are as per the packing slip. If any damage in transit or shortage is found the same is to be intimated to M/s. Greaves Cotton & co. Ltd., (with a copy to Sam Engineering Company, Coimbatore). For any correspondence on a particular pump, the serial number has to be strictly adhered which is printed on the name plate.

4.2 Direction of Rotation:

Clockwise from the driven end.

4.3 Starting the Pump

Before starting single stage or multistage centrifugal pumps it is essential that they are properly primed. Pumps of this type are not self-priming and if, on starting a pump fails to generate its pressure properly, it should be shut down at once and re-primed.

1. Check that the direction of rotation is correct and that the pump is generating pressure. This check may be made either by pressure gauges or in their absence, by opening the air cocks slightly.
2. Check up the Oil level or grease.
3. Check up whether the stuffing box packing is over tightened or not.
4. If water cooling is provided, the outlet temperature must be checked. A difference of $20^{\circ}\text{F} = 10^{\circ}\text{C}$ between inlet and outlet is acceptable.
5. It is recommended that the stuffing boxes are re-packed periodically without waiting for a complete collapse of the packing. Most packing deteriorates with age, and the usual accompanying hardening, if ignored, results in more sleeve wear. **It is easier and less expensive to replace the packing than to replace the sleeves.**

4.4 Stopping the Pump:

1. Close the isolating valve on the delivery side.
2. Stop the prime mover, meanwhile keeping the running of the pump under observation.
3. Turn off the cooling water, if any.

5.0 **DISMANTLING AND REASSEMBLY:**

The pump should not be dismantled for inspection or renewal of the internal components except by trained staff or by one of our expert erectors.

The following directions apply to pumps with conventional stuffing boxes and anti-friction bearings as shown in the sectional drawing enclosed in the end of the manual.

5.1 Dismantling:

Dismantling is to begin from the discharge side after disconnecting all pipings. The procedure should be as follows.

1. Remove the discharge side bearing cover 37.3 and roller bearing 33.4.
2. Remove the discharge side bearing housing 36.2 and the stuffing box housing 46.3 along with the gland 46.4.
3. Unscrew the shaft sleeve 53.43.
4. Remove the balancing disc 61.3.
5. Take off nuts of Tie-bolts 93.04.
Caution: Now the stage casing 11.10 & 11.83 has to be supported, or otherwise they will collapse at next step.
6. Remove the Delivery casing 11.9 and the diffuser 18.3.
7. Remove the Impellers 24.2, stage casings 11.10 & 11.83 with their diffusers 18.3 and spacers 53.3 & 53.4 for each stage.
8. Finally dismantle the suction side bearing housing and the stuffing box housing.

A hammer must never be used to drive off the couplings balancing discs, stage casings, impellers, diffusers and spacing sleeves, since this will result in damage to these components.

After the dismantling has been completed, the completed, the cold shaft is to be tested for true running, particularly if it has become warm in the procedure described above. Shafts that are to be used in pumps handling hot liquids can never be permanently straightened after they have been subjected to thermal stresses; they deform immediately they are again exposed to heat. **The sealing surfaces require special care** when dismantling the pump. They must be protected from damage, and ground surfaces are to be placed one by one, seal surface down, on clean wood or cardboard.

If dismantling discloses that the pump has to be sent away for a major overhaul, it must be reassembled and properly mounted on the bed plate before being dispatched. The makers should be consulted beforehand.

5.2 Reassembly:

The parts constituting the rotor assembly are numbered consecutively, starting from the suction end, and the mating parts must always be kept together. Before mounting the rotating parts on the shaft, the latter must be well coated with a suitable lubricant so that each part slides readily into position, and can later be more easily taken off the shaft.

If the old components of the rotor assembly cannot be rendered fit for service, a new rotor set must be assembled from the stock of spares. In either event, the whole rotor must be tested for true running. The rotor assembly must then be dynamically balanced, and again dismantled.

DIMENSIONS – REQUIREMENTS OF COOLING, STUFFING BOX PACKING – DETAILS OF BEARINGS.

| Size of Pump | | MD 80 | MD 100 | MD 125 |
|-------------------------------|--------------------|---------------------------------------|---------------------------------------|---|
| Extension Shaft MM | | 30x80L | 36x80L | 45x145L |
| ----- | | | | |
| Stuffing box Packing space | | | | |
| A. Conventional | MM | 45/65x54 | 55/75x54 | 75/105x65 |
| B. Special | MM | 45/65x74 | 55/75x74 | 75/105x120 |
| ----- | | | | |
| Packing for Stuffing boxes | MM | ID 45xOD 65x10Sq. 5 Nos. Each side | ID 55xOD 75x10Sq. 5 Nos. Each side | ID 75x OD 105x 15 Sq.-6 Nos. Each side |
| ----- | | | | |
| Cooling Connection in | | ¼ BSP | ¼ BSP | ½ BSP |
| ----- | | | | |
| Cooling water Required | M ³ /Hr | 0.5 | 0.5 | 1 |
| ----- | | | | |
| 'O' Rings | P.NO. | | | |
| | 42.24 MM | ID 35x2 | ID 45x3 | ID 56x4 |
| | 42.23 MM | ID 170x3 | ID 210x3 | ID 250x4 |
| | 42.4 MM | ID 250x3 | ID 330x4 | ID 380x4 |
| ----- | | | | |
| Gaskets | P.NO. | | | |
| | 41.03 MM | 80/120x0.3 | 91/128x0.4 | 110/160x0.3 |
| | 41.2 MM | 66/115x0.8 | 76/135x0.4 | 91/170x0.3 |
| ----- | | | | |
| Bearings both ends | | N 307 | N 308 | N 310 |

The Clearances that are to be maintained are as follows.

| | Clearance in new condition | Permissible Wear | Maximum Play |
|---|-------------------------------|---------------------|-----------------|
| Diametral MM | | | |
| Between Impeller 24.2 and Wear Ring 51.4 | 0.3 | 1.2 | 1.5 |
| ----- | | | |
| Between Spacing Sleeve 53.4 and Throttle Bush 55.23 | 0.3 | 0.7 | 1.0 |
| ----- | | | |
| Between Spacing Sleeve 53.4 and Sleeve Suction Side 55.4 | 0.3 | 1.7 | 2.0 |
| ----- | | | |
| Between the hub of the Balancing Disc 61.3 or the Spacing Sleeve 53.3 and the discharge casing 11.9 or in MD Sizes 200 to 350 between the spacing Sleeve 53.3 and the Sleeve Delivery Casing 55.24 in the discharge casing 11.9 | 0.3 | 0.2 | 0.5 |

SPARE PARTS

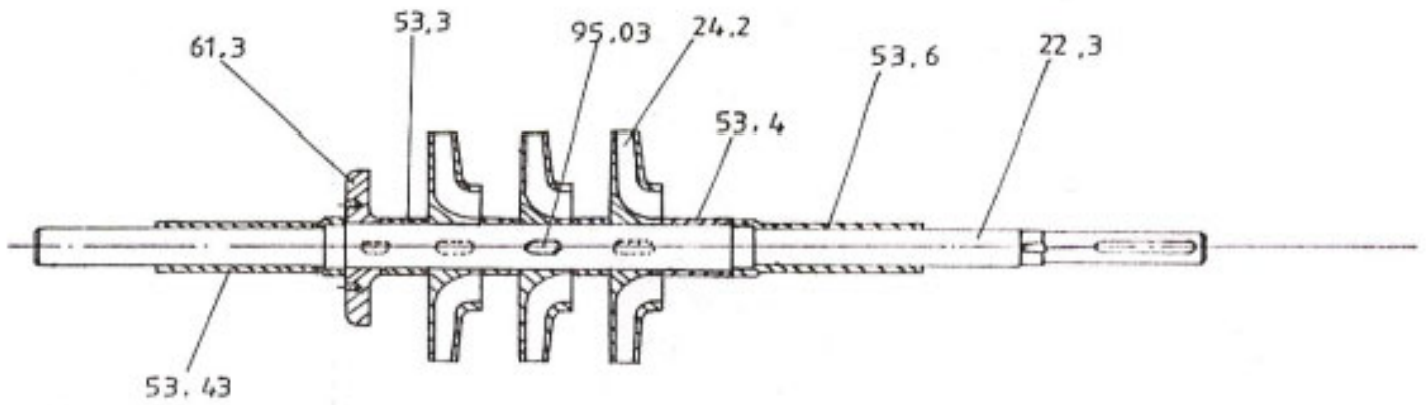
It is essential that a reserve of replacement components is always in stock to permit of prompt remedying of any breakdown. It is advisable that this includes the following, viz.

1. Complete Rotor Assembly consisting of the following:

| CODE NO. | PART NAME | SPARES REQUIRED |
|-----------------------------|------------------------------|-----------------|
| 22.3 | Pump shaft with keys | 1 set |
| 24.2 | Impeller | n |
| 55.4 | Sleeve (Suction side) | 1 |
| 55.24 | Throttle Bush (Delivery end) | 1 |
| 53.4 | Spacer | n+1 |
| 53.6, 53.43 | Shaft Sleeve | 1+1 |
| 61.3 | Balancing Disc | 1 |
| 61.4 | Balancing Disc Seat | 1 |
| 18.3 | Diffuser | n |
| 33.4 | Cylindrical roller Bearing | 2 |
| 51.4 | Wear Ring | n |
| 42.4, 42.23 42.24, 42.25 | 'O'-Rings | 2 Sets |
| 47.3 | Packing | 2 Sets |
| 41.03, 41.2 | Gasket | 1 Set |

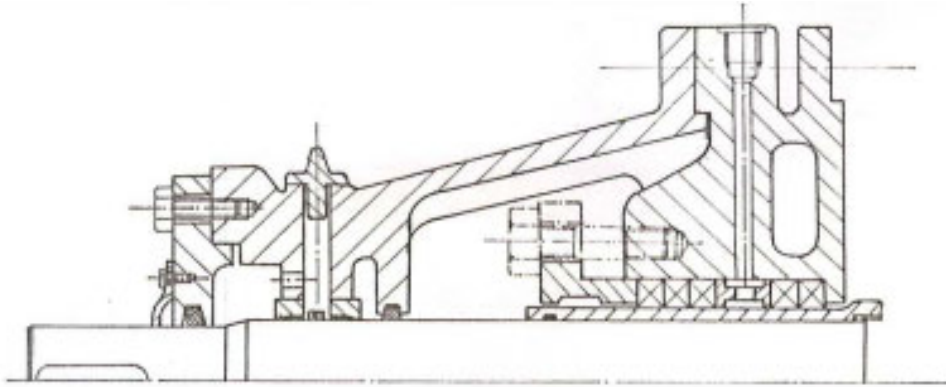
Note: n=number of stages.

ROTOR ASSEMBLY

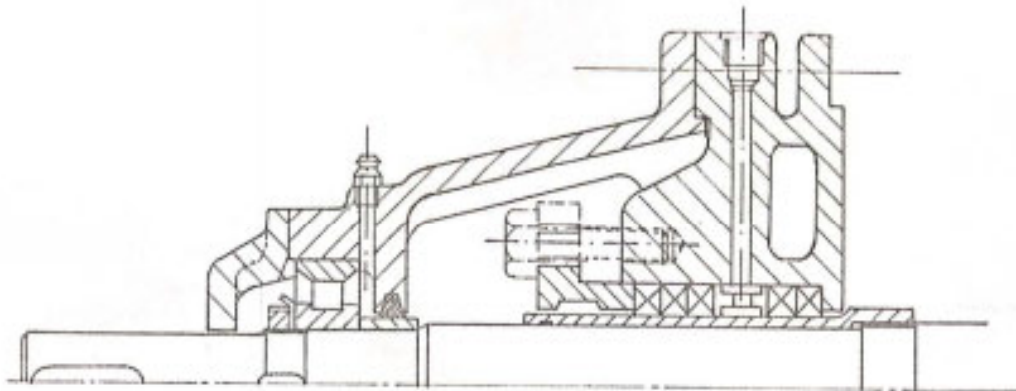


- 22,3. PUMP SHAFT
- 24,2. IMPELLER
- 53,3. SPACER
- 53,4. SPACER
- 53,43. SHAFT SLEEVE
- 53,6. SHAFT SLEEVE
- 61,3. BALANCING DISC
- 95,03. KEY (IMPELLER)

FIGURE . NO : 1

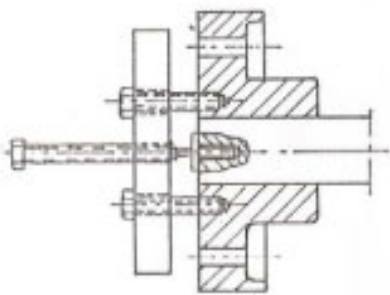


Bush Brg with Oil Lubrication

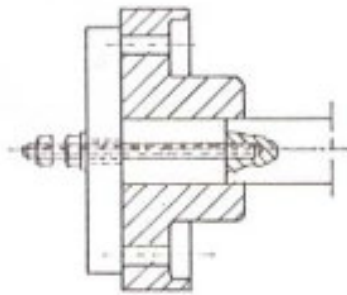


Roller Brg with Grease Lubrication

FIGURE . NO : 2

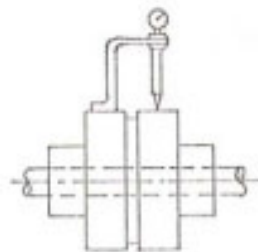
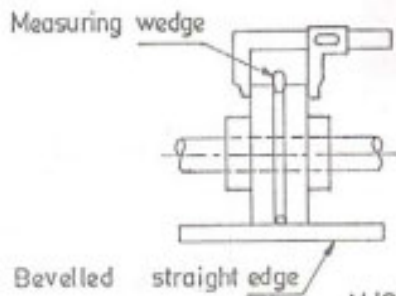


Tool for removing half Coupling.



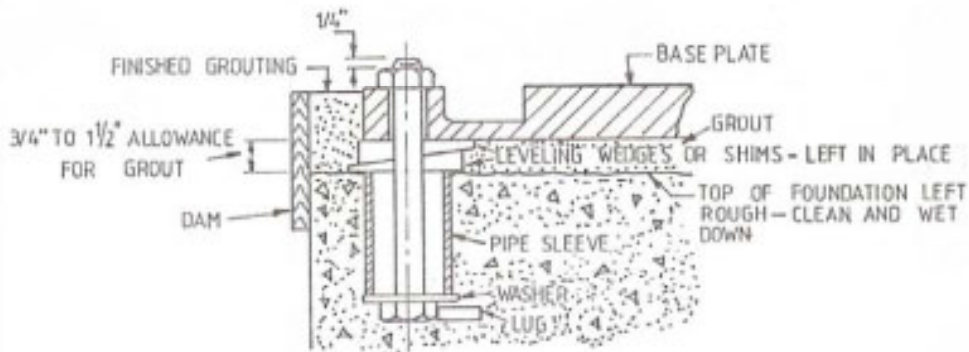
Tool for mounting half Coupling.

FIGURE NO:- 3



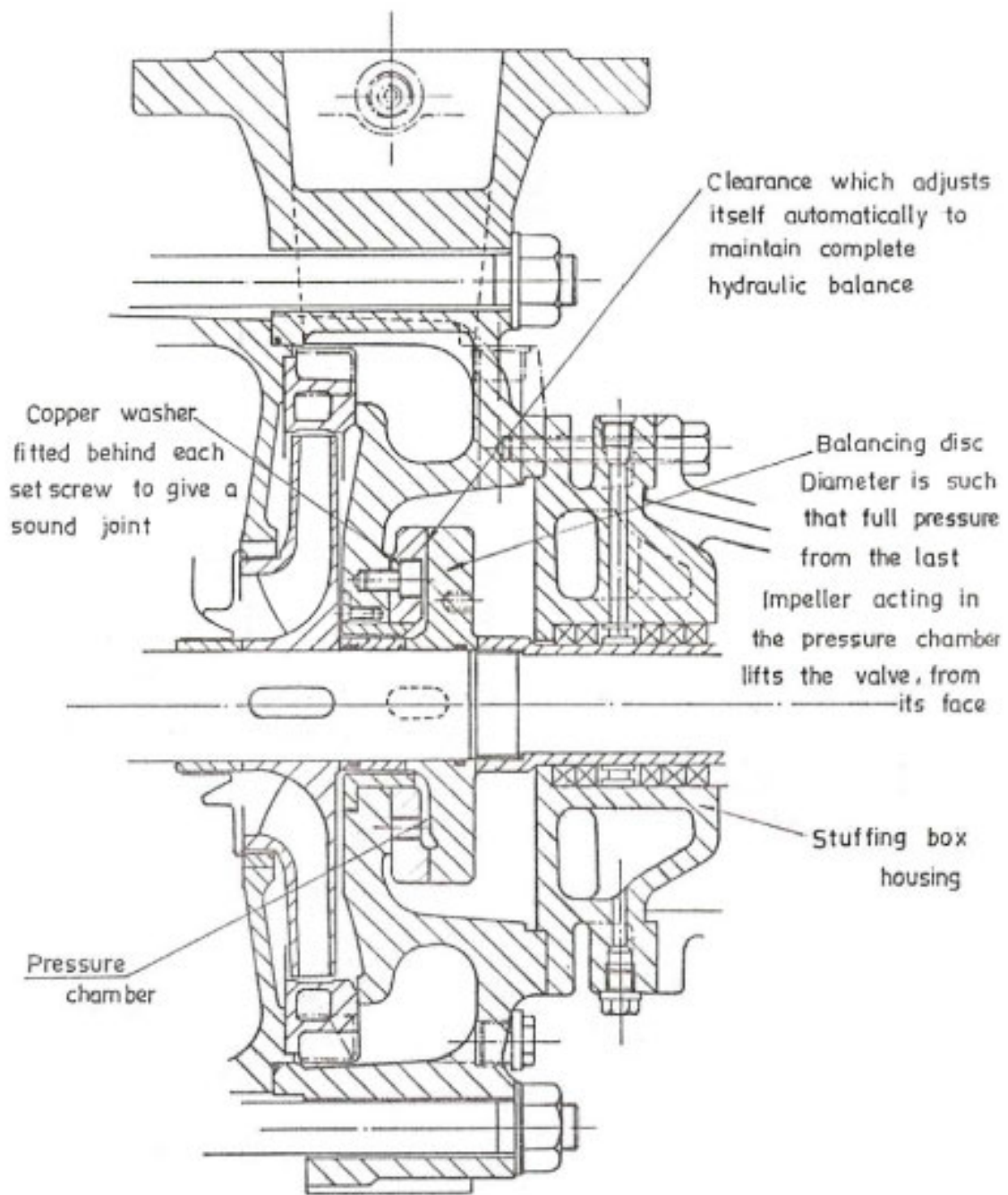
ALIGNING OF COUPLING

FIGURE NO:- 4



TYPICAL FOUNDATION BOLT DESIGN

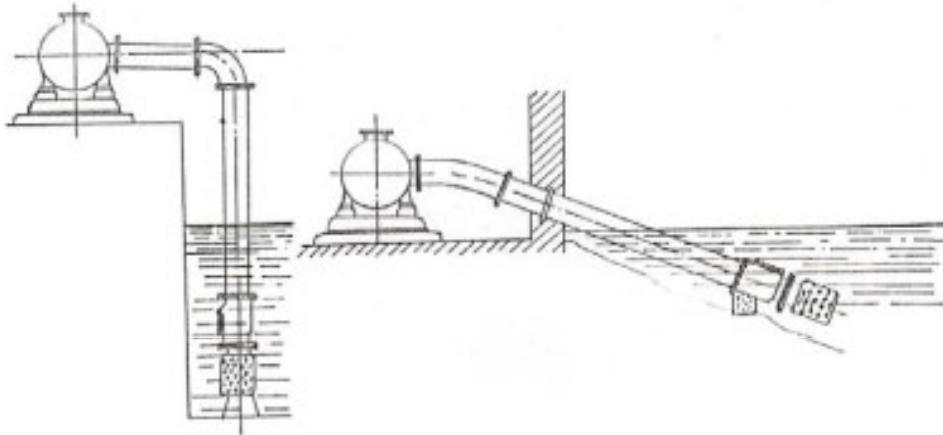
FIGURE NO :-5



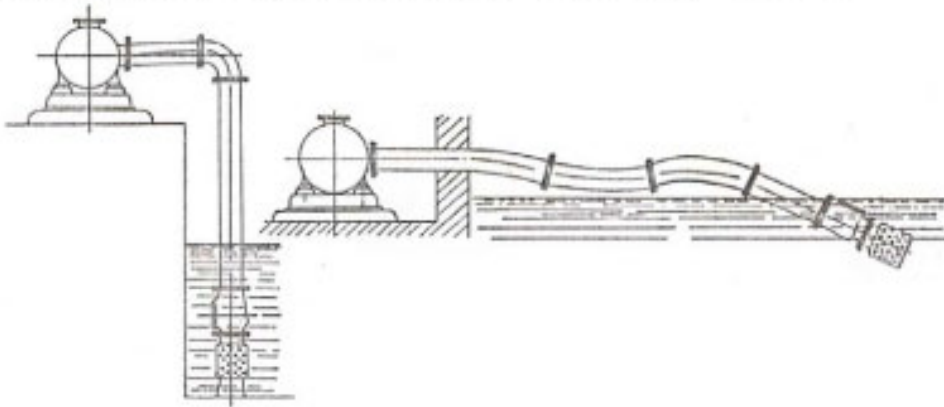
General Arrangement of Balancing Disc

FIGURE NO :-6

Examples of Good and Bad Suction Layouts



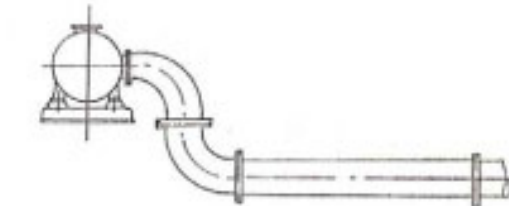
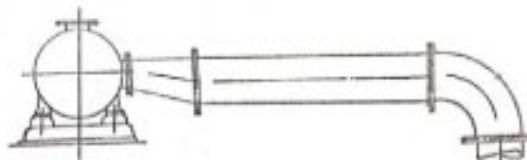
Good suction layouts, showing pipes rising all the way to the pump



Bad suction layouts, which will cause air pockets and failure to pump

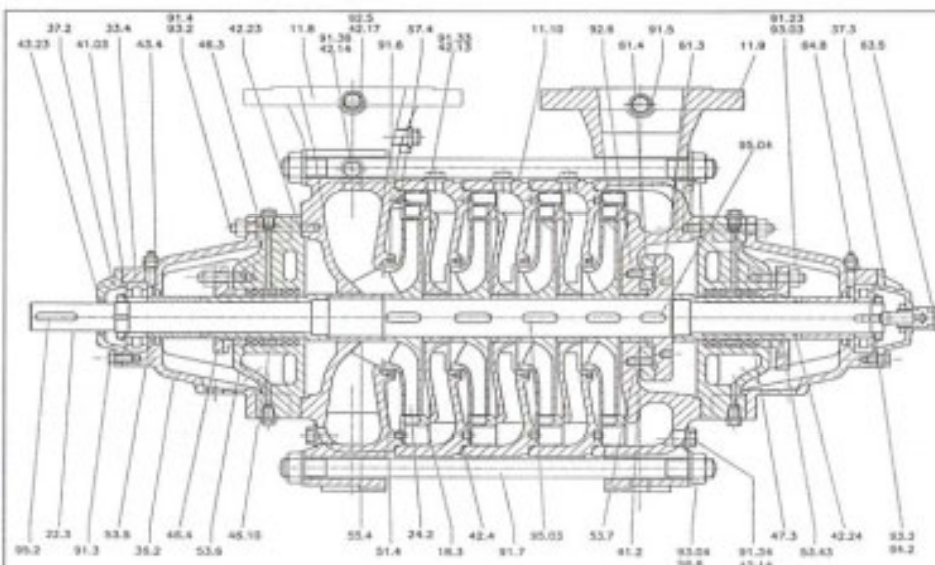


Showing how an air pocket may be formed when the suction pipe is bigger than the pump branch



Showing how the fault in the illustration on the left may be avoided

FIGURE NO 1-7



| CODE NO | PART NAME | MATERIAL | QTY |
|---------|--------------------------------|-----------------|------|
| 11.6 | SECTION CASING | | 1 |
| 11.8 | STAGE CASING | | 1 |
| 11.10 | STAGE CASING | | n-1 |
| 18.3 | DIFFUSER | | n |
| 22.3 | PUMP SHAFT | | 1 |
| 24.2 | IMPELLER | | n |
| 33.4 | CYLINDRICAL ROLLER BRG | STEEL | 2 |
| 36.2 | BEARING HOUSING | S 210 FC 200 | 2 |
| 37.2 | BEARING CAP/COVER | S 210 FC 200 | 1 |
| 37.3 | BEARING CAP/COVER | S 210 FC 200 | 1 |
| 41.03 | FLAT GASKET | CAF-8 | 2 |
| 41.2 | FLAT GASKET | CAF-8 | 1 |
| 42.13 | SEALING WASHER | TEFLON | 1 |
| 42.14 | SEALING WASHER | TEFLON | 2 |
| 42.17 | SEALING WASHER | TEFLON | 1 |
| 42.4 | O-RING | NEOPRENE RUBBER | n |
| 42.23 | O-RING | NEOPRENE RUBBER | 2 |
| 42.24 | O-RING | NEOPRENE RUBBER | 2 |
| 43.23 | FELT SEAL | FELT | 1 |
| 43.4 | FELT SEAL | FELT | 2 |
| 46.10 | LAYERS RING | SS 316 | 2 |
| 46.3 | STUFFING BOX (SEALING) | | 2 |
| 46.4 | GLAND | | 2 |
| 47.3 | GLAND PACKING | | 2000 |
| 51.4 | WEAR RING | | n |
| 53.7 | SPACER | | 2 |
| 53.5 | SPACER | | 2 |
| 53.43 | SHAFT SLEEVE | | 1 |
| 53.8 | SHAFT SLEEVE | | 1 |
| 55.4 | SEALING(SUCKION SIDE) | | 1 |
| 56.8 | WASHER | C15 IS 228 | 18 |
| 57.4 | CYLINDRICAL PIN | MS-316 | n |
| 61.3 | BALANCING DISC | | 1 |
| 61.4 | BALANCING DISC | | 1 |
| 63.5 | SHAFT/SHAFT INDICATOR WITH PIN | SS 316 EN 8 | 1 |
| 64.8 | GREASE nipple | STEEL | 2 |
| 91.23 | SLICOUNTER BLANK W/SCREW | MS-316 | 4 |
| 91.23 | STUCCO/LAND | | n |
| 91.3 | HEX/SCREW(CAP) | S 1363 MS | n |
| 91.33 | SCREW PLUG | | 1 |
| 91.34 | DRAIN PLUG | | 2 |

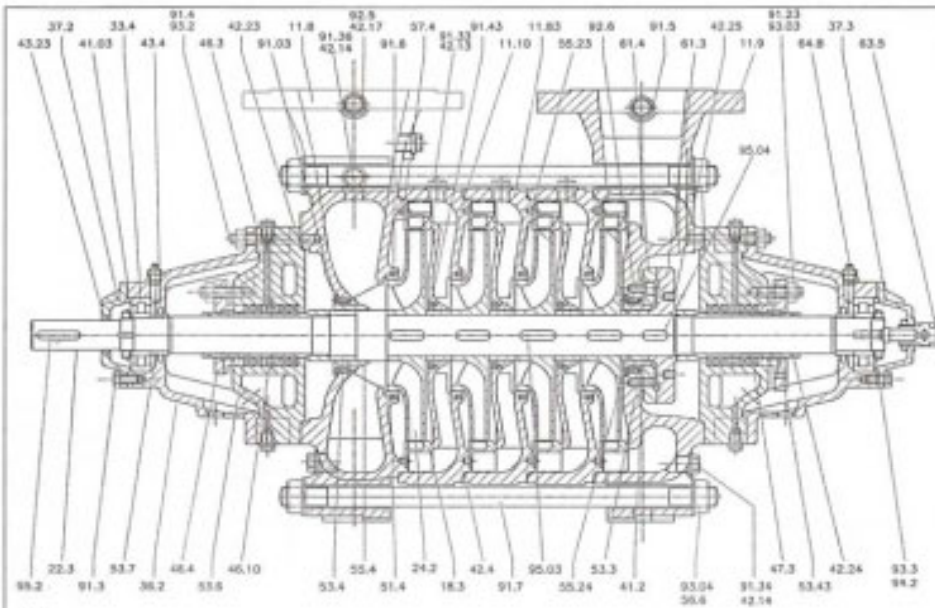
NOTE
 * MARKED ITEMS REQUIRE SPARES FOR TWO YEAR NORMAL OPERATION

| CODE NO | PART NAME | MATERIAL | QTY |
|---------|------------------------|-------------|-----|
| 91.4 | STUD | SS 316 EN 8 | 8 |
| 91.5 | SCREW PLUG | | 1 |
| 91.6 | SOCKET HEAD GRUB SCREW | MS-316 | n |
| 91.7 | TC BOLT | | n |
| 91.8 | SOCKET HEAD GRUB SCREW | MS-316 | n |
| 91.9 | HEX NUT (GLAND STUD) | | 2 |
| 93.04 | HEX NUT | MS IS 1363 | 16 |
| 93.2 | HEX NUT | MS IS 1363 | 8 |
| 93.3 | LOCKNUT & LOCKWASHER | MS IS 1363 | 2+2 |
| 95.03 | KEY (IMPELLER) | | n |
| 95.04 | KEY (BALANCING DISC) | | 1 |
| 95.2 | KEY (COUPLING) | | 1 |

NOTE
 1) n = No of stages 2) The diag shows only 4 stages
 3) Actual pump shall be supplied in stages.

PUMP TYPE : MD 80/205
 SIZE : 100 x 80
 QTY : ?
 ORDER REF : ?
 DIRECTION OF ROTATION : C/CLOCKWISE FROM DRIVE END

SAM TURBO INDUSTRY LIMITED
 TITLE : SECTIONAL DRAWING WITH BILL OF MATERIAL
 SUPPLIED THROUGH : SAM TURBO INDUSTRY LIMITED
 CUSTOMER :
 PROJECT :
 DRAWN/DL : SP/ / CHECKED/DL : / APPD./DL : /
 REV.No.: 0 1 2 3 4 DRAWING No.: 440-06/
 DATE : / /



| CODE NO | PART NAME | MATERIAL | QTY |
|---------|--------------------------------|-----------------|------|
| 11.6 | SECTION CASING | | 1 |
| 11.8 | STAGE CASING | | 1 |
| 11.10 | STAGE CASING | | n-2 |
| 18.3 | DIFFUSER | | n |
| 22.3 | PUMP SHAFT | | 1 |
| 24.2 | IMPELLER | | n |
| 33.4 | CYLINDRICAL ROLLER BRG | STEEL | 2 |
| 36.2 | BEARING HOUSING | S 210 FC 200 | 2 |
| 37.2 | BEARING CAP/COVER | S 210 FC 200 | 1 |
| 37.3 | BEARING CAP/COVER | S 210 FC 200 | 1 |
| 41.03 | FLAT GASKET | CAF-8 | 2 |
| 41.2 | FLAT GASKET | CAF-8 | 1 |
| 42.13 | SEALING WASHER | TEFLON | 1 |
| 42.14 | SEALING WASHER | TEFLON | 2 |
| 42.17 | SEALING WASHER | TEFLON | 1 |
| 42.4 | O-RING | NEOPRENE RUBBER | n |
| 42.23 | O-RING | NEOPRENE RUBBER | 2 |
| 42.24 | O-RING | NEOPRENE RUBBER | 2 |
| 43.23 | FELT SEAL | FELT | 1 |
| 43.4 | FELT SEAL | FELT | 2 |
| 46.10 | LAYERS RING | | 2 |
| 46.3 | STUFFING BOX (SEALING) | | 2 |
| 46.4 | GLAND | | 2 |
| 47.3 | GLAND PACKING | | 2000 |
| 51.4 | WEAR RING | | n |
| 53.5 | SPACER | | 2 |
| 53.7 | SPACER | | 2 |
| 53.4 | SPACER | | 1 |
| 53.43 | SHAFT SLEEVE | | 1 |
| 53.8 | SHAFT SLEEVE | | 1 |
| 55.4 | SEALING(SUCKION SIDE) | | 1 |
| 55.4 | SEALING(SUCKION SIDE) | | 1 |
| 55.25 | THRUST BUSH | | n-1 |
| 56.8 | WASHER | C15 IS 228 | 18 |
| 57.4 | CYLINDRICAL PIN | MS-316 | n |
| 61.3 | BALANCING DISC | | 1 |
| 61.4 | BALANCING DISC | | 1 |
| 63.5 | SHAFT/SHAFT INDICATOR WITH PIN | SS 316 EN 8 | 1 |
| 64.8 | GREASE nipple | STEEL | 2 |
| 91.23 | SLICOUNTER BLANK W/SCREW | MS-316 | 4 |
| 91.23 | STUCCO/LAND | | n |
| 91.3 | HEX/SCREW(CAP) | S 1363 MS | n |
| 91.33 | SCREW PLUG | | 1 |
| 91.34 | DRAIN PLUG | | 2 |

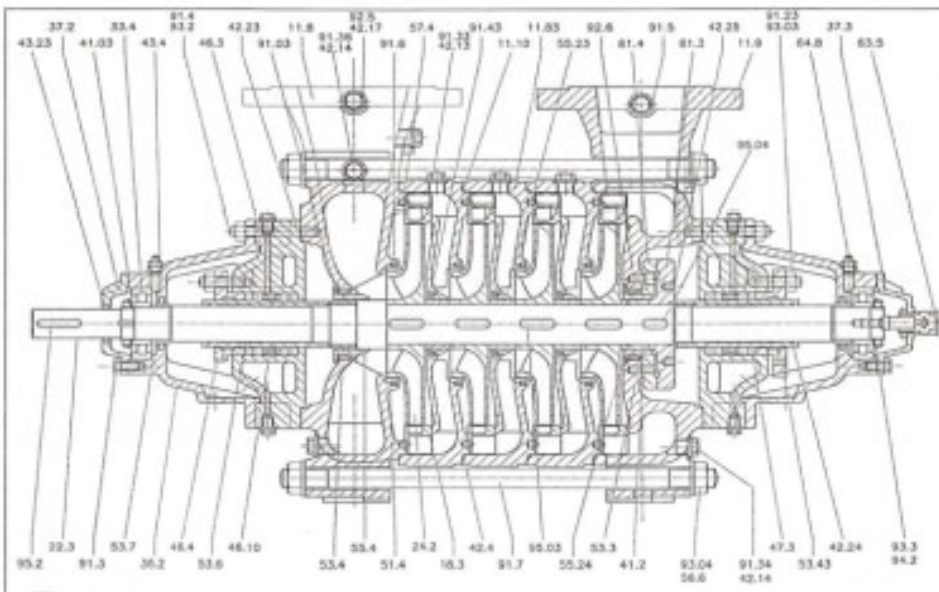
NOTE
 * MARKED ITEMS REQUIRE SPARES FOR TWO YEAR NORMAL OPERATION

| CODE NO | PART NAME | MATERIAL | QTY |
|---------|------------------------|-------------|-----|
| 91.36 | SCREW PLUG | | 1 |
| 91.4 | STUD | SS 316 EN 8 | 8 |
| 91.43 | SOCKET HEAD GRUB SCREW | MS-316 | n-1 |
| 91.5 | SCREW PLUG | | 1 |
| 91.6 | SOCKET HEAD GRUB SCREW | MS-316 | n |
| 91.7 | TC BOLT | | n |
| 91.8 | SOCKET HEAD GRUB SCREW | MS-316 | n |
| 91.9 | HEX NUT (GLAND STUD) | | 2 |
| 93.04 | HEX NUT | MS IS 1363 | 16 |
| 93.2 | HEX NUT | MS IS 1363 | 8 |
| 93.3 | LOCKNUT & LOCKWASHER | MS IS 1363 | 2+2 |
| 95.03 | KEY (IMPELLER) | | n |
| 95.04 | KEY (BALANCING DISC) | | 1 |
| 95.2 | KEY (COUPLING) | | 1 |

NOTE
 1) n = No of stages 2) The diag shows only 4 stages
 3) Actual pump shall be supplied in stages.

PUMP TYPE : MD 100/250
 SIZE : 125 x 100
 QTY : ?
 ORDER REF : ?
 DIRECTION OF ROTATION : C/CLOCKWISE FROM DRIVE END

SAM TURBO INDUSTRY LIMITED
 TITLE : SECTIONAL DRAWING WITH BILL OF MATERIAL
 SUPPLIED THROUGH : SAM TURBO INDUSTRY LIMITED
 CUSTOMER :
 PROJECT :
 DRAWN/DL : SP/ / CHECKED/DL : / APPD./DL : /
 REV.No.: 0 1 2 3 4 DRAWING No.: 440-06/
 DATE : / /



| CODE NO | PART NAME | MATERIAL | QTY |
|---------|------------------------|---------------|-----|
| 11.8 | SECTION CHARG | | 1 |
| 11.9 | DELIVERY CASING | | 1 |
| 11.10 | STAGE CHARG | | 1 |
| 11.85 | STAGE CHARG | | 1-2 |
| 18.3 | DIFFUSER | | 1 |
| 22.5 | PUMP SHAFT | | 1 |
| 32.3 | IMPELLER | | 1 |
| 32.4 | CYLINDRICAL ROLLER BRG | STEEL | 2 |
| 36.2 | BEARING HOUSING | IS 212 IS 200 | 1 |
| 37.2 | BEARING CAPWATER | IS 212 IS 200 | 1 |
| 37.3 | BEARING CAPWATER | IS 212 IS 200 | 1 |
| 41.2 | FLAT GASKET | CAF-8 | 2 |
| 41.3 | FLAT GASKET | CAF-8 | 1 |
| 42.2 | SEALING WASHER | TEFLON | 1 |
| 42.3 | SEALING WASHER | TEFLON | 2 |
| 42.4 | SEALING WASHER | TEFLON | 1 |
| 42.5 | SEALING WASHER | TEFLON | 1 |
| 42.6 | SEALING WASHER | TEFLON | 1 |
| 42.7 | SEALING WASHER | TEFLON | 1 |
| 42.8 | SEALING WASHER | TEFLON | 1 |
| 42.9 | SEALING WASHER | TEFLON | 1 |
| 42.10 | SEALING WASHER | TEFLON | 1 |
| 42.11 | SEALING WASHER | TEFLON | 1 |
| 42.12 | SEALING WASHER | TEFLON | 1 |
| 42.13 | SEALING WASHER | TEFLON | 1 |
| 42.14 | SEALING WASHER | TEFLON | 1 |
| 42.15 | SEALING WASHER | TEFLON | 1 |
| 42.16 | SEALING WASHER | TEFLON | 1 |
| 42.17 | SEALING WASHER | TEFLON | 1 |
| 42.18 | SEALING WASHER | TEFLON | 1 |
| 42.19 | SEALING WASHER | TEFLON | 1 |
| 42.20 | SEALING WASHER | TEFLON | 1 |
| 42.21 | SEALING WASHER | TEFLON | 1 |
| 42.22 | SEALING WASHER | TEFLON | 1 |
| 42.23 | SEALING WASHER | TEFLON | 1 |
| 42.24 | SEALING WASHER | TEFLON | 1 |
| 42.25 | SEALING WASHER | TEFLON | 1 |
| 42.26 | SEALING WASHER | TEFLON | 1 |
| 42.27 | SEALING WASHER | TEFLON | 1 |
| 42.28 | SEALING WASHER | TEFLON | 1 |
| 42.29 | SEALING WASHER | TEFLON | 1 |
| 42.30 | SEALING WASHER | TEFLON | 1 |
| 42.31 | SEALING WASHER | TEFLON | 1 |
| 42.32 | SEALING WASHER | TEFLON | 1 |
| 42.33 | SEALING WASHER | TEFLON | 1 |
| 42.34 | SEALING WASHER | TEFLON | 1 |
| 42.35 | SEALING WASHER | TEFLON | 1 |
| 42.36 | SEALING WASHER | TEFLON | 1 |
| 42.37 | SEALING WASHER | TEFLON | 1 |
| 42.38 | SEALING WASHER | TEFLON | 1 |
| 42.39 | SEALING WASHER | TEFLON | 1 |
| 42.40 | SEALING WASHER | TEFLON | 1 |
| 42.41 | SEALING WASHER | TEFLON | 1 |
| 42.42 | SEALING WASHER | TEFLON | 1 |
| 42.43 | SEALING WASHER | TEFLON | 1 |
| 42.44 | SEALING WASHER | TEFLON | 1 |
| 42.45 | SEALING WASHER | TEFLON | 1 |
| 42.46 | SEALING WASHER | TEFLON | 1 |
| 42.47 | SEALING WASHER | TEFLON | 1 |
| 42.48 | SEALING WASHER | TEFLON | 1 |
| 42.49 | SEALING WASHER | TEFLON | 1 |
| 42.50 | SEALING WASHER | TEFLON | 1 |
| 42.51 | SEALING WASHER | TEFLON | 1 |
| 42.52 | SEALING WASHER | TEFLON | 1 |
| 42.53 | SEALING WASHER | TEFLON | 1 |
| 42.54 | SEALING WASHER | TEFLON | 1 |
| 42.55 | SEALING WASHER | TEFLON | 1 |
| 42.56 | SEALING WASHER | TEFLON | 1 |
| 42.57 | SEALING WASHER | TEFLON | 1 |
| 42.58 | SEALING WASHER | TEFLON | 1 |
| 42.59 | SEALING WASHER | TEFLON | 1 |
| 42.60 | SEALING WASHER | TEFLON | 1 |
| 42.61 | SEALING WASHER | TEFLON | 1 |
| 42.62 | SEALING WASHER | TEFLON | 1 |
| 42.63 | SEALING WASHER | TEFLON | 1 |
| 42.64 | SEALING WASHER | TEFLON | 1 |
| 42.65 | SEALING WASHER | TEFLON | 1 |
| 42.66 | SEALING WASHER | TEFLON | 1 |
| 42.67 | SEALING WASHER | TEFLON | 1 |
| 42.68 | SEALING WASHER | TEFLON | 1 |
| 42.69 | SEALING WASHER | TEFLON | 1 |
| 42.70 | SEALING WASHER | TEFLON | 1 |
| 42.71 | SEALING WASHER | TEFLON | 1 |
| 42.72 | SEALING WASHER | TEFLON | 1 |
| 42.73 | SEALING WASHER | TEFLON | 1 |
| 42.74 | SEALING WASHER | TEFLON | 1 |
| 42.75 | SEALING WASHER | TEFLON | 1 |
| 42.76 | SEALING WASHER | TEFLON | 1 |
| 42.77 | SEALING WASHER | TEFLON | 1 |
| 42.78 | SEALING WASHER | TEFLON | 1 |
| 42.79 | SEALING WASHER | TEFLON | 1 |
| 42.80 | SEALING WASHER | TEFLON | 1 |
| 42.81 | SEALING WASHER | TEFLON | 1 |
| 42.82 | SEALING WASHER | TEFLON | 1 |
| 42.83 | SEALING WASHER | TEFLON | 1 |
| 42.84 | SEALING WASHER | TEFLON | 1 |
| 42.85 | SEALING WASHER | TEFLON | 1 |
| 42.86 | SEALING WASHER | TEFLON | 1 |
| 42.87 | SEALING WASHER | TEFLON | 1 |
| 42.88 | SEALING WASHER | TEFLON | 1 |
| 42.89 | SEALING WASHER | TEFLON | 1 |
| 42.90 | SEALING WASHER | TEFLON | 1 |
| 42.91 | SEALING WASHER | TEFLON | 1 |
| 42.92 | SEALING WASHER | TEFLON | 1 |
| 42.93 | SEALING WASHER | TEFLON | 1 |
| 42.94 | SEALING WASHER | TEFLON | 1 |
| 42.95 | SEALING WASHER | TEFLON | 1 |
| 42.96 | SEALING WASHER | TEFLON | 1 |
| 42.97 | SEALING WASHER | TEFLON | 1 |
| 42.98 | SEALING WASHER | TEFLON | 1 |
| 42.99 | SEALING WASHER | TEFLON | 1 |
| 43.00 | SEALING WASHER | TEFLON | 1 |

NGIX
 * MARKED ITEMS REQUIRE SPARES FOR TWO YEAR NORMAL OPERATION

| CODE NO | PART NAME | MATERIAL | QTY |
|---------|------------------------|-------------|-----|
| 91.38 | SCREW PLUG | | 1 |
| 91.4 | STUD | BS 970 EN 8 | 8 |
| 11.43 | SOCKET HEAD GRUB SCREW | ASB-318 | 4-1 |
| 31.5 | SCREW PLUG | | 1 |
| 91.8 | ROCKET HEAD GRUB SCREW | ASB-318 | 2 |
| 32.7 | SK BUSH | | 8 |
| 92.5 | VENT PLUG | C15 IS 228 | 1 |
| 92.8 | SOCKET HEAD GRUB SCREW | ASB-318 | 4 |
| 93.03 | HEX NUT (ISLAND STUD) | | 4 |
| 93.04 | HEX NUT | | 18 |
| 93.3 | HEX NUT | MS IS 1363 | 8 |
| 93.4 | LOCKWASH B LOCKWASHER | MS IS 1363 | 2+2 |
| 95.03 | KEY (IMPELLER) | | 1 |
| 95.04 | KEY (BALANCING DISC) | | 1 |
| 95.2 | KEY (COUPLING) | | 1 |

NGIE
 1). n = No of stages 2). The drg shows only 4 stages
 3). Actual pump shall be supplied in stages.

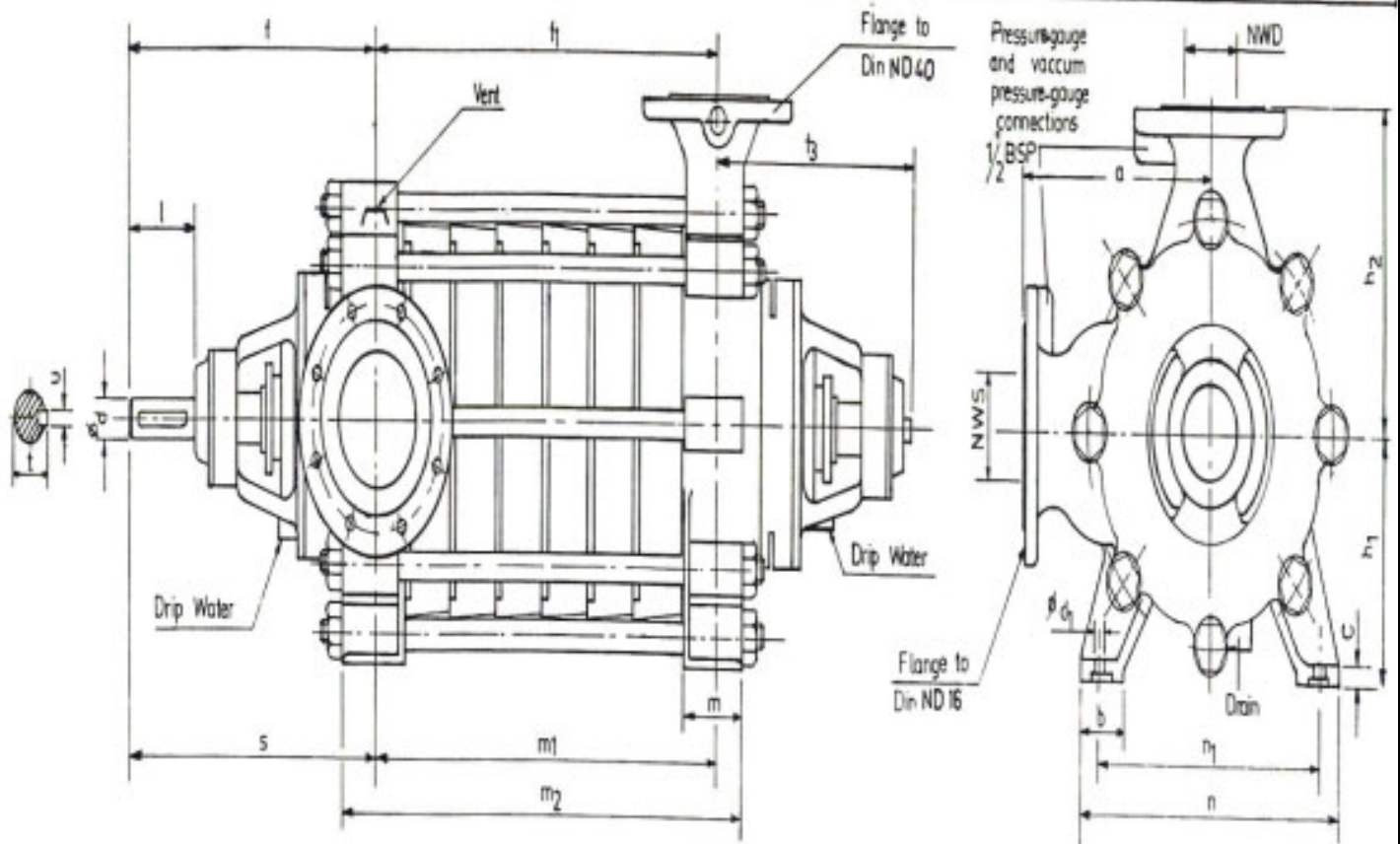
PUMP TYPE : MG 125/300V
 SIZE : 150 x 125
 QTY : 1
 ORDER REF :
 DIRECTION OF ROTATION : CLOCKWISE
 FROM : DRIVE END

| | | | |
|---|----------|--------|--------|
| REVISED | REVISION | DATE | APPD |
| SAM TURBO INDUSTRY LIMITED | | | |
| TITLE : SECTIONAL DRAWING WITH BILL OF MATERIAL | | | |
| SUPPLIED THROUGH SAM TURBO INDUSTRY LIMITED | | | |
| CUSTOMER : | | | |
| PROJECT : | | | |
| DRWNG/CL : | APP/CL : | DATE : | |
| REV/NO : | NO : | DATE : | DATE : |
| DATE : | DATE : | DATE : | DATE : |

OVERALL DIMENSIONAL DRAWING

For Sam Multistage Pump

Drg. no:
440-07



| TYPE | NWD | NWS | a, h ₂ | n ₁ | c | d ₁ | n | t ₁ | m | b | d | u | t | l | s, l | t ₃ |
|--------|-----|-----|-------------------|----------------|----|----------------|-----|----------------|-----|-----|----|----|------|-----|------|----------------|
| MD 80 | 80 | 100 | 240 | 275 | 12 | 14 | 325 | 170 | 60 | 60 | 30 | 8 | 32.9 | 96 | 350 | 295 |
| MD 100 | 100 | 125 | 300 | 360 | 16 | 18 | 420 | 225 | 75 | 70 | 36 | 10 | 35.3 | 99 | 388 | 298 |
| MD 125 | 125 | 150 | 375 | 450 | 20 | 23 | 530 | 280 | 95 | 90 | 45 | 14 | 48.5 | 141 | 507 | 305 |
| MD 150 | 150 | 200 | 450 | 560 | 25 | 27 | 650 | 335 | 130 | 110 | 55 | 16 | 59 | 115 | 525 | 449 |

| TYPE | MD 80 | | MD 100 | | MD 125 | | MD 150 | |
|-------------|---------------------------------|----------------|---------------------------------|----------------|---------------------------------|----------------|---------------------------------|----------------|
| | h ₁ , m ₁ | m ₂ | h ₁ , m ₁ | m ₂ | h ₁ , m ₁ | m ₂ | h ₁ , m ₁ | m ₂ |
| No of Stage | | | | | | | | |
| 1 | 83 | 143 | 105 | 175 | 130 | 220 | 178 | 308 |
| 2 | 146 | 206 | 180 | 250 | 230 | 320 | 301 | 431 |
| 3 | 209 | 269 | 255 | 325 | 330 | 420 | 424 | 554 |
| 4 | 272 | 332 | 330 | 400 | 430 | 520 | 547 | 677 |
| 5 | 335 | 395 | 405 | 475 | 530 | 620 | 670 | 800 |
| 6 | 398 | 458 | 480 | 550 | 610 | 720 | 793 | 923 |
| 7 | 461 | 521 | 555 | 625 | 730 | 820 | 916 | 1046 |
| 8 | 524 | 584 | 630 | 700 | 830 | 920 | 1039 | 1169 |
| 9 | 587 | 647 | 705 | 775 | 930 | 1020 | 1162 | 1292 |
| 10 | 650 | 701 | 780 | 850 | 1030 | 1120 | | |
| 11 | 713 | 773 | 865 | 925 | 1130 | 1220 | | |
| 12 | 776 | 836 | 930 | 1000 | 1230 | 1320 | | |

Max. no of allowable stages for MD80, MD100 & MD125 upto 12 stages only.

Max no of allowable stages for MD 150 upto 9 stages only