VERTICAL CENTRIFUGAL PUMP (VO)

OPERATION AND INSRUCTION MANUAL

ORDER REF :

PUMP TYPE :

SERIAL NO :

CUSTOMER :

PROJECT

SAM TURBO INDUSTRY PRIVATE LIMITED

(An ISO 9001-2008 CERTIFIED QMS COMPANY)

Avinashi Road,

Neelambur,

Coimbatore-641062

SAM TURBO INDUSTRY PVT LTD

NEELAMBUR, COIMBATORE- 641062

WARRANTY

WE WARRANTY THAT THE PUMP SUPPLIED BY US IS FREE DEFECTIVE MATERIAL AND FAULTY WORKMAN SHIP. THIS WARRANTY HOLDS GOOD FOR A PERIOD OF 12 MONTHS FROM THE DATE OF COMMISIONING 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

1.GENERAL

VO Models are vertical version of SAM'S standard horizontal pump's model of CPC, TCH, FF, FF+AR, AR, ARS, THM, TPS & TPP.

Vertical centrifugal pumps recommended in all cases where space economy matters. These pumps are suitable for handling clear liquids, Corrosive liquids, Slurries, Thermic fluid, Hazardous, Inflammable and Toxic liquids. The complete range of VO pumps are covered by 4 power series, one bed assembly with identical shaft diameter for maximum interchangebility. Pumps when properly installed and given proper care in operation and maintenance should operate satisfactory for a long period.

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FORWARD AND GUARANTEE:

Inspect the pump and accessories upon arrival for any damage or loss which have been incurred during shipment. Report on damage or shortage immediately to the sales department of our factory.

We are not liable for the damage incurred through failure to observe the instructions for erection the 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 technicians only, or following our approval writing, it may be done by you. If contrary to our acknowledgement of order, you wish to use the pump for different service please ask for our acceptance. Otherwise the guarantee given for this pump will not be valid.

2. STORAGE & PRESERVATION OF PUMPS

Protect the equipment upto 6 months in an indoor environment. The pump must be protected against damage, dust or any aggressive environment. Pumps stored for period exceeding one year should be serviced every 12 months. They should be disassembled, cleaned and the whole preservation process described below should be repeated.

- All inlet connections in the pump should be closed.
- Suction and discharge flanges should be covered to prevent the entry of any kind of foreign material.
- The surfaces to be preserved should be covered with the preservatives suitable for the storing environment.
- Mechanical seals should be cleaned by compressed air. No other liquid of material should be applied to the min order to prevent damage to the secondary sealings and too-ring/gaskets.

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- Pumps waiting for the installation or startup should be turned manually every 15 days. If it is difficult to move the shaft by hand, use a suitable spanner, by protecting the surface of the shaft at the point of operation.

3. DESCRIPTION OF THE PUMP

Pump Nameplate / Ordering Spare Parts / Spare Parts List

Every 'SAM' pump has a name plate giving following details:

- Pump type
- Serial Number / Year
- Duty conditions (Head, Capacity)
- Motor details (KW & RPM)

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.

Constructional Features:

In many cases (large setting heights of above 2.5 meters) Pump will be despatched in dismantled condition. The complete assembly will be done at the site only.

For this purpose the components will be supplied in the following Assemblies:

1. Bed assembly With Base plate, Bearing, Drive shaft and Drive column pipe.

2. Line column assembly consists - Column pipe, Shaft & Star support with Bush bearing and coupling sleeve set.

3. Pump column assembly consists - Pump shaft, Column pipe, Casing cover with bush Bearing and Casing with strainer.

4. Delivery pipe assembly consists - Delivery pipes, bend and extension (optional) & cooling pipes

Prior to assembly clean the fitting surface and seats of all the parts. To facilitate the assembly easy, wet all fittings and sliding surfaces by oil or grease. After completing assembly of the pump including delivery pipe assembly and cooling / sealing pipes connection, pump's shaft hand free rotation to be ensured before putting in the sump**.**

Vertical Pump's shafts are supported by bush bearing, pumps are often used in plants and installed in the sump, reservoir, column, on the tank locations and where there are space or weight restrictions.

Advantage of vertical pumps

1. Alignment between motor and pump is easier.
2. Casing is submerged in the liquid (Self priming)
3. Vertical adjustment of impeller to maintain efficient performance.
4. Simple mounting and minimum space required.
5. High temperature capability.

Vertical pump's impellers are similar to those are used in horizontal centrifugal pumps. pump's main bearings are Angular contact ball bearing of 33 series up to 3000 mm setting height and 73 series 2 nos for above 3000 mm setting height , mounted back to back as per the recommendation of API 610.

DIRECTION OF ROTATION: Clockwise pump viewed from drive end.

4.ERECTING THE PUMP

A crane of adequate capacity must be available which permits Slow, Jerk free, raising and lowering of the set. The pump is submerged directly into the pit. Down to certain installation depths it can be suspended free, beyond these depth a lateral guidance of the pump is required (Provision of a pump guide piece at the bottom of the pit.) See acknowledgement of order and or arrangement drawing.

The suspension pipes are bolted with bearing bed and bed is mounted on the base plate. Thus, the support for the base plate (on beam or foundation) has to be designed for the total weight of the set. Provision of a suction bell will considerably reduce the required minimum submergence. In the standard design of the pump the delivery pipe is carried upwards through the base plate.

Drive of pump is effected via a shaft assembly (Pump shaft, line shaft, drive shaft rigidly connected by sleeve couplings) running in the centre of the suspension pipes.

The shaft assembly is guided by bush bearings. Depending on the pumping liquid, bush bearing & Lubrication is recomanded either grease / external water / liquid handled external clear water with column under pressure.

Levelling of base plate and coupling alignment:

Check by means of a spirit level whether the pump is suspended vertically. For pumps suspended free the permissible deviation for the vertical (pump without guide piece or foot bend and piping) is 5mm per meter Installation depth.

After installation the rotor must rotate freely by hand. Should this not be the case, the set must by no means be put into operation.

Pumps are supplied along with pin & bush couplings, for taking care of more radial loads. After piping, coupling alignment to be checked with straight edge as the motors are seated on the bearing bed steps.

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5. Laying and connecting pipes

After grouting the base plate, the pipe may be connected. The diameter of pipes are not determined by those of pump discharge branches. On short delivery pipe runs the diameter should be such that the pipe resistance constitutes but a small portion of delivery pipe runs the most economic pipe diameter must be assessed in each particular case. Abrupt changes in pipe cross section and sharp bends should be avoided.

Once the flange bolt have been loosened, the flange must not yield more than the amount corresponding to the gasket thickness nor must they be out of parallel nor bear against each other under stress. See that the flange gaskets do not extend into the bore of piping. As the pipe branch should not absorb pipe forces and moments, the pump must not be used as a locating point of the piper work.

Delivery line:

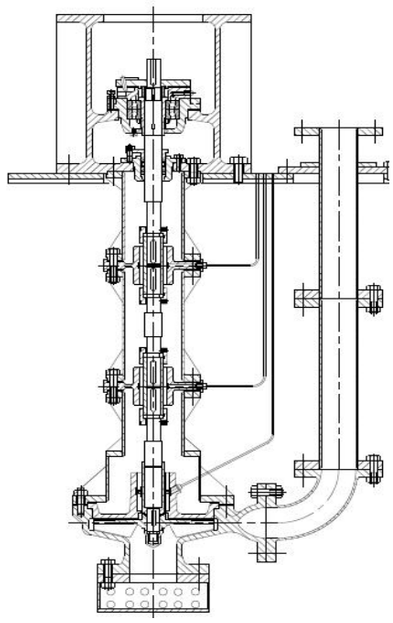
Install a gate valve / flow control valve in the delivery line as close to the pump branch as possible. As a matter of principle, it is recomanded to place a non return valve between the pump branch and regulating valve, thus protecting the pump against reverse rotation and water hammering effect which may occur in case of sudden shutdown.

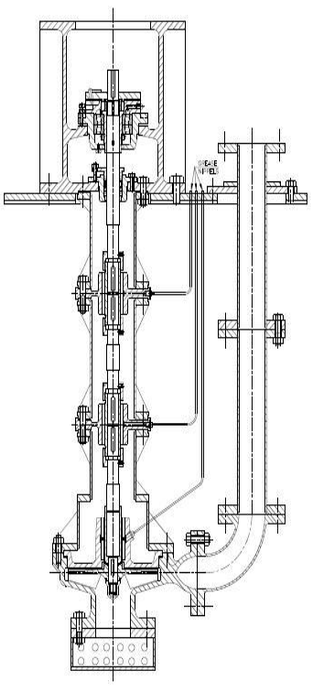
In slurry & sludge application NRV won't work hence there are possibilities of unscrewing impeller from the shaft due to back flow while stopping, it is recomanded to disengage the ratchet arrangement.

After 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. Delivery pipes must be supported and clamped.

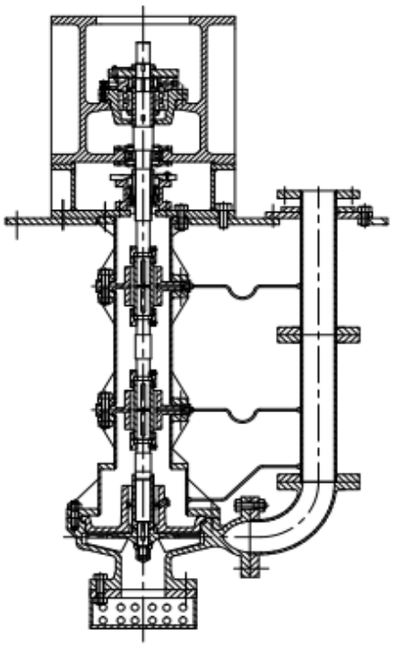
6. LUBRICATION ARRANGEMENT:

VO + BG: Bronze bush bearings with grease, individual pipe lines are provided for supply. Grease to each sleeve type bearings support from the top of base plate itself. :For pump above setting height of 5 meters, a grease pump driven by the main pump is recomanded which feeds small quantity of grease for all the bearings through individual pipe lines.



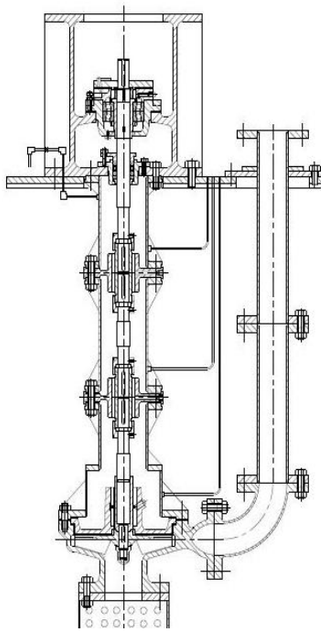


VO + C/TW : Carbon / Teflon bush bearing arrangement with external water / steam. Individual pipe lines are provided for Teflon and they are brought above the base plate. In case of crystallising liquids use of carbon bushes are recommended with steam as lubrication medium



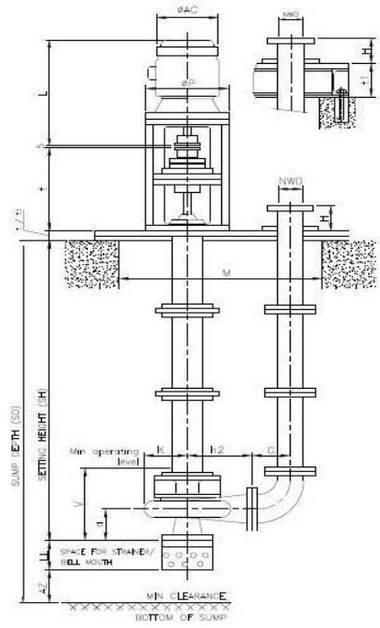
VO + C / TId : Carbon / Teflon Bush arrangement with lubrication by the liquid handled which should be clear / without any contamination.

VO + RW : For handling highly abrasive slurry, cutless rubber bush bearings are fitted at the shaft joints and entire column pipes are supplied with water under pressure arrangement. By this procedure, we completely eliminate the entry of highly abrasive slurry into the bush bearing region. For this purpose a steady flow of 1.5 to 3 m^3/h of fresh water with 1 kg/cm2 higher of pump design delivery pressure. To ensure the flow & pressure at the pump inlet, pressure gauge and flow indicator in the pipeline above base plate to be installed, During operation of the pump sealing water out let line valve should be in closed condition.



The sealing water pump shall be started 10 minutes before starting of the main pump to remove all solid particles settled inside the column pipe & bush bearing. It is also advisable to inter-lock the sealing water pump with the main pump so that main pump will not run on any occasion without the sealing water supply.

7. STARTING AND STOPPING - VO + RW



Before Initial starting, check the motor direction of rotation after detaching coupling, after connecting coupling, ensure that the pump shaft is rotating freely by hand. Water should be available in the sump to avoid dry running of the pump. Sealing / cooling water should be opened 10 minutes before starting the pump. Pressure gauge should be made available at delivery pipe before check valve. The regulating valve in the delivery line should be closed or in the case of automatic operation valve should be in open condition. the full back pressure should be on the non-return valve during stopping of the pump. Once the pump has run up to working speed, open the regulating valve in the delivery line slowly until the required service data of the pump are reached. Prolonged operation against closed regulating valve in the delivery line may lead to destruction of the internal pump parts and must therefore be avoided. See that the lowest admissible liquid level in the pit (minimum submergence) is maintained during starting up as well as during operation. The required minimum submergence prevents vibration and thus damage to the set which may occur due to the formation of air entraining vortices which may extend as far as the interior of the pump

An alteration of the service data of the pump which might become necessary may be effected only with the aid of the regulating valve in the delivery line. Particular care should be taken that the overloaded if the specific weight driver does not get of the liquid handled is greater than that originally provided. When starting up automatically operated plants, all isolating valves, hence the delivery gate valve too, must be kept open.

Stopping : If there is no back flow preventer (a ‘swing’ type or ‘lift’ type or other check valve) close the regulating valve in the delivery line. Do not switch off driver until then.-

Re Starting ; Take care that pump shaft does not rotate backwards. Starting with the shaft rotating in opposite direction may lead to shaft damage

Non Reverse Ratchet ; All vertical pumps are provided with non - reverse ratchet arrangement. This provides to avoid anti clockwise direction of rotation.

NOTE There are two types of arrangement. If the liquid in not very abrasive, Individual pipe lines are provided for every sleeve type rubber bush and they are to be lubricated by low pressure flushing water from external source. The sliding surface of the rubber bearings should not get in contact with grease or oil. The soft soap which is free from acid and mixture of Glycerine and graphite in the ratio of 2:1 can be clean the rubber bushes.

8. SUPERVISION AND MAINTENANCE:

Re-greasing of Main bearing; Using a grease gun through the grease nipples. During re-greasing there is always the risk of dirt entering the bearing space. Care should be taken that grease container and greasing devices are clean and the lubricant will not be contaminated when transferred into another container.

1500 Lts / min.	1800 Lts. / min.	3000 Lts. / min.
Every 2500 operating hours	Every 2000 operating hours	Every 1500 Operating hours

LUBRICATING QUANTITIES

When Installing the rolling contact bearings with fresh grease charge, the hollow spaces of the rolling contact bearings shall always be completely filled with grease the housing space on both sides, however only be filled one third. If the bearings are over greased (too much grease in the bearing) there is the danger of hot running.

As lubricating grease a lithium soap high quality bearing grease shall be used which is free from resins and acids and which shall have a rust inhibiting effect.

GREASE SPECIFICATIONS FOR VO+BG:

Name of the firm	**SPEED (1450 RPM)**	**SPEED (2900 RPM)**
INDIAN OIL HINDUSTAN PETROLEUM	SERVOGEM – 3 NATRA - 3 LITHON -3	SERVOGEM – 2 NATRA – 2 LITHON – 2

LOCATION	**DESCRIPTION**	**FRAME**	**LUBR. INTERVAL (Operating- Hours)**		**Qty.of Grease (gms.)**
			1450 rpm	**2900 rpm**	
11	Bearing (Drive end)	150 VO	1200	500	15
		180 VO	1100	400	20
		225 VO	900	300	20
		300 VO	800	250	25
13 14	Line shaft/Pum end bush bearings (Requirement given for 1 NO.bush bearing) GROUP- A	150 VO	250	200	20
		180 VO	250	200	20
		225 VO	200	200	30
		300 VO	200	200	30

LUBRICATION SPECIFICATION FOR VO + C / Tld :

- External source water, Pumping liquid should be clear and free from dirts & sand particles.
- Lubrication interval – continuous

LOCATION	**DESCRIPTION**	**FRAME**	**SPEED RPM**	**CAPACITY (Per bush) (m3/hr)**	**PRESSURE kg/cm2**
L 3	Line shaft / pump end byush bearing For group B,C Flushing arrangement	150 VO	1450/ 2900	0.3 - 0.5	1.0
		180 VO	1450/ 2900	0.3 - 0.5	1
		225 VO	1450/ 2900	0.3 - 0.5	1.5
		300 VO	1450/ 2900	0.5 - 0.8	1.5

LUBRICATION SPECIFICATION FOR VO + RW：

LOCATION	DESCRIPTION	FRAME	SPEED RPM	CAPACITY (Per bush) (m3/hr)	PRESSURE kg/cm2
L 5	Line shaft / pump end bush bearing For group D Column pipes under pressure	150 / 180	1450/ 2900	0.8 - 1.0	1 kg higher than the pump's discharge pressure
		225/ 300	1450/ 2900	1.0 - 1.2	

The Installation of the new packing is to be done with special attention to the following:
The surface of the shaft protecting sleeve must be in perfect condition, otherwise the shaft protecting sleeve must be changed.
The old packing must be completely removed as otherwise the running faces of the shaft protecting sleeve will get damaged within the short time in spite of the new packing.
The quality of the packing material used must suit the operating conditions.

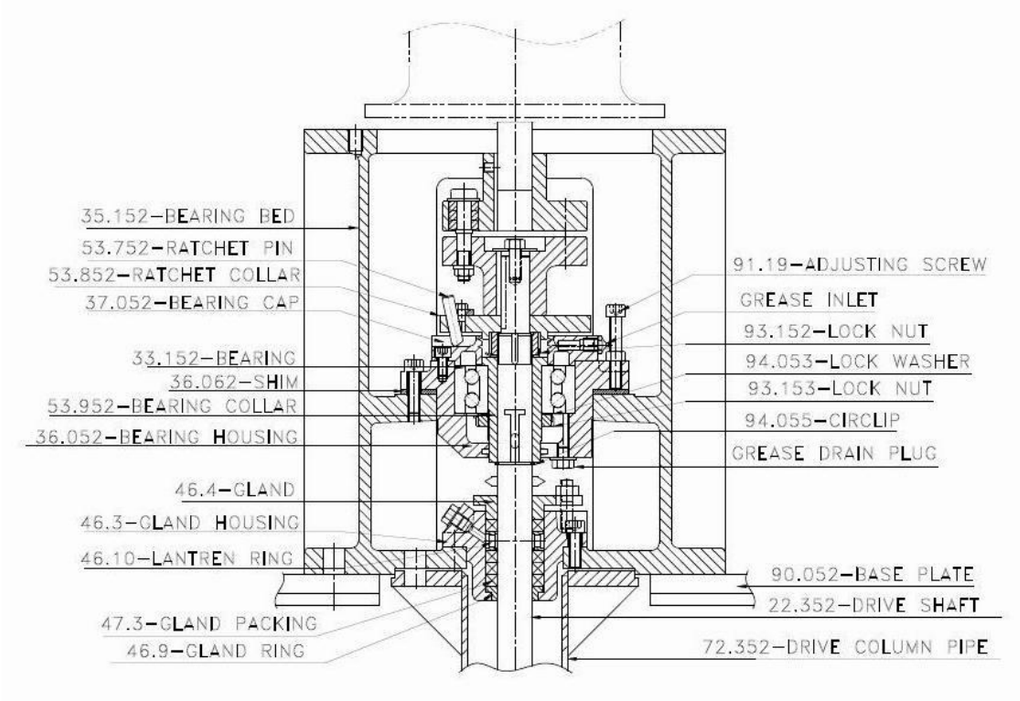
9. Dismantling & Assembling

If the set has been maintained and serviced carefully breakdowns which necessitate the dismantling should not occur. If however faults occur the cause should be located before dismantling if possible. If technical persons are not available we recommend that you request the service of an erection engineer or despatch the set to our works for checking.
If the set is being stripped by yourselves, all parts must be handled with greatest care, avoiding blows and shocks. All parts must be carefully cleaned, tested for wear and if necessary reconditioned or replaced with new parts. When assembling the pump take into account the pump section drawing. After assembly, the rotor must turn easily by hand. Otherwise the bearings coupling shaft seal and wear rings opposite the impeller may get damaged prematurely.

BEARING NUMBER WITH FRAME SIZE AND SETTING HEIGHT :

FRAME	Setting height Up to 3000 mm	Setting height Above 3000 mm
150	3309	7309 X 2
180	3311	7311 X 2
225	3313	7313 X 2
300	3316	7316 X 2

Bearing bed assembly



1.Insert the bearings (part no.33.152) on bearing collar (part no.53.952) and fasten by lock nut & Lock washer (part no.93.152) for positive looking.

2.Insert the bearing collar with bearing, into the bearing housing.

3.Insert the Drive shaft (Part No.22.352) into the bearing housing assembly, which was already assembled with circlip and key provided. Circlip provided for locking the bearing collar with drive shaft, key provided to give positive drive to bearing collar with drive shaft.

4.Arrest the bearing collar with drive shaft by means of Lock nut and Lock washer.(part no. 93.153 & 94.053)

5.Assemble the bearing cap cum ratchet (part no.37.052) through the drive shaft and tighten the bearing cap with bearing housing. Such that the outer race of the bearing fit on the bearing housing.

6.Insert the ratchet collar (Part no.53.852) into the drive shaft which was already assembled with ratchet pin and ratchet plate fixed (Part no.53.752). In drive shaft a key is to be provided to give drive for ratchet plate and coupling.

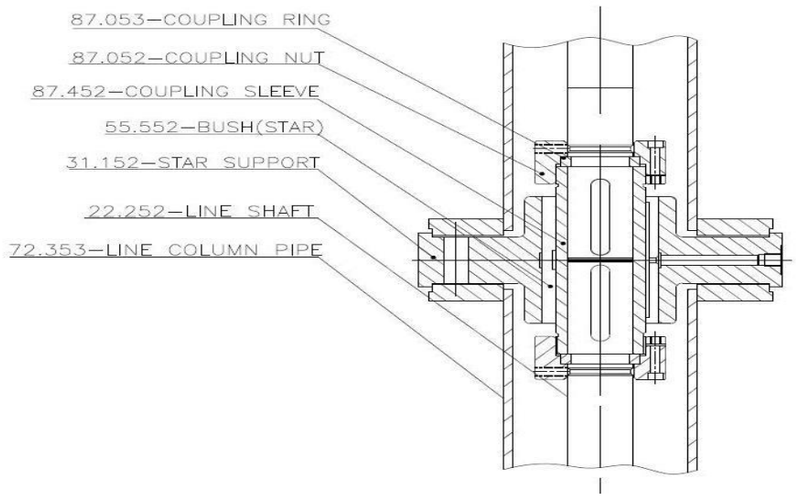
7.Fit the gland housing assembly (Part no.46.3) felt seal cover with the bearing bed (part no.33.152) and the bearing bed fitted to the base plate by means of screws.

8.With the bearing assembly unit, a deflector to be provided on the drive shaft, just after the circlip (part no.94.055) and inserted through gland housing assembly.

9.Before fixing the bearing housing in the bearing bed, the metallic shims (part no.36.062) are to be provided. Normally the shims packed to 3-4mm with 0.5mm MS/Copper sheets. Apart that adjusting screws with lock nut (part no.91.19) was also provided in the bearing Housing. (To adjust the rotor assembly with Impeller.)

10.Insert the pump coupling to the drive shaft (Drive end) and Lock it by means of washer and locking screw.

Column Pipe Assembly



1.Insert the split off coupling rings (part no.87.053) with coupling nut (part no.87.052) to the Drive shaft (pump end-part no. 22.352)

2.Slip the coupling sleeve (part no.87.452) with key on the shaft. Tighten the coupling nut over the sleeve and lock with grub screws. Place the drive column pipe (part no.72.352) with bearing bed (Gasket to be provided between bearing bed / Column pipe & Column pipe/Star support) and bolt the star support (part no.31.152) with Intermediate bush bearing (part no.55.552) which will slide on the Coupling sleeve.

3.Slide the line shaft (part no.22.252) in the coupling sleeve with coupling ring and nut.

4.Tighten the coupling nut and coupling ring with grub screws.

5.Place the line column pipe (Part no.72.353) over the star support with gasket and Tighten the bolts. Repeat this procedure according to the numbers of line Shafts. For short setting height, the drive shaft (single shaft) must already be installed. instead of Line & pump shaft

6.Place the pump shaft (part no.22.3) and pump column pipe (part no.72.354)

Assembly Procedure of VO +ARS

1. Place the 1.shaft sleeve (53.5) on the pump shaft with key.

2. Place the bush housing (17.3) with bush bearing (55.553) over the column pipe with proper gasket.

3. Place the wear plate (14.7) and fix it with bush housing.

4..Screw the Impeller with shaft by providing a O-Ring between sleeve and Impeller.

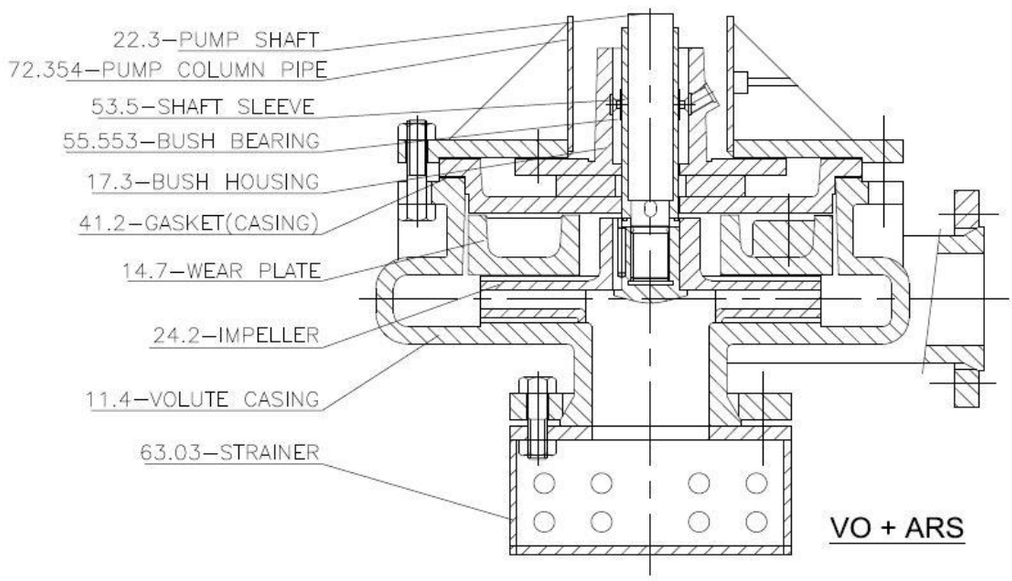
5. By the adjustment of the adjusting screws in the bearing housing, rotor assembly can be moved up and down to keep the clearance between wear plate and impeller (2 to 3m

6. Mount the casing by providing the gasket / O-Ring between casing and bush housing by using studs with column pipe.

7. Care should be taken so that orientation of the delivery of the casing should suit the base plate. Then check up the free rotation of the rotor assembly tight the lock nut provided in the adjusting screw.

.8. It is important to position the Impeller correctly in relation to the casing. No rubbing can be allowed with side walls or front walls of the casing. This can be avoided by adjusting the screws in the bearing housing.

Dismantling Procedure of VO+ARS



1.Remove the suction spool / Strainer connection.

2.Remove the delivery bend (72.055) while removing the delivery bend will find a sealing gasket which is tobe preserved carefully.

3.Remove the volute casing (11.4) by loosening the stud provided.

4.The Impeller in now visible. Give a lever of sufficient diameter and length between the vanes of the impeller (Inside the suction bore of the impeller) thereby preventing the rotation of same.

5.Now rotate the coupling in the opposite direction as that of normal running direction by hand. This process will make the impeller unwind form the shaft and at the same time coming out towards the operator standing before.

6.Stop it in the middle and provide holding and further unwind so that the impeller will come out and hang on the holding.

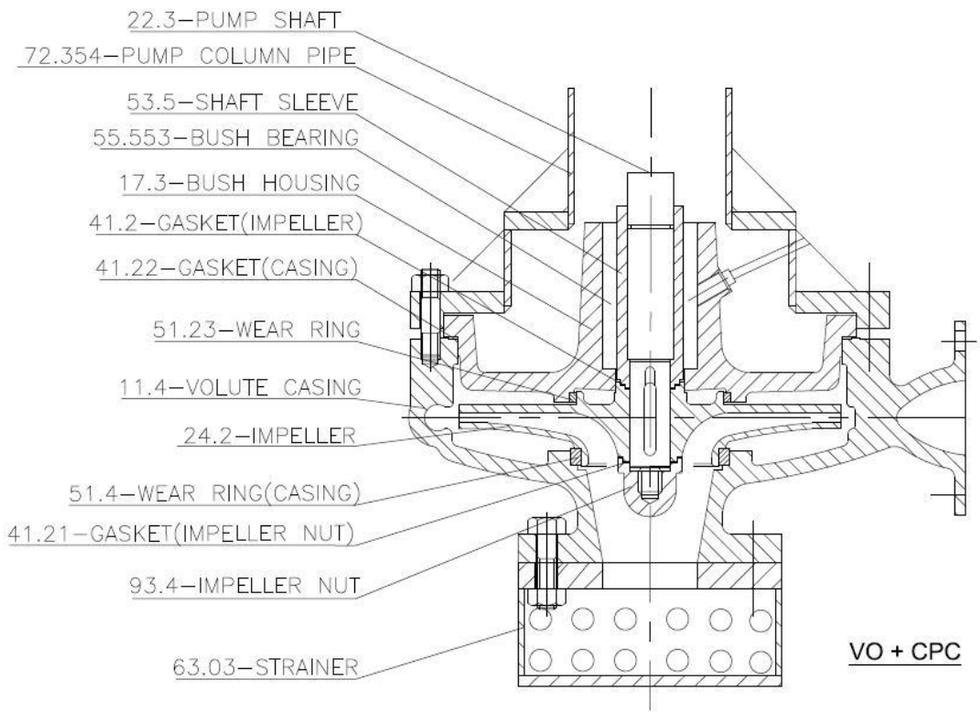
7.The above procedure is to be adopted in reverse fashion for assembling.

8. If you need further dismantling remove wear plate (14.7) by loosening the fixing bolts provided with bush housing. Now the bush housing (17.3) and bush bearing (55.553) can be removed.

9.Now the bed assembly with bearings, column pipe, and shaft with sleeve is free for further dismantling.

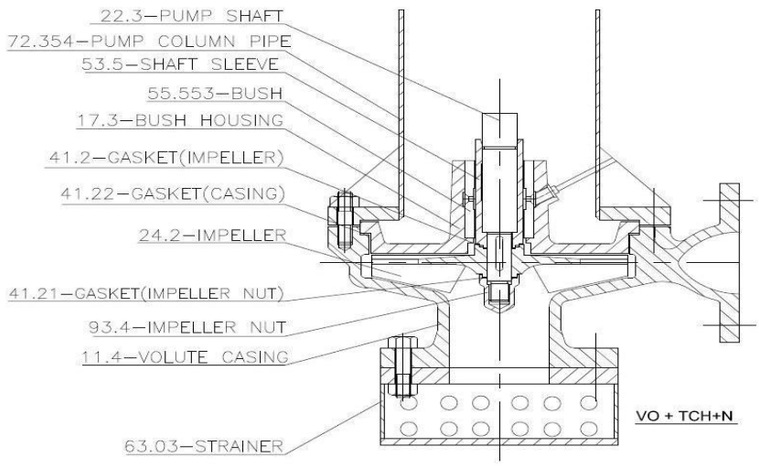
10.Preserve all sealing O-Rings and gaskets provided in between the wetted parts.

Assembly of VO+CPC



1. Place the shaft sleeve (part no.53.5) on the pump shaft (part no.22.3) with key.
2. Place the bush housing (part no.17.3) with bush bearing (part no.55.553) over the pump column pipe (part no.72.354)
3. Place the Impeller (part no.24.2) and tighten the Impeller nut (part no.93.4) with Gaskets between sleeve / Impeller, Impeller / Impeller nut (Part no.41.2 & 41.21)
4. By the adjustment of the adjusting screws in the bearing housing, the rotor assembly can be moved up and down, with this aid to keep the clearance between the casing cover and Impeller evenly.
5. Mount the casing (part no.11.4) over the casing cover with a Gasket (part no.41.22)
   Care should be taken so that orientation of the delivery of the casing should suit with the base plate. Then check up the free rotation of the rotor assembly. Tight the lock nut provided in adjusting screw.
6. It is important to position the Impeller correctly in rotation to the casing. No rubbing can be allowed with side walls or front walls of the casing. This can be avoided by adjusting screws in bearing housing.

Assembly of VO+TCH+N.



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6. By the adjustment of the adjusting screws in the bearing housing, the rotor assembly can be moved up and down, with this aid to keep the clearance between the casing and Impeller 0.5 mm for achieving better efficiency from the pump
7. Mount the casing (part no.11.4) over the bush housing with a Gasket (part no.41.22)
   Care should be taken so that orientation of the delivery of the casing should suit with the base plate. Then check up the free rotation of the rotor assembly. Tight the lock nut provided in adjusting screw.
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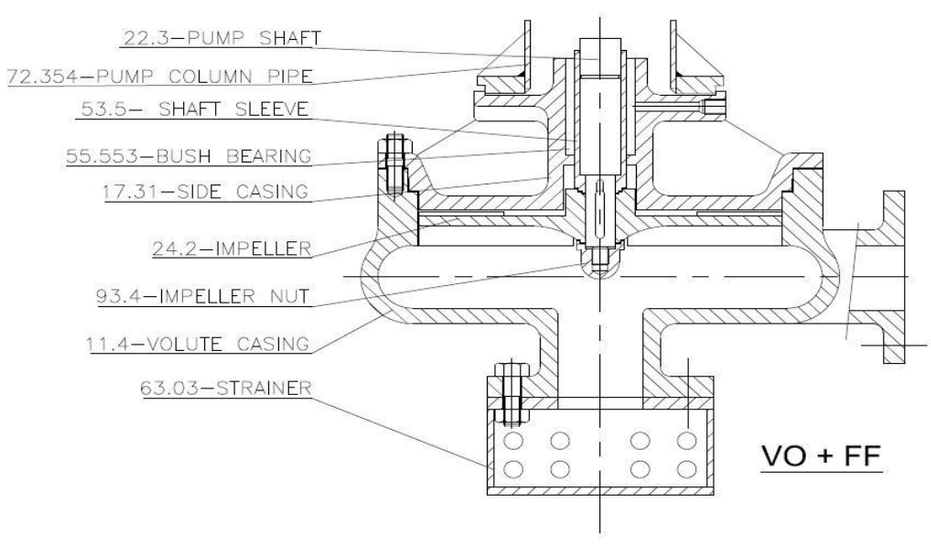
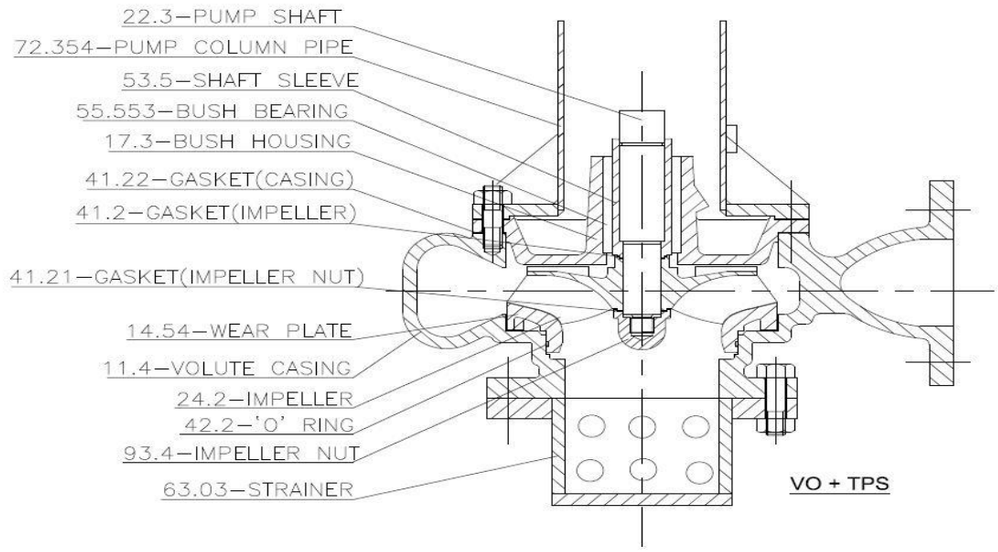
VO+FF Vortex



1. Place the shaft sleeve (part no.53.5) on the pump shaft (part no.22.3) with key.
2. Place the bush housing (part no.17.3) with bush bearing (part no.55.553) over the pump column pipe (part no.72.354)
3. Place the Impeller (part no.24.2) and tighten the Impeller nut (part no.93.4) with Gaskets between sleeve / Impeller, Impeller / Impeller nut (Part no.41.2 & 41.21).
4. By the adjustment of the adjusting screws in the bearing housing, the rotor assembly can be moved up and down, with this aid to keep the clearance between the Impeller and wear plate 0.5 mm for achieving better efficiency from the pump
5. Mount the casing (part no.11.4) over the bush housing with a Gasket (part no.41.22).

   Care should be taken so that orientation of the delivery of the casing should suit with the base plate. Then check up the free rotation of the rotor assembly. Tight the lock nut provided in adjusting screw.
6. It is important to position the Impeller correctly in rotation to the casing. No rubbing can be allowed with side walls or front walls of the casing. This can be avoided by adjusting screws in bearing housing.

Assembly of VO+TPS

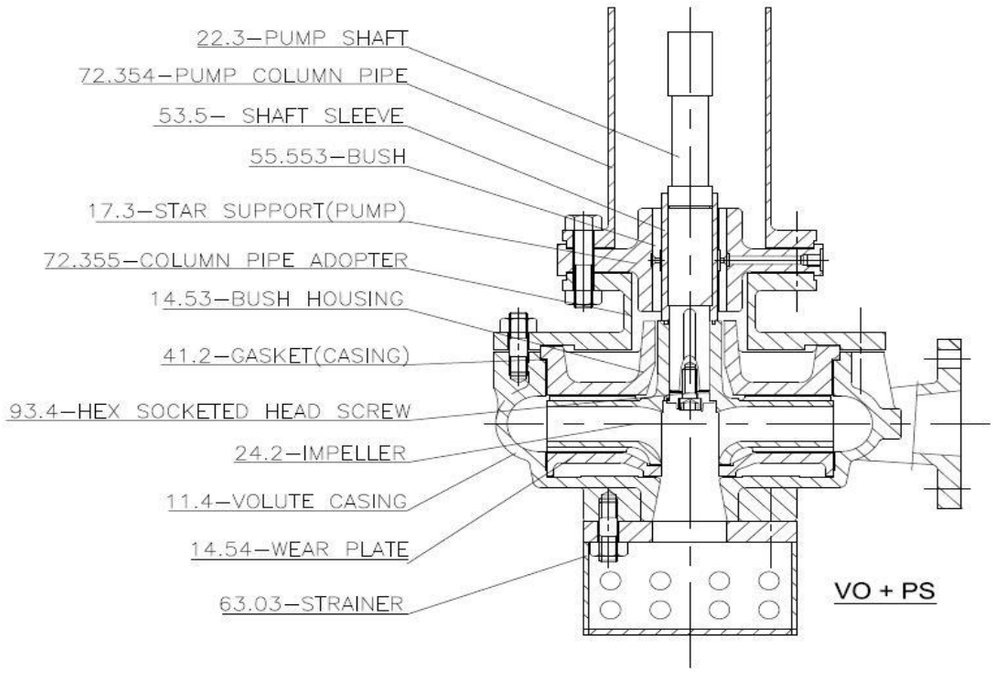


1. Place the shaft sleeve (part no.53.5) on the pump shaft (part no.22.3) with key.
2. Place the side casing (part no.17.3) with bush bearing (part no.55.553) over the pump column pipe (part no.72.354)
3. Place the Impeller (part no.24.2) and tighten the Impeller nut (part no.93.4) with Gaskets between sleeve / Impeller, Impeller / Impeller nut (Part no.41.2 & 41.21)
4. By the adjustment of the adjusting screws in the bearing housing, the rotor assembly can be moved up and down, with this aid to keep the clearance between the side casing and Impeller 1 mm.
5. Mount the casing (part no.11.4) over the bush housing with a Gasket (part no.41.22)

   Care should be taken so that orientation of the delivery of the casing should suit with the base plate. Then check up the free rotation of the rotor assembly. Tight the lock nut provided in adjusting screw.

6. It is important to position the Impeller correctly in rotation to the casing. No rubbing can be allowed with side walls or front walls of the casing. This can be avoided by adjusting screws in bearing housing.

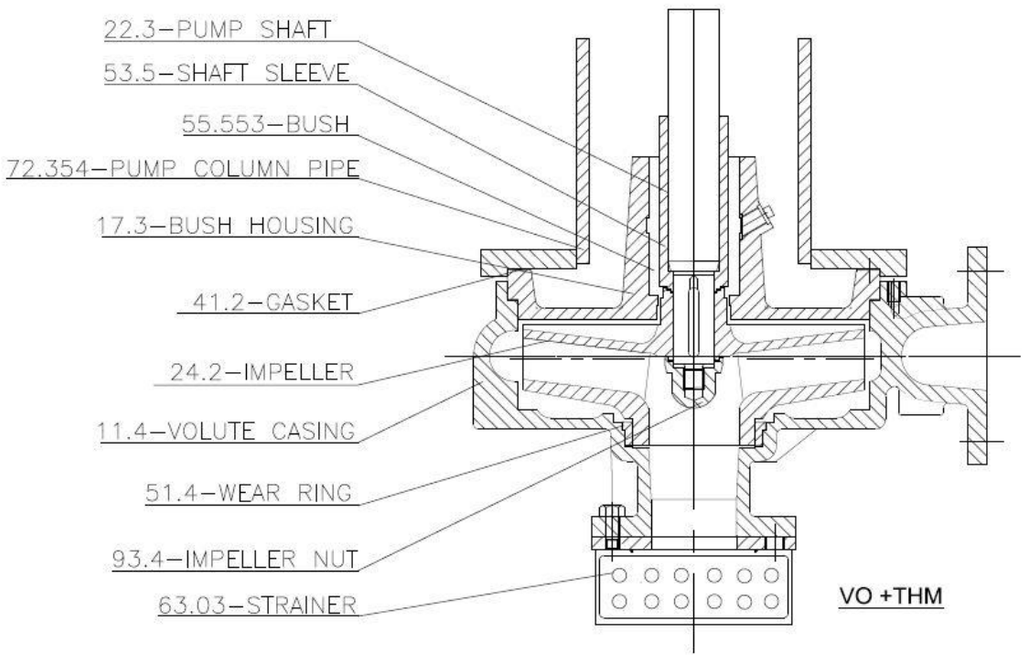
Assembly of VO+PS



1. Place the shaft sleeve (part no.53.5) on the pump shaft (part no.22.3) with key.

2. Place the column pipe adopter (72.355) with bush bearing (part no.55.553) over the pump column pipe (part no.72.354).
3. Place the star support (17.3) and Impeller (part no.24.2) and tighten the Hex socket head screw (part no.93.4) with Gaskets between sleeve / Impeller, Impeller / Impeller nut (Part no.41.2 & 41.21)
4. . By the adjustment of the adjusting screws in the bearing housing, the rotor assembly can be moved up and down, with this aid to keep the clearance between the casing cover and Impeller evenly.
5. Mount the casing (part no.11.4) over the bush housing (14.53) with a Gasket (part no.41.2)
6. Care should be taken so that orientation of the delivery of the casing should suit with the base plate. Then check up the free rotation of the rotor assembly. Tight the lock nut provided in adjusting screw.
7. It is important to position the Impeller correctly in rotation to the casing. No rubbing can be allowed with side walls or front walls of the casing. This can be avoided by adjusting screws in bearing housing.

Assembly of VO+THM



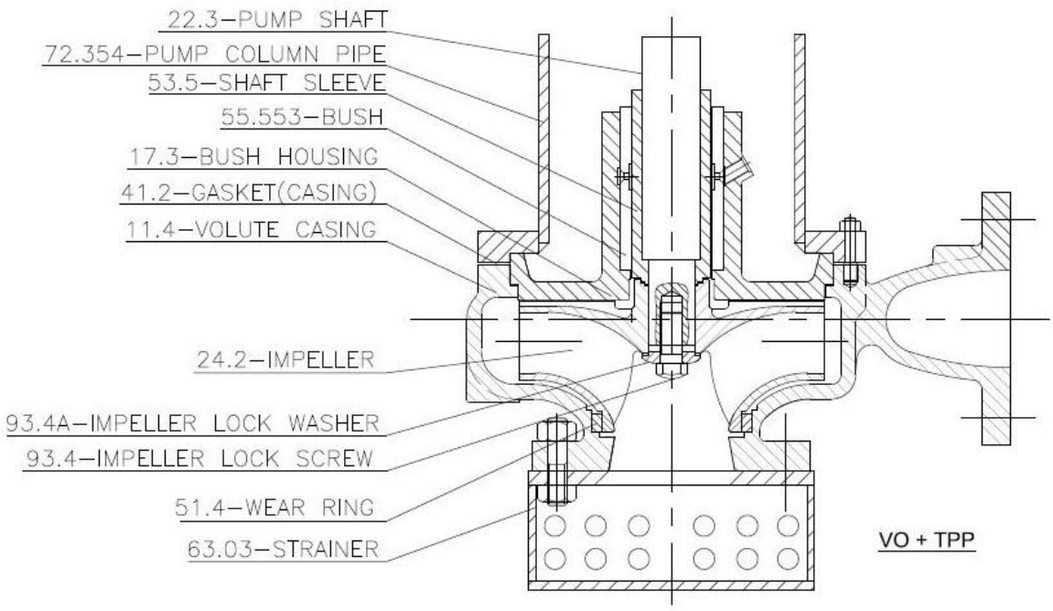
1. Place the shaft sleeve (part no.53.5) on the pump shaft (part no.22.3) with key.
2. Place the bush housing (part no.17.3) with bush bearing (part no.55.553) over the pump column pipe (part no.72.354)
3. Mount the casing (part no.11.4) over the bush housing with a Gasket (part no.41.22)

   Care should be taken so that orientation of the delivery of the casing should suit with the base plate. Then check up the free rotation of the rotor assembly. Tight the lock nut provided in adjusting screw.

IMPELLER CLEARANCE ADJUSTING PROCEDURE :

1. The Impeller can be adjusted with complete rotor assembly by means of adjusting screw with lock nuts (part no.91.19) provided in bearing housing In
2. factory set, normally 3 to 4 mm gap was maintained between bearing housing and bearing bed. The gap was packed with 1.0 and 0.5 mm thick MS Sheet Shims (Part no.36.062)To adjust the Impeller, release the lock nuts in adjusting screw and remove a shim from all sides.
3. Loosen the adjusting screw from all sides uniformly to maintain required clearance.
4. After adjusting the impeller, be sure to lock the locknuts in adjusting screws.
5. Tighten the screws with bearing housing to the bearing bed.
6. It is important to position the impeller correctly in relation to the volute casing.

Assembly of VO+TPP



1. Place the shaft sleeve (part no.53.5) on the pump shaft (part no.22.3) with key.
2. Place the bush housing (part no.17.3) with bush bearing (part no.55.553) over the pump column pipe (part no.72.354)
3. Place the Impeller (part no.24.2) and tighten the Impeller screw (part no.93.4) with lock washer (part no.93.4A)
4. By the adjustment of the adjusting screws in the bearing housing, the rotor assembly can be moved up and down, with this aid to keep the clearance between the casing cover and Impeller evenly.
5. Mount the volute casing (part no.11.4) over the bush housing with a Gasket (part no.41.2)Care should be taken so that orientation of the delivery of the casing should suit with the base plate. Then check up the free rotation of the rotor assembly. Tight the lock nut provided in adjusting screw.
6. It is important to position the Impeller correctly in rotation to the casing. No rubbing can be allowed with side walls or front walls of the casing. This can be avoided by adjusting screws in bearing housing.

Part name	**VO+ AR**	**VO+ TCH**	**VO+ TPS**	**VO+ PS**	**VO+ THM**	**VO+FF**	**VO+ CPC**	**VO+TPP**
Impeller	R	R	R	R	R	R	R	R
Gasket	R	R	R	R	R	R	R	R
'O' Rings	R	R	R	R	R	R	R	R
Packing / Felt seal	R	R	R	R	R	R	R	R
Wear ring					R		R	R
Shaft sleeve	R	R	R	R		R	R	R
Wear plate	R		R					
Bush bearing	R	R	R	R	R	R	R	R
Wear plate								
Suction side	R			R		-	-	
Delivery side								

13. TROUBLE - CAUSE – REMEDY:

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

Sl.no	Trouble	Cause – Remedy -
1.	Pump does not deliver	1 7 8 9 10 11 12 15 16 17 18 19 20 24 26 27 58 59 60
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 22 23 58 59 60
3.	Delivery performance reduced	1 3 7 9 10 11 12 14 15 20 21 22 23 24 52 55 59
4	Pump delivers too much	17 58 59 60
5	Delivery is interrupted	1 3 6 7 8 9 10 11 12 13 14 15 16 17 20 23 24 26 27 58 59 60
6	Pump runs in reverse direction	54
7	Very Noisy	1 2 5 6 7 8 11 12 14 16 20 21 23 56 57 58 59
8	Unsteady running of pump	20 21 23 32 33 34 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 53 56 57 60 64 65
9	Pump casing not leak-proof	45 47 52
10	Excessive leakage form stuffing box	21 25 28 29 30 31 32 45 48 49 50 55
11	Pump rotor blocked in stand still position	23 43 45 46 47 51
12	Pump is heating up and seizing	23 24 25 26 27 28 29 30 31 40 43 45 46 47 48 49 50 51
13	Bearing temperature increase	20 21 22 23 32 33 34 35 36 37 38 39 40 41 42 43 44 46 47 48 49 50 53 56 57 60
14	Lubricating water pressure drops / increases	32
15	Motor will not start	15 23 62
16	Motor is difficult to start	15 17 23 28 29 43 44 45 46 47 51 60 61 62
17	Motor is running hot or burning out	15 17 23 28 29 51 57 58 59 60 61 62 63

CAUSE -REMEDY :

1. Suction filter, foot valves clogged.
2. Nominal diameter of suction line too small.
3. Inlet casing does not reach far enough into the delivery liquid.
4. Ground clearance of inlet casing too narrow.
5. Too many bends in the suction line.
6. Shut off valve in the feed line in unfavourable 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 of flanges in the suction line not leak-proof.
10. Ingress of air via leaking valves & fittings in the suction line.(St.box etc)
11. Suction lift too great, water level in pit too low.
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 to high (number of revolutions of driver lower than nominal number of revolutions of pump.)
18. Speed too low (number of revolutions of driver lower than nominal number of revolution of pump.)
19. Incorrect direction of rotation (electric motor connected incorrectly, leads on the terminal board inter changed.
20. Impeller clogged.
21. Impeller damaged.
22. Wear rings worn.
23. Separation of crystals from the delivery liquid falling below the temperature limit / Equilibrium temperature.
24. Sealing liquid line / Circulation line clogged.
25. Sealing line contaminated.
26. Lantern ring in the stuffing box is not positioned below the sealing
27. Liquid inlet.
28. Sealing liquid omitted.
29. Packing incorrectly fitted.
30. Gland tightened too much / slanted.
31. Packing material not suitable for operating conditions.
32. Shaft sleeve / shaft worn in the region of the packing.
33. Bearing worn out.
34. Insufficient lubrication of bearings (also in case of automatic lubrication)

35. Grease lubricating line broken.
36. Rolling contact bearings over-greased.
37. Grease quality unsuitable.
38. Rolling contact bearings incorrectly fitted.
39. Bearings dirty.
40. Bearings rusty. (Corroded.)
41. Axial thrust too great because of worn wear rings and / or back vanes
42. obstructed relief holes.
43. Alignment of coupling faulty or coupling loose.
44. Elastic elements of coupling worn.
45. Foundation incorrectly performed.
46. Motor pedestal incorrectly aligned.
47. Pump casing under stress.
48. Insufficient alignment of the support pipe.
49. Pipework under stress.
50. Shaft runs untrue.
51. Shaft bent.
52. Rotor insufficiently balanced.
53. Rotor parts fowl with casing.
54. Unsuitable casing seal.
55. Vibration of pipe work.
56. Non return valve sticks.
57. Contaminated delivery liquid.
58. Delivery flow too small.
59. Delivery flow too great.
60. Pump unsuitable for parallel operation.
61. Type of pump unsuitable.
62. Pump incorrectly rated.
63. Short circuit in the motor.
64. Setting of circuit breaker for motor too high.
65. Causes attributable to driver.
66. Structure has not been properly investigated in respect of static and vibrations.