ZM SPLIT CASING PUMPS

OPERATION & MAINTENANCE MANUAL

SAM TURBO INDUSTRY PVT LIMITED

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WARRANTY

We warranty that the pump supplied by us is free 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 dispatch 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 warranty 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.

GENERAL

“ZM” pumps are centrifugal single stag and double suction radial impeller . The complete range of “ZM” pumps are covered by 6 Power Series, thereby, reducing inventory and achieving maximum interchangeability of parts. Pumps when properly installed and given proper care-in operation and maintenance should operate satisfactorily for a long period.If equipment is to be stored for long periods of time (six months or more), the following precautions should be taken to insure that the equipment remains in good condition.

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.

STORAGE & PRESERVATION OF PUMPS

Protect the equipment up to 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 any kind of foreign environment
- The surfaces to be preserved should be covered with the preservatives suitable for 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 to ‘o’-ring/gaskets.
- Oil in the bearings bed should be drained.

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

DESCRIPTION OF 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.

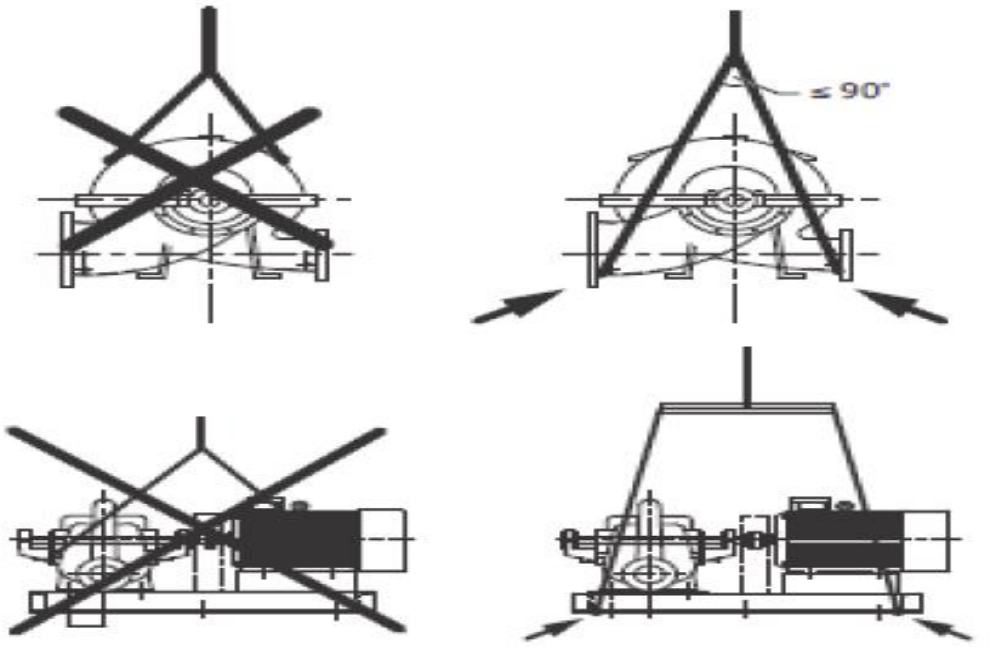
Constructional Details

SAM ZM are single volute with axial split casing. Especially Fan pump (with straight & staggered vane) for stock feed, stock circulation, centri-cleaner, water and fire-fighting application. The wide passages in the Suction Zone of the impeller with less number of vanes and non-clogging design helps to handle stocks & water easily. This casing is split along the horizontal centre line of the pump shaft, suction and discharge nozzles both are being located in the lower half. With this arrangement, it is not necessary to disconnect suction or discharge piping to make repairs or replace the rotating element. Upper and lower half casings are bolted together and doweled to maintain a smooth volute contour inside the pump. Supporting feet are integrally cast in the lower half casing and are drilled for bolting and doweling to base plate.

Bearing brackets form a drip pocket for collecting stuffing box leakage and are provided with drilled and tapped connections for draining. The brackets also contain an overflow hole to release the water before it reaches the shaft, in case drain piping should become clogged. Suction and discharge flanges are drilled and tapped for gauge connections. Pump suction and discharge nozzles are drilled and tapped on the underneath side for complete pump drain.

Wear rings are provided to minimize internal bypassing of the liquid being pumped, and to achieve better efficiency from pump. Bearings are oil lubricated.

Direction of Rotation: Clockwise and Anti-Clockwise pump viewed from driven end.



ERECTING THE PUMP: 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.

Grouting: Grout compensates for unevenness in the foundation and distributes the weight of the unit uniformly on the foundation. It also prevents lateral shifting of the base plate and reduces vibration. Use a non shrinking grout. Foundation bolts should be tightened evenly, but not too firmly. Grout the unit as follows:

1. Build a strong form around the base plate to contain the grout.

2. Soak the foundation top thoroughly, and then remove surface water.

3. Pour grout. Tamp liberally while pouring in order to fill all cavities and prevent air pockets. The space between the foundation and base plate should be completely filled with grout. In order to prevent the base plate from shifting, fill under the base plate at least four inches in from all four edges. Wedges may be left in place.

4. After the grout has hardened (usually about 48 hours), thoroughly tighten foundation bolts and check alignment.

5. Approximately 14 days after the grout has been poured or when it is thoroughly dry, apply an oil base paint to exposed edges of the grout to prevent air and moisture form coming in contact with the grout.

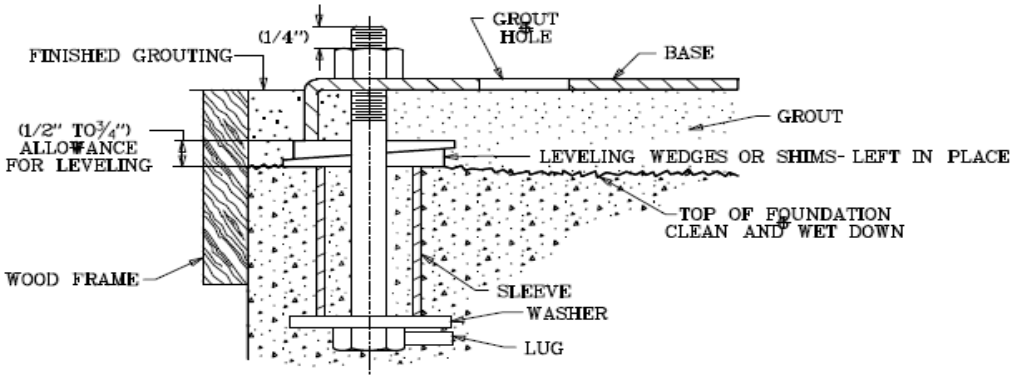


FIG. 3 TYPICAL FOUNDATION BOLT DESIGN

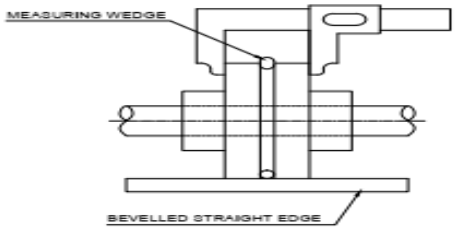


FIG 1(a)

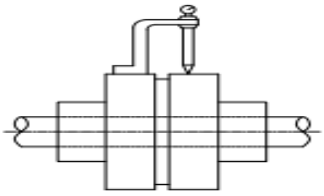


FIG 1(b)

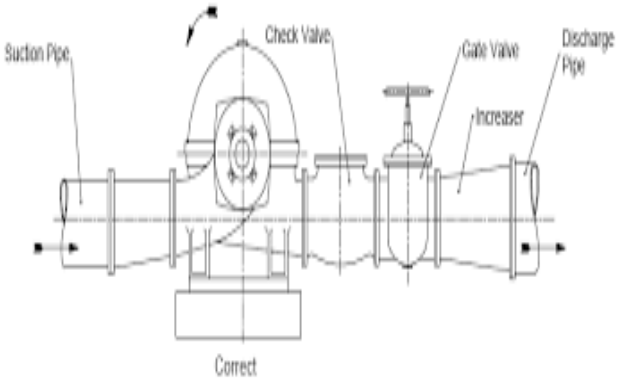
Leveling the Base plate, aligning the Coupling

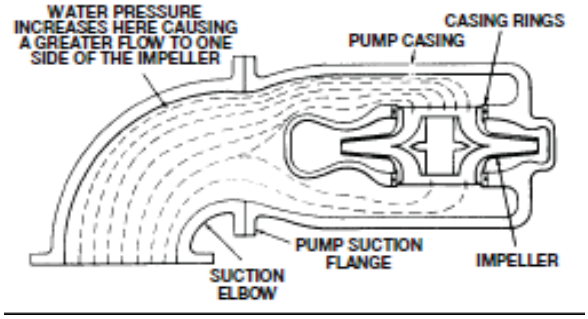
Level accurately the base plate which carries the complete set with the aid of a spirit level. Place metallic packing between the base plate and foundation close to the foundation bolt holes. To prevent sagging of the base plate, place metallic packing if required - also between the foundation bolt holes.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

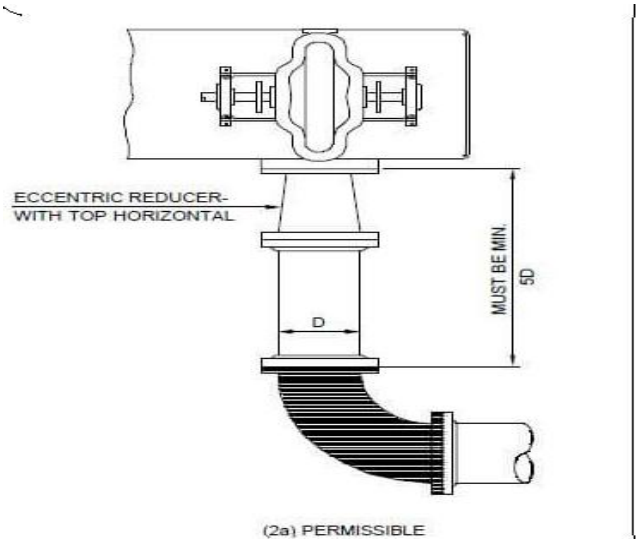
At every check take care that the axial float of the rotor is taken into account, i.e when measuring the rotor and the driver shaft must always be brought to bear in the same direction

LAYING & CONNECTING PIPES :

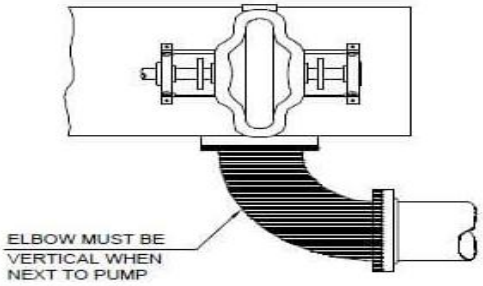
The suction and discharge piping should be installed with the shortest and most direct runs. Elbows should preferably be of the long radius type. Pipes must line up naturally. The piping must never be pulled into position by the flange bolts. Such action may draw the pump out of alignment. Pipes should be support independently of the pump so as not to put any strain on the pump casing. Suction piping, if not properly installed, is a potential source of faulty operation. Suction lines should be free of air leaks, and arranged so there are no loops or high spots in which air can be trapped.







(2a) PERMISSIBLE



(2b) WRONG

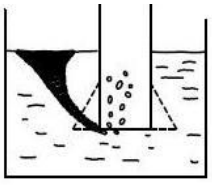


Fig. 5 Enlarging the suction pipe usually prevents whirlpools and the resultant entrance of air into the pipes

FIG. 5

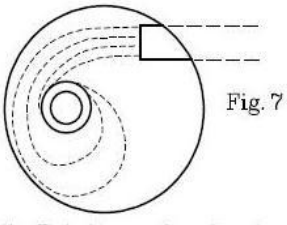


Fig. 7

Fig. 7 Rotation of water in the well, as illustrated, can be prevented with a baffle.

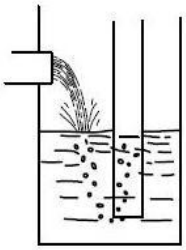


Fig. 6(a) Water falling into sump churns air into the sump liquid and causes trouble in the suction line

Fig. 6(a)

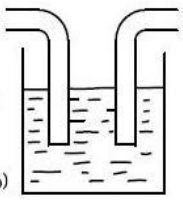


Fig. 6(b) Supply line should extend down into the sump to prevent the churning of air into the water.

Fig. 6(b)

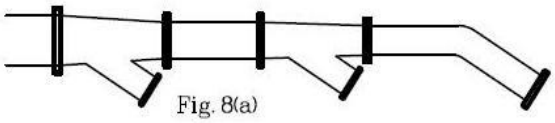


Fig. 8(a)

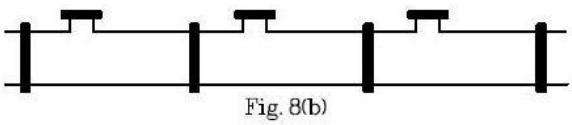


Fig. 8(b)

Fig. 8(a) Shows the tapering header which should be used if two or more pumps are served with one intake line. the pipe shown in FIG. 8(b) should never be used

Generally the suction line is larger than the pump suction nozzle, and eccentric reducers should be used. Eccentric reducers are not necessary for bottom suction pumps.

If the liquid supply is located below the pump centre line, the reducer should be installed with the straight side up. Most often air enters the suction pipe entrained in the liquid. Installations with a static suction lift preferably should have the inlet of the vertical suction piping submerged in the liquid to four times the piping diameter.

A large suction pipe will usually prevent the formation of vortexes or whirlpools, especially if the entrance is flared. A floating vortex breaker (raft) around the suction piping may be provided if a tendency appears for a vortex to form at the liquid surface.

A stream of liquid falling into the sump near the intake pipe will churn air into the liquid. The supply line should extend down into the sump. Liquid supply entering a well perpendicular to the intake line tends to rotate the liquid, which interferes with the flow into the suction line. A baffle placed in front of the supply pipe will remedy this situation. A short elbow should never to bolted directly to the pumps suction nozzle.

The disturbance in the flow caused by the sharp bend so near the pump inlet may result in noisy operation, loss in efficiency, and capacity, and heavy end thrust. A long sweep or long radius elbow placed as far away from the pump as practicable should be used if a bend is necessary in the suction line. If separate suction lines cannot be used for each pump, then a tapering header with Y-branches should be used.

A straight branch header should never be used. Prior to installing the pump, suction piping and pump should be inspected internally, cleaned and flushed. If a strainer is installed in the suction line, the openings in the screen must be checked and cleaned periodically. The opening must be smaller than the sphere size allowed by the impeller.The flow velocity in the suction pipe should be 1.5 to 2.5 mts /sec., for normal cases, but should not exceed 3 mts /sec

Discharge piping should be installed with check valve and gate valve, with the check valve being between the pump and the gate valve. The check valve prevents reverse flow and protects the pump from excessive backpressure. The gate valve is used to isolate the pump for maintenance, priming and starting.

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 rubbis

LUBRICATION

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

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.

FIRM	Lubricating oil for temperature up to 80°C	
	Speed up to 1500 rpm	Speed over 1500 rpm
Indian Oil	Servo system 150	Servo system 68
Hindustan Petroleum	ESSTIC 55, TERRESSO 56	ESSTIC 50 TERRESSO 52
Mobil	MOBIL VACTRA 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

TO INSTALL A CONSTANT LEVEL OILER AS BELOW:

1.Unscrew upper screw sub assembly from lower sub assembly. (Refer Fig.1)

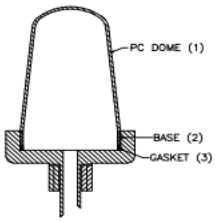


Fig.1

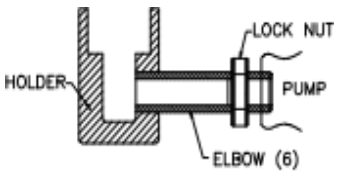


Fig.2

2.Fix lower sub assembly (elbow type) on pump.

Please note Pump has two tapings.One tapping is for CLO and other is a drain, which is at a lower height

3.Once lower sub assembly is fixed, tighten locknut to ensure that CLO is 90° with respect to ground.

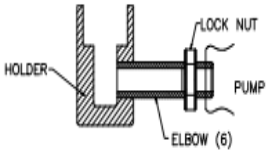


Fig.3

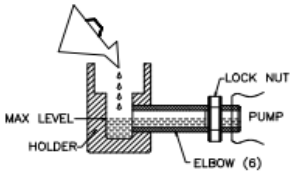


Fig.4

4.Fill oil in pump with a can. Oil should be filled either by opening breather of pump or from the lower sub assembly. (Ref. Fig.4)

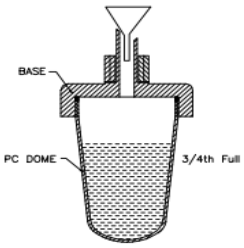
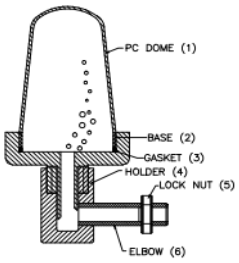
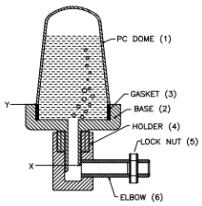


Fig.5

5.Once initial oil level is maintained in pump, take upper sub assembly, reverse, it and put it oil in dome through the hole by using a suitable funnel (3/4th full). DO NOT UNSCREW DOME from the sub assembly to fill oil. (Ref.Fig.5)



6.Once oil is filled dome, reverse and screw it on the lower sub assembly. Do not over tighten. Some bubbling will take place, this is O.K., bubbling will stop once oil has reached its level. I=i.e. (Ref.Fig.6)



7.Once bubbling has stopped ,the pump should be started .CLO will automatically maintained oil level in pump. Refill oil whenever oil level in doom goes below level Y ref.step 1,5,6.

Note:1-In case of pump is already full of oil before installing CLO, it is recommended to check oil level in sump as per step 4.

In case there is excess oil, drain it out and bring it to half the elbow overfilling oil will cause oil to overflow from above the holder resulting in oil leakage.

Note:2-Keep vent holes of breather in pump clean, if it is chocked it will cause leakage from oilcup.

STARTING AND STOPPING ; After coupling alignment and before bolting the coupling halves, check the pump direction of rotation. Pump rotation is indicated by an arrow attached to the casing assembly

STARTING

1. Pump shaft should rotate freely by hand.
2. Check the bearing lubricant
3. Open the valve in the pump suction line.
4. Close discharge valve
5. Prime the pump, If the pump operates under positive head, open vent valve on top of the pump casing till all entrained air has escaped, close the vent valves. Rotate the shaft, if possible, to allow any air trapped in the impeller passages to escape.
6. If the pump operates on a suction lift and a foot valve is included in the system, fill the pump and the suction line with liquid from an outside source. Trapped air should be allowed to escape through the vent valve while filling.
7. If the pump operates on a suction lift and no foot valve is provided, use a vacuum pump or ejector operated by air, steam, water, etc. to evacuate air from the pump case and suction line by connecting the ejector to the priming connection on top of the pump case.
8. Open valves in stuffing box seal lines, if fitted. Start driver. Open discharge valve slowly when the pump is up to speed
9. Overheating and / or loss of prime will result if the pump is operated against a closed valve for more than a few minutes.
10. The coupling guard should be in place when the unit is started. Stay clear of any exposed rotating parts while the pump is operating. Contact with rotating parts may result in injury to personnel
11. Adjust the gland packing, until there is a slight leakage from the stuffing box. Mechanical seals need no adjustment there should be no leakage.

STOPPING

The pump may be stopped with the discharge valve open without causing damage. However, in order to prevent water hammer effects, the discharge valve should be closed first.

1. Close discharge valve.
2. Stop driver.
3. Close water seal valves.
4. Close valve in the pump suction line. If danger of freezing exists, drain the pump completely.

Minimum operating Flow

All centrifugal pumps have limitations on the minimum flow at which they should be operated. The most common limitation is to avoid excessive temperature buildup in the pump because of absorption of the input power into the pumped fluid. Other less understood reasons for restrictions are:

1. Increased radial reaction at low flows in single volute casings.
2. Increased NPSHR at low flows.
3. Noisy, rough operation and possible physical damage due to internal recirculation.
4. Increased suction and discharge pulsation levels.

The size of the pump, the energy absorbed, and the liquid pumped are among the considerations in
Determining these minimum flow limitations. For example, most small pumps such as domestic home circulators, service water pumps, and chemical pumps have no limitations, except for temperature buildup considerations while many large, high horsepower pumps have limitations as high as 40-50% of the best efficiency point capacity.

SUPERVISION AND MAINTENANCE

Stuffing Box: The purpose of a stuffing box is to limit or eliminate leakage of the pump fluid and to prevent air from entering the suction spaces along the pump shaft. Pumps are equipped with packing (limited leakage) or mechanical seals (no leakage). Normally, the pumped liquid is used to lubricate the stuffing box seal. If the liquid is dirty, gritty, or contains material that would gum or jam the seal, use a sealing liquid from an external source. If suction pressure is above atmospheric pressure, seal piping may not be required. For pumps equipped with packing, there must always be a slight leakage from the glands. The amount of leakage should be 100 drops/min, but we recommend a steady dripping of liquid through the gland. Stuffing box glands should be adjusted after the pump is started. When leakage is excessive, tighten gland bolts evenly a little at a time. Allow an interval for packing to adjust to new position. Never tighten gland to be leak proof, as this will cause overheating and undue wear on shaft sleeves.

Replace stuffing box packing as follows:
1. Shutdown the pump.
2. Take precautions to prevent the driver from being inadvertently started.
3. Remove the gland bolt nuts and gland.
4. Remove and discard old packing rings – note location of lantern ring. When repacking stuffing box, lantern ring must be positioned such that the water seal connection is opposite lantern ring.
5. Clean out the stuffing box.
6. Inspect shaft sleeve for wear – if it is scored or grooved, it should be replaced.

7. Make sure the stuffing box bushing (if furnished) is set at the bottom of the box.
8. Insert rings of packing and tap lightly to seat against bushing. Be sure rings are of the proper size an length and installed with cuts staggered. Lantern ring must be installed opposite sealing water connection.
9. Install gland and tighten, finger tight. With the pump running, adjust gland as described previously. Care should be taken during the first hour of operation to take up on the
packing gradually just enough to maintain the required amount of leakage.
If the pump is operated daily, the stuffing box packing should be renewed about every two to three months before it gets hard and scores the shaft sleeves. Mechanical seals should be removed, assembled, and or adjusted according to the seal manufacturer's instructions. There should be no leakage from the gland if mechanical seals are used, except for a brief run in period.
.

Bearings:

Frequency of lubrication depends upon operating conditions and environment, therefore, lubrication intervals must be determined by experience. Lubricants need replacing only because of contamination by dirt or dust, metal particles, moisture or high temperature breakdown. Oil lubricated units are provided with constant level oilers. Bottles should be kept filled at all times so that there is a visible supply of oil. All lubricants have a tendency to deteriorate in the course of time, therefore, sooner or later it will be necessary to replace the old lubricant with new. Bearings, which are dismantled, are, of course, much more easily cleaned than bearings, which stay in assembled equipment.

Oil Re-lubrication: (pumps are shipped without oil in bearing housing)

1. Remove drain plug and allow any residue oil to completely drain.
2. Remove constant level oiler bottle and clean thoroughly.
3. Replace drain plug.
4. Fill bottle, screw it to the lower reservoir of oiler and allow oil to flow into bearing housing
reservoir. Repeat this procedure until a supply of oil remains in the bottle.

For ball bearings, the oil level should be at about the middle of the lower most ball. For ring oiled sleeve bearings, the oil level should be about 1/8 inch over the lowest point of the oil ring. Proper lubrication is essential to the pump operation. Do not operate the pump if sufficient lubricant is not present in the bearing housing of if lubricant is contaminated with excessive dirt or moisture. Operation of the unit under these conditions will lead to impaired pump performance, and possible bearing failure. Do not operate the pump with excessive amount of lubricant. Such action will cause bearings to overheat.

Wear Ring Clearance

Running fits between wear rings is given under the pump specifications. When these clearances are doubled, or the capacity of the pump is reduced by 5 to 10%, the rings should be renewed. The purpose of these rings is to keep internal bypassing of the liquid being pumped to a minimum. Clearances should be checked periodically and whenever the pump casing is opened. Check with feeler gauge or by direct measurement. Measure ID of case ring and OD of impeller ring, then compute clearance (ID minus OD).

OIL SEALS AND BEARINGS DETAILS:

PUMP TYPE	OIL SEAL		BEARINGS		PACKING
	DE	DE/NDE	DE	NDE	
ZM II 375/00	ID45XOD65X8	ID48XOD72X8-2	6309	6309	ID65XOD90X12.5-10
ZM II 440/00	ID55XOD70X8	ID60XOD75X8-2	6311	6311	ID80XOD105X12.5-10
ZM II 530/01	ID65XOD90X10	ID68XOD90X10-2	6313	7216-2	ID90XOD122X16-10
ZM II 325/05	ID65XOD90X10	ID68XOD90X10-2	6313	7216-2	ID90XOD122X16-10
ZM II 530/02	ID75XOD100X10	ID82XOD110X10-2	6315 C3	7315-2	ID102XOD134X16-12
ZM II 530/03	ID75XOD100X10	ID82XOD110X10-2	6315 C3	7315-2	ID102XOD134X16-12
ZM II 375/05	ID75XOD100X10	ID82XOD110X10-2	6315 C3	7218B-2	ID104XOD134X15-12
ZM II 630/03	ID75XOD100X10	ID82XOD110X10-2	6315 C3	7218B-2	ID102XOD134X16-10
ZM II 375/06	ID85XOD110X12	ID95XOD120X12-2	6317	7317-2	ID123XOD155X16-10
ZM II 440/07	ID100XOD120X12	ID105XOD130X12-2	NU 2220	7220-2	ID133XOD165X16-12

DISMANTLING AND ASSEMBLING

DISMANTLING PROCEDURE

1. Remove the coupling guard and disconnect coupling halves.
2. Disconnect any piping from the upper half casing that will interfere with its removal.
3. Remove the glands (Part no. 452)and the gland bolts (Part no. 902)
4. Remove the steady pin from casing.
5. Remove casing fixing bolts and the bearing housing fixing bolts from the lower casing.
5. Drain oil from the bearing housing (Part no. 350) (oil lubricated ball bearing units only).
6. Remove the outboard oil reservoir with bolting.
7. Screw jackscrews down to separate upper and lower case.

8 .Lift upper casing (Part no. 105.01) straight up until clear of the impeller.
9. Place slings around the shaft near the bearing housings and lift rotating element from
lower casing
11. Place rotating element in a clean, dry work area for necessary disassembly. Case wear Rings will be loose on assembly.

Disassembly of Rotating Element:

1. Remove the pump half coupling.
2. Detach bearing cover (Part no. 360.01&360.02) (inner & outer) and separate covers from the bearing housings.
3. Remove bearing housings (Part no. 350).
4. Remove bearing locknut and oil sleeve (Part no.923 & 652), oil ring (Part no. 644) and bearings (Part no. 320 & 321). (Oil lubricated ball bearings only).
5. Unscrew the grub screw fitted on the thrower and remove the thrower from shaft (Part no. 507).
9. Remove packing (Part no. 461), lantern ring (Part no. 458), and stuffing box bushing, if applicable the number of packing rings on either side of the lantern ring. The lantern ring must be installed opposite seal water inlet. For repair and removal of mechanical seals.
10. Loosen setscrews in sleeve nut (Part no. 921) and unscrew the nut from the shaft (Part no. 211).
11. Remove o-ring (Part no. 412) with shaft sleeves (Part no. 524) .
12. Remove casing wear rings (Part no. 502). On most pumps, casing rings may be removed before disassembling rotating element.
13. Impeller (Part no. 234) with impeller rings can now be removed from either end of the shaft. When removing the impeller, note the direction of the vanes. The impeller must be installed with the vanes in the same direction.

Remove Impeller Rings:

It is not necessary to remove the impeller from the shaft to replace the impeller rings. First remove the rotating element. Remove the locking set screws from the rings.

Inspection:

Visually inspect parts for damage affecting serviceability. Check o-rings and gaskets for cracks, nicks, or tears; packing rings for excessive compression, fraying or shredding, and embedded particles. Replace if defective in any way. Mount the shaft between lathe centers and check eccentricity throughout the entire length. Eccentricity should not exceed .002 inches. Bearing surfaces should be smooth and

shoulders square and free of nicks. Measure OD of impeller hub or impeller wear rings and ID of casing wear ring. Compute diametric clearance (ID minus OD). Examine impeller passages for cracks, dents or embedded material. Examine shaft sleeves for wear.

ZM Pump Assembly of rotor & Pump assembly:

Before assembling parts of the rotor, the bearings and the pump casing ascertain that all surfaces are absolutely clean and without any dust particles. Before mounting check that shaft runs true. Out of true must not exceed the value of 0.03 mm. The parts should be assembled in the following sequence.

1. Check the impeller vanes direction (P. no. 234) & along with wear rings fix on the shaft(P. no. 211).
2. Fix the sleeves (P. no. 524) with O-ring (P. No. 412) at the both side of impeller. Fix the sleeves nuts with hand tight (to be tightened after positioning the impeller at the bottom casing).
3. Insert the thrower and inner bearing covers along with oil seals to both the shaft ends.
4. Fix the bearing spacer and bearings on the NDE side shaft in back to back arrangement, bearing nut to be tightened on the bearing & locked with the shaft.
5. Fix the bearing on the DE side shaft and oil sleeve to be tightened with shaft (set screw available in sleeve)
6. Fix the casing wear rings in the bottom casing & Insert the bearing housings on the bearings..
7. Fix the oil rings and insert the inner & outer bearing covers (oil seal also fitted in DE side) to bearing housing.
8. The complete set of rotating assembly to be placed with bottom casing, bearing housings should be carefully placed on locating pin. Tight the bearing housing/ casing joint bolts.
9. Check the casing wear ring positions there is a locating pin available in the casing/wear ring.
10. Check the impeller position if its touch with casing then to adjust the impeller with help of sleeve lock nuts. After positioning the impeller the sleeve lock nut to be tightened along with grub screw.

11.Fix the gasket on the bottom casing , mount the top casing , fit the casing steady pin in that location. Top and bottom casing half's with help of casing joining bolts. Check the pump hand free rotation.

12.Fix the gland packing and lantern rings. After that split gland to be fitted with pump.

13.Connect the auxiliary piping and If bearing housing positioning bolts is available in the pump the special care to be taken for adjusting the complete rotor set.

When mounting the impeller part No . 234, pay attention to the direction of rotation of the entry of blade !! Shaft Sleeve part No . 524 With same position numbers in sectional drawing both part No . 921 Sleeve nuts have right-hand thread With different part numbers one impeller nut will be provided with left-hand and the other with right- hand thread.

Note: The thread of the nut of the stationary bearing side has the same direction as the direction of rotation of the shaft, when looking at the shaft against the drive side. The impeller nuts should not be tightened now Push casing wear rings with keys over impeller part No . 502 rings. Part No. 940.10 Push neck bush (optional) Part No. 456

Mechanical Seal (See Seal drawing)

Sealing Cover: First of all, the sealing covers are completely pre-assembled. This includes the installation of the cover neck bushes, the o-rings and the correct mounting of the stationary seal ring. When mounting the stationary seal rings pay attention to pins in the seal cover. If pins are incorporated, the stationary rings with their grooves and bores must be pushed carefully over these pins.When screwing on the covers make sure the leakage drain bores point downwards. Here too, the sleeve nut (or the impeller nut) must not yet be tightened and secured.

Shaft Bearings: After complete assembly of the rotor and bearings this structural unit will be inserted into the pump casing lower half (part 105.02), taking care that the half collar of the neck bushes (part 456.02) is inserted in such a way that it is not towering the gasket and that the fitting keys (part 940.10) are inserted in the grooves in the pump casing lower part. Furthermore the half collars of the neck bushes and the wear rings have to be pushed to the casing lower part up to solid fitting. Subsequently, the complete rotor will be centered by means of adjusting screws which are positioned at the casted on bearing lanterns of the casing lower part, and secured with the nuts belonging to it. Now the bearing housings are bolted to the pump lower half. Then adjust and secure the throwers (part 507). +

Adjustment of Impeller Center Position_ After completion of the assembly the impeller must be in the centre of the pump volute. This position is achieved with the aid of the sleeve nuts (part 921). After adjustment the sleeve nuts are firmely tightened on both sides and secured with keys and circlips. Tthe radial clearances between the impeller and casing wear ring (part 234 and 503) have to be checked.

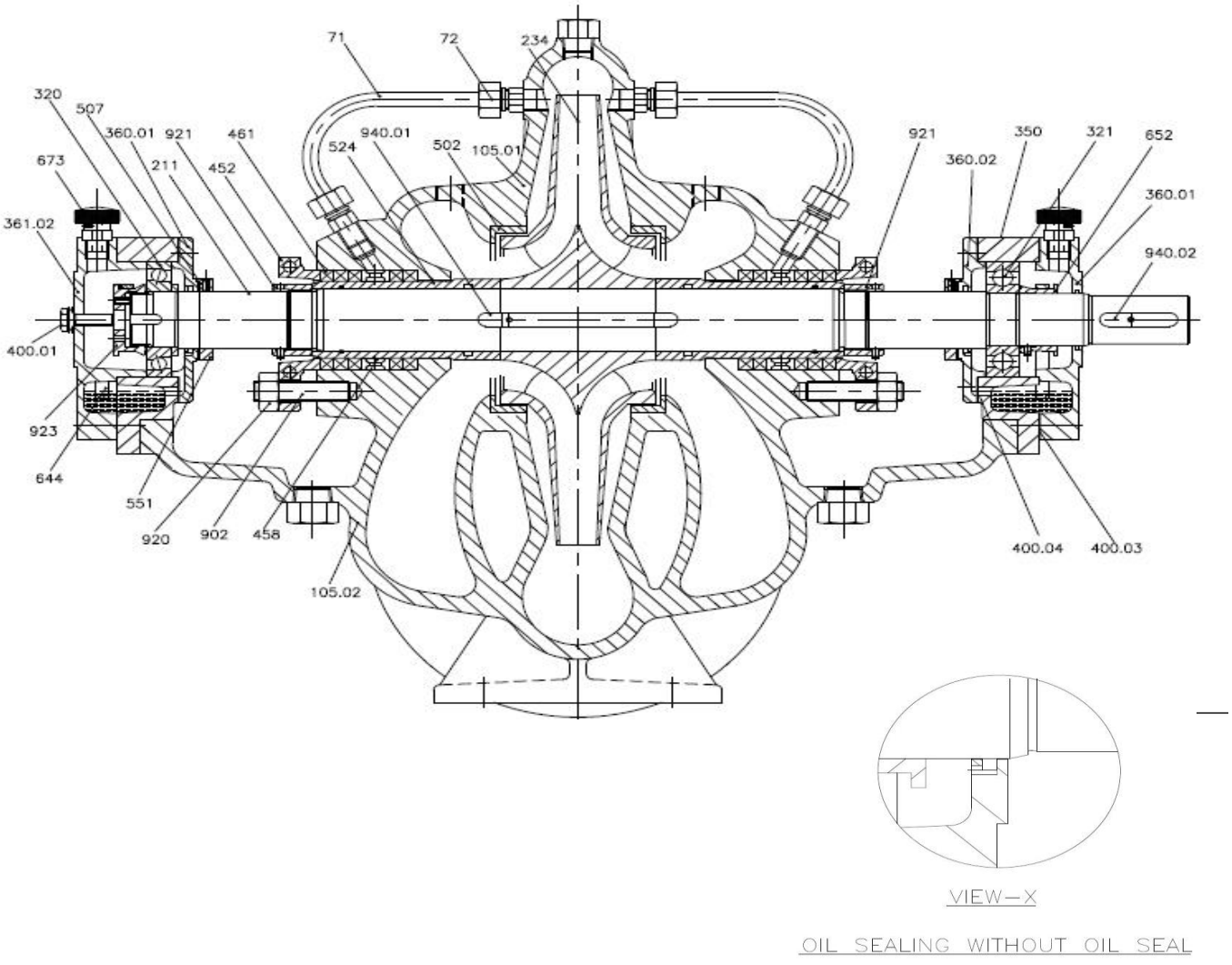
Locating of the Pump Casing Upper Half ; Prior to locating the pump casing upper half (part 105.02) the casing gasket plate (part 400.01) must be checked. It must be undamaged and clean, and its shape must conform to that of the pump casing. Any gaps must be eliminated, particularly in the areas where the gasket plate is in contact with other sealing areas, as gaps would lead to leakage within the pump casing (casing wear rings and neck bushes).For the same reason and this applies in particular to pumps with mechanical seal the front faces of the gasket plates are cut to size after the pump casing upper half has been screwed on to ensure that leakages are prevented on the gaskets of the mechanical seal covers. Generally compressed asbestos fiber gasket of 1.0 mm thickness will be provided as gasket plate.

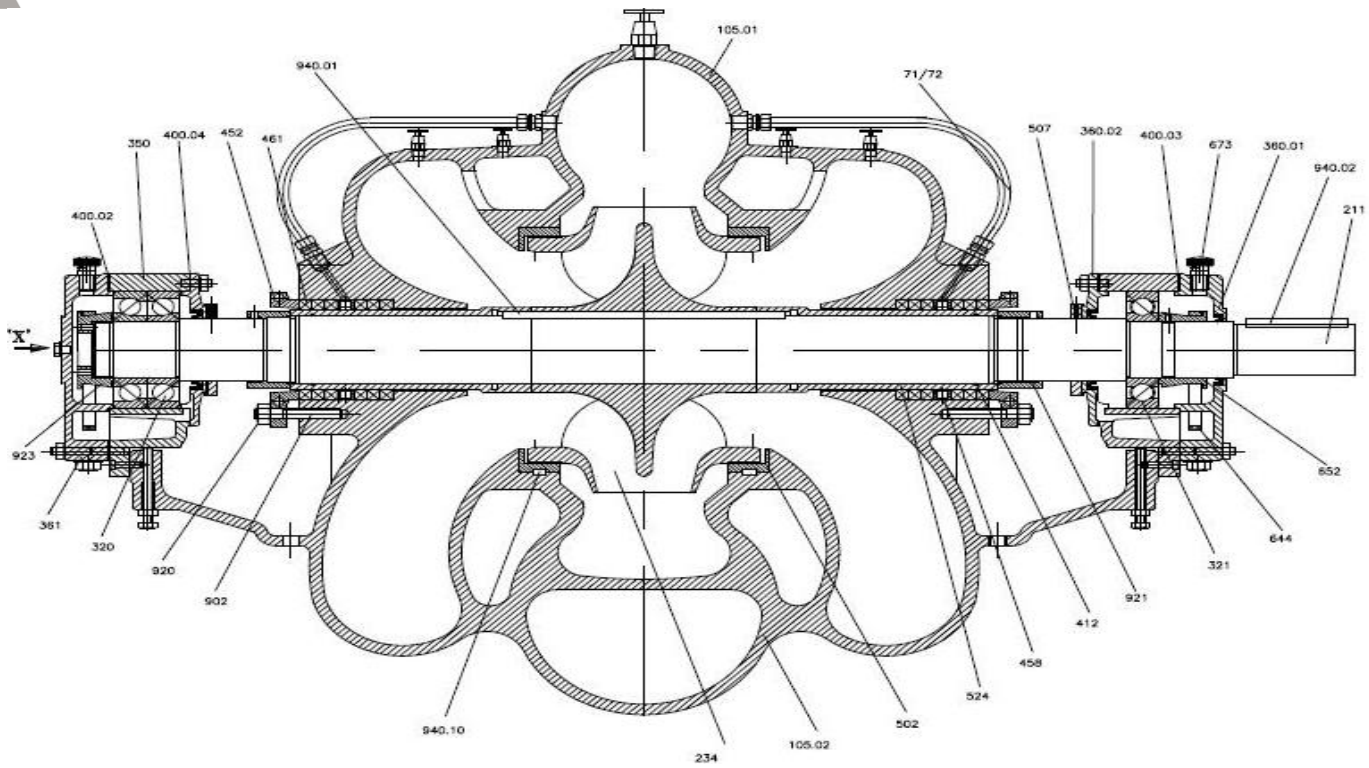
Recommended Spare Parts_ Spare parts should already be in stock at the client's for the initial startup. In order to minimize down-time we recommend to obtain one complete set of spare parts like rotor assembly, wear rings, bearings, mech. Seals and Stuffing box packing for normal operation of several pumps of the same size we recommend a minimum storage according to VDMA – rule 24 296, sheet 1.The following VDMA instructions have been based on a 2 years, continuous operation

Spare parts	Number of pumps (include Stand-by pumps)						
	2	3	4	5	6 & 7	8 & 9	10 & more
	Number of Spare Parts						
Impeller	1	1	1	2	2	3	30%
Case Wear ring	2	2	2	3	3	4	50%
Impeller wear ring	2	2	2	3	3	4	50%
Shaft with key & shaft screws or nuts	1	1	2	2	2	3	30%
Bearings	1	1	2	2	3	4	50%
Shaft Protecting sleeve	2	2	2	3	3	4	50%
Thrower	1	1	2	2	2	3	30%
Packing rings	16	16	24	24	24	32	40%
Gaskets for pump casing sets:	4	6	8	8	9	12	150%
Other gaskets sets:	4	6	8	8	9	10	100%

PART NO	PART NAME	PART NO	PART NAME
105.01/105.02	CASING (TOP & BOTTOM)	*507	THROWER
* 211	PUMP SHAFT	*524	SHAFT SLEEVE
*234	IMPELLER	*S526	CENTERING SLEEVE
*320	ANG.CON.BALL BRG	*551	BEARING SPACER
*321	BALL BEARING	638	CONSTANT LEVEL OILER
350	BEARING HOUSING	638.01	NIPPLE (FOR OILER)
*360.01	BEARING COVER-OUTER	*644	OIL RING
*360.02	BEARING COVER-INNER	652	OIL SLEEVE
*361	BEARING END COVER	673	BREATHER
*400.01	GASKET-CASING(105.01/105.02)	902	STUD-GLAND
*400.02	FLAT GASKET(361/350)	920	HEX NUT-GLAND STUD
*400.03	FLAT GASKET(360.01/350)	921	SLEEVE NUT
*400.04	FLAT GASKET(360.02/350)	923	BEARING NUT
*412	O' RING(SLEEVE)	940.01	KEY-IMPELLER
*452	GLAND	940.02	KEY-COUPLING
*458	LANTERN RING	71/72	COOLING CONNECTION ASSY
*461	GLAND PACKING	*73.01	OIL SEAL-INNER BRG.CAP
*502	CASING WEAR RING	*73.02	OIL SEAL-OUTER BRG.CAP

ZM II 440/00 , Without Oil Seal

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360.02
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211
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105.02
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412
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644
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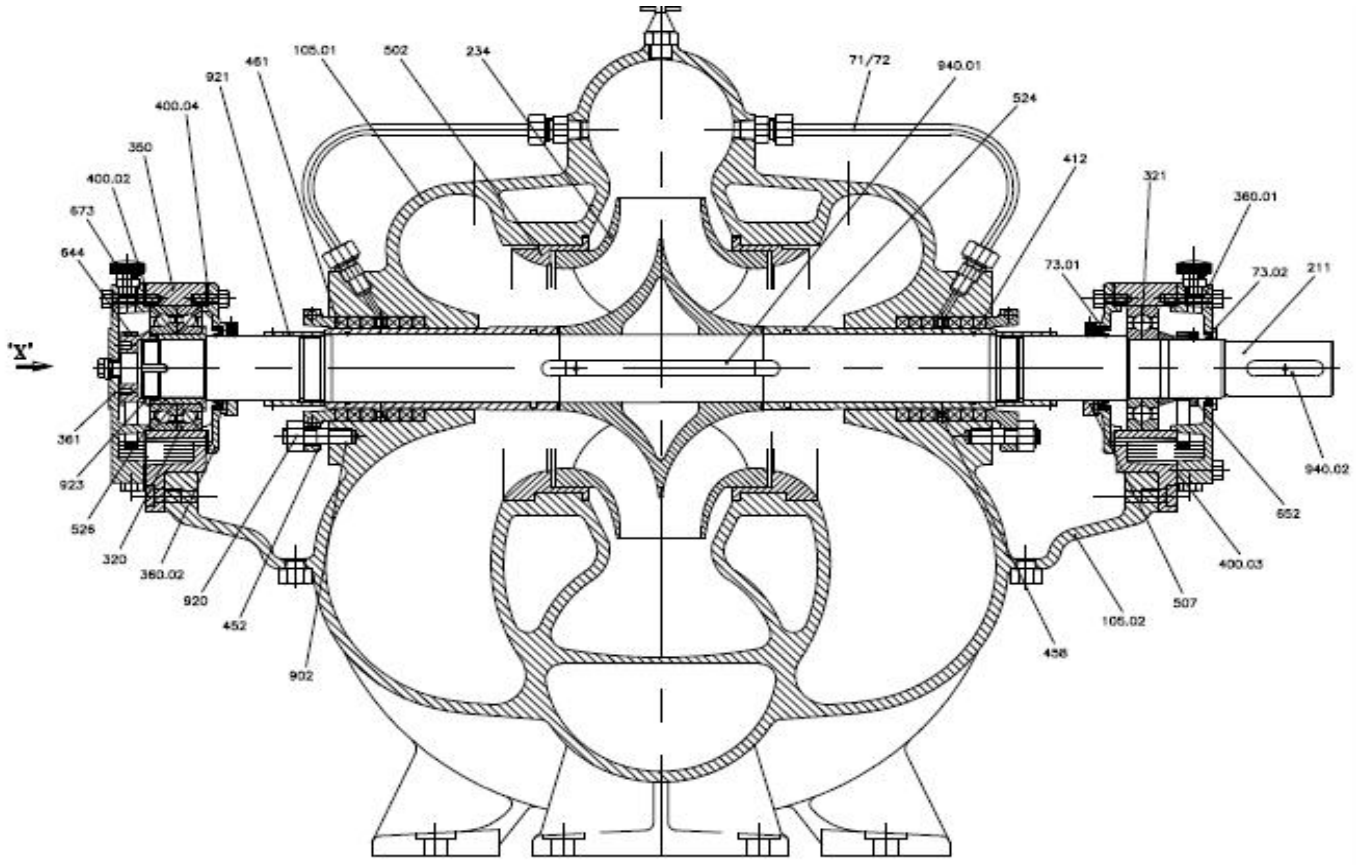
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452
902
71/72
940.01
524
412
321
360.01
73.01
73.02
211
940.02
652
400.03
507
105.02
458

ZM II 630/03

Trouble-Cause-Remedy

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

Trouble	Cause -remedy no.
Pump does not deliver	1 - 2 - 3 - 4 - 6 - 11 - 13 - 14 - 19 – 23
Capacity too small	2 - 3 - 4 - 5 - 6 - 7 - 8 - 11 - 13 - 14 - 17 - 19 - 20 - 23 - 29 - 31 – 52
Discharge pressure too small	4 - 5 - 11 - 13 - 15 - 17 - 19 - 29 – 31
Excessive power required	12 - 13 - 15 - 16 - 17 - 23 - 24 - 26 - 27 - 29 - 33 - 34 - 34 - 40 - 43 - 48 - 49 - 52
Excessive stuffing box leakage	10 - 24 - 26 - 32 - 33 - 34 - 35 - 36 - 38 - 39 - 47 – 48
Excessive stuffing box temperature	9 - 10 - 24 - 26 - 33 - 34 - 35 - 36 - 37 - 38 - 39 – 48
Excessive wear of packing or mechanical seal	9 - 10 - 24 - 26 - 28 - 32 - 33 - 34 - 35 - 36 - 37 - 38 - 39 – 48
Excessive noise or vibration of Pump	2 - 3 - 4 - 5 – 6 - 7 - 15 – 18 – 23 – 24 -25 - 26 - 27 - 28 - 31 - 35 - 36 - 40 - 42 - 43 - 44 - 46 – 49
Overheating or excessive wear of bearings	12 - 14 - 15 - 16 - 17 - 18 - 24 - 25 - 26 - 27 - 28 - 30 - 36 - 38 - 40 - 41 - 42 - 43 - 44 - 45 - 49 - 50 – 51
Overheating and seizing of pump	1 - 4 - 18 - 19 - 21 - 22 - 24 - 25 - 27 - 28 - 35 - 36 - 40 - 41 – 49

Possible Reasons for Operating Troubles

a) Hydraulic reasons

1. Pump not vented
2. Pump or suction line not completely filled with liquid
3. Suction lift too great, suction head too small
4. Insufficient margin between suction and vapour pressures

5. Excessive air on gas in the pumping liquid
6. Air pockets in suction line
7. Air inhaled into suction line
8. Air inhaled though stuffing box
9. Flushing or circulation line blocked
10. Lantern ring incorrectly located
11. Speed too low
12. Speed too high
13. Incorrect direction of rotation
14. Total head of the system greater than specified
15. Total head than specified
16. Specific gravity of liquid different from specified value
17. Actual viscosity differs from specified value
18. Operation at too low capacity
19. Pumps are unsuitable for parallel operation
20. Strainer blocked
21. Actual temperature of fluid differs from specified value
22. Too fast temperature changes

b) Mechanical reasons

23. Foreign bodies in the impeller
24. Incorrect alignment
25. Foundation block too weak
26. Bent shaft
27. Rubbing of rotating parts on fixed parts
28. Worn bearings
29. Worn wear rings, distance sleeves and throat bushes
30. Wrong design of suction line, leading to asymmetrical flow or vortexing

31. Impeller damaged
32. Shaft sleeve worn
33. Incorrectly installed packing
34. Incorrect packing type installed
35. Non concentric running of rotor due to bearing wear or incorrect alignment
36. Rotor not properly balanced
37. Stuffing box pulled up too tightly
38. Insufficient cooling
39. Dirt or grit in sealing, flushing or circulating fluids
40. Excessive thrust
41. Excessive oil in bearing housing, blocking oil passages
42. Defective lubrication
43. Bearings incorrectly installed or damaged during installation
44. Dirt in bearings or lubrication system
45. Access of water into the bearings
46. Difficulties arising from the pump driver
47. Sealing rings of mechanical seal damaged
48. Incorrectly adjusted mechanical seal, wrong spring tension
49. Incorrectly installed rotor, shaft nuts loose
50. Unsuitable lubricant
51. Oil level too low
52. Inner leaking due to damaged sealing.