‘MD’ & ‘MDP’ - MULTI STAGE PUMP

OPERATION AND MAINTANANCE 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

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 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.

GENERAL

Multistage pumps have a horizontal, barrel type construction with an axial thrust. Hence, it is suitable boiler feed water service, condensate extraction and for general water and fire-fighting systems.

The complete range of MD pumps are covered by 4 power series and MDP pumps are covered by 2 power series , thereby reducing inventory and maximum interchangeability of pump parts.

Pumps when properly installed and given proper care-in operation and maintenance should operate satisfactory for a long period.

FORWARD AND GUARANTEE:

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

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 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 too-ring/gaskets.

  .

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 name plate / ordering spare parts/spare parts list

Every 'SAM' pump has a name plate giving following detail
Pump Type
Serial Number / Year
Duty Conditions (Head & Capacity)
Motor Details (KW & RPM)

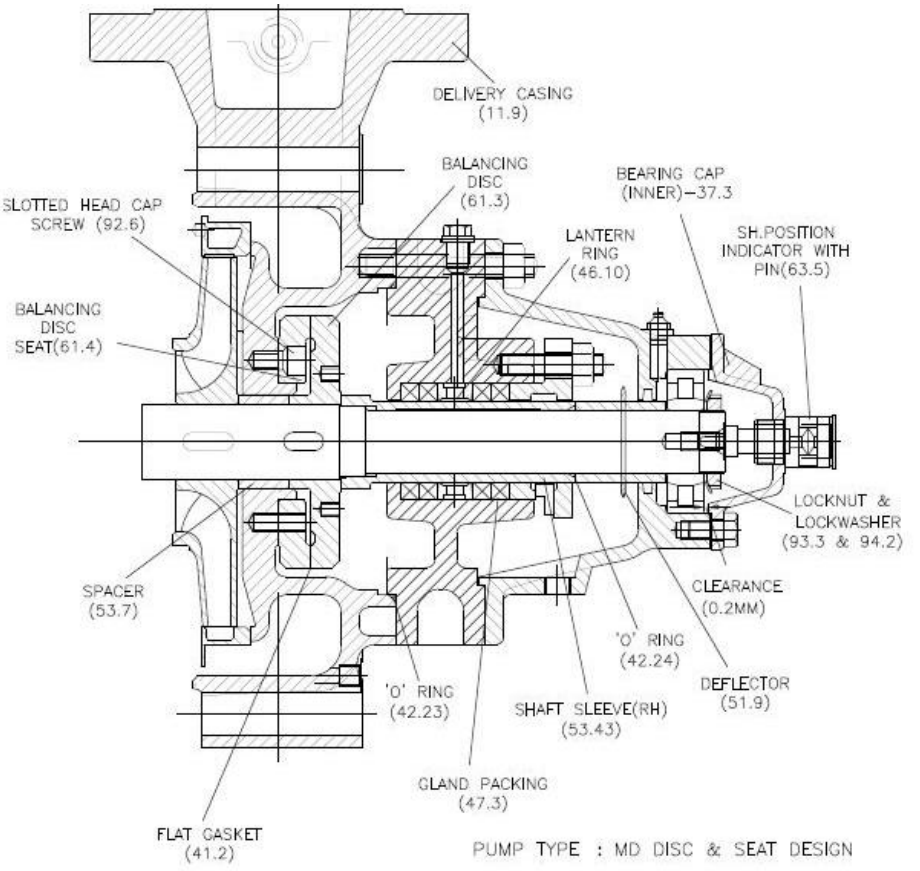
While you correspond with us for your requirements of spare parts or any technical information, please always quote the above details in your letter.

Constructional Feature

SAM 'MD' and 'MDP' high pressure centrifugal pump's Impellers are of Single entry type and impellers are fitted 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 employ a special device at the delivery end.

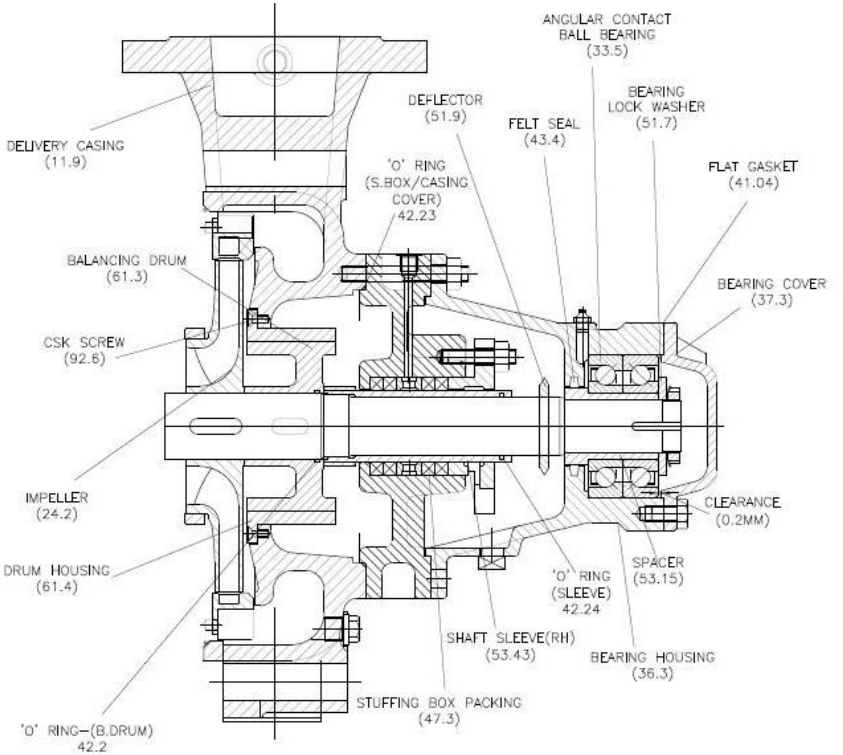
The pumps are available for the capacity range of 10m3/hr to 550 m3/hr and for differential head up to 400meters. Standard design will be suitable for temperature up to 105ºc

Balancing disc & seat design - Balancing Disc (61.3) secured on the shaft and disc seat (61.4) is fixed with delivery casing, during operation, pump delivery pressure is exerted on the balancing disc and moves towards opposite direction of pump suction side and thus axial thrust is neutralized. Roller bearings are fitted at DE & NDE side, during startup, shaft will have oscillation till the pump achieves design delivery pressure. To check shaft operating position (p.no-63.5) SH.position indicator with pin is fitted at NDE side shaft end.



During operation of the pump, the delivery pressure creates gap to pass the pumping liquid flow in between Disc & seat, if pressure varies there is a chances of Disc & seat rubbing and unbalancing of thrust hence it is mandatory to operate in design pressure.

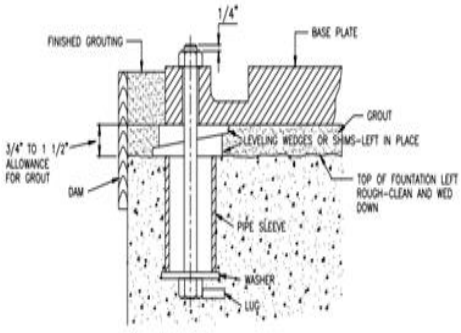
Balancing Drum design - Balancing Drum (61.3) secured on the shaft with limited radial clearance. This balancing drum rotates with close clearance inside the Drum housing (61.4), which is fixed in the delivery casing. During operation, pump delivery pressure is exerted in the cavity of drum and moves towards opposite direction of pump suction. shaft movement is locked by the angular contact bearing fitted at NDE side of the pump.



PUMP TYPE : MD DRUM DESIGN

ERECTING THE PUMP:

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.



TYPICAL FOUNTATION BOLT DESIGN

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 to prevent air and moisture form coming in contact with the grout.

Assembling the set of base plate

If the assembly of the pump with the motor is done on a common base plate 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 motor must never be used to lift the complete set as meant to carry the weight of the motor only.

If you furnish the motor yourselves, the clearance between the motor and pump coupling halves as shown on the arrangement drawing must be strictly absorbed. Difference in level between the shaft centre lines of pump and motor must be equalized by suitable packing (Plane parallel shims) when the pump and motor holding-down bolts are finally secured, care must be taken to avoid distortion.

Leveling the base plate & aligning the couplings:

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 bolts 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 bolts holes with bolts inserted-with a quick-setting cement compound. After the grout has set, tightened the nuts crosswise. Check once again the alignment with a sprit level.

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 0.05 mm . The radial alignment is achieved by dial gauges, the permissible tolerance being 0.05mm provided that the type of coupling is such as to allow this check. Otherwise a coupling aligner must be used, permissible tolerance 0.05mm

When the coupling is Pin and Bush type, a gap of 3 to 5 mm should be left between the two halves. 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.

LAYING & CONNECTING PIPES

After grouting the base plate, the pipe work may be connected. The diameters of the piping are not determined by those of the pump and suction branches. On short delivery pipe runs the diameter should be such that the pipe resistance constitutes, but a small portion of the delivery head. For long pipe runs the most economic pipe diameter must be assessed in each particular case. The flow velocity in the suction piping should be 1.5 to 2.5 mts / sec., for normal cases but should not exceed 3 meters/sec.

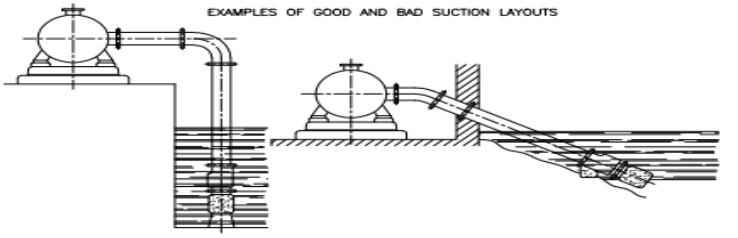
Once the flange bolts have been loosened, the flanges must not yield more than the amount corresponding to the gasket thickness, nor must they be out of the parallel nor bear against each other under stress. See that the flange gaskets do not extend into the bore of the piping. Clean carefully all pipe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

Suction and Feed Line:

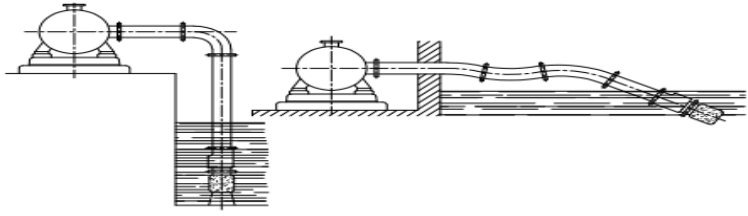
The Suction pipe should be as short as possible and when dealing with cold liquids the total suction lift (including friction) should not normally exceed 15 feet. An arrangement of suction pipe work which is common to two or more pumps operating on a suction lift is not recommended. The inlet bore of the suction pipe should be set as deeply as possible below liquid level and be provided with a foot valve fitted with a suction strainer. The foot valve must, however, be far enough away from the bottom to avoid inlet losses becoming too great and thereby lowering the performance. The isolating valves in the suction or feed line must remain fully open during the operation and must never be used for regulating, The following precautions should be take 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.

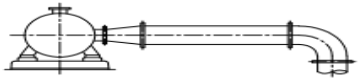
4. The suction pipe work must be fully supported so that the suction flange should not carry any weight. The typical good and bad alignments are shown in Fig.No.7



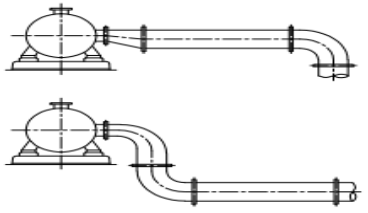
GOOD SUCTION LAYOUTS, SHOWING PIPES RISING ALL THE WAY TO THE PUMP



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 AN THE LEFT MAY BE AVOIDED

FIGURE NO : 7

Delivery Line:

Install gate valve or an output control valve in the delivery line as close to the pump branch as possible. it is recommended to install a non-return valve between pump branch and regulating valve, thus protecting the pump against reverse rotation and furthermore the pump and the foot valve against water- hammer which may occur in case of sudden shut-down. Pressure Gauge to be fitted in between volute casing delivery flange and NRV /valve.

Relief check valve:

The power requirement of the pump do not decrease lineally with fall in the rate of flow, and even relatively high when Q is zero. In this case whatever the power absorbed will converted into heat energy, which will lead to vaporization 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 vaporization 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 in a delivery branch. The valve automatically opens when the flow is reduced to a safety minimum.

ATTENTION: It is essential that no strain is put on the pump casing by the pipe works; such strain may be caused by the weight of the pipes or by the tightening up of badly fitting pipes. Hence after connecting up the piping, the coupling alignment must be rechecked. It must be possible to turn the rotor easily by hand. In case of inadequate alignment, the bearings, coupling, shaft seal and impeller wear ring may get damaged prematurely. In accordance with safety prescriptions the coupling must be protected with a guard against contact.

Sealing Liquid Lines:

SAM 'MD' &'MDP' Pumps are provided with conventional Gland Packing with Lantern Ring arrangement depends on the pressure, temperature and nature of the liquid being pumped. The purpose of shaft seal is to prevent the entry of high pressure liquid through the gap between the shaft and the casing or the entry of air if the interior of the pump is less than atmospheric pressure Cooling Water Lines : 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 Manufacturer.

LUBRICATION: The bearings have been lubricated before shipment,

The following specification greases are available in the market

Firm Name	Speed 1450 rpm	Speed 2900 rpm
INDIAN OIL	SERVOGEM 3	SERVOGEM 2
CALTEX	STARFAK 3	STARFAK 2
HINDUSTAN PETROLEUM	NATRA 3 or LITHON 3	NATRA 2 or LITHON 2

In the case of new bearings, renew the grease after about 200 hours and then about once a year, if the bearing temperature is always below 50°C and there is only small risk of contamination. If the bearing temperature is up to 80°C and if there is danger of contamination, the grease should be renewed about every six months.

AMOUNT OF GREASE IN BEARING HOUSING			
TYPE	**QTY**	**LUB INTERVAL/hr**	**SPEED (rpm)**
80/205	15 Gms	1200	1500
100/250	20 Gms	500	3000
125/305	25 Gms	1100	1500
		400	3000
150/400	30 Gms	1000	1500

STARTING AND STOPPING

Starting-up: Direction of rotation: Clock wise from the driven end.

When pumping from a tank, the liquid level must always be well above the inlet opening. The parameter as indicated on the pump nameplate must not be exceeded while operating. Before starting 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.

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. Check up the grease. Checkup whether the stuffing box packing is over tightened or not. If water cooling is provided, the outlet temperature must be checked. A difference of 20°F=10°C between inlet and outlet is acceptable.

The isolating valve in the feed line should be fully open. The regulating valve in the delivery line, however, should be closed, or in the case of automatic operation, the full back pressure should be on the non-return valve. Make sure that there is a flow in the pipes supplying the external sealing liquid,

the cooling water for the shaft seal and, if required, the cooling water for the oil bath. Do not switch on motor until then. If the delivery pressure does not rise continuously as speed increases, stop the set and prime once more carefully.

Once the pump has run up to working speed, open the regulating valve in the delivery line slowly until the required service data are reached. Prolonged operating against closed regulating valve in the delivery line may lead to destruction of the internal pump parts and must therefore be avoided. An alteration of the service data which might become necessary may be effected only with the aid of regulating valve in the delivery line. 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 (non-return flap, non- return valve, etc) close the regulating valve in the delivery line. Do not switch off motor until then. Close isolating valve in the feed line only if necessary. Once the pump has completely cooled down, shut off the external sealing and cooling Water supply. If pump draws from a vacuum tank, close vacuum equalizing pipe. However, do not shut off the sealing liquid supply.

If a vacuum gauge without relief valve is attached to the suction branch of the pump, then it must be isolated before stopping the pump set. If as a result of prolonged shut-down a change in the concentration of the liquid, crystallization, or solidification etc., can be anticipated, drain pump and, if necessary, flush with a suitable liquid. If there is danger freezing up during prolonged shut-down periods (e.g. where the pump set is located in the open) the pump including the cooling chamber, heating chamber, etc., must be drained.

Re-Starting: Before-starting the set, take care that the pump shaft is at rest and does not rotate backwards. Starting with the shaft rotating in opposite direction may lead to shaft damage. Maximum allowable bearing temperature 80^{o} c

SUPERVISION AND MAINTENANCE

Repacking- 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 100°C. When the temperature is above 100°C, a specially designed Stuffing Box with the provision of Cooling Jacket is also available

When a new pump is being put into service It is recommended that the stuffing boxes are re-packed periodically without waiting for a complete collapse of the packing. Most packing deteriorate 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**.**

watch the packing performance more closely than normal. For the checking, shut off the cooling water to the gland (if applicable).During the first hours, the stuffing box is allowed to leak quite a good deal, about 100 drops a minute. If the leakage decreases, slacken the packing gland. If you want to reduce the leakage, tighten the packing stepwise at intervals of about 10 minutes and continue until the packing performance is satisfactory. . A suitable leakage is 100 drops a minute should be allowed from the stuffing box for ascertainment of lubrication and of the correct packing tightness. see that the water channels are clear and the shaft is free of warpage and score marks. When selecting the packing type, observe the quality and temperature of the liquid being pumped and the shaft sleeve material. Carefully form the packing into the right ring shape over the shaft sleeve. Note the location of the lantern ring.

Stuffing box cooling:

If a liquid being pumped evaporates at the pumping, then Temperature the stuffing box should be cooled. This prevents the packing from running dry due to the evaporation of the liquid handled. For location of the cooling water connections, see arrangement drg. The regulation valve, which should be placed in the outlet line, is to beset in such a manner that the heating up of the cooling water does not exceed 15°C.

Mechanical Seal:

Concerning the pumps fitted with a mechanical seal, we refer the special instructions for installation, provided by seal manufacturers. The life of a mechanical seal depends on various factors such as cleanliness of the liquid handled, its lubricating properties etc., Due to diversity of operating conditions it is, however, not mechanical seal, even for a few seconds, must be avoided, never operate the pump without liquid.

When renewing or changing the mechanical seal, check pump shaft for true running and take care that the shaft sleeve surface is in perfect condition in the area of the mechanical seal. For more particulars please see the instructions for installation and maintenance of mechanical seals given by the concerned seal manufacturers.

If the shaft seal is to be converted from packing to mechanical seal at a later date, this is feasible for a fair number of standard mechanical seals without re-machining the stuffing box chamber. Shaft sleeve and the gland (suitable to the seal to be installed by you) along are to replaced. These can ordered with us as extra components, giving complete details about the mechanical seal you propose to install.

Flushing of the Mechanical Seal:

When the temperature of the liquid handled is in the vicinity of the boiling point it is recomanded to provide flushing line to seal to avoid damage due to evaporation of the liquid between the rotary seal faces and If abrasive particles can get to the seal faces. The smaller the particles the easier it is for them to get lodged between the contact faces. This will destroy the faces and lead to breakdown of the seal. The flushing is achieved by means of circulating line (Self- flushing) or through an external flushing system (external flushing). To regulate the flushing liquid a throttling element (e.g. a flow controller) can be installed in the circulating line. The required pressure of the external flushing liquid depends on the type of pump and service conditions.

BRG/GLD PACKING/O RING/GASKET/COOLING WATER FLOW DETAILS

PUMP SIZE	MD 80	MD 100	MD 125	MD 150
SHAFT EXTN	ø30 X 80L	ø36 X 80L	ø45 X 145L	
GLAND PACKING	ID45 X OD65 X 10Sq.	ID55 X OD75 X 10Sq	ID75 X OD105 X 15Sq.	ID84.6XOD 115X 16.SQ
No of Packings	5 rings.	5 rings.	6 rings.	6 RINGS
COOLING.CON	1/4" BSP	1/4" BSP	1/2" BSP	½" BSP
COOLING WATER	0.5	0.5	1.0 M3/Hr	1.0 M3/HR
'O' Ring				
p.no-42.24	ID35xø2	ID45xø3	ID56xø4	ID35xø3
p.no-42.23	ID170xø3	ID210xø3	ID250xø4	ID315xø4
p.no-42.4	ID250xø3	ID330xø4	ID380xø4	ID 70xø3
GASKET				
P.NO-41.03	80x120x0.3	91x128x0.4	110x160x0.3	131x181x0.4
BEARING				
D.E	N 307	N 308	N 310	N 312
N.D.E (drum design)	7310-2nos	7310-2nos	7312- 2nos	

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 special shaft sleeves

Part name & number	Clearance in New condition	Permissible Wear
Impeller 24.2 / Wear Ring 51.4	0.3	1.2
Balancing Drum 61.3 / Drum Housing 61.4	0.3	0.7
Spacing Sleeve 53.4 / Sleeve Suction Side 55.4	0.3	1.7
Drum Housing / Balancing Drum	0.2	0.4

(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 seal and it is specially adopted to the duty, the Impellers and spacers may be of Carbon Steel, stainless Steel, Bronze, chrome steel depending on the nature of the fluid being pump.

DISMANTLING AND ASSEMBLING:

Preparations

- Make sure that the motor cannot be started
- Close the suction and discharge valves, open bottom tap of the casing
- Disconnect the seal water and cooling water pipes
- Detach the coupling guard
- Remove the couplings

DISMANTLING AND REASSEMBLY

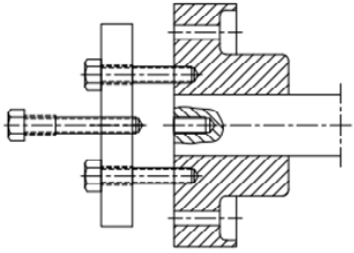
The pump should not be dismantled for inspection or renewal of the internal components except by trained staff or by one of our expert erectors. The following directions apply to pumps with conventional stuffing boxes and anti-friction bearings as shown in the sectional drawing enclosed in the end of the manual.

Dismantling of MD (Disc & Seat) Pumps:

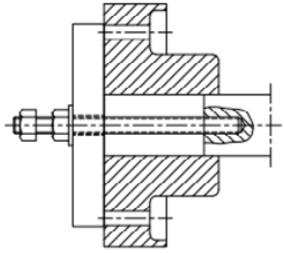
Dismantling is to begin from the discharge side after disconnecting all piping's. The procedure should be as follows.

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
6. Remove the delivery casing 11.9 and the diffuser 18.3
7. Remove the impellers 24.2, stage casings 11.10 with their diffusers 18.3 and spacers 53.3 & 53.4 for each stage
8. Finally dismantle the suction side bearing housing, stuffing box housing and coupling.



TOOL FOR REMOVING HAIF COUPLING



TOOL FOR MOUNTING HAIF COUPLING

Dismantling of MD (Drum) pumps:

1. Dismantling is to begin from the discharge side. The procedure should be as follows.
2. Remove the discharge side bearing cover (37.3).
3. Remove the discharge side bearing housing 36.3, Lock nut, Lock washer and spacer. Using the Two forcing screws on the bearing housing, withdraw Bearing housing (36.3) along with Bearing Sleeve (53.15). Remove the bearings. Then remove the stuffing box (46.3) along with the gland (46.4).
4. Unscrew the shaft sleeve 53.43.
5. Remove the balancing drum 61.3.
6. Take off nuts of Tie-bolts 93.04.
7. Remove the delivery casing 11.9 and the diffuser 18.3.
8. Remove the Impellers 24.2, stage casings 11.10 with their diffusers 18.3 and spacers 53.7 for each stage.
9. Finally dismantle the suction side bearing housing, stuffing box housing and coupling.

A hammer must never be used to drive off the couplings balancing drum, stage casings, impellers, diffusers and spacing sleeves, since this will result in damage to these components.
After the dismantling has been 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 re-assembled and properly mounted on the bed plate before being dispatched. The makers should be consulted before hand.

Assembling of MD – Disc & Drum design

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

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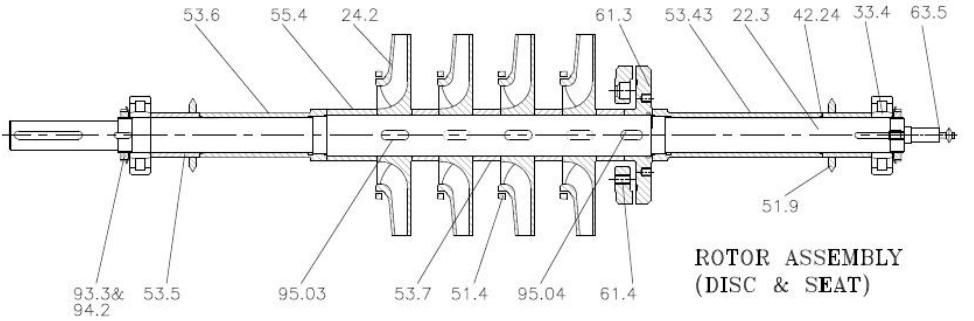
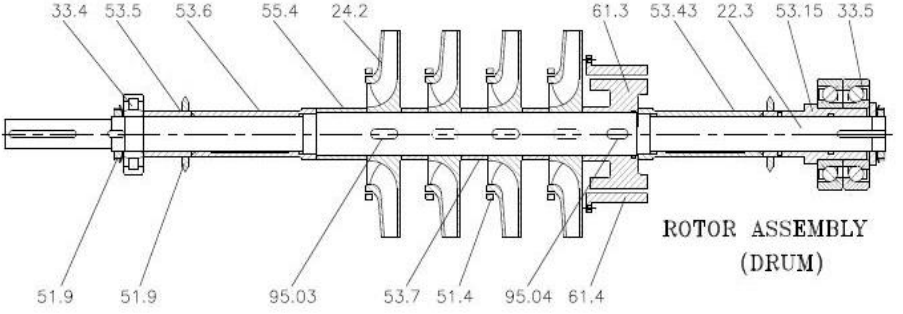


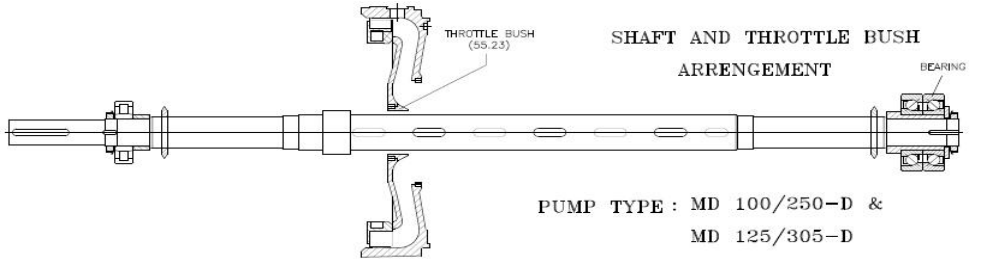
ROTOR ASSEMBLY
(DISC & SEAT)

53.5	SPACER
53.6	SHAFT SLEEVE (L.H) D.E
55.4	SLEEVE (SUCTION SIDE)
24.2	IMPELLER
61.3	BALANCING DISC
53.43	SHAFT SLEEVE (R.H) N.D.E
22.3	PUMP SHAFT
42.24	'O' RING
51.4	WEAR RING
95.03	KEY (IMPELLER)
53.7	SPACER
95.04	KEY (BALANCING DISC)
33.4	CYLINDRICAL ROLLER BRG
63.5	SH.POSITION INDICATOR PIN
93.3 & 94.2	LOCKNUT & LOCKWASHER
51.9	DEFLECTOR
61.4	BALANCING DISC SEAT



ROTOR ASSEMBLY
(DRUM)

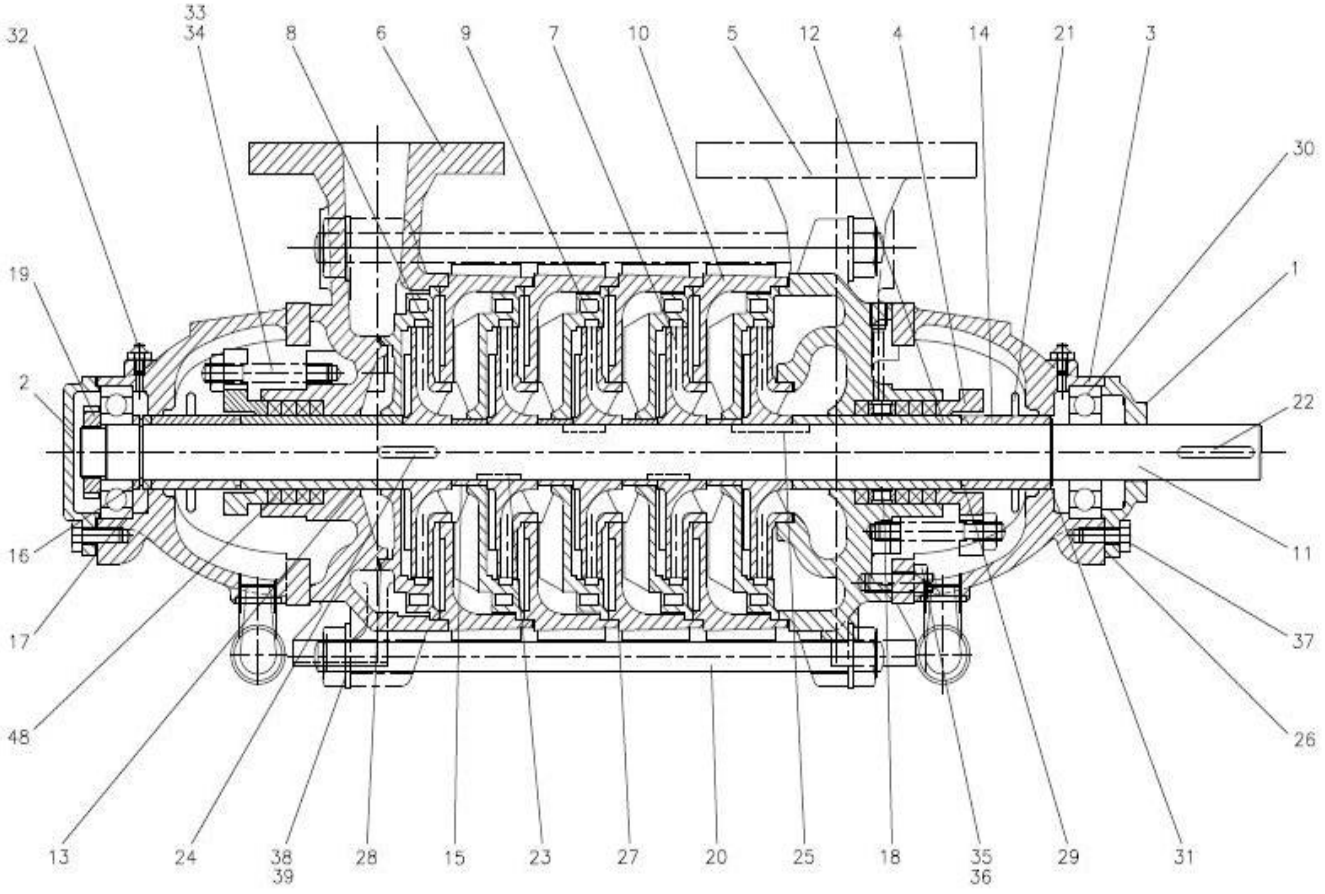
53.5	SPACER
53.6	SHAFT SLEEVE (L.H) D.E
55.4	SLEEVE (SUCTION SIDE)
24.2	IMPELLER
61.3	BALANCING DRUM
53.43	SHAFT SLEEVE (R.H) N.D.E
22.3	PUMP SHAFT
53.15	BEARING SLEEVE
51.4	WEAR RING
95.03	KEY (IMPELLER)
53.7	SPACER
95.04	KEY (BALANCING DRUM)
61.4	DRUM HOUSING
33.4	CYLINDRICAL ROLLER BRG
33.5	ANGULAR CONT. BEARING
93.3 & 94.2	LOCKNUT & LOCKWASHER
51.9	DEFLECTOR



Bill of material for- MDP 40/135:

C.No	Part name	Qty		C.No	Part name	Qty
1	Bearing cap (DE)	1		21	Deflector	2
2	Bearing cap (NDE)	1		22	Key (Coupling)	1
3	Bearing bracket	2		23	Key(Impeller)	n-2
4	Gland	2		24	Key (Spacer-last stage)	1
5	Suction casing	1		25	Key (Sleeve)	1
6	Delivery casing	1		26	Gasket (Bearing cap)	2
7	Impeller	n		27	Gasket (Stage casing)	n
8	Diffuser (Last stage)	1		28	O-Ring (Diff/D.casing)	1
9	Diffuser	n-1		29	O-Ring (Shaft/ D.Bush))	2
10	Stage casing	n-1		30	Bearing (S.R.D.Groove ball 6306)	2
11	Shaft	1		31	Circlip	2
12	Shaft sleeve (S.side)	1		32	Grease nipple	2
13	Shaft sleeve (D.side)	1		33	Stud (Gland/casing)	4
14	Distance bush	2		34	Hex.nut(Gland /Casing)	4
15	Spacer (Impeller)	n-1		35	Stud (B.Housing/ Casing)	8
16	Spacer (Bearing)	1		36	Hex. Nut (B.Housing/casing)	8
17	Spacing collar	1		37	Hex screw (B.Caps/B.Hsg)	6
18	Lantern ring	1		38	Washer (Tie bolts)	8
19	Grooved nut	1		39	Hex.Nut (Tie bolt)	8
20	Tie bolt	4		40	Packing (St.Box)	8

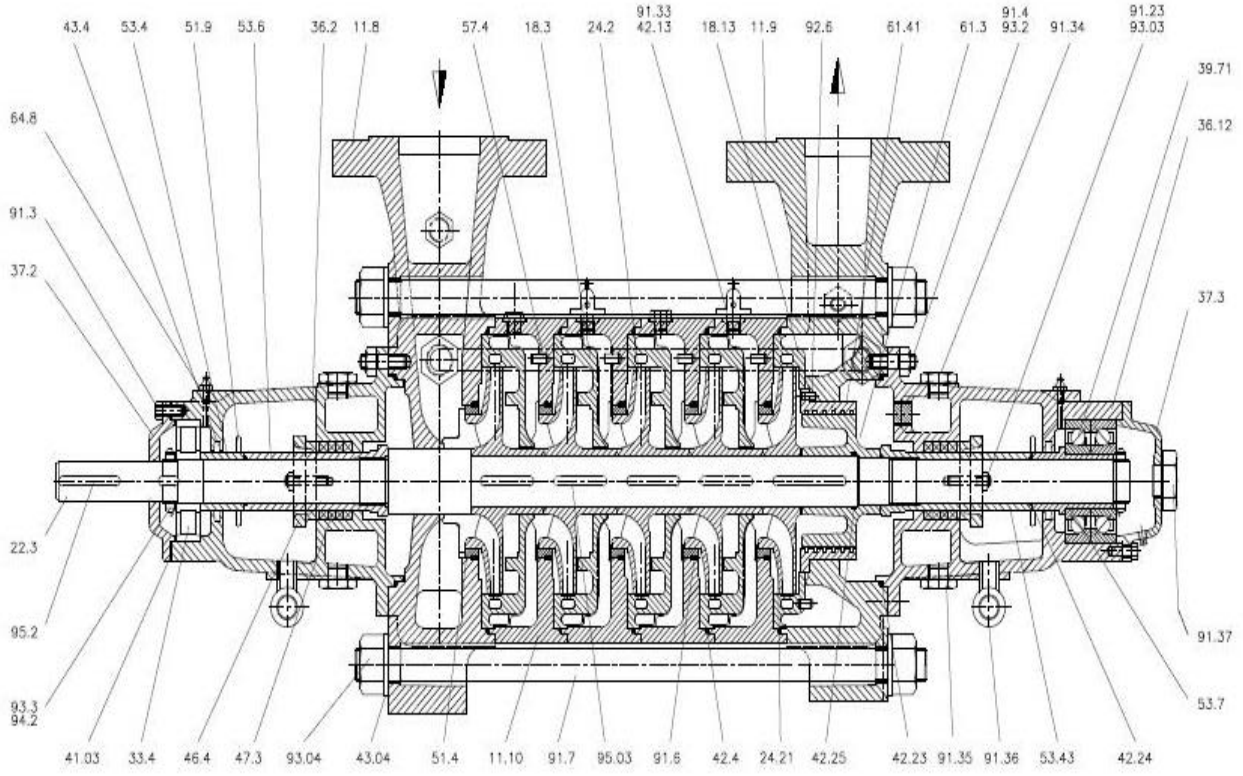
Note –n –No of stages



PUMP TYPE : MDP 40/135

Bill of material of MDP 65/185

C. no	Part name	Qty	C. no	Part name	Qty
11.8	Suction casing	1	64.8	Grease nipple	2
11.9	Delivery casing	1	91.3	Hex.screw (Brg.cap)	6
11.1	Stage casing	n-1	91.7	Tie bolt	8
18.3	Diffuser	n-1	93.3	Grooved nut	1+1
18.13	Diffuser (Last stage)	1	94.2	Loch washer	1+1
22.3	Pump shaft	1	93.4	Hex.Nut(Tie bolt)	16
22.4	Impeller	n-1	43.04	Washer (Tie bolts)	16
22.21	Impeller (Last stage)	1	95.2	Key (Coupling)	1
51.4	Wear ring	n	95.03	Key (Impeller)	n
33.4	Bearing (Cyld.roller)	1	51.9	Deflector	2
39.71	Ang.cont.ball. Bearing	2	41.03	Flat gasket	2
61.41	Drum housing	1	91.6	Soct.hd. grub screw	n
61.43	Balancing drum	1	92.6	Soc.hd.grub screw	3
36.2	Bearing housing (DE)	1	91.23	Stud (Glnd/brg.hsg)	4
36.12	Bearing housing (NDE)	1	91.33	Aircock / Screw Plug	n-1
37.2	Bearing cover (DE)	1	91.34	Srew plug(Colg.inlet)	2
37.3	Bearing cover (NDE)	1	91.35	Srew. plug(Colg.outlet)	2
42.4	O-Ring (Stage casing)	n-1	91.36	Drain elbow	2
42.23	O-Ring(Casing/Brg.Hsg)	2	91.37	Plug(Brg cap dl.side)	1
42.24	O-Ring(Sleeve/Spacer)	2	93.03	Hex nut	4
42.25	O-Ring (Sleeve/Drum)	1	42.13	Sealing washer	n-1
46.4	Gland	4	91.4	Stud	12
47.3	Packing -set	2	93.2	Hex nut	12
53.6	Shaft sleeve (LT)	1	61.3	Balancing Disc	1
53.43	Shaft sleeve (RT)	1	61.4	Disc Seat	1
53.4/ 53.7	Spacer (Bearing)	1+1	41.2	Flat Gasket (Bal.Disc)	1
63.5	Indicator	1	57.4	Cylindrical pin	n-1
63.6	Indicator Pin	1	**Note:** n- No of stages		

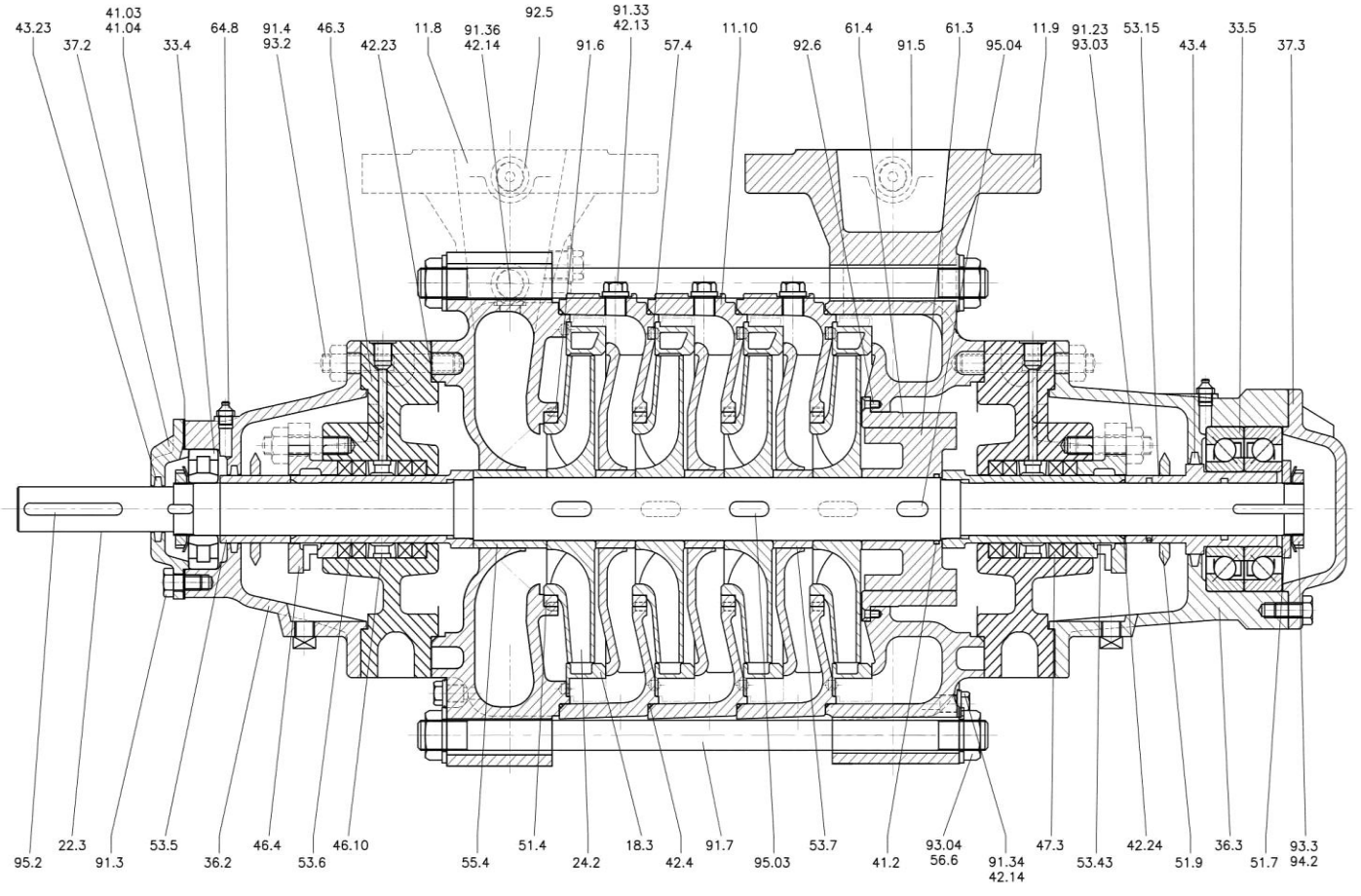


PUMP TYPE : MDP 65/185-D

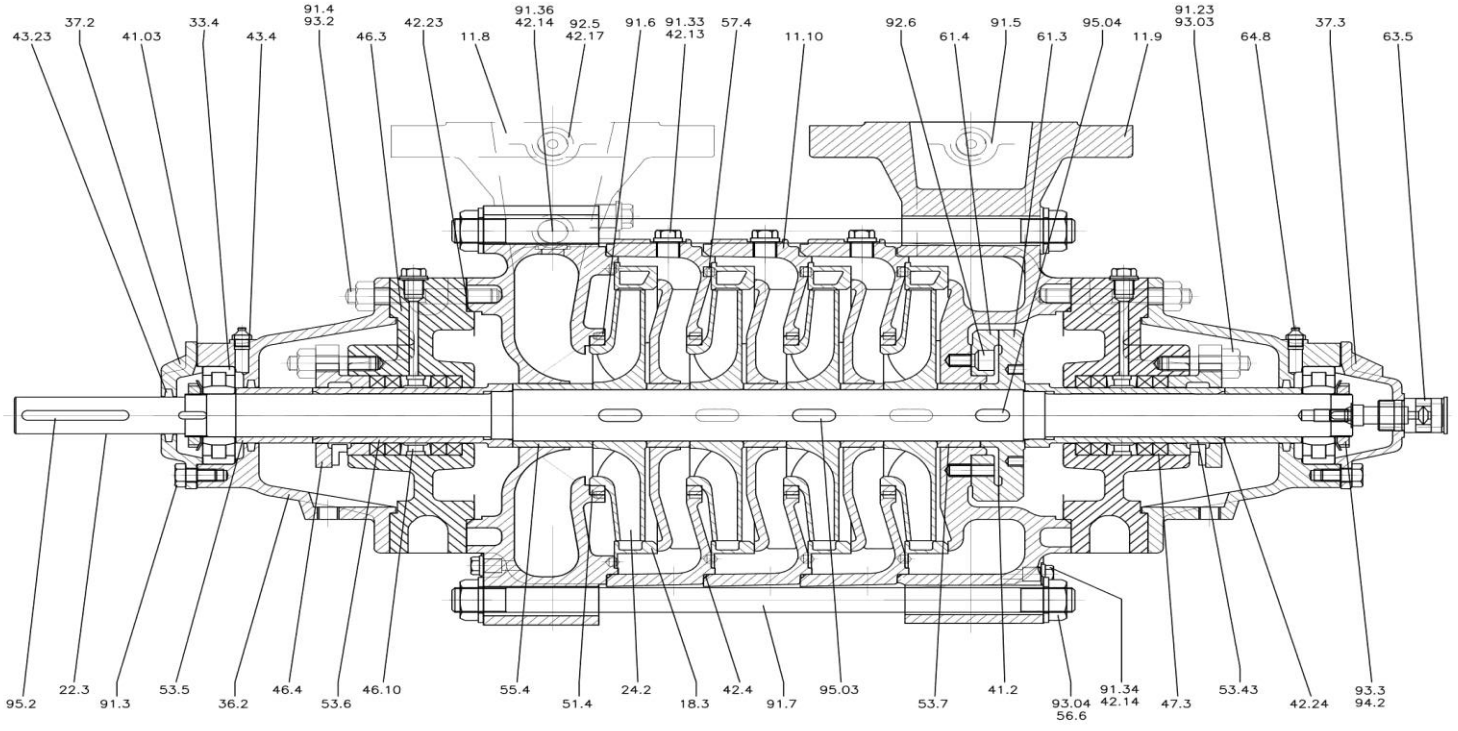
Bill of material for MD 100/250, 125/305 & 150/370 A

c.no	part name	qty	56.6	Washer (Tie rod)	16
11.8	Suction casing	1	57.4	Cylindrical pin	n
11.9	Delivery casing	1	61.3	Bal.Disc	1
11.1	Stage casing	n-1	61.4	Disc seat	1
18.3	Diffuser	n	63.5	Sh.position indicator&pin	1
22.3	Pump shaft	1	64.8	Grease nipple	2
24.2	Impeller	n	91.23	Stud (Gland)	4
33.4	Cyl.rol.bearing	2	91.3	Hex scerw (Brg cap)	6
33.5	Ang.con.ball brg (Drum)	2	91.33	Screw plug / Air cock	n
36.2	Bearing Hsg	2	91.34	Drain plug	1
36.3	Bearing Hsg (Drum)	1	91.4	Stud	8
37.2	Brg cap (Outer)	1	91.5	Screw plug	1
37.3	Brg cap (Inner)	1	91.6	Soc.head.grub.srew	n
41	Flate gasket (Brg. cap)	2	91.7	Tie bolt	8
41.2	Flate gasket(Bal.disc)	1	92.5	Vent plug	8
42.1	Sealing washer	1	92.6	Slot.head cap screw	4
42.1	Sealing washer	1	93.03	Hex nut (Gland stud)	4
42.2	Sealing washer	1	93.04	Hex nut	16
42.4	O-ring (St. casing)	n	93.2	Hex nut	8
42.2	O- ring (St.box/casing)	2	93.3	Lock nut	2
42.2	O- ring (Sleeve)	2	95.03	Key (Impeller)	n
43.2	Felt seal	1	95.04	Key (Bal.disc)	1
43.4	Felt seal	2	95.2	Key (Coupling)	1
46.1	Lantern ring	2	61.3	Balancing drum	1
46.3	St.box housing	2	61.4	Drum housing	1
46.4	Gland	2	53.15	Spacer (Bearing)	1
47.3	Gland packing(Set)	2	53.7	Spacer (Impeller)	n
51.4	Wear ring	n	53.5	Spacer (Bearing)	2
51.7	Bearing lock washer	1	53.43	Shaft sleeve (NDE)	1
51.9	Deflector	2	53.6	Shaft sleeve (DE)	1
42.3	O-ring (Bal.disc)	1	55.4	Sleeve (S.Side)	1
91.4	Screw plug(Suc.casing)	1	94.2	Lock washer	2

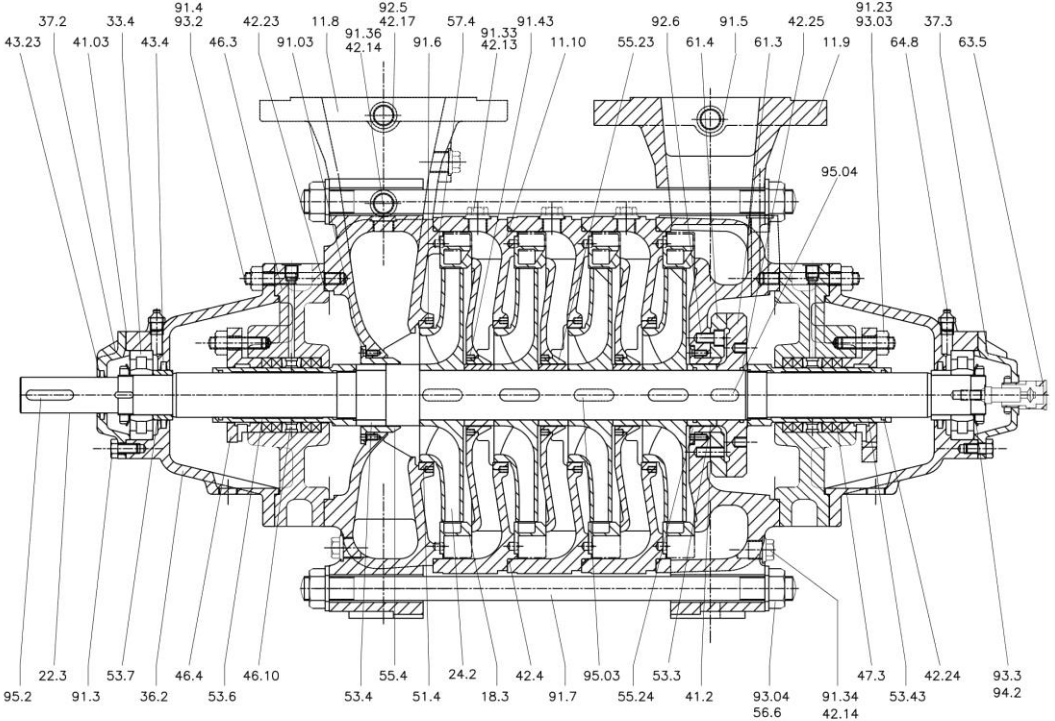
Note: n- No of stages



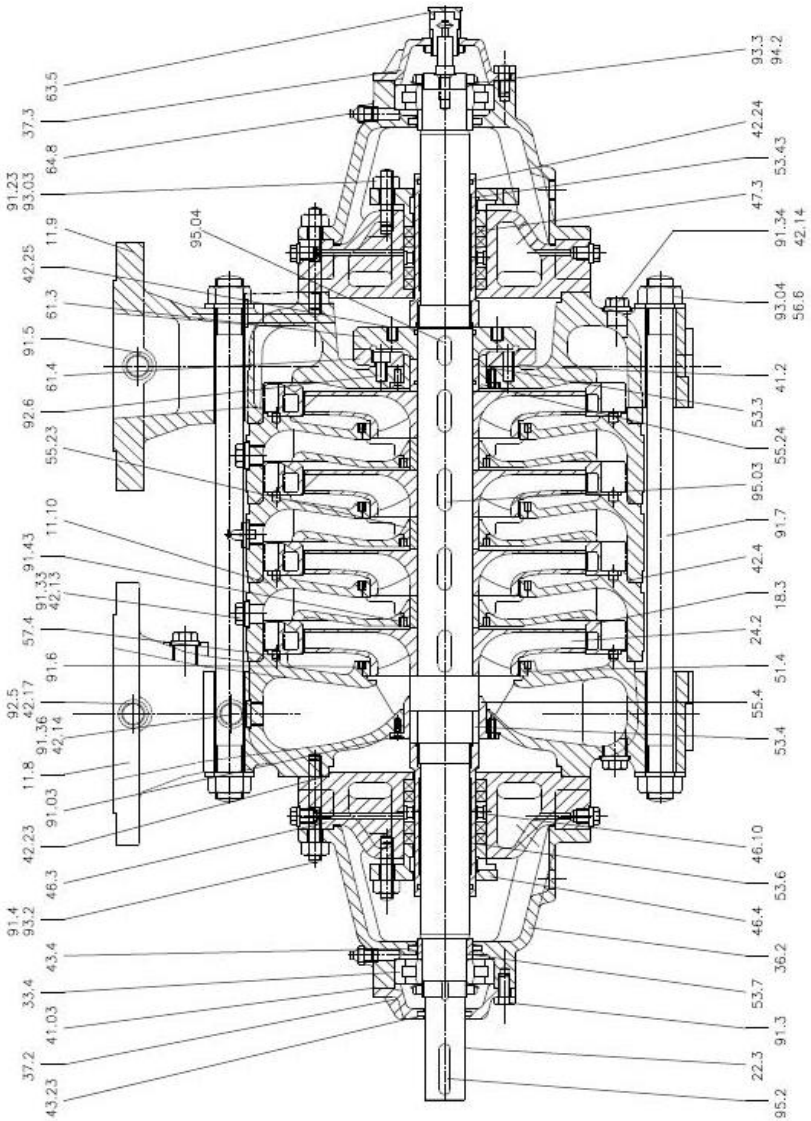
PUMP TYPE : MD 80/205 DRUM DESIGN



PUMP TYPE : MD 80/205 DISC & SEAT DESIGN



PUMP TYPE : MD 100/250 DISC & SEAT DESIGN


91.23
93.03
64.8
37.3
63.5
95.04
11.9
42.25
61.3
91.5
61.4
92.6
55.23
91.43
11.10
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57.4
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42.17
91.36
42.14
11.8
91.03
42.23
46.3
91.4
93.2
43.4
33.4
41.03
37.2
91.3
43.23
95.2
22.3
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91.7
95.03
55.24
53.3
41.2
93.04
56.6
91.34
42.14
47.3
42.24
53.43
93.3
94.2

TROUBLE – CAUSE – REMEDY

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

Sl.no	TROUBLE	CAUSE – REMEDY NO.
1	Pump does not deliver	1 7 8 9 10 11 12 15 16 17 18 19 20 24 26 27 31 68 69 70
2	Pumps delivers at reduced Capacity	1 2 3 4 5 6 7 8 9 10 11 12 14 15 16 17 18 19 20 21 23 24 26 31 59 65 68 69 70 74
3	Pump delivers too much	17 68 69 70
4	Very noisy	1 2 5 6 7 8 11 12 14 16 20 21 23 26 67 68 69 70 74
5	Unsteady running of the pump	20 21 23 33 34 36 38 39 40 41 42 43 47 48 49 52 54 55 56 57 58 63 66 67 70
6	Pumping casing not leak proof	52 54 59 60
7	Excessive leakage from stuffing box	21 25 28 29 30 32 33 55 56 57 65
8	Fumes from stuffing box	23 24 25 26 27 28 29 32 45 46 65
9	Mechanical Seal leaking	21 23 24 31 45 46 55 57 65 75
10	Pump is heating up and seizing	23 24 25 26 27 28 30 32 43 45 46 49 50 52 54 55 56 57 58
11	Bearing temperature increase	20 21 23 33 34 36 39 40 41 42 43 44 45 47 48 49 50 52 54 55 57 63 66 67 70
12	Motor is difficult to start	15 17 23 28 29 49 50 54 58 70 71 72
13	Motor is running hot burning out	15 17 23 28 29 43 58 68 69 70 71 72 73
14	Pump vibrating	1 3 9 10 14 15 16 32 36 44 47 48 49 51 52 53 56

CAUSE - REMEDY :

1. Suction filter, foot valve clogged.
2. Nominal diameter of suction line too small.
3. Suction does not reach down far enough into the delivery liquid.
4. Ground clearance of suction too narrow
5. Too many bends in the suction line.
6. Shut-off valve in the feed line in un-favorable position
7. Incorrect layout of suction line (Formation of air pockets)
8. Valve (s) in the suction and/or feed line not fully open.
9. Screwed joints or flanges in the suction line not leak – proof
10. Ingress of air via leaking valves and fittings in the suction line (Stuffing box etc).
11. Suction lift too great.
12. Available NPSH too low (difference between pressure at suction branch and vapour pressure too low).
13. Cut-out level for starter too low (In automatic plants.
14. Delivery liquid containing too much gas and/or air.
15. Delivery liquid too viscous
16. Insufficient venting
17. Speed too high (number of revolutions of driver higher than nominal number of revolutions of pump)
18. Speed too low (number or revolutions of driver lower than nominal number of revolutions of pump).
19. Incorrect direction of rotation (electric motor, incorrectly connected, leads on the terminal board interchanged).
20. Impeller Clogged.
21. Impeller damaged.
22. Separation of crystals from the delivery liquid (falling below the temperature limit/equilibrium temperature).
23. Sealing liquid line/circulation line clogged.
24. Sealing liquid line contaminated.

25. Lantern Ring in the stuffing box is not positioned below the sealing liquid inlet.
26. Sealing liquidomitted.
27. Packing incorrectlyfitted.
28. Gland tightened too much/slanted.
29. Packing material not suitable for operating conditions.
30. Mechanical Seal blocked; O-ring-rotating seal ring or stationary seal ring damaged.
31. Shaft sleeve/shaft worn in the region of the packing.
32. Bearing wornout.
33. Insufficient lubrication of bearings (also in case of automatic lubrication).
34. Specified oil level not maintained.
35. Oil qualityunsuitable.
36. Rolling contact bearings incorrectly fitted.
37. Axial stress on rolling contact bearings (no axial clearance for rotor)
38. Bearings dirty.
39. Bearings rusty(corroded).
40. Axial thrust too great because of worn wear rings, obstructed relief holes.
41. Radial shaft seal ring has not much tension (local heating-up of shaft)
42. Insufficient cooling water chambers.
43. Sediment in the cooling water chambers.
44. Alignment of coupling faulty or coupling loose.
45. Elastic element of coupling worn.
46. Foundation in correctly performed.
47. Base plate not rigid enough in the event of erection without foundation.
48. Pump casing under stress.
49. Pipe line under stress.
50. Shaft runs untrue.
51. Shaft bent.
52. Rotor insufficiently balanced.
53. Rotor parts touching the casing.
54. Unsuitable casingseal.

55. Casing screw not light enough
56. Vibration of pipe work.
57. Non return valve gets stuck.
58. Contaminated deliveryliquid.
59. Delivery flow too small.
60. Delivery flow too great.
61. Pump unsuitable for parallel operation.
62. Type of pump unsuitable.
63. Incorrect designing of pump for existing operating conditions.
64. Voltage too low/power supply overloaded.
65. Short circuit-in the motor.
66. Setting of circuit-breaker for motor handled too high.
67. Temperature of the liquid too high.
68. Spring of the mechanical seal damaged.