ETA-N

End Suction Volute Pump

TORISHIMA PUMP

PT TORISHIMA GUNA INDONESIA

CONTENTS

0. General

0.1. Before starting initial operation

CEN type pump is the general purpose single-stage single suction centrifugal pump conforming to JIS B8313-81 "End Suction Centrifugal Pumps". Each pump model fully satisfies the specified requirements of the said JIS Standard. If installed properly and operated correctly, the pump can perform its specific performance in satisfactory condition throughout a long term. Before putting the pump into initial operation, carefully read this Instruction Manual to handle, operate, and maintain the pump properly. Keep this Manual all the times where operator or maintenance personnel can have access to it easily for study any time when required.

All the pump parts and components are so manufactured under severe quality control that they can fulfil their functions to entire satisfaction. But any fault or trouble attributed to one of the causes described below shall be out of our guaranty.

1. The ordered pump is used to handle the liquid of a different nature, density, temperature, or others than those clearly specified in the order specification, or operates outside the operating range specified there in.
2. Pump damage is caused as a result improper handling and operation, faulty installation, the use of unsuitable material, faulty or unskilled piping, etc.
3. Pump damage is caused by natural disaster
   When repair is required, it is recommended to repair the pump by our skilled serviceman as far as possible or to return it to our factory.

0.2. Quality Control

All inspection and test for material, dimensions, performance, etc, are performed in the manufacturing process. Only pump that have fully satisfied the specified performance value upon inspection and test are allowed for shipment.

0.3. Name plate

Any pump is provided with a name plate. Please inform us of the followings when ordering spare parts and replacement parts.

(1) Pump type, Mfg. No. (Indicated in TS), date of production, etc. (identified on the name plate).

(2) Parts name, material, quantity, etc. described in Sectional Drawing and Spare Parts List.

0.4. Handling

When handling the pump directly coupled with the driver, hook a lifting rope on the pump and its driver as illustrated below. (Absolutely avoid to hook a lifting rope on the eye bolt of the driver).

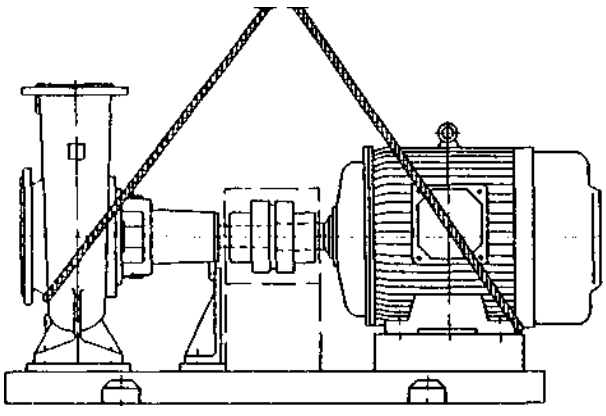


Fig. 1

1. Installation

1.1. Installation of common baseplate

Installation and centering of the pump should be performed by skilled workers. Improper installation and centering would cause various troubles during the pump running. When the pump and its driver are shipped as directly coupled on the common baseplate, they have already been leveled and centered completely at our fabrication shop before shipment.

However, install the common baseplate (with pump and driver properly in the sequence given below and recheck the level and centering of pump and its driver).

(1) Prepare packers (steel wedges) and several kinds of 1 mm ~ 0.1 mm thick levelling shims.

(2) After complete cure-up of the pump foundation, place and position packers on the foundation at the both sides of each anchor bolt seat so that the common bed can be put on the packers later on. Thereafter, grout concrete on the foundation floor at each packer position and re-place and reposition the packers on the concrete. In this case, don't fail to keep each packer right horizontal after adjusted by use of a level. The height of each packer is to be fine-adjusted by insertion of shim(s) when the common bed is installed thereon. Accordingly, at this stage only horizontality adjustment of the packers is sufficient.

(3) After complete cure-up of the concrete with packer on, temporarily install the common baseplate (with pump and driver) on the packers and check the center height of the pump. Furthermore, hold a level on the discharge flange to make fine-adjustment of the pump horizontality in both axial and crosswise directions by inserting previously prepared levelling shims between the baseplate and each packer.

(4) After the pump was positioned and levelled, make pre-center alignment between the pump and the driver using a centering jig (refer to 1.2 for the detail). In this case, recording the numeral date on pre-alignment will be helpful when the direct coupled condition is checked.

(5) After pre-centering, grout concrete in each anchor bolt holder.

(6) After complete cure-up of the concrete in each anchor hole, tighten each anchor bolt nut with uniform tightening torque. In this case, check and readjust the center alignment between coupling halves, based on the recorded numeral pre-alignment data.

(7) After the above check, grout mortar under the common bed till it reaches entirely all the corners of the bed so that no cavity exists under the bed.

(8) After completion of all the above items, connect the suction pipe and discharge pipe to the respective flanges of the pump.

1.2. Direct Coupling

The pump shaft and the driver shaft must be centered in line. Therefore, make centering in the following procedure without fail.

(1) For centering of the coupling, put a straightedge on the both coupling halves and insert a wedge gauge in the axial clearance between the coupling halves, as illustrated in Fig. 2, to check run-out of the coupled shafts.

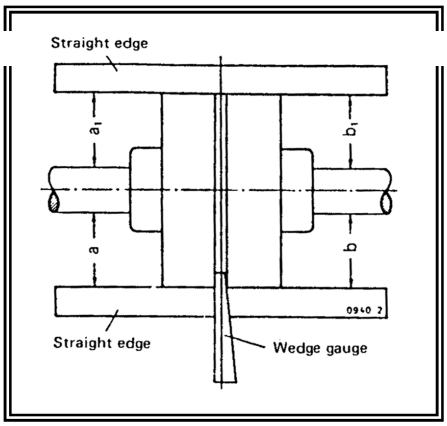


Fig. 2 Aligning a non-spacer type flexible coupling

(2) In this case, measure the concentricity and parallelism of the coupling halves (the both shafts) respectively at 4 points spaced at 90°. The specified accuracy shall be within 0.1 mm respectively.

(3) Check the driver's rotating direction without fail, before connecting one coupling half (pump side) and other coupling half (driver side) together. The correct rotating direction of the pump is shown with an arrow mark on the side face of the bearing pedestal, that is, clockwise direction viewing from the driver side.

(4) If the rotating direction is correct, connect two coupling halves together.

(5) Further, if the temperature of pumping liquid exceeds the normal temperature range of changes widely during pump running, the direct coupling will possibly deviate a little. In such case, therefore, use the coupling with large flexibility.

1.3. Piping

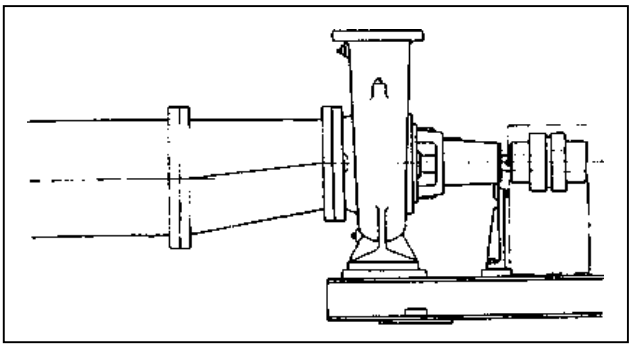
After completion of the direct coupling work, the suction and discharge pipes must be connected to the respective flanges of the pump. Perform the piping connection with good care for the following items.

(1) When connecting the suction and discharge pipes, take proper measure to prevent piping load from directly acting on the pump. Direct load to the pump by piping would cause trouble.

(2) The suction line must be installed in upward slope (about 1/50) toward the pump prevent air leak and air pocket in the case of suction lift. And it must be installed in downward slope reversely in the case of forced suction.

(3) Take to minimize various losses of the suction pipe and avoid sudden changes of cross-section and use of abrupt bends in the suction piping. Select the pipe size such that the flow velocity in the pipe does not exceed 3 m/s.

(4) When the suction pipe size is different from the pump suction nozzle size, use an eccentric tapered pipe to connect the suction pipe and pump suction nozzle and to prevent air pocket. (Fig. 3)



(5) When a sluice valve is installed on the discharge line, located the valve as close as possible to the discharge nozzle of the pump. Further, when a check valve and a sluice valve are provided o the discharge line, locate the check valve between the pump discharge nozzle and the sluice valve.

(6) In case of starting operation of a plant for the first time, various foreign matters remain in its pipe line and may possibly flow into the pump. In such case, therefore, provide a strainer on the suction line for complete removal of foreign matters. The strainer used shall have the passing area equal to 3 ~ 4 times the sectional area of the suction pipe. If the strainer is clogged with foreign matters during the pump running, readings of the suction line pressure gauge will fluctuate. Sometimes, clean the strainer to remove foreign matters.

(7) When external flushing water piping is provided, clean adequately the flushing water pipe before connecting.

(8) The temperature of pumping liquid significantly different from the atmospheric temperature would cause the pipe line to shrink or expand. In such case, install a flexible pipe, etc. on the pipe line to prevent the load by shrinkage o the pump.

(9) After completion of the piping work, recheck that the pump is free from abnormal load by piping as well as free from alignment deviation, and make re-adjustment when required upon rechecking.

2. Operation

2.1. Starting

(1) Before starting the initial operation after installation, observed the following check items and, if anything abnormal is found, take necessary corrective action in accordance with this manual.

(1) Are the pump and the suction pipe filled up with pumping liquid ?

(2) Is the driver's rotating direction correct ? (Pump rotates clockwise viewing from the driver's side)

(3) No abnormal in the direct coupling ?

(4) No abnormal load to the pump by piping ?

(5) Is the flushing pipe connected properly and the water flow rate proper ?

(6) Are the suction valve fully opened and the discharge valve fully closed ?

(7) Isn't the gland packing tightened irregular or too excessively? Also, isn't there any abnormal leakage from the gland packing ?

(8) Can the pump be turned lightly by hand ? Isn't there any touch of contact in the pump ?

(2) If nothing abnormal is found upon checking the above items, turn on the driver's start switch and of it immediately to check that the pump rotates smoothly and shut downs quietly.

(3) If normal rotation of the pump is confirmed, gradually open the discharge valve up to the specified running speed. When leakage from the gland is much, re-tighten the gland packing with equal torque for adjustment

(4) If the pump continues running with the discharge valve fully closed, the liquid temperature in the pump will rise, causing trouble of the pump. In such case, shut down the pump immediately without fail.

(5) When starting the pump after long term shut –down, recheck the above check items (1), and (5) then (8) to verify that the pump is abnormal-free.

2.2. Shutdown

Follow the procedure given below for shutting down the pump.

(1) Gradually close the discharge sluice valve up to full close position. However, it may be left as opened providing that a check valve is included in the discharge pipe and the back pressure is sufficient.

(2) Turn of the driver 's stop switch. At the same time, check that the pump rotational speed declaration smoothly and stops quietly.

(3) Stop external flushing, if any.

(4) Fully close the suction valve when the pump is kept as shutdown for long time.

(5) When there is a possibility of freezing in the pump, completely drain out the pumping liquid from the volute casing. (Complete drain of the liquid in the line is more safety).

2.3. Operation and Maintenance

2. 3. 1. General

The pump must run quietly without abnormal vibration all the times. Therefore, carefully observe the following check items while the pump is in running and, if anything abnormal is found, shut down the pump immediately and search the cause.

(1) Does the suction pressure fully satisfy the pump required NPSH (NPSH req.) ?

(2) Is the specified discharge pressure satisfied ?

(3) Isn't the driver in overload running ?

(4) Are the both suction pipe and volute casing filled up with pumping liquid and the discharge valve fully opened in the pump running ?

(5) Is the bearing temperature normal ? (no abnormal temperature rise ?)

(6) Is leakage from the gland proper ?

(7) Is the pump running with no abnormal noise and no vibration ?

2.3.2. Shaft seal

The shaft seal is available in two different types of gland packing and mechanical seal. The descriptions here under covers the gland packing seal type. Refer to Chapter IV for the detailed instructions of the mechanical seal.

The gland packing insertion space in the casing cover is designed to be equivalent the either five packing rings (4610) or three packing rings plus one lantern ring (4580).

The gland bush (4540) is of split type as to facilitate insertion of the packing rings.

(1) Gland packing without lantern ring

The seal type is applied to the suction pressure of 0,5 kgf / cm^2G and over or the handling of odorous liquids (e.g. ammonia water and benzine, benzol or lubricant for outdoor use, etc.). In such cases, self flushing or external flushing is not applied to the gland packing.

(2) Gland packing with lantern ring

This seal type is applied to the following cases.

- Clean liquid under suction pressure of 0.5 kgf/cm^2G or under suction lift.
- Pumping the liquid from vacuum tank.
- The pump shaft and its gland packing must be protected from abrasion for handling liquid containing abrasive component, (e.g. handling of sewage and the like).

In such cases, either self flushing or external flushing by proper liquid is applied to the gland packing as described below.

(a) Self-flushing

In this case, flushing liquid is conducted into the lantern ring through a passage provided in the casing cover.

(b) External flushing

This flushing system is applied to such case that inclusion of external liquid in the pumping liquid is allowed. In this case, same of the flushing liquid flows into the volute casing and the remaining is discharged into the atmosphere through the clearance in the gland bush.

In the case of the gland packing shaft seal, packing ring (4610), lantern ring (4580) and gland bush (4540) are inserted in the stuffing box. In this case, the outside surface of shaft protecting sleeve (5240) must keep smooth all the times.

Any flaw on the shaft protecting sleeve surface or irregular tightening and over-tightening of the gland (4520) would cause the shaft seal to be overheated and the packing rings to deteriorate earlier than expected.

When the packing rings are replaced with new ones, packing material highly resistant to pumping liquid and its temperature must be used. Before replacement, clean the lantern ring, gland bush and gland and, cut the packing material to the specified dimension with a proper cutter using the cutting jig illustrated in Fig. 4. Thereafter, insert the packing rings, one by one into the stuffing box so that the butt ends of each ring are offset by 90° from each other on the shaft protecting sleeve. (Refer to Fig. 5.)

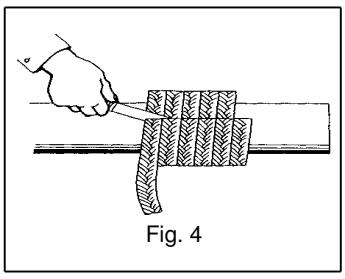


Fig. 4

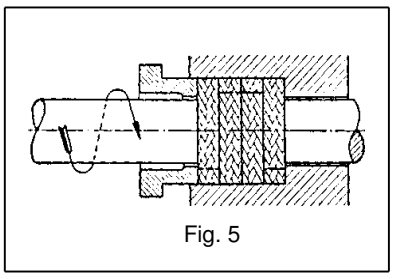


Fig. 5

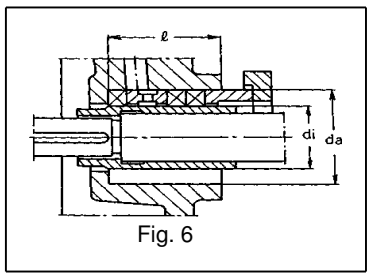


Fig. 6

Set the gland bush to such extent that it fits a little in the stuffing box. Then, tighten the gland packing (packing rings) lightly and put the pump in running-in operation for a meantime. Thereafter, re-tighten the gland packing to such extent that leakage from the gland reaches 10 cc / min. ~ 20 cc / min. Refer to Fig. 6 and table 1 for the detailed construction of the shaft seal and the number of packing rings.

Number of gland packings

Without Lantern Ring	5
With Lantern Ring	3

Pump Sizes	Bearing Sizes	Stuffing Box			Size and length of a gland pasking
		di	da	ℓ'	
50 x 32 - 125 50 x 32 - 160 50 x 32 - 200 50 x 32 - 250 50 x 40 - 125 50 x 40 - 160 50 x 40 - 200 65 x 50 - 125 65 x 50 - 160 65 x 50 - 200 80 x 65 - 125 80 x 65 - 160	25	30	46	45	8 x 126
50 x 40 - 250 65 x 50 - 250 80 x 65 - 200 80 x 65 - 250 100 x 80 - 125 100 x 80 - 160 100 x 80 - 200 125 x 100 - 160.1	35 A	30	46	45	8 x 126
50 x 40 - 315.1 65 x 50 - 315.1 80 x 65 - 315.1 100 x 80 - 250 125 x 100 - 160 125 x 100 - 200.1 125 x 100 - 200	35	40	60	56	10 x 165
100 x 80 - 315.1 125 x 100 - 250.1 125 x 100 - 250 125 x 100 - 315 150 x 125 - 200 150 x 125 - 250 200 x 150 - 200	45A	40	60	56	10 x 165
100 x 80 - 400.1 150 x 125 - 315 200 x 150 - 250	55	50	70	56	10 x 196
125 x 100 - 400 150 x 125 - 400 200 x 150 - 315 200 x 150 - 400	65A	50	70	56	10 x 196

Table 1

2.3.3. Gauges

For the operation control, it is recommended to provide a compound gauge on the suction pipe line and a pressure gauge at the pump casing or close to the casing on the discharge pipe line.

These gauges shall be able to indicate the pressure equivalent to about 150% of the maximum operating pressure. Also, connect a gauge cock to each of these gauge.

When handling liquid containing suspensions or solid, attach suitable strainers. Further, to prolong the life of the gauges, open the gauge cock only when reading pressure gauge, in other words, keep it closed all the times except when reading the pressure.

2.3.4. Bearing

The pump shaft is supported with two single row deep ball bearings (3210, 63 series), which are srinkage-fitted in the shaft and housed in the bearing case. These bearings are lubricated with high-grade bearing grease.

Periodic maintenance and inspection of the bearing is not required.

The maximum allowable temperature of the bearings is either 75 °C on the outside wall of the bearing housing of the room temperature plus 40 °C.

3. Dismantling and Reassembling

3.1. General

Before overhauling, be sure to check that the pump is in absolutely unstable condition.

In addition, check without fail that the both suction and discharge line sluice valves keep full-close position, the pump casing is normal in its temperature and no pressure is loaded to the pump casing (that is, the casing is empty).

When overhauling, maximum possible effort must be made to avoid accidental trouble. Also, good care must be exercised to protect the pump components / parts from impact and flaw in handling of them.

3.2. Dismantling

For dismantling the pump, follow the disassembling sequence given below with reference to 3.5 “Exploded View” and parts names listed therein.

(1) Remove any small piping if any.
(2) Remove the coupling guard.
(3) Remove the coupling and then remove the prime mover from the common bed.
(4) Unscrew off the nuts for casing cover and the bolts fixing support foot (1830) to the common bed.
(5) Pull out the casing cover and the bearing housing with rotating elements as assembled. In the case of large size pump, hoist up the casing cover end or support it with a proper means to prevent the assembly parts from turning a side.
(6) When some parts require replacement or repair according to their condition, take out those from the pump shaft. When removal of such parts is difficult because of long term use of the pump, penetrate well-known penetration oil or use a special tool. In any case, don’t hammer them.
(7) Follow “Exploded View“ for disassembling the parts / components. (Refer to 3. 5)
(8) When replacement of the ball bearings is required upon inspection, pull out the pump shaft with bearings fitted on from the bearing case in direction to the prime mover and heat up the bearing only by acetylene gas. And the bearing can be taken out from the shaft.
(9) After overhauling, check that various gaskets on the sealing surface are free from flaw and break, and replace them with new one when required.

3.3. Reassembling

Reassemble the overhauled components and parts in the reverse sequence of the overhauling with reference to “Exploded View“. For normal running of the pump, specially follow the precautions given below.

(1) Clean adequately each pump component / parts. Prevent adhesion of dust on the connections and joint portions.

(2) When replacing the ball bearings, use the designated bearing No. (63 series, LLU-C3) without fail and fit them in the pump shaft by shrinkage-fit after warming them in heated oil of 110 °C ~ 120 °C.

(3) Take good care not to damage each gasket and the sealed contact surface of each parts.

(4) After completion of the reassembling work, check the direct coupling condition as instructed in 1. 2 and start the pump as instructed in 2. 1.

3.4.2 Recommended List of Spare Parts for 2 Year's Operation

Part no.	Part designation	No. of pumps (including stand-by pumps)						
		2	3	4	5	6 and 7	8 and 9	10 and more
Pump with soft-packed stuffing box		Quantity of Spare parts						
2100	Shaft	1	1	2	2	2	3	30%
2300	Impeller	1	1	1	2	2	3	30%
3210	Ball bearing	2	2	4	4	6	8	50%
3300	Bearing housing	—	—	—	—	—	1	2 pieces
4610	Gland packing	4	4	6	6	6	8	40%
5020	Casing wear ring	1	1	1	2	2	2	50%
5240	Shaft protecting sleeve	1	1	1	2	2	2	20%
——	Flat gaskets	4	6	8	8	9	12	150%

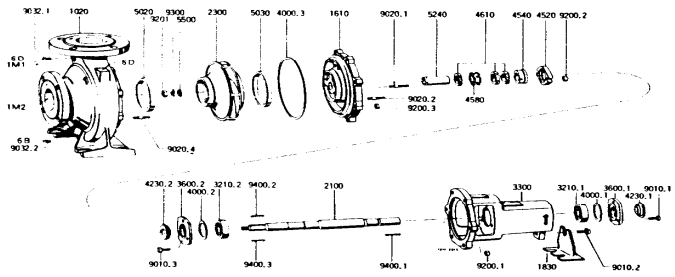
3.4.3. Interchangeability of Pump Components

Pump sizes	Bearing sizes	Part Designation / Part no.	Volute casing 1020	Casing Cover 1610	Impeller 2300	Casing wear ring 5020	Impeller wear ring 5030	Shaft 2100	Shaft protecting sleeve 5240	Bearing housing 3300	Bearing cover 3600	Labyrinth ring 4230	Ball bearing 3210	Lantern ring 4580	Gland 4520	Gland bush 4540	Grand packing 4610	Mechanical seel 4300
50 x 32-125	25		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
50 x 32-160			2	1	2	1	4	1	1	1	1	1	1	1	1	1	1	1
50 x 32-200			3	2	3	1	4	1	1	1	1	1	1	1	1	1	1	1
50 x 32-250			4	3	4	1	5	1	1	1	1	1	1	1	1	1	1	1
50 x 40-125			5	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1
50 x 40-160			6	1	6	1	4	1	1	1	1	1	1	1	1	1	1	1
50 x 40-200			7	2	3	1	4	1	1	1	1	1	1	1	1	1	1	1
65 x 50-125			8	1	7	3	1	1	1	1	1	1	1	1	1	1	1	1
65 x 50-160			9	1	8	3	4	1	1	1	1	1	1	1	1	1	1	1
65 x 50-200			10	2	9	2	4	1	1	1	1	1	1	1	1	1	1	1
80 x 65-125			11	1	10	4	4	1	1	1	1	1	1	1	1	1	1	1
80 x 65-160			12	1	11	4	4	1	1	1	1	1	1	1	1	1	1	1
50 x 40-250	35A		13	3	4	1	5	2	1	2	2	2	2	1	1	1	1	1
65 x 50-250			14	3	12	3	5	2	1	2	2	2	2	1	1	1	1	1
80 x 65-200			15	2	13	4	4	2	1	2	2	2	2	1	1	1	1	1
80 x 65-250			16	3	14	4	5	2	1	2	2	2	2	1	1	1	1	1
100 x 80-125			17	1	15	6	4	2	1	2	2	2	2	1	1	1	1	1
100 x 80-160			18	4	16	6	7	2	1	2	2	2	2	1	1	1	1	1
100 x 80-200			19	5	17	6	7	2	1	2	2	2	2	1	1	1	1	1
125 x 100-160.1			20	4	18	8	7	2	1	2	2	2	2	1	1	1	1	1
50 x 40-315.1	35		21	6	19	3	9	3	2	3	2	2	2	2	2	2	2	2
65 x 50-315.1			22	7	20	6	10	3	2	3	2	2	2	2	2	2	2	2
80 x 65-315.1			23	7	21	7	10	3	2	3	2	2	2	2	2	2	2	2
100 x 80-250			24	8	22	7	9	3	2	3	2	2	2	2	2	2	2	2
125 x 100-160			25	9	23	11	10	3	2	3	2	2	2	2	2	2	2	2
125 x 100-200.1			26	9	24	8	10	3	2	3	2	2	2	2	2	2	2	2
125 x 100-200			27	9	25	11	10	3	2	3	2	2	2	2	2	2	2	2
100 x 80-315.1	45A		28	7	26	8	10	4	2	4	3	3	3	2	2	2	2	
125 x 100-250.1			29	10	27	8	10	4	2	4	3	3	3	2	2	2	2	2
125 x 100-250			30	10	28	11	10	4	2	4	3	3	3	2	2	2	2	2
125 x 100-315			31	7	29	11	10	4	2	4	3	3	3	2	2	2	2	2
150 x 125-200			32	11	30	12	13	4	2	4	3	3	3	2	2	2	2	2
150 x 125-250			33	12	31	12	13	4	2	4	3	3	3	2	2	2	2	2
200 x 150-200			34	11	32	14	13	4	2	4	3	3	3	2	2	2	2	2
100 x 80-400.1	55		35	13	33	10	12	5	3	5	4	4	4	3	3	3	3	3
150 x 125 -315			36	14	34	12	12	5	3	5	4	4	4	3	3	3	3	3
200 x 150-250			37	15	35	15	13	5	3	5	4	4	4	3	3	3	3	3
125 x 100-400	65A		38	13	36	11	12	6	3	6	5	5	5	3	3	3	3	3
150 x 125-400			39	13	37	12	12	6	3	6	5	5	5	3	3	3	3	3
200 x 150-315			40	14	38	15	12	6	3	6	5	5	5	3	3	3	3	3
200 x 150-400			41	13	39	15	12	6	3	6	5	5	5	3	3	3	3	3

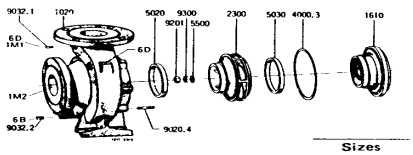
Note: 1) Same number means same component.
2) Same number in casing wear ring and impeller wear ring means same component.

3.5 Exploded View and List of Components

Pump with soft-packed stuffing box



Pump with push-in discharge cover



Sizes
50×32-125
50×32-160
50×40-125
50×40-160
65×50-125
65×50-160
80×65-125
80×65-160
100×80-125
100×80-160
125×100-160. 1
125×100-200. 1
125×100-160
125×100-200
150×125-200
150×125-315
200×150-200
200×150-250
200×150-315

Part No.	Part Designation	Part No.	Part Designation	Part No.	Part Designation
1020	Volute casing	4000.3	Flat gasket	5240	Shaft protecting sleeve
1610	Casing cover	4520	Gland	5241	Seal sleeve
1830	Support foot	4540	Gland bush	5500*	Washer
2100	Shaft	4850	Lantern ring	9021	Gland bolt
2300	Impeller	4610	Gland packing	9032.1	Plug
3210.1	Ball bearing	5020	Casing wear ring	9032.2	Plug
3210.2	Ball bearing	5030	Impeller wear ring	9201	Hexagonal nut
3300	Bearing housing			9300	Washer
3600.1	Bearing cover			9400.1	Key
3600.2	Bearing cover			9400.2	Key
4000.1	Flat gasket			9400.3	Key
4000.2	Flat gasket				

*Only for pumps with bearing size 25 and 35A

4. Mechanical Seal

4.1. General Cautions

(1) The mechanical seal service life is significantly shortened by impurities if include therein. Therefore, clean the mechanical seal and the pump internals when reassembling and prevent invasion of such impurities into the mechanical seal from the flushing line during pump running.

(2) Absolutely avoid dry–running (including the running at seal chamber pressure less than the atmospheric pressure). Dry–running would cause seizure and damage of the mechanical seal and occasional damage of the pump.

(3) The sliding end face of the mechanical seal is finished very accurately by lapping. So, it must be handled with good care neither to flaw nor break the sliding end face.

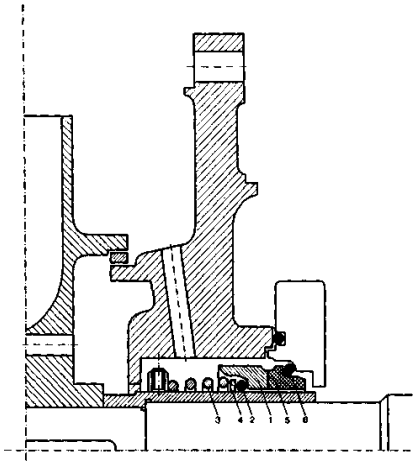
(4) Once overhauled, replace the sliding end face of the mechanical seal with new one or repair it by lapping as a rule.

4.2. Type

It is only recommended to use mechanical seal " Brugman " M3 sery with Dw 30, 40 and 50 according to the casing cover construction it self is standard and interchangeable type.

Part No.	Identification	PCS	Part No.	Identification	PCS
1	Housing seal face	1	4	Bearing-ring	1
2	O - ring	1	5	Stationary Seat	1
3	Conical Spring	1	6	O - ring	1

Fig. 7 Construction of mechanical seal
Brugman M3 Series



5. Troubleshooting

Possible Trouble	Cause	Emergency remedy and correction action	Final remedy and correction action
Failure of full water in pump.	Air suction from gland packing.	Increase the sealing water to gland. Retighten gland.	Replace packing rings.
	Air suction from discharge valve.	Try to throttle discharge valve.	Check seat surface.
	Discharge end not submerged.	Check whether discharge end is under the water.	
	Faulty vacuum pump.	Try to throttle the circulation rate when the circulation rate of replenishment is too much.	Inspect and repair the pump.
	Faulty intake air solenoid valve.	Use by-pass. Open the valve by hand if hand wheel is attached.	Inspect and repair the valve.
Starting failure.	No starting conditions ready.	Check each condition. Short-circuit and start if instrument is faulty. Check whether startable independently.	Inspect and repair instrument and circuit.
	Protection circuit in working.	Check fault reset.	Inspect circuit.
Discharge failure or low water rate.	Imperfect priming.	Re-priming. Check whether it is caused by air suction from the gland.	Check air leak from the intake air line and repair the leakage portion.
	Impeller clogged with foreign matter.	Once stop and restart.	Overhaul and clean.
	Insufficient immersion depth caused by water level down (or reduce flow area caused by deposited dediment).	Gradually close discharge valve. Wait for a meantime under this condition till suction water level comes up.	Investigate the setting. Remove sediment.
	Too low suction head (or cavitation).	Check water level in feed water tank and make sure that all suction line valve are sufficiently opened. If necessarily, fix the valve hand wheel in full-open position.	Inspect and clean the suction line.
	Too high suction lift (or cavitation).	Check suction water level and whether the foot valve opens sufficiently.	Inspect and clean the suction line. Use larger pipe size if necessary. Use strainer with hole area of 3 to 4 times the sectional area of pipe.
		Interchange the wiring connected to the terminal of motor.	

	Reverse rotating direction.	Check each impeller and other parts for loose and retighten it if loosened.	-
	Abnormal wear of pump component.	-	Overhaul and repair the pump.
Overloaded driver.	Too high rotational speed.	-	Adjust governor.
	Pump running significantly deviated from its rated condition.	Adjust discharge valve opening degree.	-
	Inclusion of sludge and foreign matter in pump.	Once stop and restart.	Overhaul and clean.
	High specific gravity and viscosity of fluid.	Reduce discharge rate up to the allowable limit of driver.	Reduce the number of impeller stage, refinish the impeller diameter, or increase motor output.
	Over tightening packing rings.	Adjust to proper clamping torque.	-
Overheated bearing.	Deviated shaft center alignment.	-	Re-align.
	Additional load to bearing by piping.	Checking the alignment at flange joint.	Change pipe support if necessary.
	Damaged bearing.		Check, repair or replace.
Overheated gland.	Too tightened packing ring.	Once loosen the gland and then gradually re-tighten it to increase leakage.	Replace packing rings if necessary.
	Too high sealing water pressure in gland.	Close a little sealing water cock a little.	Lower sealing water pressure.
	Insufficient gland sealing water rate.	Raise water rate a little.	-
Vibration, abnormal noise.	Pertly clogged impeller.	Once stop and restart.	Overhaul and clean.
	Break of impeller.	-	Overhaul and replace.
	Too small discharge rate.	-	Operate at around specified discharge rate.
	Deviated alignment of pump to driver.	-	Re-align.
	Air invasion, cavitation.	-	Inspect and clean suction line.
	Running at a point of critical speed.	As it possibly happens of speed changing, operate at high speed or low speed side.	-
	Damaged bearing.	-	Inspect and repair or replace.
	Damaged coupling rubber.	-	Replace with spare rubber.