

MANUAL OF INSTALLATION, OPERATION AND MAINTENANCE

BOMBAS BEK



ISO 9001

BUREAU VERITAS
Certification



 **IMBIL**®

Pumping Solutions

Dear Proprietor

Congratulations! You have just acquired a simple piece of construction equipment, designed and manufactured with the most advanced technology, with excellent performance and easy maintenance.

The purpose of this Manual is to provide the user with the equipment's details, and the correct Installation, Operation and Maintenance techniques.

IMBIL recommends that the equipment is installed and cared for as recommended by the correct technique and in accordance with the instructions contained in this Manual, and that it is used in accordance with the service conditions for which it was selected (flow, Total Dynamic Head, speed, voltage, frequency and temperature).

IMBIL is not liable for defects arising from the breach of these service prescriptions, and recommends that this Manual is used by the personnel responsible for installation, operation and maintenance.

 Soluções em Bombeamento	
MODEL	
SERIES	
TAG:	
ROTOR	
ROTATION	
DIRECTION	
FLOW [Q]	
AMT/	
PRESSURE	
YEAR OF	
MANUF.	

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In the event of query about the equipment or when ordering spare parts, indicate the part's code, pump lime and also the series no. found on the identification plate and recorded in low relief at the pump suction flange.

NOTE

IMBIL asks that the customer, straight after receiving the GUARANTEE DOCUMENT for his/her equipment, fills in the data and sends the stub to IMBIL, facilitating the exchange of information between IMBIL and the CUSTOMER.

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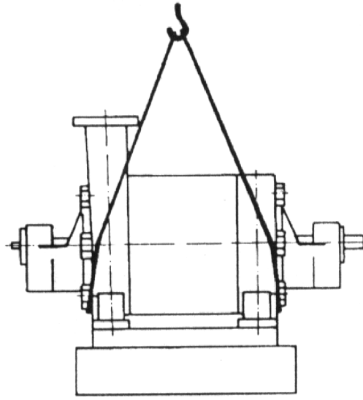
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RECEIPT INSPECTION

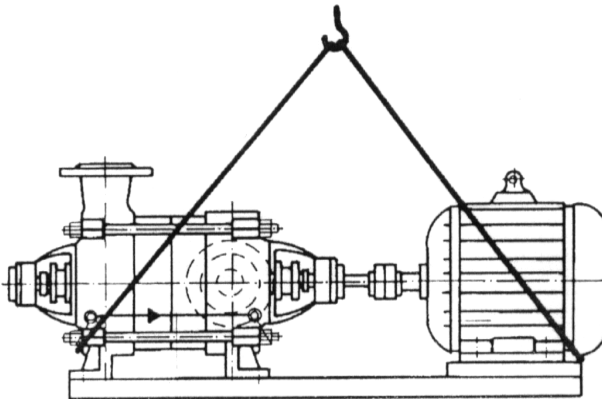
Inspect the equipment as soon as you receive it, and check it against the Bill of Sale, notifying immediately of any potential missing or damaged parts

TRANSPORTATION

- 1 - The Transportation of the linked set or of the separate equipment parts, must be made carefully and within safety standards.
- 2 - The motor and the pump must be transported by the lifting eye or hoisted as shown below before being coupled together.



- 3 - The motor-pump set must be transported as per the diagram below.



STORAGE

- 1 - When a pump must be stored before it can be installed, the nozzle protective flanges, or any other protection sent by IMBIL, must not be removed.
- 2 - Bearings receive lubrication at the factory, which protects them from rusting for a short period of time.
 - In pumps stored for a period of more than 30 days, special precautions will be required.
 - All existing connections should be properly capped.
 - Remove the gaskets and the mechanical seals in order to avoid the corrosion of the plates, or damage to the sealing components such as rings, gaskets and seats.
 - Spray Rustilo DW301 oil on the pump every 30 days. Bearings with grease need not receive new load.
 - Rotate the shaft weekly with your hand so that all the moving parts are lubricated.
 - The painted surfaces should not receive any kind of protection other than the existing paintwork.

NOTE: Before installing the pump, clean the protections of the tip shaft, sleeve and flange with suitable solvent and follow the instructions in this Manual.

LOCATION

Choose the installation location so that:

- 1 - It is easily accessible for inspection and maintenance.
- 2 - It is above the flooding level.
- 3 - The pipes are simple and straightforward so that the NPSH * is sufficient to avoid cavitation.
- 4 - There is sufficient space for removing the motor.
- 5 - The foundation is stable so that it does not move horizontally or vertically, leaving the pump supported by the pipes.
- 6 - The identification plates of the pump and the motor are visible.
- 7 - There is circulation of sufficient air around the motor in order to guarantee a perfect refrigeration.

$$*NPSH_r = 10 - H_s + \frac{V^2}{2g} + 0.5$$

Where:

NPSH = required suction height (m)

Hs = suction height (m)

V = suction speed (m/s)

g = gravity acceleration (m/s²)

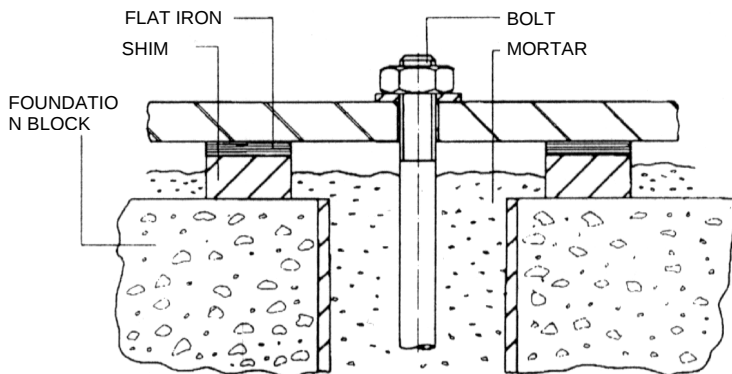
FOUNDATION

The pump must preferably be installed in horizontal position. Use a single base for the pump and the motor, a permanent foundation of concrete or structural steel with sufficient mass for absorbing normal vibrations, preventing the set from suffering distortion or hindered alignment.

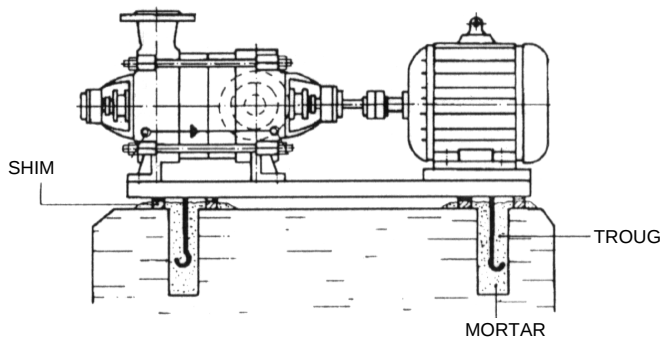
BASE LEVELING AND SETTLEMENT

- 1 - Place the bolts in troughs made in the foundation block by drilling the base. And between the bolts and the base, place metallic shims to level them.
- 2 - Introduce specific cement mortar around the bolts and under the base through existing openings, filling all gaps for a solid fixing and vibration-free operation.
- 3 - Tighten the nuts on the bolts after the curing of the mortar, verifying the transverse and longitudinal leveling with level of precision (0.1 mm/m). If it is uneven, add thin plates between the base and the shim for correction.

Levelling of the Base

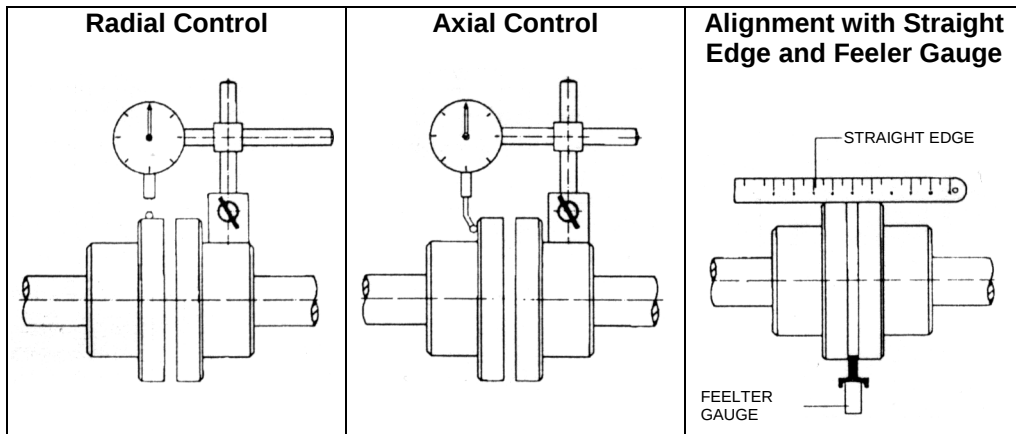


Settlement of the Base



COUPLING ALIGNMENT

- 1 - Execute the alignment with the suction and delivery pipes already connected.
- 2 - The installation of the coupling must be made under heat (oven or oil bath at 100°C). Do not strike the equipment to operate the coupling assembly.
- 3 - With the aid of a comparator clock or, failing that, straight edge and feeler gauge, control the radial and axial misalignment to avoid abnormal vibrations that interfere with the shelf life of the equipment.



- 4 - When the drive is made by belts, the pump and driver's shafts must be parallel, the pulleys aligned with each other, and in turn, the belts stretched properly.
- 5 - The radial and axial alignments should remain within a tolerance of 0.15 mm, obeying the clearance between the ends of the motor shaft and the pump, as specified by the coupling manufacturer.
- 6 - For better security in the operation, a Coupling Guard or a Driver Shield must be installed (example: Belt-Guard), according to Law 65/4 MTb Ordinance 3214 (RN 12 item 12.3).

GENERAL RECOMMENDATIONS FOR PIPES

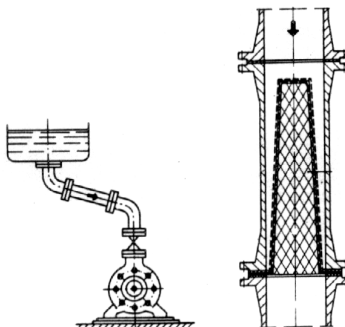
For Suction and Delivery Pipes

- 1 - The pipe must only be connected to the pump's flange once the base settlement mortar has been cured.
- 2 - To avoid loss to the pipe load, whenever possible, it must be short, straight and tight. Curves, where required, must have a long radius.
- 3 - The pump must not be used to support the piping. The tube flanges must be connected to those of the pump, completely free of tension, without transmitting force to the casing, avoiding misalignment and its consequences.

- 4 - Provision should be made for expansion joints when the pumped liquid is subjected to high temperature variations.

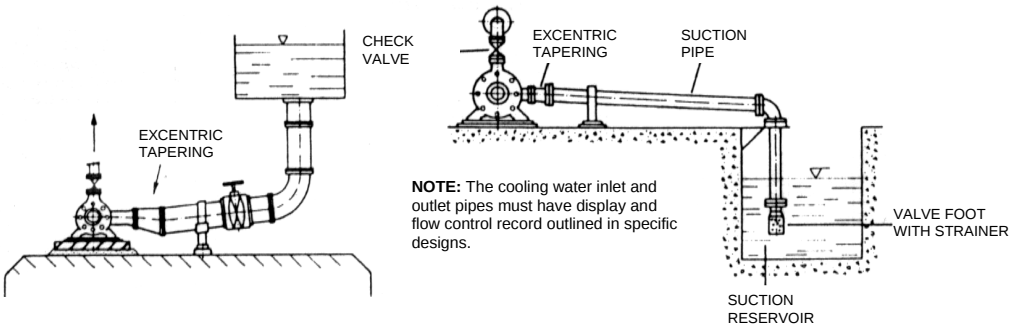
For Suction Pipe Only

- 1 - The horizontal segment of the suction pipe when positive, should be installed with a slight upwards slope towards the pump-suction tank, and when negative, a slight downward slope in the same direction, preventing the formation of air pockets.
- 2 - When the use of tapering is required, it should be eccentric, mounted with the cone pointing downward, preventing the formation of air pockets.
- 3 - The nominal diameter of the pump's suction flange, does not determine the nominal diameter of the suction pipe. The flow rate of the fluid should be established between 1 and 2 m/s. When the use of tapering is required, it should be eccentric, mounted with the cone pointing downward, thus avoiding the formation of air pockets.
- 4 - Foot valve when applicable, generally receives a filter to prevent foreign bodies from reaching the pump.
Make arrangements for the valve's passage area to be 1.5 times larger than the area of the pipe, and the filter's free passage area to be 3 to 4 times larger than the area of the pipe.
- 5 - In installations with positive suction, it is recommended to install a valve to block the passage of fluid. Check that during the pump operation the valve remains fully open.
- 6 - It is advisable to avoid the installation of more than one pump in a single suction pipe, especially when in this piping, the absolute pressure is lower than the gauge pressure, with the pump in operation.
- 7 - You should provide a valve for each pump in installations where multiple pumps suck from the same tank, and connect the tank and suction pipe with direction changes below 45°.
- 8 - The piping and the tank must undergo a rigorous wash before installation. But as drops of solder and other impurities are shed after a while, especially when pumping hot liquids, provisions should be made for the installation of a hat-type filter as shown in the diagram to the side. This filter should be made of stainless steel with a mesh screen with a maximum of 0.5 mm and a wire thickness of 0.25 mm. After a few weeks, if there are no further impurities, the filter may be removed.



Only for Delivery Pipe

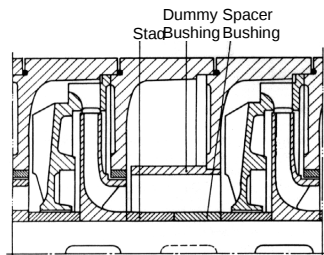
- 1 - A valve must be installed to regulate the pumping flow and pressure, soon after the pump's delivery flange is installed.
- 2 - It is advisable to install a check valve between the pump outlet and the valve, when the length of the delivery piping is relatively large.
- 3 - When the diameter of the pipe is different from the diameter of the delivery flange diameter, the connection should be made through a concentric tapering.
- 4 - Provide suction valves where it is necessary to purge the air.
- 5 - For pumps installed in parallel, each pump should have its check valve, to prevent backflow of water or overloading of the foot valve, when one of the pumps is turned off.
- 6 - Provide cable-mounted joints to absorb the strain.
- 7 - Protect the pump from operating below the Minimum Flow Calibrated Orifice, which maintains permanent by-pass to the suction reservoir or Minimum Flow Valve that opens an alternative route every time the flow rate is reduced below the minimum value($0.2 \times Q$).



DUMMY STAGE

If the pump is to operate during a period under conditions different from those which were originally set, dummy bushings may be installed. To do so, remove the rotor and the diffuser of the stage to be dummied, and install a spacer bushing and a dummy bushing.

See diagram at the side.



START-UP ACTION

- 1 - Make sure the assembly is aligned and well fixed to the base, that the suction and discharge flanges are well connected to the pipes and, when they exist, the auxiliary connections are put into operation.
- 2 - Eliminate possible dirt and moisture in the bearings, and fill with oil using the quantity and quality outlined in the instructions in the "Bearing Block Maintenance" item.
- 3 - Make the electrical connection to ensure that the motor's protection system works.
- 4 - Check the direction of rotation of the driver with the pump uncoupled.
- 5 - Prime (fill) the pump and its suction pipe, eliminating the air thereon. Rotate the pump shaft by hand in order to ensure a good priming.
Priming can also be done by vacuum.
- 6 - Make sure that the gasket tightening nuts are just touching.
- 7 - Completely open the suction valve. Allow the pump to reach the pumping temperature. Close the delivery valve almost completely.
- 8 - If there is a check valve and the pump should have an open valve, observe whether there is counter-pressure in the system. In the absence of counterpressure the pump should only operate with the delivery valve partially closed, opening gradually until reaching the working point.

ACTION IMMEDIATELY AFTER START-UP

- 1 - When the driver is already working at the nominated rotation speed, slowly open the delivery pipe valve, so as to regulate the pump capacity.
- 2 - Make sure that the assembly operates without abnormal vibrations and noise.
- 3 - Control the tension value of the mains voltage and amperage of the electric motor.
- 4 - Make sure that the suction pressure value and the temperature of the pumped liquid are the values specified in design.
- 5 - Control the bearing temperature, which should not exceed 45°C above ambient temperature, but the sum should not exceed 90°C. In the first 2-3 hours of operation the temperature tends to increase, stabilizing thereafter.
- 6 - Adjust the packing, tightening the packing gland nuts evenly, allowing the drip (observing the leak values, minimum of 10 cm³/minute and maximum of 20 cm³/min).
- 7 - Check the suction pressure, discharge pressure and flow.
- 8 - Ensure that the differential temperature of the cooling water does not exceed 10 °C, and that the device that ensures minimum flow is operating.

N.B.: Check the items above every 15 minutes in the first two hours, every hour for the next 10 hours and then weekly.

PERIODIC SUPERVISION OF EQUIPMENT

WHAT?	WHEN?			
	WEEKLY	MONTHLY	BIANNUALLY	ANNUALLY
Abnormal vibrations and noise	■			
Gasket leakage	■			
Operating point of the pump	■			
Suction pressure	■			
Oil Level	■			
Current drawn by the motor and voltage of the network	■			
Bearing temperature		■		
Coolant temperature		■		
Oil change interval (See "Bearing Block Maintenance" section)		■		
Alignment of Motor-Pump set			■	
Recalibration of the measurement instruments			■	
Pump, Base and Driver fixing screw			■	
Replace the packing , if necessary			■	
Protection device to lower the minimum flow operation.			■	
Coupling Lubrification, when applicable			■	
Disassemble pump for maintenance and thoroughly inspect roller bearings, seals, o-rings, rotors, inside of carcass, thickness of the walls, areas of wear, coupling, etc.				■

* In facilities operating in good condition and where the pumped liquid is not being aggressive to the Pump materials, Annual supervision may be Bi-Annual.

ACTION TO STOP PUMP

- 1 - Close the delivery pipe valve.
- 2 - Switch off the driver, observing the gradual stopping of the equipment.
- 3- Close the suction valve when present.
- 4 - Close auxiliary pipes when present.

BEARING BLOCK MAINTENANCE (Oil)

- Maintenance includes control of oil level and temperature of the bearings.
- The first oil change must be made after the first 200 or 300 hours of work. The next changes must be every 3000 hours, or at least once a year (whichever comes first).
- The pumps leave the factory without oil in the bearing block, and the filling is made in the following way:
 - 1 - Check that the bearing block is free of dirt and moisture.
 - 2 - Remove the plug from the top of the bearing block. Check that the drain plug is tight.
 - 3 - Fill with oil until it overflows through the spillaway of the bearing block's lid.
 - 4 - Replace the plug at the top of the bearing block.
- The first oil change must be made after the first 200 or 300 hours of work. The next changes must be every 3000 hours, or at least once a year (whichever comes first).

Table of Recommended Oils

Manufacturer	Up to 3000 rpm	More than 3000 rpm
ATLANTIC	EUREKA-68	EUREKA-68
CASTROL	HYSPIN - AWS-68	HYSPIN - AWS-46
ESSO	OIL TURBINE - 68	OIL TURBINE - 46
MOBIL OIL	DTE-24	DTE-26
IPIRANGA	IPITUR AW-68	IPITUR AW-46
PETROBRÁS	MARBRAX TR-68	MARBRAX TR-46
SHELL	TELLUS-68	TELLUS-46
TEXACO	RECALL R&O - 68	RECALL R&O - 46

Oil Quantity per Bearing Block (in liters)

BEK Pump	40	50	65	80	100	125
1st Load	0.11	0.17	0.17	0.23	0.23	0.28
Approx. annual spend	2.30	2.30	2.30	2.30	2.90	2.90

BEARING BLOCK MAINTENANCE (Grease)

- The pump already leaves the factory with the bearings lubricated with Lithium-based grease with a drip point lower than 180°C.
- The bearing block must be re-lubricated every 3 months, thus avoiding deterioration and rust, and washed every two years.

Table of Recommended Greases

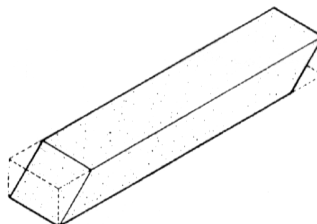
Manufacturer	Up to 3000 rpm
CASTROL	LM 2
ATLANTIC	LITHOLINE 2
ESSO	BEACON 2
IPIRANGA	ISAFLEX 2
MOBIL	MOBIL GREASE 77
PETROBRÁS	LUBRAX INDL GM A 2
SHELL	ALVANIA R 2
TEXACO	MARFAK MP 2

GASKET MAINTENANCE

If the gasket-tightener has already been tightened more than 8 mm, and there is still excessive leakage, change the gaskets in the following way:

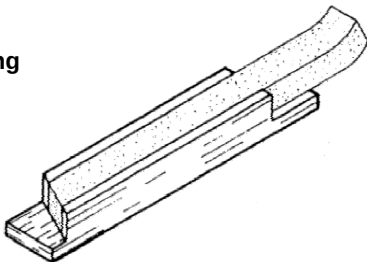
- 1 - Release the nuts of the packing gland, and then remove the gasket-tightener.
- 2 - Carefully remove the gaskets with the aid of a wobble stick, clean the gasket housing well, removing any residue.
- 3 - Check the surface of the protective sleeve that should be smooth, with no bumps or marks that will damage the gasket. If the protective sleeve presents marks, it may undergo a re-machining at its outside diameter of a maximum of 1 mm, or it must be replaced.
- 4 - The gaskets are normally supplied as continuous strips, which should be cut into rings with angled ends in the proper diameter size for the shaft sleeve and assembled as directed below.

Gasket Oblique Cut



5 - For the cutting of the gasket rings, we advise the use of a simple device as shown in the diagram below:

Device for cutting Gasket Rings



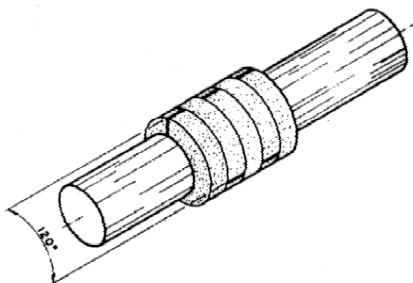
Having cut the first ring, check that its size is correct, for the perfect adjustment of the gasket's housing.

6 - Spread a thin layer of grease on the inner and outer diameters of the gasket rings and assemble one at a time in the following order:

- One gasket ring.
- One lock ring.
- Other gasket rings

Shift the joints of the second ring, about 120 degrees from the position of the first ring and thus proceed consecutively, until the last gasket ring, as the diagram shows below:

Position of the rings lagged at 120°



7 - Make sure that the shaft can be rotated after assembly of each ring, place the packing gland pinning the last ring, tighten the nuts with both hands and rotate the shaft to make sure it does not touch the packing gland.

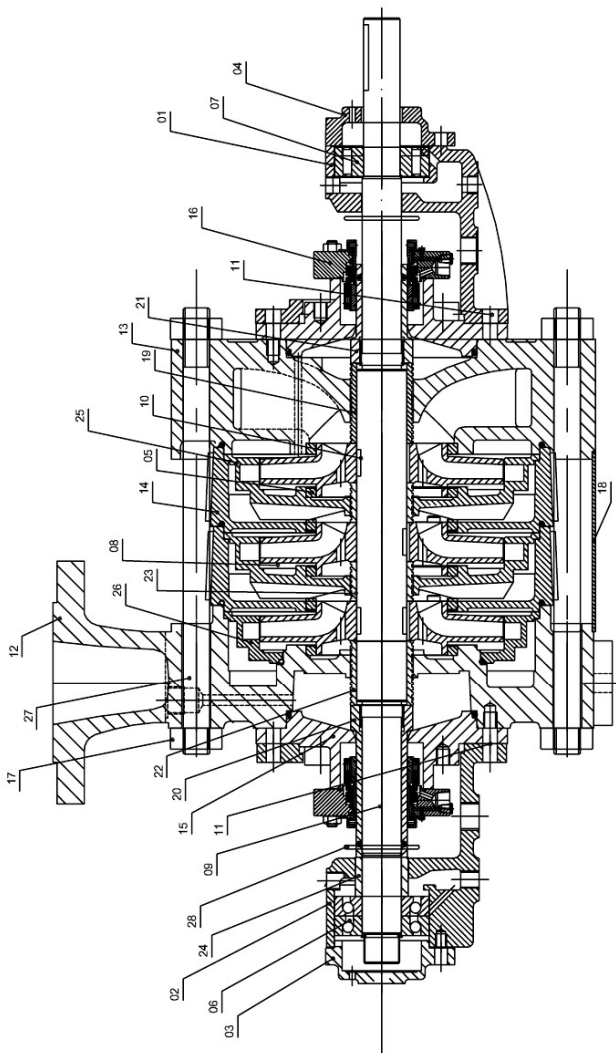
REMOVAL OF THE MECHANICAL SEAL

Removing the mechanical seal

- Remove the bearings as described in sections (01/02).
- Remove the spacer sleeve (24).
- Remove any (circulation) auxiliary piping in accordance with the pump's operation.
- Loosen the gland nuts of the mechanical seal until the seal's spring spring is no longer in tension.
- Remove the seal (16) with the ring and the rotor
- Remove the protective sleeve (20) - Remove the sealing box (15).

ITEM	DESCRIPTION	MATERIAL
01	Bearing Housing suction side	A216 WCB
02	Bearing Housing discharge side	A216 WCB
03	Bearing cap suction side	A216 WCB
04	Bearing cap discharge side	A216 WCB
05	Wear ring	A747 CFCU1
06	Bearings 7306 (2x - back to back)	NOT AVAILABLE
07	Bearings NU 207	NOT AVAILABLE
08	Impeller	A487 C6NM
09	Shaft	AISI 420
10	Key seal	AISI 316
11	Bearing housing screws	AISI 316
12	Discharge volute casing	A216 WCB
13	Suction volute casing	A216 WCB
14	Stage body	A216 WCB
15	Seal Housing	A216 WCB
16	Mechanical Seal	NOT AVAILABLE
17	Volute Nut	AISI 316
18	Cover plate	A36
19	Space sleeve suction side	AISI 420
20	Shaft sleeve discharge side	AISI 316
21	Shaft sleeve suction side	AISI 316
22	Space sleeve discharge side	AISI 420
23	Stage sleeve	AISI 420
24	Adjust sleeve	AISI 420
25	Intermediary diffuser	A487 C6NM
26	Last stage diffuser	A487 C6NM
27	Rod	SAE 1045
28	Deflector	RUBBER

* Items 20 and 21 are supplied by mechanical seal manufacture
These items are supplied with mechanical seal (Item 16)



RE-FITMENT OF THE MECHANICAL SEAL

After of pump mount and it confirm it adjustments it needs, follow the steps:

First mount the shaft sleeve (Pos. 12 e 13) in the position at both sides;

Second mount of rotative set (Pos. 1, 2, 3, 4, 5 e 8) on the sleeve, attention to the spring side (cw and ccw);

Third mount the seat (Pos. 5ª, 6 e 7) in the cover (Pos. 10 e 11) and mount the cover at the pump bore;

Fourth fix of bolts and screws bore at the correct position;

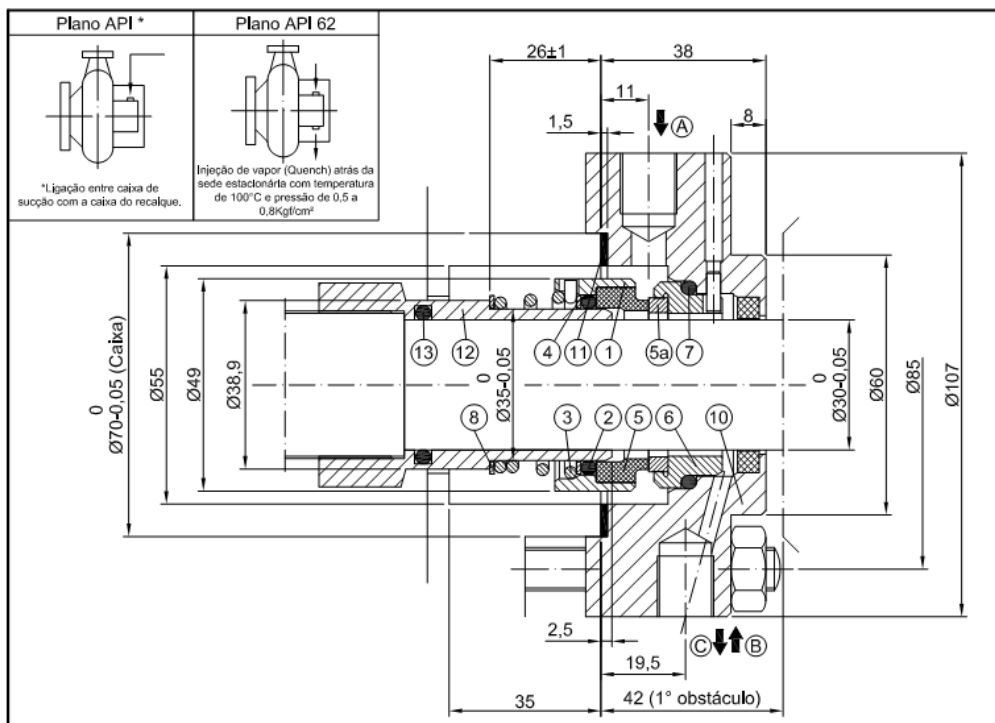
Finally connect the pipe of circulation in the cover;

Note: The mount distance of the mechanical seal is automatic with fixing of cover.

Observation:

Motor view with clockwise rotation, should be spring right;

Motor view with counterclockwise rotation, should be spring left;



PURE GRAPHITE GASKETS

It is possible to manufacture pure graphite gasket rings, split or closed. An example is ROTATHERM gasket, which provides a high-accuracy result value, whose assembly requires corresponding care.

Assembly

- The rings should be placed with the joint shifted to 120°, one over the other.
- The gasket rings are to be printed in the area of the gasket by means of a pressure ring or the respective packing gland.
- There must be no gap between the internal diameter of the sealing chamber and the external diameter of the rings. There must be a gap of 0.3mm in the diameter, between the protective bushing and the internal diameter of the rings.

Operation

- The nuts of the packing gland must be tightened slightly by hand, before setting the pump in operation.
- Fill the pump. The gasket must be leaking! Observe the fluid leakage for 5 minutes.
- The leakage can be reduced after the first 5 minutes of operation. The nuts of the packing gland can be tightened by 1/6 of a turn, and then the fluid leakage must be observed for a further 5 minutes.
- As long as the leakage is excessive, the previous process must be repeated, until a minimum leakage value is reached (minimum of 10 cm³/minute and a maximum of 20 cm³/minute).
- Once the leakage has been regulated, it must be observed for a further 2 hours.

Maintenance

- After some time in operation, if the fluid leakage increases, the nuts of the packing gland must be tightened uniformly, by 1/6 of a turn.
- When it is no longer possible to adjust the leakage via the packing gland, a new gasket ring must be placed.

PUMP DISASSEMBLY

- Switch the driver off. Obey the usually safety rules in relation to the electrical and mechanical parts, and accidents. In the case of pumps working with fluid at high temperatures, you should wait until it reaches room temperature.
- Close the Suction and Pressure Valves.
- Drain the pump, removing the plugs.
- Close and disconnect the auxiliary pipes.

- Remove the Coupling Protector, extract the Coupling lock screw. Next, extract the Coupling Bushing from the side of the pump, using a suitable puller.
- When a component demonstrates some difficulty in disassembly, we suggest the use of a lubricant oil.
- Drain the oil from the Bearing Block. Loosen the screw that fixes the Bearing Block Cover, and then remove it. (See fig. 1)
- Loosen the tab of the locking plate that locks the Bearing's Bushing Fixture, using a pin or the tip of a screwdriver. (See fig. 2)

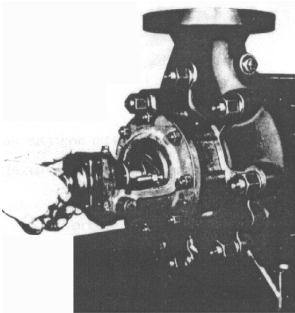


Fig. 1

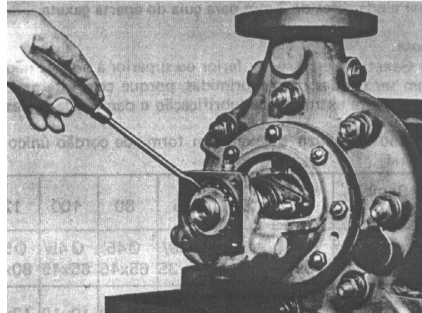


Fig. 2

- Unscrew the Bearing's Bushing Fixture, using a pin or spanner and a hammer. (See fig. 3)
- With the Bearing's Bushing Fixture disconnected from the Bearing, use a tube to strike the front face of the Bearing's Bushing Fixture, aiming to release the Taper Sleeve Lock.

N.B.: Prop shaft at the other end, while using the tube, in order to avoid damage to the contact surfaces of the Balance Disk and Counter-Balance Disk.

- With the Taper Sleeve Lock released, extract the Bearing's Bushing Fixture, Locking Plate, and Taper Sleeve Lock, using two screwdrivers leaning on the bearing's blocks face. (See fig. 4)

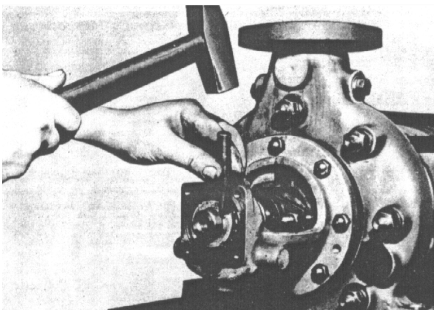


Fig. 3

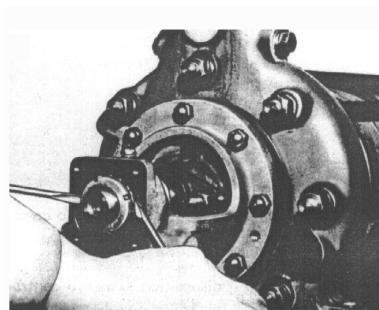


Fig. 4

- Tighten the screws extracted from the Bearing Block uniformly, and release it. (See fig. 5)
- Extract the Bearing Block, by hand. (See fig. 6)

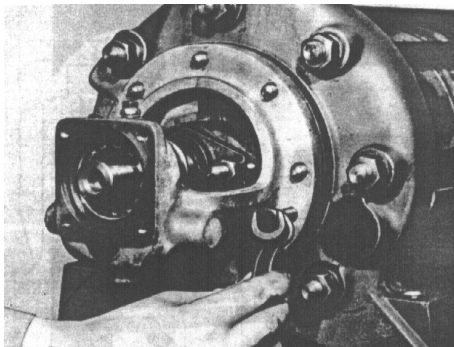


Fig. 5

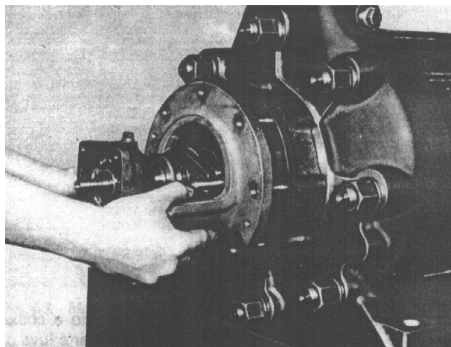


Fig. 6

- Extract the Centrifuge Ring. To this end, insert the tip of a screwdriver in the slot of the ring, causing it to increase its internal diameter so that it is easily extracted from the shaft. (See fig. 7)
- Loosen the nuts, and extract the Packing Gland.

N.B.: If the pump **has a cooling system**, in this stage it is necessary:

- To loosen the inlet and outlet auxiliary pipes of the coolant;
- To loosen the nuts and extract the Cooling Chamber Cover;
- Remove the O'ring and the Flat Joint.

- Extract the Gasket Gland, together with the Gasket Rings, which will be within it. (See fig. 8)

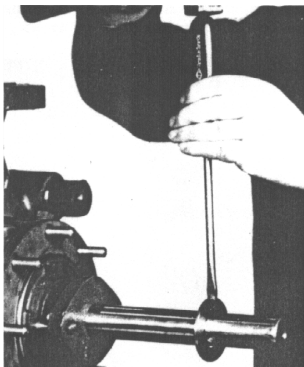


Fig. 7

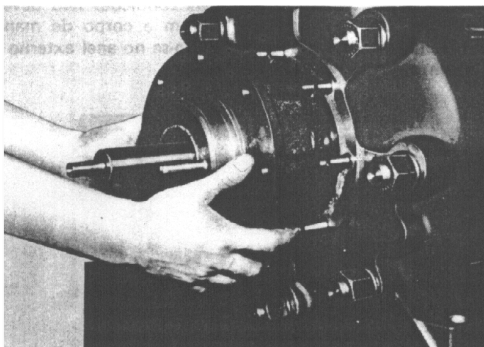


Fig. 8

- Remove the O'ring.
- Lock the other end of the shaft using the key and a device for locking the Shaft. Loosen the shaft's Protective Sleeve and remove it along with the O-ring. (See fig. 9)

N.B.: Whenever you secure or loosen the Protective Bushing, lock the operating end of the shaft.

- Remove the O'ring.
- Lock the other end of the shaft using the key and a device for locking the Shaft. Loosen the shaft's Protective Sleeve and remove it along with the O-ring. (See fig. 9)

N.B.: Whenever you secure or loosen the Protective Bushing, lock the operating end of the shaft.

- Loosen the nuts, and disassemble the clamps and protective cover.
- The disassembly sequence must be made from the side of the Pressure Housing.
- Make markings on the parts, to avoid problems at the time of assembly.
- Unscrew the nuts and remove the rods.
- Wedge the lower region of the Stage Bodies with wood, avoiding strain and blow to the Shaft. Pass two rods and rope over the Pressure Housing, in order to facilitate disassembly and avoid strain to the Shaft. (See fig. 10)
- Using a lever or a piece of lead, disengage the pressure housing and disassemble it. (See fig. 10) The Last Stage Diffuser and the O-ring will come off along with the Housing Pressure
- Disassemble the Rotor of the last stage and its Key. To do this, make a lever in the region supporting the vanes so that breaks and cracks do not occur. (See fig. 11)

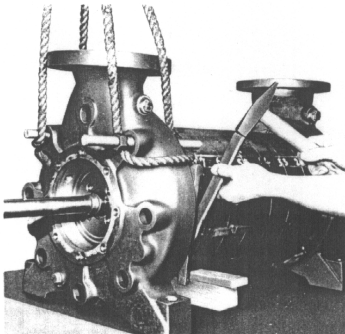
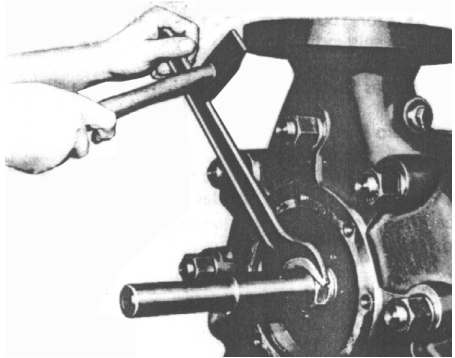


Fig. 10

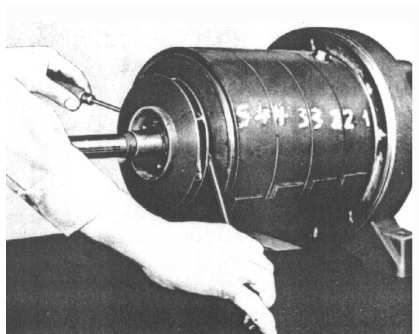


Fig. 11

- Disassemble the O'ring.
- Support the next Stage Body and disassemble it. Along with the Stage body, the Diffuser and the Wear Ring will come out.
- Disassemble the Stage Bushing and Rotor of the next stage together with the respective Key.
- Continue in this sequence until the first Stage Body has been dissassembled.
- Remove the Pressure Housing shaft, and the first stage Rotor, Suction Spacer Bushing and Suction Protective Sleeve will come out together.

BEFORE PUMP ASSEMBLY

Analysis of Parts

- Shaft: Cannot have warping of more than 0.08mm per meter.
- Stage bodies: Check the parallelism of the mounting faces, not allowing a deviation greater than 0.05 mm.
- Bearings: It must not have excessive gapping, rust or discoloration.
- Bearing Block: The deviation in perpendicularity between the diameter where the Bearing fits and the mounting surface must not exceed 0.05 mm, as this would cause damage to the Bearings.
- Rotors / Spacer Bushings / Stage Bushings / Wear Ring / Diffusors / Protective Bushings: The deviation in perpendicularity between the internal diameter (external diameter in the case of Diffusers) and the contact surfaces in assembly must not exceed 0.05 mm. Check that the Spacer Bushing is not scraping the Suction housing.

Table: Radial Clearance in Diameters

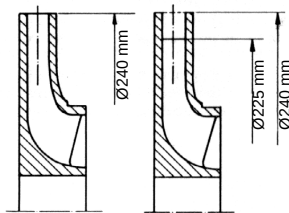
	Original Clearance (mm)	Maximum Clearance (mm)
Between Rotor and Wear Ring	0.3	1.0
Between Stage Bushing and Intermediary Diffuser	0.3	1.0
Between Spacer Bushing and Suction Housing	0.3	1.5
Between Gasket Gland and Protective Bushings	0.5	1.5

- The radial clearance must be the same in each stage of the passage regions, or recirculation of the pumped liquid.
- When a worn part of a stage exceeds the maximum radial clearances, all equivalent parts of the other stages must be replaced.
- All parts that have deviation and clearance values higher than those specified must be replaced, thus preventing the sum of these gaps causing irregular contact and premature wear, or even locking the Pump.

Wearing of Rotor Diameter

If there is a need to lower the Rotor diameter, as it relates to a multi-cellular Pump, this is only carried out on the inner vanes, conserving the closing sidewalls.

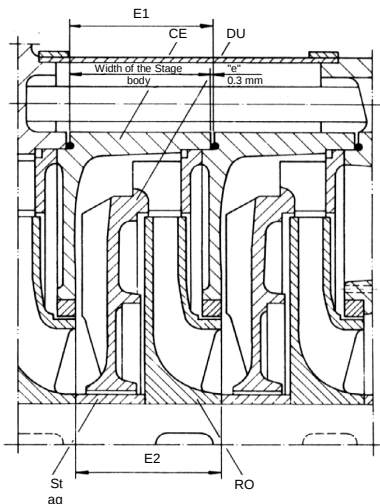
In our example, we lowered a Ø240 mm Rotor to Ø225 mm. (See diagram at the side.)



Control of Part Dimensions

To ensure a uniform positioning of the Rotors in relation to the Diffusers and Stage Bodies, the following controls can be made:

Measure the Stage Body, and add 0.3, ("e") to the measurement found, and we will have measurement E1. The total of the Rotor + Stage Bushing measurements supplies measurement E2. The necessary condition is $E1 = E2$. If there is a difference, it must be compensated by the Stage Bushing. If $E2 < E1$, use a larger bushing. If $E2 > E1$, re-machine the bushing removing half of each side, maintaining the parallelism between the contact faces.



Control of Turn-table Assembly

We suggest that the dynamic balancing of the turntable assembly is made, when a part is replaced or retrieved. For this, it is necessary:

- To assemble the Protective Sleeve suction side (without O'ring), resting it firmly on the camshaft lobe. Also assemble the Coupling Bushing pump side and its key.
- To assemble Spacer Bushing, Rotors (with their Keys), Stage Bushings. The Rotors must be assembled in the same sequence in which they will work.
- To assemble the Protective Sleeve pressure side (without O'ring) and tighten it firmly.

Once the Set is assembled, control the radial run-out in the cube region of the Rotor, on the outside of the Protective Bushings and the Spacer Bushings, with a maximum value of 0.05 mm.

PUMP ASSEMBLY

- All the parts must be clean and free of burrs. The assembly must be made on a flat surface, such as a straightening bench, for example.
- The tightening of the screws must be crossed and uniform.
- Parts with tight assembly and screw fixation must receive a layer of Molybdenum disulfide (e.g. Molykote paste G)

- Adjust the Rotors in the Shaft and Keys, making them move freely without manual force.
- Install the O'rings in the Protective Bushings.
- Mount the Protective Sleeve on the Shaft until it touches the lobe, tightening with medium force.
- Mount the Spacer Bushing on the Shaft.
- Mount the Key, the Rotor of the first stage and the Stage Bushing.
- Support the part of the Stage Body that receives the Wear Ring on the Straightening bench.
- Mount the Wear Ring on the Stage Body, using a rubber hammer or a piece of lead.
- Mount the Intermediary Diffusers on the Stage Bodies. Do not mount the Diffusers on the existing lock on the inside of the Stage Body,
- Mount the Diffusor of the Last Stage and the O'ring on the Pressure Housing.
- Mount the Shaft on the Suction Housing.
- Mount the O'rings on the Stage Bodies and on the Suction Housing.
- Mount the Stage Body on the Suction Housing, using a rubber hammer or a piece of lead. Make sure the external lobe of the Stage Bodies not interfere with the passage of the rods.
- Assemble another Rotor with its Key, and Stage Bushing on the Shaft.
- Assemble another Stage Body, supporting its upper part with a piece of wood.
- Repeat this sequence until the last Stage Body is assembled.
- Assemble the Pressure Housing on the last Stage Body.
- Install the Rods, washers and nuts. Leave the tips of the Rods that have a longer thread on one side.
- Tighten the Rods in a crossed and uniform manner, using a torque wrench and values in Table below:

Pump	No. of Stages	Torque (Kg.m)
BEK 40	1 to 10	7.5
	11 to 16	8.0
BEK 50	1 to 10	8.5
	11 to 15	10.0
BEK 65	1 to 10	12.0
	11 to 14	15.0

Pump	No. of Stages	Torque (Kg.m)
BEK 80	1 to 8	20.0
	9 to 12	23.0
BEK 100	1 to 6	25.0
	7 to 11	27.0
BEK 125	1 to 6	30.0
	7 to 10	32.0

- Mount the Protective Sleeve, along with the O-ring.
- Guide the O'ring in the Gasket Gland and mount it on the Pressure Housing which already has stud bolts.

N.B.: If the pump **has a cooling system**, in this stage it is necessary:

- To Guide the Flat Joint on the Cover of the Cooling Chamber and the O'ring in the appropriate channel of the Gasket Gland;
- To mount the Cover of the Cooling Chamber, fitting it on the Gasket Gland;
- When using new bearings, use a piece of wood to mount them on the Bearing block (as per the diagram to the side). When assembly is no longer possible in this way, use a tube in the external diameter of the Bearing until it reaches the bottom of the Bearing block.
- The ideal position of the inner race of the Bearing suction side in relation to the rollers is one where even with the entire set thrust into the pressure side, the locking plate not rub against the roller fixing assembly.
- Mount the Packing Gland and pull the nuts. Install the Centrifuge Ring, opening it with a screwdriver to facilitate assembly on the shaft.
- Assemble the Bearing Block and fix it with the nuts. (See fig. 12)
- Mount the Taper Sleeve Lock, the Bearing's Fixing Nut, the Locking Plate and the Bearing's Inner Ring on the shaft. (See fig. 13)

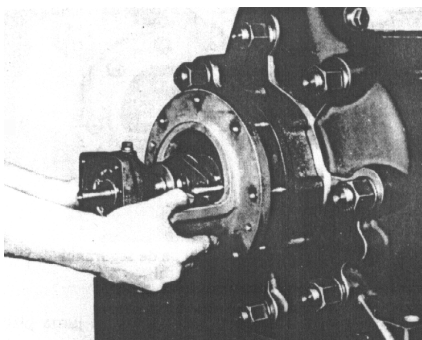
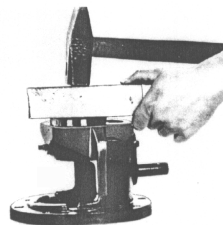


Fig. 12

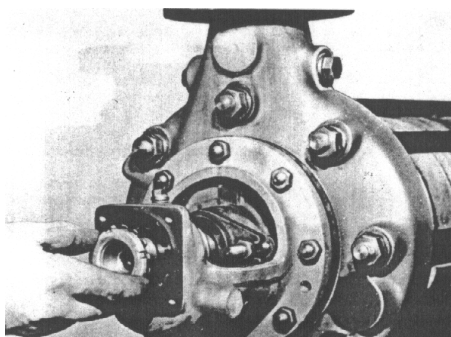


Fig. 13

- Check that the Turntable Assembly turns freely.

- Tighten the Taper Sleeve Lock through the Bearing Block, using a pin and a hammer or a spanner. Strike the face of the nut with a tube (fig. 14). With each hit, the assembly enters a little and loosens. Tighten the nut and hit it with a tube until the inner race is correctly positioned. The ideal position of the inner race in relation to the rollers is one where even with the wear of the axial thrust balancing system; the locking plate does not rub against the roller fixing assembly.
- Give the final tightening of the Bearing Fixing Nut until one of the tabs of the Locking Plate coincides with one of the grooves of the Bearing Fixing Nut. Make the lock using a screwdriver (See fig. 15).

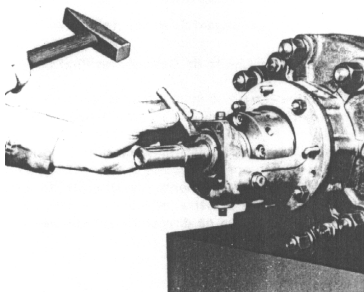


Fig. 14

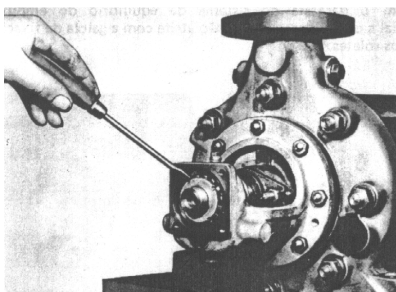


Fig. 15

- Install the pin on the end of the Shaft.
- Mount the Bearing Block Cover with the Flat Joint (Leave the spillway hole of the Bearing Block Cover in the lower position).
- Fix the Bearing Block Cover with the screws.

N.B.: Once assembly of the pump is complete, before packing, check that the turntable assembly is turning freely without contact with stationary parts.

FUNCTION ANOMALIES AND LIKELY CAUSES

NINE SYMPTOMS

- | | |
|-----------------------------------|---|
| 1 - Insufficient Flow | 6 - Excessive Leakage in Gasket |
| 2 - Motor Overload | 7 - Excessive Heating of Pump Housing |
| 3 - Excessive End Pressure | 8 - Irregular Operation of Pump Making Noises |
| 4 - Overheating of Bearing Blocks | 9 - Pump Demonstrating Vibrations |
| 5 - Leakage in Pump | |

LIKELY CAUSES	NINE SYMPTOMS									
	1	2	3	4	5	6	7	8	9	
Excessively high pressure	■									
Total height of installation higher than the nominal height of the Pump	■									
Pump and/or pipes are not totally full of fluid when pumping or sealing	■						■	■	■	
Rotor and/or suction pipe are blocked	■								■	
Formation of air pockets in the pipe	■								■	
Available NPSH lower than NPSH required	■						■	■	■	
Entry of air in the sealing chamber	■									
Incorrect Rotation Direction	■									
Very low rotation	■									
Wearing of the internal parts of the Pump	■							■	■	
Very low suction pressure	■							■	■	
Specific weight of viscosity of the fluid is higher than that specified		■								
The Packing gland is tightening in an incorrect way		■								
The minimum flow valve does not seal with the pump at full load		■								
The motor is only operating in 2 phases		■								
The counter-pressure of the system on the pump is lower than expected		■							■	
Very high rotation		■	■	■				■	■	
Specific weight is very high			■							
Very high suction pressure			■							

LIKELY CAUSES	NINE SYMPTOMS									
	1	2	3	4	5	6	7	8	9	
Motor/pump assembly is misaligned				■		■		■	■	
Parts of the pump outside the radial and axial run-out specified. Pressure and suction pipes exert mechanical stresses				■				■	■	
Lack or excess of use of lubrication not appropriate for bearing block				■				■		
Base, motor or pump fixed inappropriately. Base not filled with mortar									■	
Bearings faulty or with inadequate manufacture clearance				■				■	■	
Friction between the rotating and stationary parts				■					■	
Loose rods and nuts					■					
O'rings, Flat joints or surfaces damaged					■					
Rapid changes in temperature					■					
Gasket worn, misplaced, improper or inefficient.						■				
Excessive roughness, grooves or ridges in Protective Sleeve. Absence of O'ring within it.						■				
Defects in the sealing fluid passage area in the sealing chamber						■				
Lack or water or inefficiency of cooling chamber						■				
Insufficient flow							■	■	■	
Unbalanced rotor								■	■	
Radial clearance excessive or different between the turn-table assembly and the stationary parts									■	
Contact surfaces and bearing block support assembly outside parallelism and perpendicularity									■	

LIKELY CAUSES	NINE SYMPTOMS									
	1	2	3	4	5	6	7	8	9	
Shaft bent towards the bearing support region									■	
Formation of steam in the pump caused by: non-operation of the minimum flow device; low suction pressure; increase variation in temperature; reduction in pressure									■	

RECOMMENDED SPARE PARTS

IMBIL recommends the quantity of spare parts, for a continuous work over a period of 2 years, in accordance with the number of Pumps as per the table below:

Part	Denomination	1	2	3	4	5	6 and 7	8 and 9	more than 10
	Last Stage Diffuser	1	2	2	3	3	4	4	40%
	Interm. Diffuser (Set) *	1	2	2	3	3	4	4	40%
	Shaft	1	1	2	2	2	3	3	30%
	Rotor (Set) **	1	2	2	3	3	4	4	30%
	Bearing (Set)	1	2	2	3	4	4	5	50%
	Gasket (Set with 8 rings)	4	6	8	8	10	10	10	100%
	Wear Ring (Set) ***	1	2	2	3	3	4	4	40%
	Stage Bushing	1	2	2	3	3	4	4	40%
	Locking Bushing ***	1	2	2	3	4	4	5	50%
	L. Pressure Protective Sleeve	1	2	2	3	4	4	5	50%
	L. Suction Protective Sleeve	1	2	2	3	4	4	5	50%
	Spacer Bushing	1	2	2	3	3	4	4	40%
	Joint Set	2	4	6	8	8	9	12	150%
	O'ring Set	2	4	6	8	8	9	12	150%
	Mechanical Seal ****								

* The number of parts in a set is the same as the number of stages in the Pump, minus one.

** The number of parts in a set is the same as the number of stages in the Pump.

*** Includes the Locking Plate and the Bearing's Bushing Fixture

**** If there is a mechanical seal, follow the manufacturer's recommendations.

ORIGINAL

WARRANTY CERTIFICATE

WARRANTY TERM

The present “**Warranty Term**” has as objective to guarantee to the user all equipment shipments and/or the materials produced by the manufacturer, under the following conditions:

This term is valid for 12 (twelve) months from the effective start-up date of the equipment or 18 (eighteen) months from the invoicing date to the original user, whichever happens first.

The equipments and materials are covered by this warranty in regards to the repair or substitution of parts by IMBIL factory or by the authorized IMBIL technical assistance service against materials or fabrication defects, as long as there is evidence of these defects and against invoice presentation, with the following restrictions:

- All the material / equipment made by IMBIL or substituted part removed against warranty will become property of the manufacturer.
- Any repair, modification or exchanges against warranty will not prorogate the original equipment or substituted part warranty term.
- The manufacturer cannot be held responsible for losses caused by the equipment stop (Loss or Damage to Property).

The warranty does not cover:

- Transportation of the defective materials from the facility where they are installed to the manufacturer plant / technical assistance service and the later return to the original costumer facilities.
- Travel and hotel expenses from the manufacturer technician, which will be charged according to the current pricing at the time of the repair service, when this it is performed at the installation site.

This warranty loses effect if the problem happens due to the following cases:

- Operational conditions that differ from the indicated by the manufacturer.
- Normal wear caused by the use or by erosion, abrasion or corrosion.
- Incorrect use, lack of knowledge from the operator, improper use, inadequate transportation, movement or stocking, assembly or operation other than the recommended by the technical manual provided by the manufacturer.

The equipments, due to constant improvements, are subject to changes without previous notice. The warranty is effective only if this slip is sent to the manufacturer.

COSTUMER WARRANTY CONTROL

Name: _____ Serial No. _____ Invoice _____ Date ____/____/____
Address: _____
ZIP Code: _____ City: _____ State: _____ Country: _____



Pumping Solutions

Reseller – Stamp and Signature

TOLL FREE NUMBER – COSTUMER SERVICE CENTER (BRAZIL): 0800 14 8500

MANUFACTURER WARRANTY CONTROL

Serial No. _____ Invoice _____ Date ____/____/____

Name: _____

Address: _____

Zip code _____ City _____ State: _____ Country: _____



Owner Signature

Reseller – Stamp and Signature

Please fill out this form, detach it and send it to the manufacturer.

CUSTOMER SATISFACTION SURVEY

Dear Customer,

The biggest concern of IMBIL Group is to offer the best Customer Service, Product, Associated Services and Technical Support. For us, it is very important to know your opinion about the IMBIL's Quality. In knowing so IMBIL Group will be able to continually improve its quality. You can contribute by filling out this Customer Satisfaction Survey.

IMBIL GROUP thanks for your help.

Customer: _____	
Address: _____	
City: _____	State: _____ Zip Code: _____
Contact: _____	Date: ____ / ____ / ____
Department: _____	Function: _____
Phone: (____) _____ - _____	E-mail: _____

Region: ☐ North ☐ Northeast ☐ South ☐ Southeast ☐ West Central ☐ Africa ☐ Central America ☐ North America ☐ South America ☐ Asia ☐ Europe ☐ Oceania	Application: ☐ Sugar and Ethanol Industry ☐ Distilleries ☐ Mining / Steel Industry ☐ Sanitation ☐ Pulp and Paper ☐ Irrigation ☐ Valve ☐ Air Conditioning ☐ Chemical / Petrochemical / Naval ☐ Food Industry / Textile ☐ Steam Generation / Cogeneration ☐ Fire Fighting ☐ Other _____
---	---

Product purchased: (Please indicate product's description and/ or serial numt) _____
Acquisition of product: ☐ IMBIL ☐ Authorized Distributor ☐ Representative _____

1. CUSTOMER SERVICES QUALITY	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Facility for contact, agility and efficiency in providing the information requested.					
2. COMMERCIAL CONDITIONS	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Meeting your expectations related to commercial conditions.					
3. DELIVERY TIME	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Meeting your expectations related to delivery time.					
4. TECHNICAL INFORMATION	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Meeting your expectations related to technical data provided with the product.					
5. DELIVERY QUALITY	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Meeting your expectations related to product shipping conditions (packaging, visual aspects).					
6. OPERATION QUALITY	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Meeting your expectations related to product and operation conditions promised.					
7. POST SALES	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Efficiency on services performed					

Would you have any suggestion on how to increase customer satisfaction on IMBIL's Products / Service?

Phones for Contacts

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Pumping Solutions

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