

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

PUMPS BP



"ISO 9001:2015 Quality
Management System"



Pumping Solutions

Mr. Proprietor

Congratulations! You have just purchased an equipment of simple construction, designed with the most advanced technology, with excellent performance and that allows easy maintenance. The goal of this Manual is to inform the user about the details of the equipment and the correct techniques for Installation, Operation and Maintenance.

IMBIL recommends that the equipment is installed and cared for according to what is recommended by the best practices and according to the instructions included in this Manual, and used according to the service conditions to which it has been selected (flow, total developed head, speed, voltage, frequency and temperature).

	
Pumping Solutions	
Model:	
Serial number:	
TAG:	
IMPELLER [Ø]:	
ROTATION:	
DIRECTION:	
FLOW [Q]:	
THD/ PRESSURE:	
Manufactured in:	
IMBIL IND. E MAN DE BOMBAS ITA LTDA - www.imbil.com.br RUA JACOB AUDI, 690 ITAPIRÁ, Indústria Brasileira CNPJ.: 51.4826776/0001-26 - FONE(19) 3843-9833	

IMBIL cannot be held responsible for faults caused by the inobservance of the service prescriptions and recommends that this Manual is used by personnel responsible for the installation, operation and maintenance.

In case of consultation about the equipment or when ordering spare parts, indicate the part code, model, pump line and also the serial number found on the identification plate.

NOTE

IMBIL requests that the customer fills out all the data right after receiving the WARRANTY TERM of his/her equipment and sends the stub to IMBIL, making the exchange of information between IMBIL and the CUSTOMER easier.

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INSTALLATION

The pumps must be installed, leveled and aligned by competent personnel. When this service is performed incorrectly it brings as a consequence disruptions at the operation, premature wearing and irreparable damages.

EQUIPMENT INSPECTION

Inspect the equipment as soon you receive it. Check it against the cargo manifest and immediately report any irregularities found to the supplier.

STORAGE

Short term storage: Put the pump in a dry place and protect it against humidity. Do not remove the protection of the suction and discharge nozzles. Protect the bearings and couplings against the entrance of strange objects. Make sure the packing rings are not assembled in the stuffing box. Manually rotate the impeller several times at least once a week to avoid oxidation and to distribute the lubricant.

Long term storage: The storage of the pumps for longer than 30 days must be avoided because this will require other precautions in addition to those mentioned above. If the shafts bushings were made of stainless steel, the graphite gaskets in the presence of a thin layer of condensed humidity may have an electrolytic action that will result in the corrosion of the bushings. This reaction does not occur in normal services conditions.

It is recommended to add additional protection through internal washing with SHELL VPI, dissolved in ethanol or ENSIS-ENGINE oil 20 or 40. To carry out this process, close the suction and discharge openings with blind flanges; fill the pump through the holes on the upper part of the housing until the level reaches the stuffing box. Manually spin the impeller to get all the rotating parts wet. Drain the liquid through the lower plugs.

This protection lasts for a period of 3 months and at the end of this period the procedure must be repeated in case the pump remains unused for longer time. Besides that, the pump must be lubricated regularly.

Do not disassemble the pump to apply the protection treatment to the internal parts.

The coupling hubs must be disassembled, protected with a corrosion inhibitor, wrapped up and put away, without having contact with other metallic parts. The exposed parts of the shafts must also be protected with a corrosion inhibitor.

CLEANING BEFORE INSTALLATION

All the residues of the products used must be removed to avoid oxidation of the faces of the suction and discharge flanges, shafts and coupling parts. The pumps that were submitted to preventive washing treatment must be cleaned with clear water at least twice before installation.

EQUIPMENT LOCATION

The pumps must be installed close to the suction liquid reservoir/source. It is important to keep in mind easy accessibility for inspection during operation and a simple suction and discharge piping lay-out. Use the least possible number of elbows and joints.

ALIGNMENT

All pumps and their starting units are assembled on appropriate baseplates and carefully aligned before leaving the factory. But as the bases have certain flexibility and may suffer deformations during transportation or due to uneven tightening of the anchor bolts it is necessary to check the alignment at the installation site if necessary. Whatever coupling is used, a correct alignment is essential for normal operation. The pumps destined to work with hot liquids must be aligned at normal service temperature. The alignment must be checked after assembly of the suction and pumping piping.

When using couplings, the shafts must be aligned in the horizontal and vertical plane. The majority of the couplings require a specific spacing between driver shaft and driven shaft (= DBSE = Distance Between Shaft Ends). Check the maintenance manual of the

coupling manufacturer.

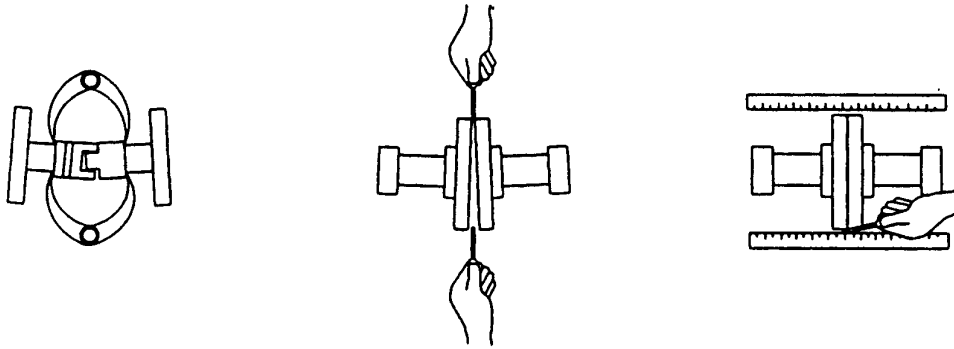


Figure 1 A – Flexible Coupling

Figure 1 B – Rigid Coupling

Flexible couplings must be aligned, which can be done with the use of a feeler gauge (See Figure 1 A). Rigid couplings must be aligned with the use of a feeler gauge to measure the distance between the two halves of the part. (See Figure 1 B). Check the parallel adjustment putting a ruler over both halves of the coupling on the top, bottom and side.

SUCTION AND DISCHARGE PIPING

One cannot obtain satisfactory operation when the piping exerts forces over the pumps. These are subject to deformations or displacements due to the tightening of the piping fixation screws. The piping flanges must be well adjusted to the pumps even before being driven in.

The suction and discharge piping, as well as their accessories that may eventually exist must be conveniently fixed close to the pump, in a way that there is no transmission of forces to the housing.

Suction piping:

- Should be as straight and short as possible. If it is impossible to avoid a long length, the diameter must be maximized to reduce the pressure losses as much as possible.
- Under no circumstances the suction diameter must be smaller than the suction flange of the pump.
- The piping must go up or down continuously, with no high or low points at its development. In this way, air pockets in the suction line, that inhibit normal pump operation, are avoided. Use only eccentric reductions with the straight side facing up (See Figure 2 A and Figure 2 B).

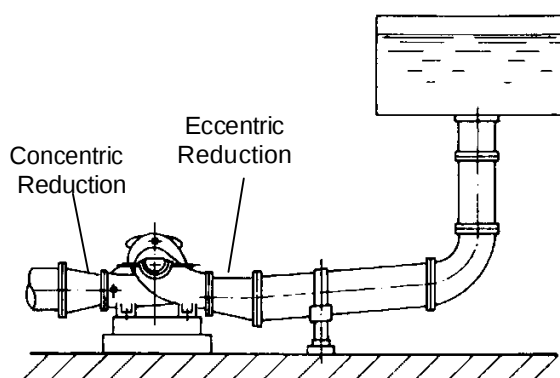


Figure 2 A – Positive suction

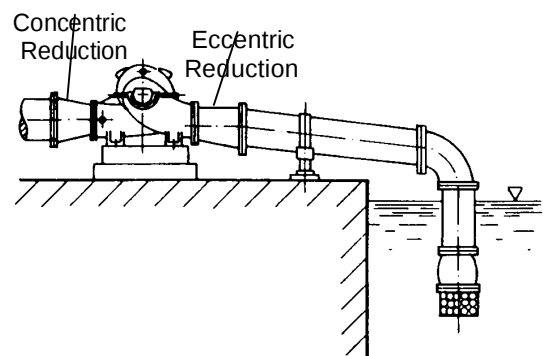


Figure 2 B – Negative suction

- The suction piping must have sufficient submergence, in order to avoid aspiration of air into the piping when the liquid level is at its minimum. Big pipings must have pipe ends into the tank at a depth equal to four times their diameter. Pipes with smaller diameters require submersion from 60 to 90cm.
- The suction piping must be inspected for leakage and the piping must be carefully washed so that the debris that may be present in the piping is not sucked into the pump.
- If the pump works with positive suction it is necessary to install a gate valve in the suction piping.
- In some special cases it is necessary to install drains at the suction piping entrance to avoid the entrance of debris.

Discharge piping:

It may be necessary to use a retention valve, a gate valve or both in the discharge piping. The retention valve is used to protect the pump against an eventual excessive system pressure or against inverse rotation caused by the return of the liquid in case of interruption of driver operation.

OTHER PIPING

Flushing line – All the drainage points of the equipment must be connected to a convenient pouring place through adequate pipings.

Bearings refrigeration piping – If the pump has either one bearing or both of them refrigerated by the pumped liquid itself, the coolant supply tube must be directly connected to the pump's discharge and the return pipe must be connected to the suction. The supply must have a valve so that the coolant flow can be regulated. If the pumped liquid cannot be used for refrigeration of the bearings it an external source is required.

Stuffing box liquid seal pipings – Generally, the stuffing box sealing liquid is collected at the discharge volute and taken to the stuffing box through pipings in which there are valves for controlling the flow. If the pumped liquid cannot be used as sealing liquid, an external source is required, that is capable of supplying clean liquid under a pressure slightly above the suction pressure.

Equipment – It is necessary to install manometers at the pump's suction and discharge, using threaded holes in the flanges. Assemble the manometers in the correct location, where there is easy access and good visibility, because these are valuable aids in the evaluation of the equipment's performance.

OPERATION

The following instructions cover the most important steps to obtain adequate pump operation. Any change to these instructions caused by peculiarities of an installation must obey the established engineering standards.

SUCTION CONDITIONS

The suction pressure must be maintained within the limits established during contract formation. If the original conditions must be changed after that, consult the nearest IMBIL representative.

PRIMING

Caution! Always prime the pump before turning it on.

Priming a centrifugal pump means removing the air, gas or vapor from the suction piping and housing. Those internal parts that require pumped liquid for lubrication may stall if the pump is not previously filled with liquid. Priming may be obtained by applying one of the methods below, according to the system lay-out:

Suction pressure above atmospheric pressure (submersed pump)

- 1) Open all the suction piping valves allowing the piping and housing be filled with liquid.
- 2) Open the purge valve located at the highest point of the housing in order to release the air from the interior of the housing.

3) When the liquid leaves continuously through the purge valve without air bubbles the pump is primed and can be turned on.

Suction pressure below atmospheric pressure (suction height)

Priming through an ejector: When there is vapor, water under high pressure or compressed air, the pump may be primed by connecting the suction of an ejector to the highest point of the casing. Proceed in the following way:

- 1) Open the suction valve and leave the discharge valve closed.
- 2) Turn on the ejector to extract the air from the housing and suction piping.
- 3) When the liquid comes out without bubbles, the pump is primed and may be turned on.
- 4) After turning on the pump, slowly open the discharge valve.
- 5) To make sure the pump will not lose priming during the start up, the ejector must continue working until the pump reaches its running speed. If the pump continues primed, the ejector will extract liquid continuously without air bubbles.

Priming through foot valve: The foot valve is used at the lowest point of the suction piping to keep the liquid in this piping and inside the housing after the initial priming. This is done as follows:

- 1) Fill the suction piping and the housing with liquid from an external source.
- 2) Open the purge valve located at the highest point of the housing to allow the air to leave.
- 3) When the liquid leaves the purge valve continuously without air bubbles the pump is primed and can be turned on.

NOTE: It is not recommended to use foot valves in cases in which the pumped liquid contains solid particles because these can get stuck between the valve and the housing, preventing sealing.

Priming through a vacuum pump: The priming can also be obtained by means of a liquid ring type vacuum pump. The operation is identical to the priming through the ejector.

PUMP START UP AND PUMP OPERATION

Preliminary instructions:

- Make sure that the packing rings are in the stuffing boxes.
- Check the rotation direction of the driver with the pump-motor uncoupled. The arrow on the pump housing indicates the correct rotation direction.
- Check if the bearings are lubricated.

Open the valves of the bearing refrigeration circuit in case these are being refrigerated by the liquid. After start-up the valves must be regulated so that it does not produce condensation of humidity on the outside of the bearings housings. If there is condensation on the outside of the bearing housings there are also conditions for condensation inside the bearings housing, with the risk of corrosion of the bearings. The ideal temperature range for operation of the bearings ranges from 38°C to 65°C, that is, from a warm sensation at touch until the maximum bearable temperature in prolonged contact by hands.

Manually rotate the impeller; if it is stuck, do not turn the pump on before locating and correcting the blockage.

Start up:

- Manually rotate the impeller several times in order to lubricate the bearings.
- Open the valves for the sealing circuit in case there is one.
- Do not operate the pump before priming it.
- Turn the driver on following the instructions from its manufacturer.
- Open the discharge valve slowly as soon as the pump reaches the normal speed.

- During normal operation the bearings must be examined once in a while to make sure that they are duly lubricated.
- Adjust the valves for liquid sealing ring feeding lines. The packing glands must be adjusted to allow a small leakage with the pump in operation in order to avoid the excessive wear of the shaft bushings by lack of lubrication. About 30 drops per minute are enough.

PUMP STOPPAGE

Normally there is a retention valve and a gate valve in the discharge piping. The retention valve must be located between the pump and the gate valve. In these cases the pump must be stopped by turning off the driver unit according to the manufacturer's instructions. The valves must be closed in the following order: discharge valve, suction valve, refrigeration liquid valve and sealing liquid valve.

In some installations it is not possible to use a retention valve due to the pressure shock that it would cause, abruptly closing the return passage under high discharge pressures. In such cases, close the discharge valve slowly before turning the driver off to avoid a pressure shock.

The pumps get partially empty through the packings when immobilized for longer periods of time. For this reason, it is recommended to always prime the pump before a new start.

LUBRICATION

GREASE LUBRICATED ROLLER BEARINGS

The roller bearings are generally filled with lubricant in the factory and normally do not require any care before operation if the pump is stored for a short time and in a clean and dry location. It is important to observe the behavior of the bearings during the first two hours of operation to make sure they are working properly.

Recommended Greases Table:

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

It is important that the grease lubrication is correctly performed. An excess or lack of lubricant is equally harmful to the bearings. The bearings must never have the bearing cap filled with grease because this leads to excessive heating and reduction of durability. It is recommended to fill only 1/3 a 1/2 of the internal space.

The maximum admissible operational temperature differs from one case to another. A continuous or sudden temperature elevation constitutes a strong indication of malfunctioning. In such cases, immediately suspend the pump operation and investigate the causes.

It is normal for the bearings to present a certain rise in temperature after being lubricated. If the temperature does not go back to normal after 4 to 8 hours of operation, the probable cause is an excess of grease which must be removed.

Some inferior quality greases contain fatty acids that attack the highly polished surfaces of the bearings, damaging them. Give preference to greases from established manufacturers that meet the conditions below:

- do not separate into their components during prolonged rest or under temperature inferior to the melting point of the grease.
- do not form gum nor become sticky.
- do not become hard or decompose.
- do not corrode the bearings.
- are free from resins, minerals, abrasives, free calcium etc.
- present consistency "2" (in case of normal applications).
- do not contain free fatty acids in a level above a corresponding 0.3 mg of KOH per gram.
- do not contain free alkalis levels above the one mentioned in the previous item.
- do not contain unsaponified free oil levels above 0.5%.

Periodic grease substitution

The frequency in which the bearing grease must be replaced depends on the intensity of use of the equipment. If the pump in question constitutes a reservation unit or is only used for a few hours every month, the replacement of the grease must be bi-annual. In a pump that works for at least 50% of the time there is no need to replace the grease more than once a year.

Periodic lubrication

Normally, in pumps that contain threaded grease nipples, spinning it two or three times is enough to refill the lubricant if necessary.

Cleaning

If the bearings need to be cleaned or if there is an opportunity to do so due to a general revision, the following instructions must be considered:

- 1) Remove the bearing caps. Using a paint brush or a clean brush, clean the caps with hot kerosene (93 to 115° C) or another non toxic solvent.
- 2) To clean the bearings, initially remove as much grease as you can with a clean cloth which does not lose threads. Use a paint brush or a brush bathed in hot kerosene to remove the grease left and solid particles that may have adhered. Spin the roller delicately to have access to all the dents.
- 3) The grease residues that are strongly oxidized and hard to remove with paint brush or brush may be softened by long immersion in hot kerosene. In extreme cases, use a mixture of alcohol and light mineral solvents.
- 4) Finally, wash the bearing with fine, clean oil and lubricate it with new grease.

Refilling with grease

Fill the complete free space between the spheres and rollers with grease. Fill the cavity of the bearing cap up to 1/3 to 1/2 of its total space and assemble the set. Observe the bearing temperatures in the first few hours of operation.

OIL LUBRICATED ROLLER BEARINGS

The oil used for lubrication of the bearings must be a well refined and high quality mineral oil that does not oxidize or form gums easily, free from any abrasive substance. Vegetable or animal oils should not be used because they tend to go rancid and corrode the metallic surfaces.

Recommended oils table:

Manufacturer	Up to 3000 rpm	Above 3000 rpm
CASTROL	HYSPIN - 68	HYSPIN - 46
ATLANTIC	EUREKA - 68	EUREKA - 46
ESSO	TURBIN OIL - 68	TURBIN OIL - 46
MOBIL OIL	DTE - 26	DTE - 24
IPIRANGA	IPTUR AW - 68	IPTURAW - 46
PETROBRÁS	MARBRAX TR - 68	MARBRAX TR - 46
SHELL	TELLUS -68	TELLUS - 46
TEXACO	REGAL R & O - 68	REGAL R & O - 46

It is important to keep the correct oil level. For this reason, some pumps have a level display. An excessively high oil level causes temperature elevation and leakages.

Oil exchange

Generally, the oil must be substituted at three months intervals. This interval can be a little longer when the bearings work under normal temperatures and when there are no contaminations.

Oil leveler

The oil leveling device maintains the oil level constant in the bearings housing, supplying only the amount necessary to reestablish the level. The device does not need to be refilled while there is oil in the transparent reservoir.

COUPLING LUBRICATION

All metallic couplings require lubrication. Follow the instructions from the coupling manufacturer regarding method and lubrication intervals.

CAUSES OF MALFUNCTIONING / DEFECTS

The most common faults that may occur in a pump, as well as their causes are described below.
The operator can many times avoid unnecessary costs by following these recommendations:

The pump does not supply liquid

- Pump was not primed.
- Insufficient Speed.
- Discharge height is superior to the maximum head admissible of the pump.
- Suction height is excessive.
- Impeller passages are partially obstructed.
- Rotation direction is inverted.

The pump capacity is insufficient

- Air entrance in the suction piping.
- Insufficient Speed.
- Discharge height is superior than the one specified.
- Suction height is excessive.
- Impeller passages are partially obstructed.
- Mechanical defects:
 - damaged impeller
 - wear rings are worn out
- Foot valve is too small or is obstructed.
- Foot valve or the suction piping entrance is not submersed enough.

The discharge pressure is insufficient

- Insufficient Speed.
- Liquid contains air or gases.
- Mechanical defects:
 - damaged impeller
 - wear rings are worn out.

The pumps loses priming after start up

- Air entrance into suction piping.
- Suction height is excessive.
- Liquid contains air or gases.

The pump overloads its driver

- Excessive speed.
- Pumped liquid, specific weight or viscosity are different than the ones considered during pump selection.
- Packing glands are excessively tight, causing excessive friction.

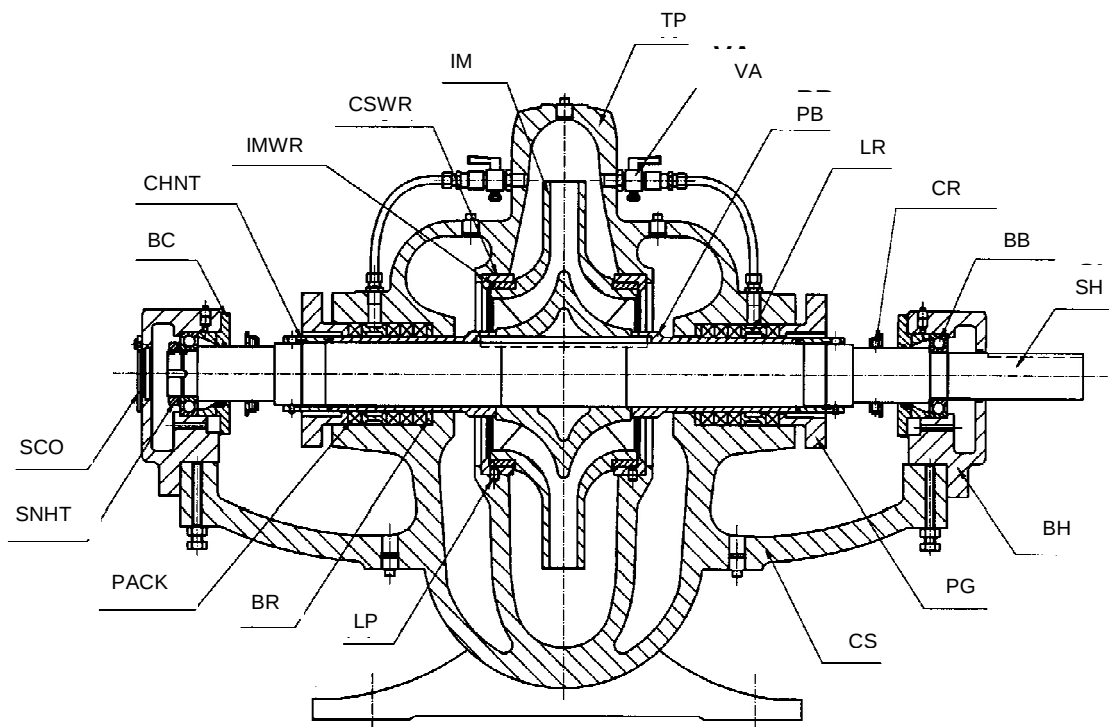
The pump vibrates

- Pump is misaligned in relation to the driver.
- Foundation is not rigid enough.
- Impeller is partially obstructed, causing unbalance.
- Mechanical defects:
 - warped shaft
 - rotor doesn't rotate freely
 - worn bearings.
- Air or vapor in the liquid.

BP PUMP PARTS LIST

Code	Description
CS	Casing
PC	Pressure cover
SH	Shaft
IM	Impeller
BH	Bearing Housing
BC	Bearing cover
SCO	Sealing cover
PG	Packing gland
CSWR	Casing wear ring
IMWR ⁽¹⁾	Impeller wear ring ⁽¹⁾
PB	Protector sleeve
CHNT	Check Nut
SHNT	Shaft nut
LR	Lantern ring
BR	Bottom ring
CR	Centrifuge ring
LP	Lockpin
BB	Ball Bearing
PACK	Packing (graphitized asbestos)
VA	Valve

(1) Not used in all the models.



MAINTENANCE

PERIODIC INSPECTIONS

It is necessary to inspect the pumps daily, as a measure to avoid bigger problems. Any abnormality observed during operation must be communicated to the person responsible for the service. Check the packing behavior and the bearing temperature (a constantly high operational temperature may be normal in certain cases). Noise, which is a very useful alert sign, must be carefully observed.

ANNUAL AND BI-ANNUAL INSPECTIONS

Check if the packing gland can move freely, clean and lubricate the studs and their nuts. Observe if the stuffing box has leakages which cannot be corrected by adjusting the packing glands and substitute the gasket rings if necessary.

GENERAL REVISION

The frequency in which the revisions must be carried out depends on the effective service hours, the working conditions and the materials used in the pump construction.

Do not disassemble the pump unless its capacity has dropped below the tolerable level or there is evidence of internal damage.

DISASSEMBLING PROCEDURE

When disassembling the pump, it is important to be careful not to damage the internal parts. In order to facilitate the assembly, organize the parts in the order in which they were disassembled. Protect the machined surfaces against metallic contact and corrosion.

Close the suction and discharge valves as well as the refrigeration and liquid sealing circuits. Drain the water from the casing.

If it is necessary to completely disassemble the pump, proceed as follows:

1. Remove the upper casing half, the purge valves and the sealing liquid piping circuit, connected to the external source if there is one.
2. Drain the oil from the bearing housings and remove the oil levelers and their nipples (if present)
3. Loosen the two parts of the coupling (Oil lubricated couplings must be drained first).
4. Unscrew the bearings and remove the guide pins. Do not touch the regulating screws.
5. Loosen the upper casing half with the aid of the extractor screws. Lift the cover through the saliencies designed for this function, lifting it vertically as much as possible.
6. Lift the rotor along with the bearings very carefully.
7. Rest the shaft in "V" blocks on a horizontal surface.
8. Remove the part of the coupling fixed to the pump and its key.
9. Unscrew the bearing covers.
10. Remove the bearings (see items related to their maintenance).
11. Remove the bearing covers and the centrifuge rings.
12. Remove the packing glands, check nuts, packings and the lantern rings.
13. Remove the protector sleeves.
14. Remove the casing wear rings.
15. Remove the impeller and its key.

Note: Observe well the direction of the rotor blades in relation to the housing so that you can put it back in the same way during the assembly.

When you reach this point, it is necessary to carry out a careful examination of all parts. All the parts that present excessive wear must be substituted, even if the pump still has a good performance.

ASSEMBLING PROCEDURE

Assemble the impeller on the shaft and mount the two protector sleeves, and check if the impeller is well centered in relation to the shaft.

Immediately mount the check nuts until they touch the protector sleeves, tightening them equally using a pin spanner wrench and then loosen every nut 1/8 of one rotation to relief the axial tension and lock them by using the lock screws.

Assemble the other parts of the rotor, leaving the gaskets to be installed during the final rotor assembling.

Install the rotor in the casing. Check if it is rotating freely and if the impeller is correctly centered in relation to the volute. In case of pumps that have impeller wear rings, those should not touch one another. In case the impeller is not well centered in the housing, loosen the check nut on the side to which the impeller must be dislocated. Tighten the opposite check nut firmly to eliminate any clearance that may have appeared due to impeller movement and then loosen both nuts 1/8 of one rotation, as explained earlier. Tighten the lock screws and continue with the assembly following the exact inverse order to that used in the disassembling procedure.

Align the pump carefully and install the packing rings.

INSTALLATION OF NEW BEARING HOUSINGS

It may be necessary to substitute one of the bearing housings or both of them. In this case, the instructions below must be followed:

1. Execute the ten first steps described in the "Disassembling Procedure".
2. Remove the packing gland, packings and the lantern rings.
3. Applying new bearings, assemble the pump again until the assembling of the rotor in its position in the casing (do not assemble the packing rings now).
4. Loosen the six bearing set screws at least 1/8", leaving the rotor in the lowest position possible and free for a certain degree of lateral displacement.
5. Tighten the new bearing housings just slightly, allowing their displacement in relation to the casing faces through the regulating screws.
6. Using the regulating screws, make sure that the clearance between the external faces of the impeller and the internal face of the casing wear ring remain the same all around in the horizontal and vertical directions. This will cause a perfect alignment of the impeller in relation to the casing, allowing the impeller to spin freely, which is essential for a good pump performance.
7. Tighten the bearing housing screws. Drill and widen the holes for the guide pins and install them.
8. Complete the assembly by mounting the packing rings.
9. Carefully check the alignment between pump and driver.

PUMP CASING MAINTENANCE

The fluid passages of the casing must be kept clean and free from corrosion. Whenever disassembling a pump, clean and paint the water passages with the appropriate paint which can firmly attach to the metal. A cleaning and repainting program must be established and followed for the casing.

Whenever the pump is disassembled a new gasket must be employed for the split case, which must be made of material identical to the original gasket and have the same thickness, besides allowing equal compression. This gasket must be cut in a single material part, following the exact profile of the pressure cover, and glued to the housing with fast drying glue for gaskets (the internal cuttings must rigorously follow the internal profile of the housing).

WEAR RINGS MAINTENANCE

As a general rule, it is recommended to substitute or recondition the wear rings from the moment their clearance doubles the original size.

In case of pumps with impeller wear ring, in order to remove these parts it is necessary to remove the fixation screws and then force them out carefully to avoid damage to the impeller. As the assembly of the wear rings is made under pressure, there is always a risk of causing permanent deformations. It is recommendable to check if the working faces of the wear rings spin without eccentricity or misalignments after their assembly.

In case the pumps do not have an impeller wear ring, machine the impeller until it presents a regular surface in the sealing area; the housing must in this case contain a wear ring with a

diameter that is appropriated to the new diameter of the impeller.

SHAFTS AND BUSHINGS MAINTENANCE

Whenever disassembling a pump, carefully check its shaft in the region where the impeller hub is fitted, below the bushings and at the fit of the bearings. The shaft could be damaged by corrosion or rust. Check if the keyway of the shaft presents distortions since excessive heating or corrosion can release the impeller from the shaft, imposing abnormal forces to the key and its keyways. Substitute a shaft that is warped or twisted.

The protective bushings must be replaced if they present excessive wear and if this does not allow an adequate sealing by the packing. The check nut and the centrifuge ring must also be analyzed, and if they present excessive wear they must be replaced.

BEARING MAINTENANCE

The bearings are generally shrink-fitted on the shafts, which makes it necessary to use an extractor to remove them. The clutches must pull the roller by its internal ring so that the necessary effort for the disassembly is not transmitted by the spheres.

Check the bearings right after disassembly, observing the existence of clearance or damages. It is recommended to install new bearings whenever possible because frequently the damages caused to the bearing during disassembly are only noticed when the pump is put in operation again.

In order to let the bearings function properly, they must have their internal rings firmly attached to the shaft so that they do not spin over them. It is also important that the fit of the external ring of the bearing does not allow relative free movement.

There are two methods generally used for fixation of the bearings on the pump shaft.

- Heat the bearing to dilate its internal ring which will contract after mounting them on the shaft.
- Force the bearing over the shaft.

The first method is preferable, where the heat should be generated and transferred in an oil bath or electric oven with a uniform temperature, kept between 93 and 121°C (the assembling must be carried out quickly).

If the use of heating is not practical, use a glove of the appropriate size (touch only the internal bearing rings) and a mechanical or hydraulic press to assemble the bearings on the shaft.

PACKING

Use only packing rings made of interwoven graphitized asbestos of high quality. Under any circumstances do not use linen packing rings because they cause rapid wear of the protector sleeves.

When replacing the packing rings, proceed as follows:

1. Loosen the packing gland.
2. Remove the lantern ring and the old packing rings with the appropriate extractor and clean the stuffing box.
3. Make sure the new packing rings are of the correct type and dimensions. Measure the stuffing box in order to determine the exact length of the packings. These may not be cut too short so that they would not complete a rotation or too long so that they would become wrinkled when put in the stuffing box.
4. Insert one ring at a time, pushing it as much as possible to the bottom of the box. Assemble each ring with the joint dislocated 90° or 120° in relation to the previous joint.
5. After assembling the adequate number of gasket rings, install a lantern ring. It is important to check whether this is located directly under the connection of the liquid sealing circuit and whether the addition of next packing rings will not affect this location.
6. Add the remaining packing rings. Assemble the packing gland and manually tighten the nuts; After that, loosen the nuts until releasing the packing gland. When tightening the packing gland, the nuts must be uniformly screwed in a way that the gasket rings receive uniform tightening.

The packing assembly must be softened. It is recommended to start the pump with the packing gland very loose. After 10 to 15 minutes of operation, gradually tight the packing gland until the leaking is reduced to a regular dripping.

It might not be possible to assemble the gland after mounting the last packing ring. When this happens, leave the packing assembly without the last ring, which will be left aside to be

installed later, when the other rings get adjusted as a consequence of the periodic retightening.

SPARE PARTS

The minimum number of spare parts to be maintained in stock depends on the severity of the service conditions and the number of pumps installed.

Have at least the following parts stand-by:

- A set of bearings.
 - A set of protector sleeves and check nuts.
 - A set of wear rings.
 - Enough material for the casing split face gasket and packing rings.
 - An oil leveler (if the bearing housing has one).
 - A set of o-rings.
-
-

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,

Imbil's greatest concern is to always offer Top Quality Products and Customer and Technical Services. It is very important to Imbil to know your opinion about our Quality because we believe this will help us constantly meet your needs. Thus, we would like to ask you to fill out this form and send it back to IMBIL.

IMBIL GROUP thanks for your help.

Customer:						
Address:						
City:		State:		Zip Code:		
Contact:					Date:	 /
Department:			Function:			
Phone:	() - 		E-mail:			
Region:	☐ North	☐ Africa	Application:	☐ Sugar and Alcohol Industry	☐ Air Conditioning	
☐ Northeast	☐ Central America	☐ Distilleries	☐ Chemical / Petrochemical / Naval			
☐ South	☐ North America	☐ Mining / Steel Industry	☐ Food Industry / Textile			
☐ Southeast	☐ South America	☐ Sanitation	☐ Steam Generation / Cogeneration			
☐ West Central	☐ Asia	☐ Pulp and Paper	☐ Fire Fighting			
	☐ Europe	☐ Irrigation	☐ Other			
	☐ Oceania	☐ Foundry				
Product purchased: (Please indicate product's description and/ or serial num.)						
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 the commercial conditions.					
3. DELIVERY TIME	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Meeting your expectations related to the delivery time.					
4. TECHNICAL INFORMATION	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Meeting your expectations related to the technical data provided with the product.					
5. DELIVERY QUALITY	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Meeting your expectations related to the product shipping conditions (packaging, visual aspects).					
6. OPERATION QUALITY	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Meeting your expectations related to the product and the operation conditions promised.					
7. POST SALES	Completly Satisfied	Very Satisfied	Satisfied	Dissatisfied	Completely Dissatisfied
* Efficiency on the services done					

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

Telephones for Contacts

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Product Engineering: +55 (19) 3843-9870 E-mail: ienge@imbil.com.br

Customer Service: +55 DDG 0800 - 148500



Pumping Solutions

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