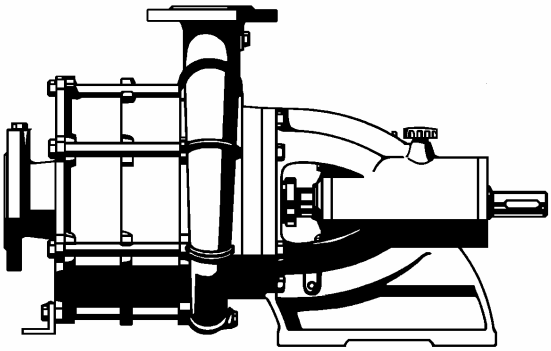
INSTRUCTIONS MANUAL

INR SERIES



Horizontal Multicellular Centrifugal Pumps

MIF-2200/00-I
03-09-02

CONTENTS

KSB BOMBAS ITUR

1.- OVERVIEW

1.1.- Application.

The content of the present manual is applicable to any pump belonging to the series described in section 4. In the event of doubt, what is indicated in the manual in Spanish prevails over the translated version.

We reserve the right to carry out modifications arising from technological innovation.

1.2.- General information on the pump

This pump is a product from BOMBAS ITUR S.A, Cº Urteta - Zarautz (Gipuzkoa)- Spain

1.3.- Technical assistance and after-sales service

To request spare parts or any Technical Assistance or After-Sales service, the pump identification number must always be given; this number is indicated on the name plate attached to the pump.

1.3.1.- Request for Assistance

Should you require assistance, contact our nearest Technical Assistance Service or the Central Customer Services Department at our Headquarters.

1.3.2.- Instructions for requesting spare parts

ATTENTION: Parts that are not supplied by KSB ITUR have not been checked or authorised by us. Installation or use of these products may, in certain circumstances, have a negative effect on the characteristics and safety of the unit. The manufacture shall not be held liable for any damage arising from the use of parts or accessories other than the original ones.
When requesting spare parts the following data must be given:

- UNIT TYPE (PUMP MODEL).
- IDENTIFICATION NUMBER
- SPARE PART NAME AND REFERENCE, AS INDICATED IN THE CROSS SECTION DRAWING (INDICATE DRAWING NUMBER).
- QUANTITY OF PARTS REQUIRED

2.- SAFETY

This instructions manual gives the basic instructions to observe during the installation, operation and maintenance of the unit. It is therefore essential for the staff member/operator in charge to read it before assembly and start-up. The manual must also be available in the area in which the unit is set up.

2.1.- Identification of safety instructions

In this manual, the important safety instructions are specifically marked. The following symbols are used:

 Safety instructions whose non-compliance could affect the safety of individuals and facilities.

 Safety instructions for prevention of electrical risks.

WARNING

Safety instructions whose non-compliance could affect the unit and its operation.

There are also indications or marks placed directly on the units so that the operator will:

- Be aware of the rotation direction (arrows).

- Recognise the auxiliary connections.

These marks must be taken into account at all times and must always be legible.

2.2.- Qualification and training of operations personnel

The personnel in charge of operations, maintenance, inspection and assembly must be duly qualified and authorised. The scope of personnel responsibility and supervision must be defined exactly by the plant operator. The plant operator must ensure that the instructions manual is fully understood by personnel members.

2.3.- Hazards arising from non-compliance with safety instructions - Guarantees

BOMBAS ITUR, S.A. disclaims any liability that might arise from non-observance of applicable safety regulations at all times during handling, installation or operation of its units.

The working conditions indicated in the order shall not be modified. Any modification required must be communicated to us.

Inappropriate use that fails to observe the working conditions, or assembly/dismantling by untrained personnel may entail risks to:

Human life.

The pump and other operation accessories.

Normal operation of the unit.

The following conditions must be fulfilled in order to avail of the Guarantee offered by KSB ITUR during the validity period:

- The instructions contained in this manual must have been followed properly.
- Any units that have been dismantled shall only have been dismantled by authorised personnel from our Technical Assistance Services or directly by personnel from our factory.

2.4.- Compliance with occupational safety regulations.

In-house working instructions relating to safety must be observed and fulfilled.

Failure to comply with safety instructions may involve danger to individuals and to the environment and/or the unit, as well as leading to a loss of any right to compensation for damages.

All safety regulations must be complied with, including those indicated by the manufacturers of electrical equipment requiring voltages that can involve danger to individuals.

2.5.- Additional hazards during operation

In normal operating conditions, the unit may give rise to additional hazards due to:

- Pumped liquid: Nature, pressure, temperature, etc.
- Rotating parts.
- Drive type
- Inappropriate installation for operation
- Overload conditions

2.6.- Safety instructions for maintenance, inspection and assembly work

 It is the plant operator's responsibility to ensure that any maintenance, inspection or assembly work is carried out by duly authorised and qualified personnel, who must read this manual carefully in order to familiarise themselves with the work in question.

Any work carried out on the unit must be performed with the unit stopped and safely disconnected.

For particular maintenance work on unit parts, refer to what is indicated in the particular manuals for these parts (e.g. motor)

When the work is done, all protection and safety devices must be reinstalled and prepared for operation.

All auxiliary items must be connected and put into service prior to operation.

Before starting up the machine, the initial start-up instructions must be fulfilled.

Due to the fact that the unit uses small parts such as nuts, screws, etc., accidental contact with which may lead to small cuts on the hands, operators are recommended to use gloves when handling.

The following additional risk-prevention instructions shall be fulfilled:

The pumped liquid may cause injuries, burns, poisoning, etc. It is therefore necessary:

- To tighten screwed connections by applying the specific screw torque, both on the screws pertaining to the pumps themselves and on those of the auxiliary connections.
- To check that the connections are properly installed and that they are defect-free.
- To check the temperature and amount of leaks occurring at the mechanical lock or packing area. Conduct such leaks to a safe area through a controlled drainage system.
- To take appropriate measures to avoid direct contact with the pumped liquid when it is necessary to prime or fill the pump or unit.
- Before dismantling the pump, if the liquid is toxic or dangerous, it must be decontaminated. For this purpose the unit must be cleaned inside by introducing a cleaning liquid into the pump and emptying it subsequently through the drainage connection. The cleaning liquid must not create hazardous situations and must be compatible with the pump components (CONSULT)
- To take appropriate measures to avoid contact with the pump if liquids are pumped at temperatures over 40ºC.
- In the event of a liquid with high steam pressure being used, beware of the danger of explosion due to pressure confinement with the pump stopped. This confinement must be avoided by opening inlet or discharge valves, or by providing a properly conducted air-vent connection in the pump impulse for liquid evacuation.

For rotating parts:

- Check that there is no rotating part without the proper protection in place (e.g. connection guard).
- Do not wear loose or baggy clothing or wear long hair loose near rotation areas to avoid clothes or hair getting caught and causing serious accidents.
- Do not force jammed rotating parts manually when the pump is prepared for operation.

When the pump is stopped it is liable to remain under pressure. Before dismantling it, is must be depressurised by making drain openings (or air vents) leading to a safe area.

When the pump is joined to considerably long piping, waterhammer may occur when it is stopped. Should this arise, appropriate anti-waterhammer elements must be put in place.

All the safety regulations indicated by the pump drive manufacturer must be observed and complied with

Inappropriate installation may lead to the unit breaking and consequent risks to individuals and/or the environment. It is therefore necessary to:

- Vent the pumps appropriately before operation.
- Check that all the auxiliary circuits required prior to start-up are working properly.
- Check that the pump impulse valves are fully open and that there is no dirt or foreign bodies in the piping.

Regarding overload conditions:

- Do not exceed the maximum permitted values (temperature, suction pressure, impulse pressure, r.p.m.) indicated in the bid and in the technical catalogue.
- Do not exceed the maximum loads permitted on the suction and impulse connections.
- The pumps must only be used in the conditions and with the liquid indicated in the bid and/or order.

An unforeseen failure in the drive power may lead to danger due to spontaneous start-up of the unit; it is up to the customer to take the necessary steps to avoid this.

When the CONTROL SYSTEM is not supplied by BOMBAS ITUR S.A, the customer is responsible for the entire machine complying with the machine safety directive, including these controls

2.7.- Forbidden unauthorised modifications

Any modification to be made to the unit must be consulted previously with KSB. ITUR. In the interest of safety, only spare parts and accessories authorised by KSB ITUR must be used. The use of other spare parts exempts KSB ITUR from any liability.

2.8.- Instructions for the safety of the installer/ operator

The installer must report any aspect of the unit that jeopardises his safety and he shall not put the unit into normal operation until the problem has been solved. The operator must immediately report any change in the unit that involves a safety hazard. Unsafe units must be dismantled and put out of service.

3.- TRANSPORT AND STORAGE

3.1.- Packaging and factory protection devices

Following the painting phase, KSB ITUR carries out the following operations:

- All the openings are sealed by means of plastic pieces or plasticised adhesives.
- All visible machined surfaces that are not made of stainless steel are covered with temporary protective peeling varnish.
- Depending on the kind of packaging ordered, they are either placed on a wooden pallet and covered with heat-weldable plastic, or they are put in a slatted or fully closed wooden crate. In all cases the units are firmly secured in order to avoid movement during transport and handling.

These protection measures are intended for transport only and at most for storage over a short period of time. In any event, the following storage instructions must be fulfilled.

3.2.- Storage instructions

WARNING

These instructions are for storage periods of under 12 months from the dispatch date. Should the period be longer, please ask for long-term storage instructions.

Before storage:

- The unit must be stored indoors, protected from bumping, direct sunlight, humidity and flooding.

WARNING *Pumps must not be piled on top of one another, even if the kind of packaging would seem to allow for this.*

- *Monobloc or jack pumps with end cover must be stored tied to the pallet sent from the factory, or secured using appropriate means to guarantee their stability.*
- The pump and the auxiliary conduits must be clear of pumped liquid.
- You are advised to cover the unpainted parts of the pump with protective material (such as Vaseline or similar).
- Apply oil or some antioxidant liquid from the suction mouth on the wear ring areas to avoid jamming.
- *Units supplied on a mobile mount (dolly, etc.) must be secured by the brake or other securing device provided*
- *The electric motor must be disconnected, the connection cables must be removed and the terminal box closed with its cover on.*
- Switchboards must be left in vertical position and disconnected.

Following storage:

- Remove the temporary protection devices (pt. 3.1) and visually check the condition of all the components.
- If the pump has been stored and/or stopped for an extended period (over 6 months) it is necessary:

  To change the packing (if there is any).
  To change the bearing lubrication
  To check the condition of the connections.
  To check the levelling.
  To check all the auxiliary connections.

- Following a short storage period, it is sufficient to turn the pump shaft manually to unlock the rotor unit.
- Follow the specific instructions applying to short storage periods in the motor and other manuals.
- Observe the other steps indicated in the "start-up" section.

WARNING

If the unit is going to be stopped for some time and there is danger of freezing, the pump must be drained completely to avoid damage due to the possible freezing of the liquid it contains.

3.3.- Transport and handling

⚠ *The unit must be transported and handled using means that are appropriate for the weight to be carried.* The weight is usually indicated on the delivery note or on the nameplate; if this is not the case and safe handling of the unit not guaranteed, please contact KSB ITUR to let them know the situation.

For handling, units that so require are equipped with appropriate eyebolts on the base. However, remember that the units should never be hoisted by means of the eyebolts on each of their elements; for example motor and pump eyebolts, which are designed exclusively for independent transport of these parts. Pump and piping flanges or joining elements such as couplings should not be used either.

WARNING *In any event, if you wish to hoist the unit by means of slings, these must be passed under the pump and motor base.*

4.- DESCRIPTION OF THE UNIT.

INR series pumps are horizontal multi-phase centrifugal pumps with radial impulse and axial suction.

INR series pumps are jack pumps with end cover.

The instructions manual basically describes the installation of the pump in a fixed place, considering the pump as a unit with independent coupling and motor.

Furthermore, depending on the size and execution requested, the pump may lack a series of parts that are not included in the design. This means that various points in this manual may not apply. These parts may be e.g.:

- Flexible coupling and connection guard
- Lock jacket or replaceable bush

The sound-pressure level of these pumps is under 95 dB (A) at any stage during operation (as long as the flow is above the minimum flow required for each model). The sound power is under 105 dB(A).

5. INSTALLATION

WARNING *The design of the piping systems, braces and other areas of the installation is created by other manufacturers .KSB ITUR offers data and remarks for information purposes only but cannot assume responsibility for the design, assembly and operation of an installation. The customer is advised to consult a foundation, pipe-work, well, etc. design specialist to complement and interpret the information given by KSB ITUR and ensure correct operation.*

5.1.-Foundations

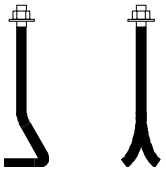
WARNING *The unit can be placed on a large foundation. This foundation must be completely flat, smooth and level.*

The unit must be secured to this foundation by means of appropriate anchor bolts to avoid possible vibrations arising during operation.

5.1.1.- Anchor Bolts

BOMBAS ITUR S.A can supply such bolts, which are put in place as follows:

- Place the unit on the foundation.
- Make the holes required for situating the bolts on the brace points in the foundation.
- Carry out an initial levelling procedure.



- When the unit is placed on the foundation, with the bolts in the holes, pour the grout on to the holes (do not use quick-dry cement) and leave to dry for 48 hours.
- Level once more and tighten the bolts

5.1.2.- Levelling

A conventional bubble level should be used for levelling; the levelling procedure should be carried out both longitudinally and transversely with respect to the unit.

If the bed needs to be wedged, you are advised to use small plywood wedges, which should be joined together with grout and water in order to provide a reliable joint and avoid subsequent deformation when the bolts are tightened.

When the process is finished you are advised to assemble a locknut on the bolt nuts in order to avoid them coming loose during the operation of the unit.

⚠ *The units supplied with a mobile bed must be secured by means of the brake or securing device before start-up.*

5.2.-Alignment

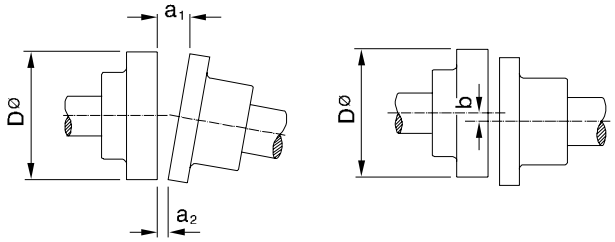
When the supply involves the entire unit (pump-motor), it has previously been aligned at the factory, but due to carriage and to fastening to the foundation, it should be realigned before start-up.

WARNING *The unit must <u>always</u> be aligned when it has been fully assembled and is ready for start-up.*

Correct alignment of standard KSB ITUR coupling involves correcting possible errors of parallelism and concentricity, using plate metal wedges on the motor.

- Measure the distance between couplings with the gauge in 4 positions offset by 90º between the coupling surfaces. The same separation (~ 3 mm without spacer, 6mm with spacer) should be obtained in all the measurements. The male and female coupling must <u>never</u> reach a stop.

- Take the following measurements:



The maximum tolerance values recommended for KSB ITUR couplings with and without spacer are indicated in the following table (measurements in mm.):

DØ	=< 500rpm		=< 1500rpm		> 1500rpm	
mm	a1-a2	b	a1-a2	b	a1-a2	b
0 to 100	0.15	0.25	0.12	0.18	0.1	0.15
101 to 200	0.2	0.28	0.15	0.22	0.12	0.18
201 to 400	0.3	0.35	0.25	0.3	0.2	0.25

NOTE: For other kinds of couplings, refer to the relevant manual.

5.3.- Pipework connections

The flanges must be placed in absolutely parallel fashion and their shafts must be concentric in order to minimise the strain on the pump necks that is liable to come about due to drift of shafts. Screws or studs must be able to pass easily through the holes in the flanges. Do not forget to place connections between the couplings.

WARNING *Do not use the pump as an installation fastening point. The suction and impulse pipes must not lead to tension in excess of the maximum values on the pump necks. Use independent bracing to bear the weight and strain of the piping. Pay attention to the flow direction indicated in the diagrams.*

The diameters of the pipes, valves and accessories must be calculated in terms of foreseeable load losses on the plant, so that the liquid speeds are:

- Speed in impulse pipe: 2 to 3 m/s.

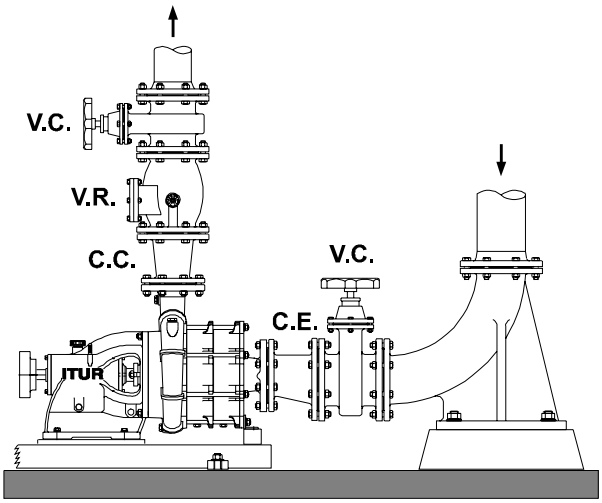
- Speed in suction pipe: 1 to 2 m/s.

<u>IN THE SUCTION PIPE</u> It is advisable to use a large strainer filter in the suction process in order to avoid dirt particles larger than the admissible size entering through the pump. Avoid very pronounced elbows and accessories that involve abrupt narrowing or widening (cones, valves etc.)

The diameter of THE IMPULSE PIPE must usually be greater than that of the pump mouth. A sluice valve must also be put in place to regulate the flow and avoid possible motor overload and also to isolate the pump during maintenance.

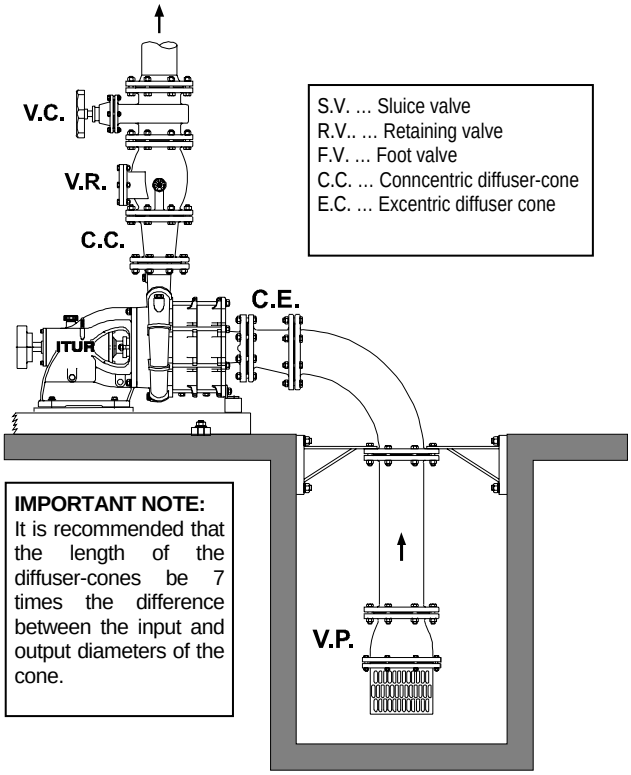
WARNING *To avoid the pumps rotating in the wrong direction, a retaining valve must be put in place (with a by-pass if there is a foot valve) in the impulse pipe.*

FOR PUMP SUCTION WITH LOAD, the suction pipe must be leak-tight and its diameter should usually be greater than that of the pump mouth. The diffuser cone may be excentric or concentric. Put a sluice valve in place for isolation during maintenance.



IF THE PUMP IS IN NEGATIVE SUCTION, the suction pipe must be absolutely airtight and must lead upwards towards the pump, with a diameter that is generally greater than that of the pump mouth. The diffuser cone for adaptation must be excentric, with the upper part horizontal. Check that the NPSH required by the pump in normal working conditions is at least 0.5 m lower than the available plant NPSH.

WARNING *To avoid the pump draining during a stop, a foot valve must be placed at the end of the suction pipe.*



IMPORTANT NOTE:
It is recommended that the length of the diffuser-cones be 7 times the difference between the input and output diameters of the cone.

5.4. Auxiliary connections

The unit is usually delivered assembled and ready for immediate operation, once the hydraulic and external electrical connections have been established.

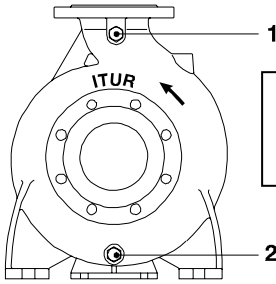
6.- PRIOR TO START-UP

The unit can be started up when all the mechanical, hydraulic and electrical connections referred to in chapter 5 "INSTALLATION" have been established. The process is as follows:

6.1.- Checking the pump

Before starting up for the first time, or following a long period of inactivity, it is essential to prime the unit. To do so:

- Disconnect the power supply of the motor or batteries.
- Remove the air-vent plug situated on the body or open a, air vent in the impulse pipe before the retaining valve and put a vent valve in place.
- Pour liquid through the impulse piping until it overflows through the vent.



1. Plug for pressure gauge, vent or priming
2. Drain plug

- While the priming is taking place, turn the pump shaft manually in order to break off any attachment.
- Plug the vent or close the vent valve.

⚠ *All the shaft protections such as, e.g., connection guards, must be in place and firmly secured (screws tightened), before starting up the unit.*

6.2.- Checking the electric motor

When establishing the electrical connection, pay particular attention so that the current type and the rated voltage indicated on the motor nameplate coincide with the current type and rated voltage of the electricity supply in the area in which the unit is to be installed.

WARNING

Check the rotation direction of the motor by switching it on for a moment. The rotation direction must coincide with that indicated by the arrow engraved on the body or base of the pump. If the rotation direction is not correct, two phases must be inverted in the motor terminal box (in the event of a three-phase motor).

Follow the indications given in the motor manual.

6.3.- Petrol or diesel motor checks

Follow the manufacturer's instructions that are attached to the unit.

7.- START-UP AND OPERATION

7.1.- Starting up the unit

- Before starting up the unit, check all the sections in chapter 6: "BEFORE START-UP".
- The unit must be started up with the suction valves fully open and the impulse valve partly closed and, when the pump has reached its design speed and the air has been eliminated from the suction, the operation point must be regulated by manoeuvring the impulse valve.
- During the priming phase, check that all the air is fully evacuated from the suction pipe.
- If the motor guard of the electric motor is tripped during start-up, the impulse valve must be closed more until the unit starts up normally.

⚠ *The pump must NEVER be operated with a very low flow or no flow; otherwise the liquid inside will quickly heat up due to internal recirculation, giving rise to risks, including explosion risk due to the high pressures that can be reached within the casing.*

7.2.-Checking instructions

During the first minutes of operation:

- There is no leak; immediately loosen the packing gland until slight dripping occurs.
- Excessive liquid leak; leave to settle for 10 minutes; press the packing gland 1/6 of a turn and leave for a further 5 minutes. Repeat the process until a drip rate of between 20 and 60 drops per minute is obtained.

Following some hours' operation:

WARNING *Check the temperature of the bearing by applying a thermocouple on the base in the area in which it is located. The normal temperature may reach up to 40 ºC above ambient temperature, but it must never be in excess of a total of 90 ºC*

.8.- LUBRICATION

The INR series has oil-lubricated bearings.

Before lubricating the pump, ensure that:

- *the pump is safely disconnected and cannot be switched on accidentally.*
- *The temperature of the bearing holder is below 40ºC, in order to avoid burning on the hands. For this purpose, measure the temperature with a thermocouple.*

WARNING *Pay particular attention to the bearing type when bearings are to be replaced, the type absolutely must be the same.*

8.1.- Oil Table

Oil recommended for normal operation (Bearing temperature up to +70ºC) in terms of the working revolutions and the diameter of the pump shaft at output on the coupling side (The ISO-VG oil grade is shown):

Shaft Diam. up to (mm)	Up to 1500 r.p.m.	Up to 2000 r.p.m.	Up to 3.000 r.p.m.	Up to 3.600 r.p.m.
28 Ø	100	68	68	68
38 Ø	68	68	46	-----

Consult your supplier if the temperature is outside the margins indicated or if the ambient temperature is expected to be below -5ºC.

8.2.- Oil Fill

WARNING *The pump leaves the factory without any oil on the bearing holder*. Once it has been assembled, it has to be filled. For this purpose:

- Release the upper plug of the holder.
- Pour oil through this hole until the level is between the minimum and maximum marks on the control rod.
- Put the upper plug back in place.

8.3.- Oil Change

Before changing the oil it is necessary to:

- Switch the pump on for a few minutes in order to fluidize it.
- Release the upper filling plug and the lower draining plug.
- Allow the oil to pour out from the base and let it drain.
- Put the lower plug back in place and fill with oil as per the previous section.

9.- REGULATIONS FOR ASSEMBLY AND DISMANTLING

Before beginning to dismantle ensure that:

The motor cannot be switched on accidentally in any circumstances. It must therefore be safely disconnected from the power supply (e.g. by removing fuses, unplugging, disconnecting the automatic switch, etc.) or from the starter batteries (disconnect the drive power).

There is no pumped liquid in the pump by cleaning the inside with a suitable liquid if the liquid inside is dangerous (hot, pollutant, inflammable, etc.)

9.1.-Pump

DISMANTLING:

To extract the bearings, shaft, replaceable bush, etc., it is virtually necessary to dismantle the entire pump.

To do so, study the attached cross-section illustration with the parts breakdown.

As a general guide to dismantling the unit follow these steps:

- Release the connection guard.
- Release the pump from the motor.
- If the coupling needs to be released, use an extractor. Never hit it to remove it, as in so doing you could seriously damage bearings or bushes.

WARNING *Before dismantling the cells, it is advisable to mark their respective positions in order to ensure that everything goes into the right position when assembly takes place.*

- Release the stays and dismantle the suction cover.
- Release the nuts from the drive and extract the drives, cells, pins and bushes successively.
- Release and remove the impulse unit.
- Extract the packing.
- Remove the shaft deflector and release the base covers.
- Extract the shaft with the bearings by hitting with a plastic cover on the end at the pump side.

ASSEMBLY:

For assembly proceed as per the dismantling process, but in inverse order.

WARNING *Check that the parts are in the right position, especially the cells and drives, and tighten the drive nuts well.*

Align the coupling (see pt. 5.2. of this Manual).

Assemble the connection guard.

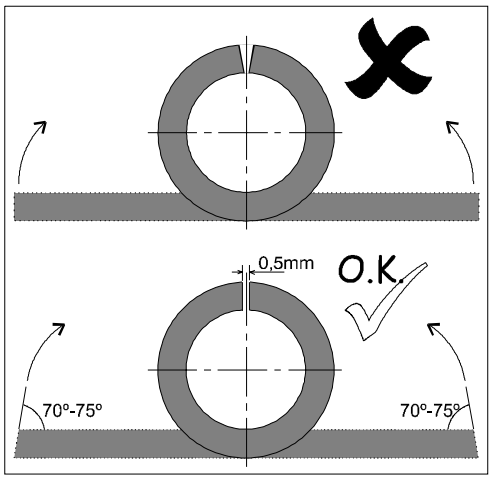
9.3.- Packing

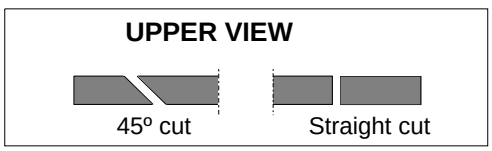
DISMANTLING:

- Release the packing gland.
- Remove the packing.
- Remove the lantern ring for cleaning.

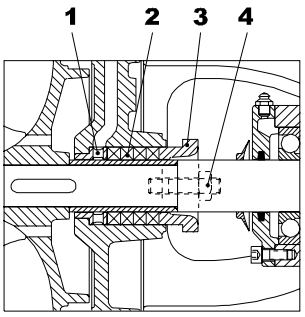
ASSEMBLY:

- First assemble the lantern ring.
- Cut the new packing, forming as many rings as are required. The cuts, as seen from above, may be straight or angled at 45º.





- During assembly, it is advisable to leave a little play of 0.5 mm in the packing cut.
- Put the rings in place one by one, pressing them against the bottom, but without forcing them. The rings should be introduced with the cutting ends alternated by 90º.
- Once the packing has been introduced, check that the shaft rotates freely, without sticking at any point.
- The whole free length of the packing gland should not penetrate. If necessary, more rings can be introduced.
- Gently tighten the packing gland nuts.
- To determine the extent to which the packing should be tightened, proceed as per point 7.2. of this manual.



1. Lantern ring
2. Packing
3. Packing gland
4. Packing gland nut

10.- PREVENTIVE MAINTENANCE

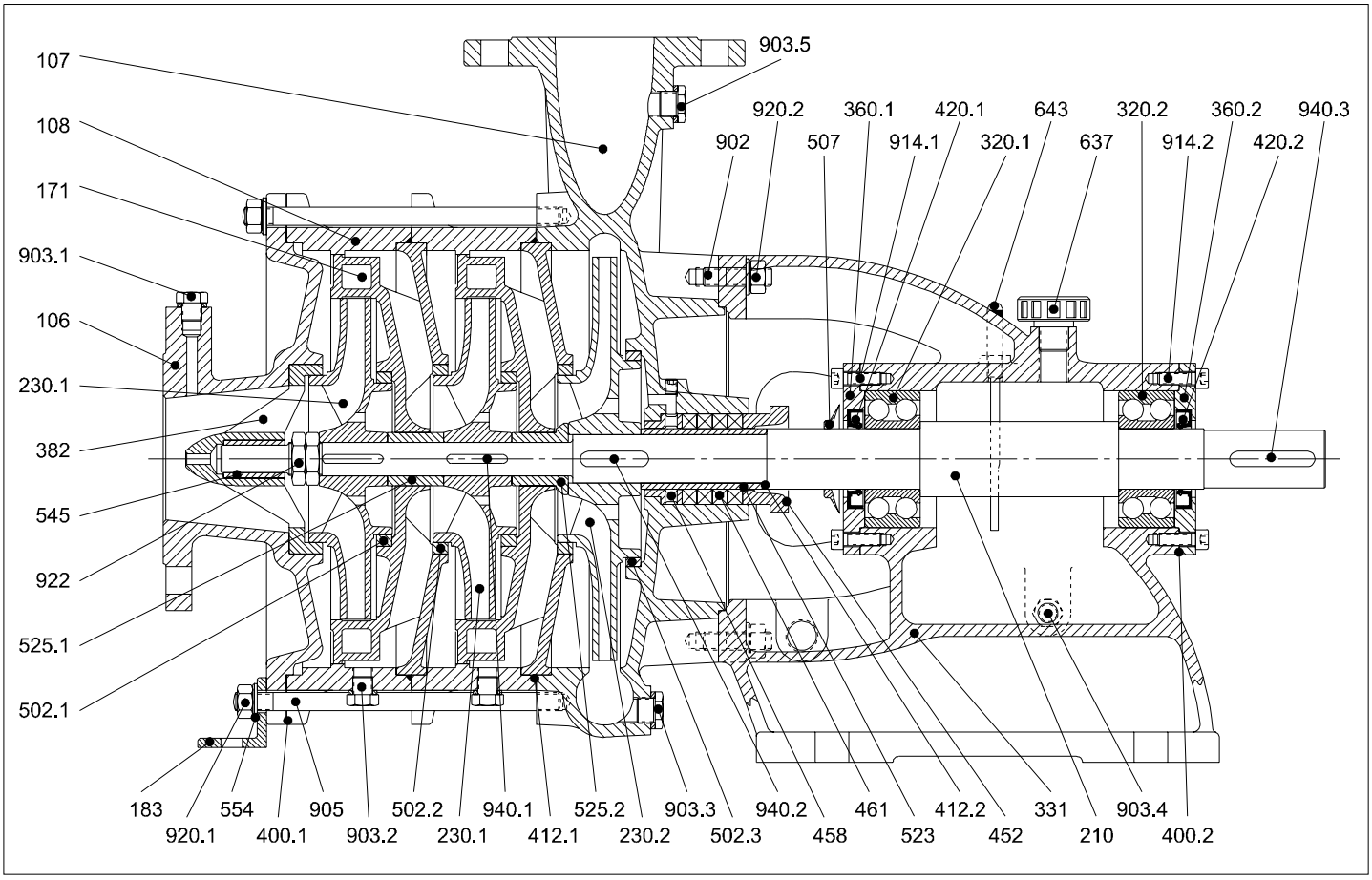
10.1.-Monitoring the pump-motor unit

Nº	DESCRIPTION OF THE OPERATION TO BE CARRIED OUT	PROCEDURE	FREQUENCY	CONSEQUENCE
1	**FULL PUMP REVISION**	Checking and dismantling of pump See point 9 of the manual	Annually	2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 17
2	Check leaks through packing	Visual inspection	Weekly	14, 15
3	Check for leaks between body and cover	Visual inspection	Monthly	13
4	Check for leaks between flanges	Visual inspection	Monthly	13
5	Check for bearing heating	With thermocouple	Quarterly	6, 7 Dismantle base
6	Check for oil leaks	Visual inspection	Monthly	11, 12
7	Check for loss of functional characteristics	Instrument reading	Depending on use	Check installation, 1
8	Check that bolts for motor/bed, pump/bed, cover/body, body/base, flanges/body connections are well tightened	Manually	Six-monthly	17
9	Check for wear of impeller and rings	Dismantle body Visual inspection	Annually	
10	Check wear on shaft and bearings	Dismantle base Visual inspection	Annually	
11	Top up base oil	See point. 8 of the manual	Every 4000 hours' operation	
12	Change bearing oil	See point. 8 of the manual	Six-monthly	
13	Change joints	Manually	Whenever they are dismantled	
14	Tighten packing glands	Manually	When leaks are excessive	
15	Change packing	See point 9.3 of the manual	Every 4000 hours' operation	
16	Change coupling rubber pads	See point 9.1 of the manual	Annually	
17	Check and align coupling	See point 5.2 of the manual	Six-monthly and whenever they are dismantled	

10.2.-Troubleshooting

ANOMALIES IN OPERATION	CAUSES	SOLUTIONS
1.- The pump does not move the liquid	a) Suction or impulse valves closed	a) Open them
	b) Wrong rotation direction	b) Change the motor connections
	c) Suction pipe or pump poorly primed (*)	c) Prime the pipe properly by placing vent connections at the highest points. Prime the pump.
	d) Air is getting in through the suction pipe	d) Check the tightness of the pipework
	e) Maximum height generated by the pump is lower than that required by the installation.	e) Increase the rotation speed. If this is not possible a larger impeller or pump must be assembled. Consult us.
2.- Insufficient flow or pressure	a) Poorly adjusted suction or impulse valves	a) Fully open the suction valve and look for the working point with the impulse
	b) Wrong rotation speed	b) Measure the speed, check the motor impeller supply voltage
	d) Poor priming	d) Fill the pump and pipes again and evacuate the air carefully
	e) Air is getting in through the locking system	e) Dismantle system lock and check it
	e) Obstruction in pipes	e) Clean pipes
	f) Impeller obstructed or worn	f) Dismantle impeller and inspect it
	g) Wear rings worn	g) Dismantle and change them
	h) Counterpressure too high	h) Increase the rotation speed. If this is not possible, a larger impeller or pump must be assembled. Consult us
3.- Excessive absorbed power	a) Liquid density or viscosity higher than normal	a) Reduce the design point, or change the motor
	b) Poor alignment between pump and motor	b) Align the coupling
	c) Obstruction inside the pump, impeller or mouths.	c) Dismantle the pump and clean it
	d) The real height to be generated by the pump is lower than that of the design point, so the flow and power are higher.	d) Partially close the impulse valve
	e) Bearings worn or incorrectly assembled	e) Change them or check the assembly
	f) Excessive friction on rotating parts	f) Dismantle the pump and check that all the components are correctly assembled.
4.- Excessive noise and vibrations	a) Worn, poorly assembled or poorly lubricated bearings	a) Replace and reassemble bearings. If necessary, lubricate them
	b) Friction rings worn or poorly assembled	b) Replace rings or reinstall them
	c) Shaft off centre or deformed	c) Dismantle and replace it
	d) Impeller off balance or worn	d) Counterbalance Impeller or change it
	e) Fastening nuts on Impeller loose	e) Dismantle the pump and tighten them
	f) Strain of pipes on the pump	f) Brace the pipes and level the unit
	g) Lack of rigidity in foundation or anchor nuts loose	g) Redo foundation or tighten bolts
	h) Poor alignment between pump and motor	h) Align the coupling
	i) Pump cavitation	i) Improve the suction. Consult us
	j) Insufficient pipe diameters	j) If possible, pipes with greater diameter
5.- Excessive base temperature	a) Poorly assembled bearings	a) Adjust them well in their casings
	b) Poorly assembled coupling, insufficient separation between the two parts	b) Check the coupling
	c) Poor alignment between pump and motor	c) Align the coupling
	d) Insufficient bearing lubrication	d) Replace bearings
	e) Excessive strain of the pipes on the pump	e) Brace the pipes and level the unit
	f) Pump cavitation	f) Improve the suction. Consult us
	g) High suction pressure	g) Consult us
6.- The friction rings are wearing too soon	a) Shaft off centre or deformed	a) Dismantle and replace it
	b) Impeller poorly balanced or worn	b) Counterbalance the Impeller or change it
	c) Poor alignment between pump and motor	c) Align the coupling
	d) Excessive strain of the pipes on the pump	d) Brace the pipes and level the unit

CROSS SECTION OF **INR** PUMP WITH PACKING (MIF2200-00-01)



Ref.	Component name
106	Suction body
107	Impulse body
108	Intermediate cell
171	Diffuser
183	Support leg
210	Shaft
230.*	Impeller
320.*	Bearing
331	End cover base
360.*	Base cap
382	Bearing-holder box

Ref.	Component name
400.*	Gasket
412.*	O-ring
420.*	Retainer
452	Packing gland
458	Lantern ring
461	Packing
502.*	Wear ring
507	Protective deflector
523	Shaft liner
525.*	Separation bushing
545	Bearing

Ref.	Component name
554	Washer
637	Oil fill plug
643	Oil level rod
902	Stud
903.*	Plug
905	Connection stay
914.*	Allen screw
920.*	Nut
922	Impeller nut
940.*	Pin

(= 1, 2, 3, ...)*

RECOMMENDED SPARE PARTS

	Part name	Reference No.	Spare parts recommended for		
			Start-up	2 years	5 years
Common parts	Wear ring	502.*	-	1	2
	Pump shaft	210	-	-	1
	Set of impellers	230.*	-	-	1
	Protective deflector	507	-	1	2
	Set of impeller nuts	922	-	1	2
	Set of bearings	320.*	-	1	2
	Set of joints	400.*, 412.*	1	2	5
	Set of pins	940.*	-	1	2
	Set of retainers	420.*	-	-	1
Packing version	Packing set	461	1	4	10
	Lantern ring	458	1	2	3
	Shaft liner	523	-	1	3

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EC CERTIFICATION

BOMBAS ITUR, S.A.

Camino Urteta, s/n Zarautz- (Gipuzkoa)- España

PRODUCT BEING CERTIFIED: PUMPS OF TYPE INR

"CE" DECLARATION OF APPROVAL

*BOMBAS ITUR, S.A. herewith declares, on its own responsibility, that the above-mentioned products, which it manufactures **(if supplied with an engine)**, and to which this Declaration is related, meets that set down in European Directives 98/37/CE, 89/336/CEE, 73/23/CEE on the laws of approximation of Member States with respect to machines.*

Harmonised rules applied:
EN 292 Part 1 and EN 292 Part 2.

MANUFACTURER'S DECLARATION

*BOMBAS ITUR, S.A. herewith declares that its above-mentioned products **(if supplied without an engine)** are intended for fitting to machinery or for assembly with other machines in order to constitute the machinery covered by Directives 98/37/CE, 89/336/CEE, 73/23/CEE.*

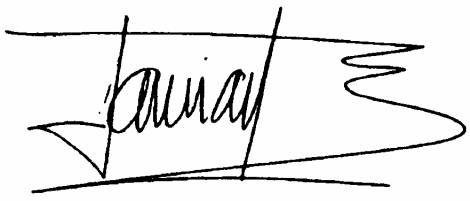
Note: this pump cannot be installed until the machinery to which it is to be fitted has been passed according to the stipulations of the previously mentioned Directive.

Harmonised rules applied:
EN 292 Part 1 and EN 292 Part 2.

ZARAUTZ, 21/02/2006

Position President

Name Juan Antonio Uriarte



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