VANE-TYPE PUMPS WITH
POSITIVE DISPLACEMENT

Instalation & Maintenance

Instalattion instructions
operation and maintenance
Family BAL

bombas TRIEF desde 1967

1. INTRODUCTION

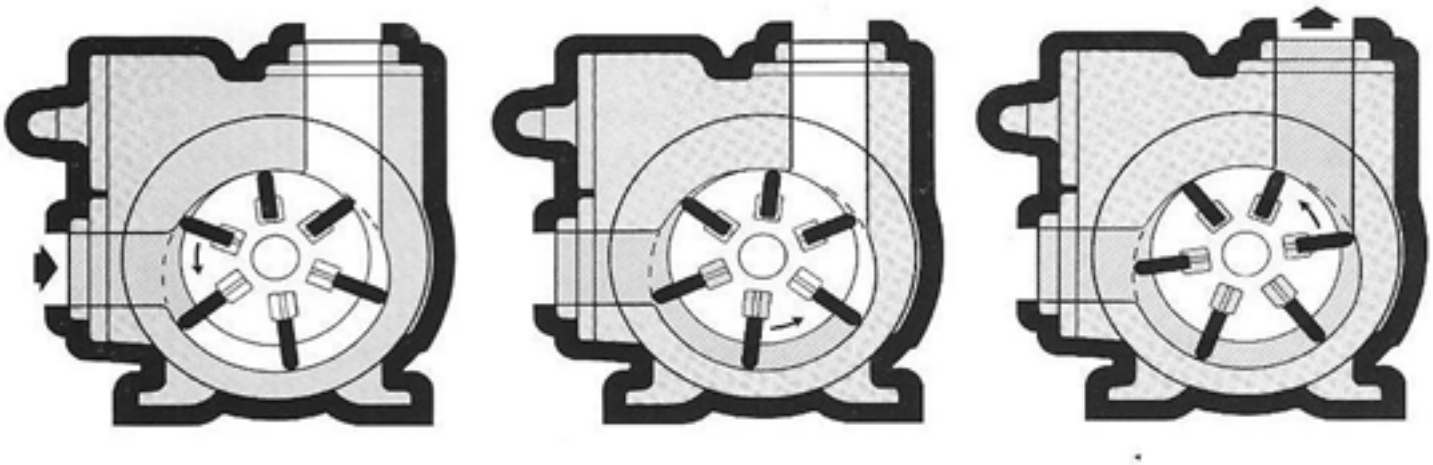
Trief vane pumps use a rotor with sliding vanes that push the liquid behind each vane from the inlet opening and move it to the pumping chamber. When the rotor turns, the liquid is transferred between the vanes to the outlet opening through which it is discharged while the pumping chamber is subjected to compression. Each vane applies a positive mechanical thrust to the liquid before it. Contact between the vanes and the chamber walls is maintained by three forces:

- The centrifugal force of the rotor's spinning.
- Thrust rods that act between the opposing pairs of vanes.
- The pressure of the liquid that penetrates through the slots in the vanes and acts on their rear part.

Each revolution of a Trief pump displaces a constant volume of fluid. The pressure variation has a minimal effect. Losses and turbulence are reduced to the minimum while the high volumetric output is guaranteed.

These are very robust pumps, made of cast iron and stainless steel, with single race ball bearings lubricated with grease and isolated from the product being pumped by mechanical seals with nitrile or veton gaskets, according to needs.

All the pumps have a built-in safety valve. They are perfectly adapted to truck service and transport in general, loading and unloading tanks, storing fuels and any other non-corrosive liquid free of suspended particles.



1.1 TECHNICAL DATA

BAL-2R MODELS	PUMP SIZE				
Maximum pump speed (rpm)	1”	1.5”	2.5”	2,5“	3”
	750	640	640	640	520
Maximum viscosity 1	20.000 (4.250)				
Maximum temperature 2	356°F (180°C)				
Maximum differential pressure	125psi (865 Kpa)				
Maximum working pressure	175 psi (1207 Kpa)				

1. The viscosity shown is in SSU (cP). cP = cSt for a fluid with a density of 1 kg/dm3.

2. The maximum surface temperature of the pump in potentially explosive atmospheres is 135°C

1.2 SAFETY INFORMATION

Serious or fatal injuries may be caused if the power supply is not disconnected and cut before undertaking maintenance.

If hazardous fluids are pumped or toxic, the system must be washed and decontaminated, both inside as outside, before maintenance.

Serious injuries to persons, damage to property or death may be caused by operating the pump without the protections properly installed.

Injury to persons or damage to property may be caused by operating the pump with a closed valve, causing the breakage of system components.

Note:

The pump must not work empty since this would increase its surface temperature and cause wear and damage to its components, causing it to malfunction. Inspect all the valves in the system, checking that they are in the correct position (see section 4.5 of this document).

2. PRACTICAL ADVICE

When choosing a pump, first decide the flow (lpm) needed and then choose the suitable pump series for the specific application.

2.1. INLET PIPE

It is assumed that the pump will give its full capacity as a function of its suction load.

However, there may be restrictions in the inlet where in the inlet pipe is too long or its diameter is too small. This restriction may even restrict the pump's liquid demand, causing cavitation and in fact breaking down the liquid into a mixture of vapour and liquid as it enters the pump.

The result of cavitation will be not only lower pumping but increased noise, vibration, wear and deterioration of the pump and of other parts of the system.

Cavitation may also be caused by using other components of insufficient size in the pipe pipe such as valves, elbows and emergency inlet connections with a consequent reduction in flow.

2.2. OUTLET PIPE

The pipe, hose, gauges and the rest of the equipment in the discharge system must be chosen for minimum flow reduction. If they are too small, it may be necessary to use low speeds in the pump to eliminate excessive pressure in the system with the consequent reduction of the discharge frequency.

If a system is designed for larger sizes, it must be remembered that the simplicity of the system also reduces resistance.

It is necessary to consider the convenience of reducing the pipe lengths and reducing the number of elbows and other accessories.

3. INSTALATTION

Note:
Trief motorised pumps must be installed only in systems designed by qualified technical personnel.

The system must comply with all the pertinent regulations and codes and must include warning signs for all the implicit dangers.

- The installation, electrical connection and earthing must comply with local regulations and the national electrical code.
- Install a switch near the pumping set that disconnects all the phases.
- Disconnect and block the power supply before carrying out installation or maintenance.

The power supply must match the specifications on the motor's property plate.

Motors equipped with heat protection automatically disconnect the electrical circuit to the the motor in the event of overload.
The motor may start up unexpectedly and without warning.

3.1. CLEANING BEFORE INSTALLATION

Foreign particles entering the pump will cause major damage.

The feeder tank and the inlet pipe must be cleaned and washed before installing and starting the installation.

3.2. LOCATION AND PIPES

A badly designed system of pipes or an unsuitable installation of the pumping set will significantly significantly reduce the pump's performance and useful life.

The following layout is recommended for the system of pipes and pump installation.

1. To minimise losses in the inlet pipe, locate the pump as near as possible to the supply.

2. The diameter of the inlet pipe and joints must be at least equal to the pump's inlet diameter.

3. Reduce the number of elements (valves, elbows, etc) and changes of direction in the the inlet pipe to the minimum. When used, these elements must be located at a minimum distance from the pump inlet equal to 5 – 10 times the pipe diameter.

4. It is recommended that a filter be installed at a distance from the pump inlet equal to 5 - 10 times the pipe diameter. With viscosities lower than 1000 SSU, the filter must have a net open surface equal to 4 times the area of the inlet pipe. With viscosities greater than 1000 SSU, consult the instructions of the filter manufacturer. Filters must be cleaned periodically to prevent a lack of supply to the pump. -

5. The inlet and outlet pipes must be free of leaks.

6. To facilitate the expansion and contraction of the pipes, expansion joints must be installed 0.9 m from the pump's inlet and outlet.

7. All the pipes and pipe elements must be properly supported so that the loads of the pipes are not transmitted to the pump.

3.3. PUMP INSTALLATION

The pump set should be installed permanently, fixing the base plate with suitably sized anchoring bolts to a concrete floor, correctly levelled according to the recommended industrial standards.

Solid foundations will reduce the system's noise and vibrations and will improve the pump's performance.

Consult the ANSI standards or a suitable pump manual for information on the suitable suitable installation and foundations for pumps.

Check the alignment of the coupling after fixing the pump set and foundation base.

3.4. ALIGNMENT OF COUPLING

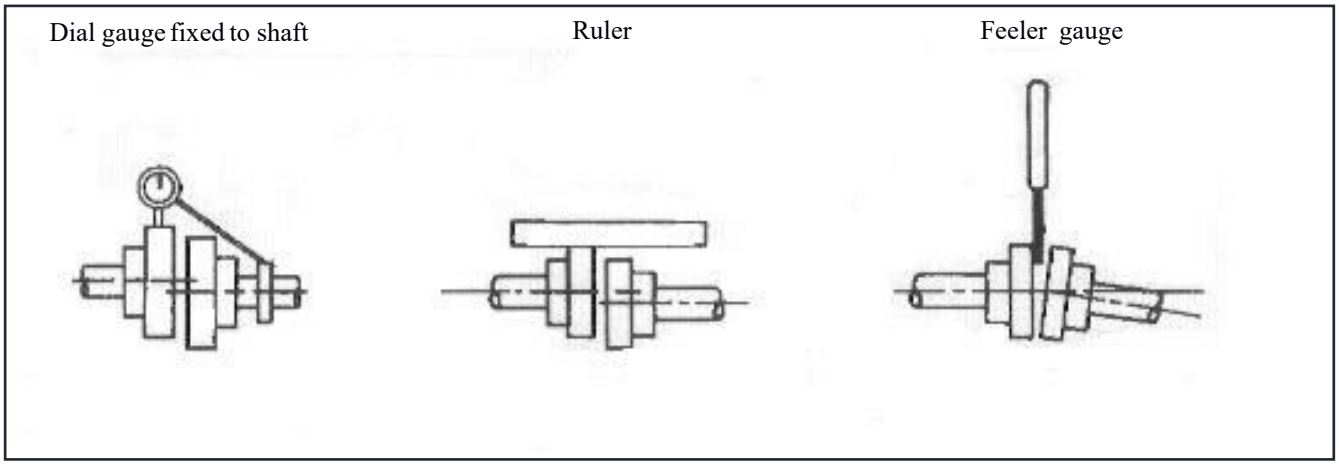
The pump must be connected directly to the gearbox and/or transmission system with a flexible coupling.

An angular and parallel coupling alignment between the pump, gearbox, motor, etc, MUST be maintained according to the manufacturer's instructions.

To check the parallel alignment, it is preferable to use a dial gauge (if none is available, use a ruler).
Turn both shafts by hand, checking the readings on the gauge for a complete revolution.
The maximum deviation must be less than 0.005" (0.127 mm).

To check the angular alignment, insert a feeler gauge between the two halves of the coupling.
Check the spacing every 90° around the coupling (four check points).
The maximum variation must not be greater than 0.005" (0.127 mm).

Alignment check



3.5. PUMP ROTATION

To set the pump's direction of rotation:

- If the pump's inlet opening and safety valve are to the right with the shaft drive side pointing towards the observer, the pump turns to the right, that is, clockwise.

- If the pump's inlet opening and safety valve are to the left with the shaft drive side pointing towards the observer, the pump turns to the left, that is, anticlockwise.

4. FUNCTIONING

Serious injuries to persons, damage damage to property or death may be caused by operating the pump without the protections properly installed.

Injury to persons or damage to property may be caused by operating the pump with a closed valve, causing the breakage of system components.

4.1. CHECKS BEFORE START-UP

- Inspect the entire system of pipes and supports to ensure that the loads of the pipes are not transmitted to the pump.

- **Ensure that all the valves and other elements installed in the pipe system are in the start-up or operating position.**

- Briefly start the motor to see if the pump rotates in the proper direction.

4.2. START-UP PROCEDURE

1. Start the motor; priming must occur within one minute.

2. Check the pressure gauge and suction gauge to ensure that the system functions within the planned parameters.

3. Check the pipes, joints and equipment associated with the system for leaks, noise, vibration or overheating.

4. If possible, check the flow to ensure that the pump is functioning within the planned parameters.

5. Check the adjustment of the safety valve by momentarily closing a valve in the outlet pipe and reading the pressure. The pressure must be 10 – 20 psi (69 – 138 kPa) above the maximum operating pressure or the adjustment of the external bypass valve (if installed).

Do not operate the pump with the valve in the outlet pipe closed for more than 15 seconds.
. If it is necessary to make adjustments, see the "Safety valve adjustment" section in this manual.

4.3. REVERSE ROTATION

Note:
The pump may rotate in the reverse direction but the safety valve will cease to function.

It is recommended that an individual safety valve be installed to protect the pump against excessive pressure. The pump will operate with a lower output level.

4.4 PUMP SAFETY VALVE

Note:
The pump's internal safety valve has been designed to protect the pump against excessive pressure; it must not be used as a valve to control the pressure in the system.

The pumping of volatile liquids in adverse inlet conditions may cause cavitation. **Partially closing the discharge valve will cause vibrations in the internal safety valve, which is NOT recommended For this type of application, install an external system pressure control valve and the** the necessary bypasses to the storage tank.

The installation of a system pressure control valve is also recommended when the pump will be functioning for longer than 1 minute with the discharge valve closed.

4.4.1. ADJUSTMENT OF SAFETY VALVE

The rating of the safety valve set in the factory is marked on the metal plate fixed to the valve cover.

It is recommended that the safety valve be adjusted to at least 10 – 20 psi (69 – 138 kPa) above the operating pressure or to the rating of the system pressure control valve.

Safety valve adjustment procedure

1. To increase the pressure adjustment.

- Remove the valve cap (number 17) and the gasket.
- Loosen the counter nut, if there is one.
- Turn the tensor stud (number 9) inwards or clockwise.
- Check the gasket and replace it if necessary.
- Refit the gasket and the safety valve cap.

2. To reduce the pressure adjustment.

- Remove the valve cap and the gasket.
- Loosen the counter nut, if there is one.
- Turn the tensor stud outwards or anticlockwise.
- Check the gasket and replace it if necessary.
- Refit the gasket and the safety valve cap.

The safety valve cap is exposed to the fluid being pumped and may contain some of that fluid.

An incorrect rating of the safety valve could cause the breakage of components in the system, injuries to persons or damage to property

4.5. HEATING CHAMBER

The heating or cooling chamber is heated or cooled by connecting it to an external circuit containing containing hot liquids such as oil or steam to heat very viscous liquids or those that freeze freeze inside the pump chamber. The chamber covers are equipped with connections ranging from 3/8" gas to ½" gas, depending on the model, through which the hot steam or oil enters.

Note: 

The liquid used in the heating chamber must have a flashpoint of at least 50 °C/122 °F above the maximum surface temperature of the pump.
The pressure in the heating chamber must not exceed 10 bar/145 psi.

Note:
When the pump is working with hot liquids that create a high surface temperature, a danger warning signal should be placed to prevent users from being burned.
All pumps with a heating chamber working in an explosive atmosphere must always have a mechanical enclosure.

4.6. PUMP SURFACE TEMPERATURE

The pump's surface temperature mainly depends on the temperature of the liquid being pumped, the operating conditions, the temperature of the liquid in the heating chamber (models with heating chamber) as well as its design.

When determining the maximum surface temperature, choose the minimum of the following values

As well as depending on the temperature of the liquid pumped, the maximum surface temperature of the pump is determined by the materials used in its manufacture.
The elastomers used may work in different temperature ranges.
The elastomers used will depend on the liquid being pumped according to their chemical compatibility with the liquid.
In the presence of potentially explosive gases, the pump's surface temperature must be equal to or less than 80% of the gas flashpoint.

In the presence of potentially explosive powder, the temperature must be equal to or less than 2/3 of the powder's flashpoint.
The maximum surface temperature must be the minimum of these possible values.

MAXIMUM/MINIMUM TEMPERATURES OF DIFFERENT ELASTOMERS

TYPE OF ELASTOMER	ELASTOMER BRAND	MIN/MAX TEMPERATURE
FPM	VITON	-25°C/+205°C
NBR	NITRILE	-30°C/+115°C
PTFE	TEFLON	-45°C/+260°C

A badly designed installation (see section 3.2 of this document) in which the pump works works empty (without liquid) or in which the fluid is recirculating inside the pump without being pumped to the discharge tank, increases the pump's surface temperature.
The pump must be freely exposed to the atmosphere for its cooling.

4.7. EQUIPMENT ATEX MARK

- **Equipment description: vane pump, series Bal – 3000, Bal – 400, BAL – 500, Bal – 600, Bal – 800.**
- **Manufacturer : Bombas Trief, s.l.:**
- **Address :** Edificio GAIETA –Zorrozgoiti 17. 48013 Bilbao
- **Mark: II 2G DT***
- **Serial number:**

Technical file reference 01.2004 Ver 1.0.

The ATEX mark plate is located next to the pump identification plate.

* All the equipment is classified as Group II category 2. The maximum surface temperature is different for each model, as shown in the following table.

TEMPERATURE CLASS	PUMP MODEL
T4 (135°C)	BAL- 2R
T2 (230°C)	BAL- C (with heating chamber)

4.8. PUMPS' SOUND EMISSION

Declared disassociated sound emission values as per the ISO 4871/1996 international standard.
Weighted acoustic power level "A", LWA (re. 1pW en dB) 83 dB (A).

Values determined from the results of the AAC 091850 test report (ENAC 88/LE 229 accreditation)) as per the UNE EN ISO 3744:1996 standard.

5. PUMP MAINTENANCE

Note:
Maintenance must be carried out by qualified technicians only, following the appropriate procedures and warnings in this manual.

Electric shock, burns or death may be caused if the power supply is not disconnected and cut before undertaking maintenance.

If pumping dangerous or toxic toxic fluids, the system must be washed and decontaminated inside and outside before maintenance

SInjury to persons or damage to property may be caused by if the system is not depressurised before undertaking maintenance on the pump.

Recommended grease

5.1. SCHEDULED MAINTENANCE

Filters

The filters must be cleaned periodically to prevent a lack of fluid supply to the pump
The frequency will depend on the application and the operating conditions.

Pump lubrication

The ball bearings should be greased at least every three months.
A higher frequency may be necessary depending on the application and the operating conditions.

Recommended grease

Repsol Molibgras EP-2 grease.

Greasing procedure

1. Remove the grease nipple (number 41) from the bearing covers (number 13).

2. Apply grease slowly with a gun until grease starts to exit the opening.
. Remove the excess grease according to the relevant standards.

3. Refit the nipples in the greasing hole.

Do NOT excessively grease the pump bearings. Although it is normal for a little grease to escape through the grease nipple, an excessive leak on pumps equipped with mechanical gaskets could cause the gaskets to break (the greasing indicator hole is located on the cylinder head between the bearing and gasket).

5.2. CHANGING VANES

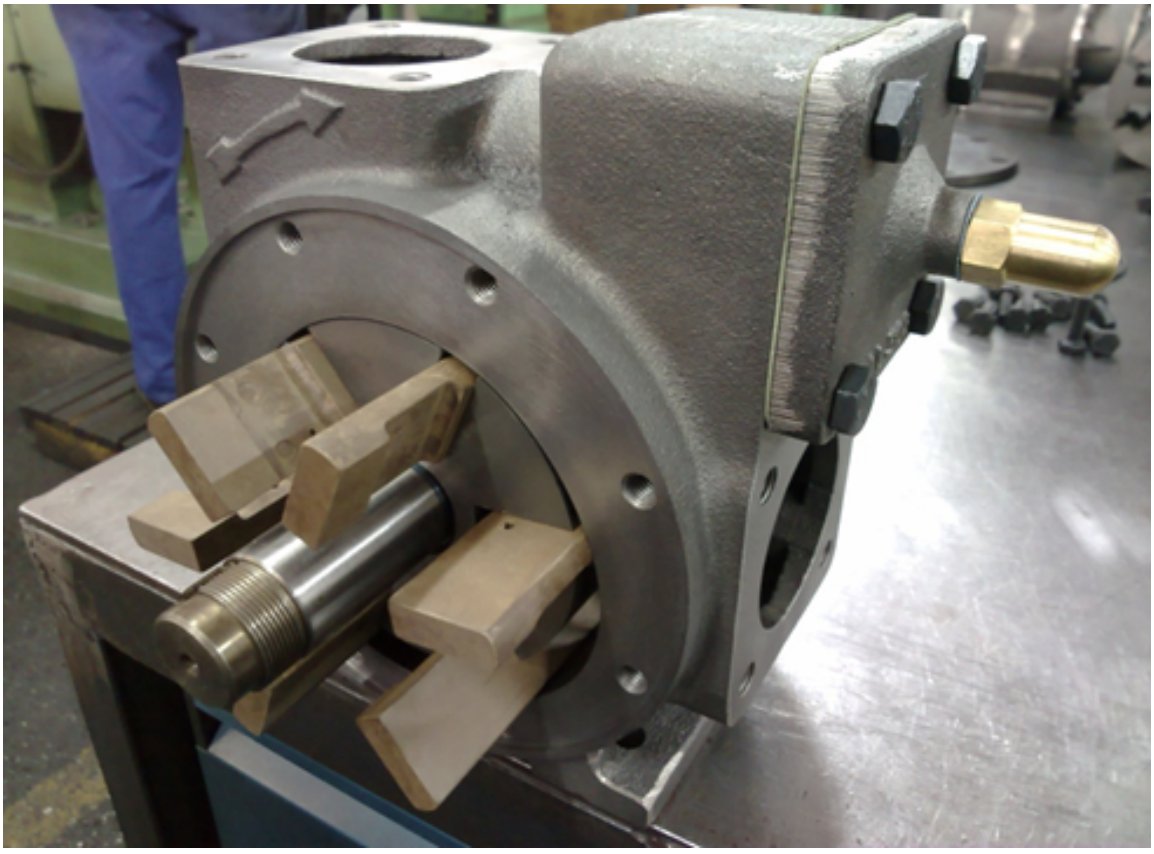
Changing the vanes (number 6) is simple. The pump will be operating again in a question of minutes. -

1. Remove just the external head assembly.
2. Remove the old vanes.
3. Insert the new vanes.
4. Refit the head.

Routine inspections are equally simple. In fact, most maintenance can be carried out without disconnecting the pump from its pipes or drive shaft. Changing the vanes does not require special tools.

5.2.1. Position of vanes

The vanes have a single position for the proper operation of the pump. The vanes have channels on their surface through which the liquid creates the sufficient pressure, together with the thrust of the rods and the action of the centrifugal force, to help the vanes to slide.
These channels must be facing the pump's direction of rotation (arrow engraved on the pump body). The rounded edge must touch the inside of the body.



6. PUMP TROUBLESHOOTING

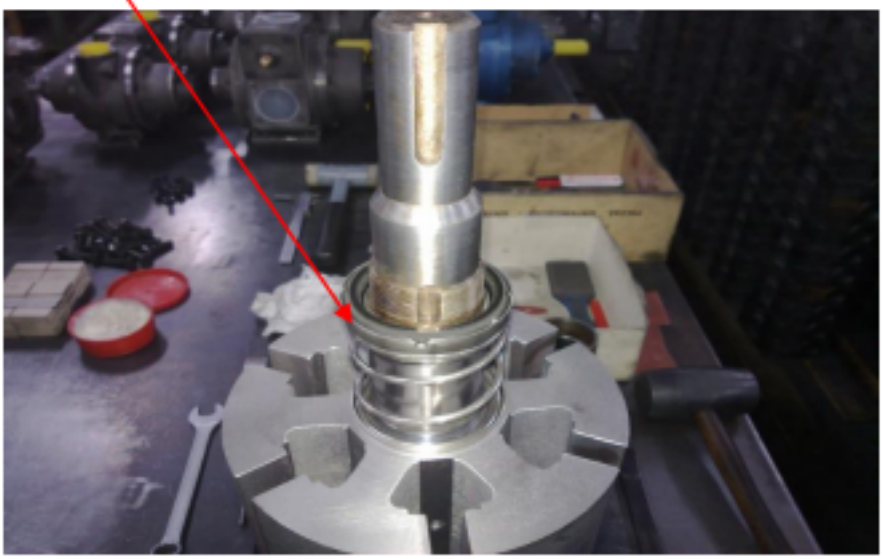
SYMPTOM	PROBABLE CAUSE
The pump does not prime	▪ The pump is not wet. ▪ Worn vanes. ▪ Inlet valve closed ▪ Air entering the inlet pipe. ▪ Filter blocked. ▪ Inlet pipe or valves blocked or too restrictive. ▪ Pump blocked by steam. ▪ Pump speed insufficient for priming. ▪ Safety valve partially open, worn or incorrectly seated.
Reduced capacity	▪ Pump speed too low. ▪ Inlet valves not fully open. ▪ Excessive restriction in inlet pipe. ▪ Damaged or worn parts. ▪ Excessive restriction in outlet pipe, causing partial flow. Safety valve worn, rated to too low a value or not properly closed. ▪ Vanes incorrectly installed.

Noise	Excessive suction in the pump due to: ▪ Joints undersized or with restrictions in the inlet pipe. ▪ Excessive pump speed for the liquid's viscosity or volatility. ▪ Pump too distant from the source of the fluid. ▪ Pump operating for too long with a blocked outlet pipe. ▪ The pump is not firmly installed. ▪ Worn or damaged bearings. ▪ Vibrations in due to incorrectly fixed pipes. ▪ Bent shaft or motor coupling misaligned. ▪ Failure of a valve in the system. ▪ Safety valve rating too low. ▪ Damaged vanes. ▪ Vanes incorrectly installed.
Damaged vanes	▪ Entry of foreign bodies in the pump. ▪ The safety valve does not open. ▪ Hammer blow – pressure spikes. ▪ Motor and pump misaligned. ▪ Vanes excessively worn or cracked. ▪ Accumulated or solidified material in the pump during start-up.
Mechanical leaks	▪ O-rings not compatible with the liquid being pumped. ▪ O-rings with notches, cuts or damage. ▪ Shaft damaged, worn or dirty in the area of the gasket. ▪ Ball bearings excessively lubricated. ▪ Excessive cavitation. ▪ Faces of mechanical gaskets with cracks, scratches, pitting or dirt.

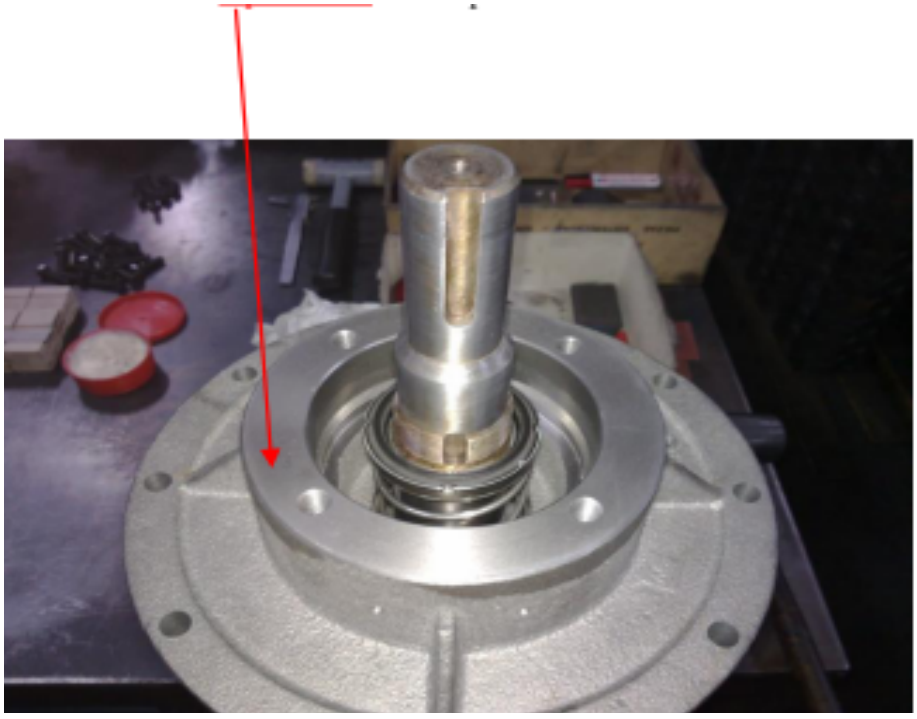
7. PUMP ASSEMBLY

Assembly

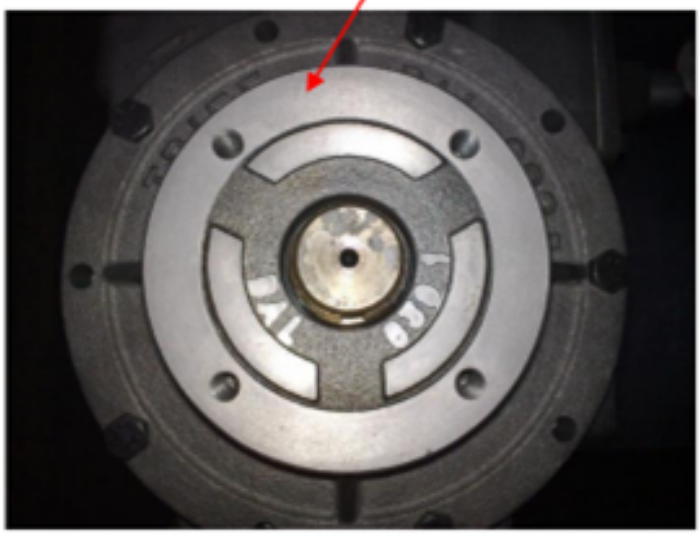
First fit the rotary mechanical seal, number 39/2, onto the pump's rotor/shaft assembly, numbers 5 and 11, respectively, by lightly oiling the pump shaft, number 11, and turning the **rotary mechanical seal, number 39/2** until it touches the base of the rotor, number 5.



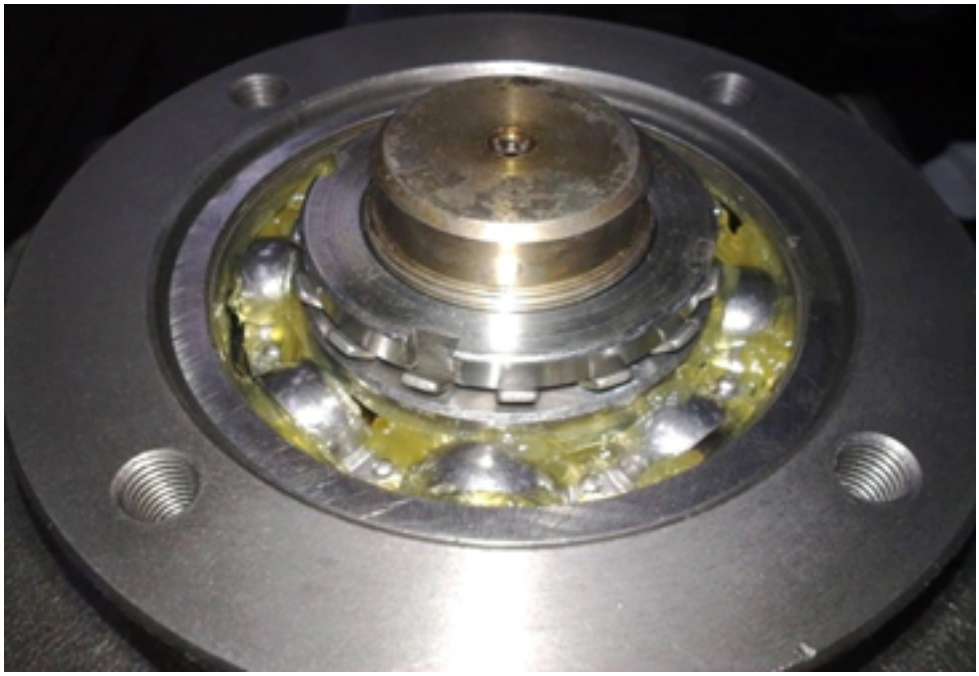
Carefully fit the **cover, number 2 D,** until it is seated on the face of the rotor, number 5.



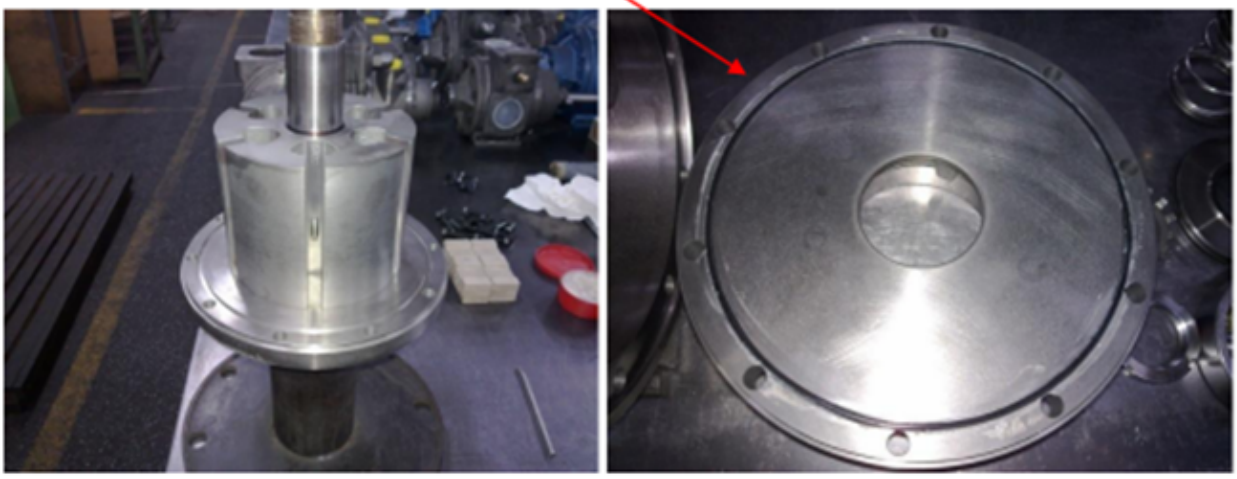
Then fit the **fixed race** of the mechanical seal number 39/I with its **O-ring** number 39/3.



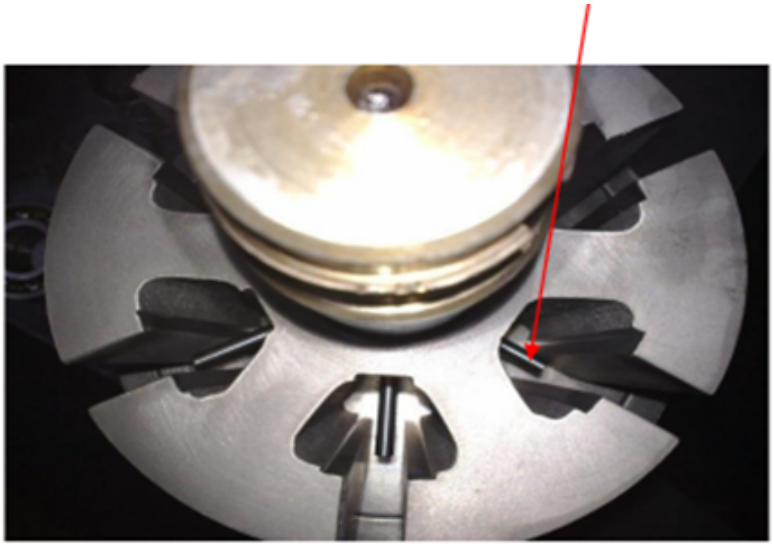
Then insert bearing, number 18, the lock washer, number 18/1 and the locknut, number 18/2 and adjust without fully tightening them.



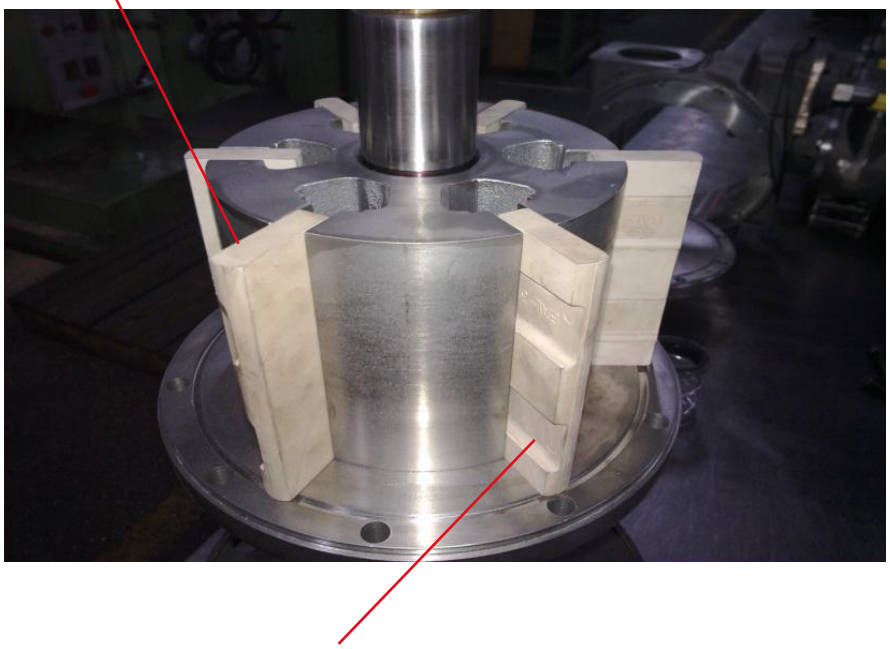
The next step is to place the unit just assembled upwards and seated on the assembly to; fit the **axial O-ring, number 27** on the cover, number 2D.



Before fitting the pump body, number 1, insert the **rods, number 7,** in their holes with a little grease to prevent their falling.



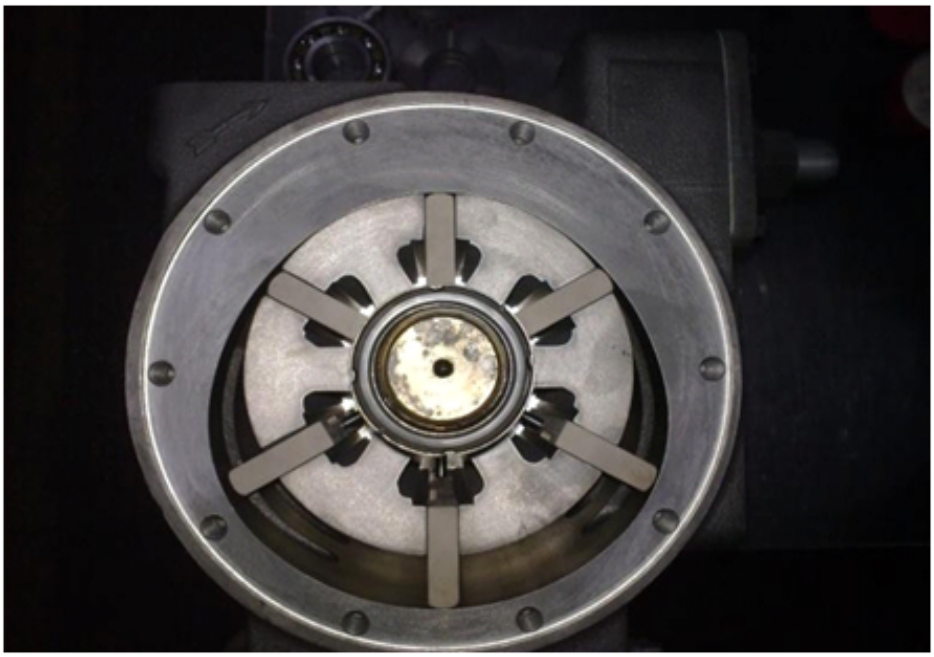
Insert the **vanes, number 6** in their slots.



The vanes, number 6, must be fitted with the **channels** facing the pump's direction of rotation and with the rounded edge facing outwards on the rotor.

Fit the body, number 1, and tighten the bolts connecting the body, number 1, with the cover, number 2D, and tighten them.

Then place the body, number 1, horizontally and install the other part of the pump.



Insert the mechanical rotary seal, number 39/2, as in the first part then fit cover number 2D,
the fixed seal race number 39/1, with its O-ring, number 39/3 and then the bearing, number 18.
Then use two bolts to fix the cover, number 2D, to the pump body, number 1, without tightening too much.
Then place the lock washer, number 18/1, together with the locknut, number 18/2
and find the correct gap between the parts of the rotor, number 5, with the body, number 1,
by slowly tightening **washer number 18/1** and **nut number 18/2**
firstly on one side of the pump and then on the other.

When the pump is averaged and turns correctly, tighten the two opposing locknuts, number 18/2, and tighten the bolts.

Grease the bearings, fit and tighten the two bearing caps, number 13, with their Klinger gaskets, number 13/1

Assembly of bypass

The bypass consist of the following parts:
The tensor cap, number 8, with its Klinger gasket, number 8/1, the stud, number 9, the grille, number 10 valve number 14, spring number 16, cap nut number 17 and its Klinger gasket, 17/1

Start assembling the bypass by inserting **valve, number 14,** in the opening in the pump body, number 1, above the inlet opening (for standard assembly).

Then insert the **spring, number 16,** until it seats in the valve, number 14.

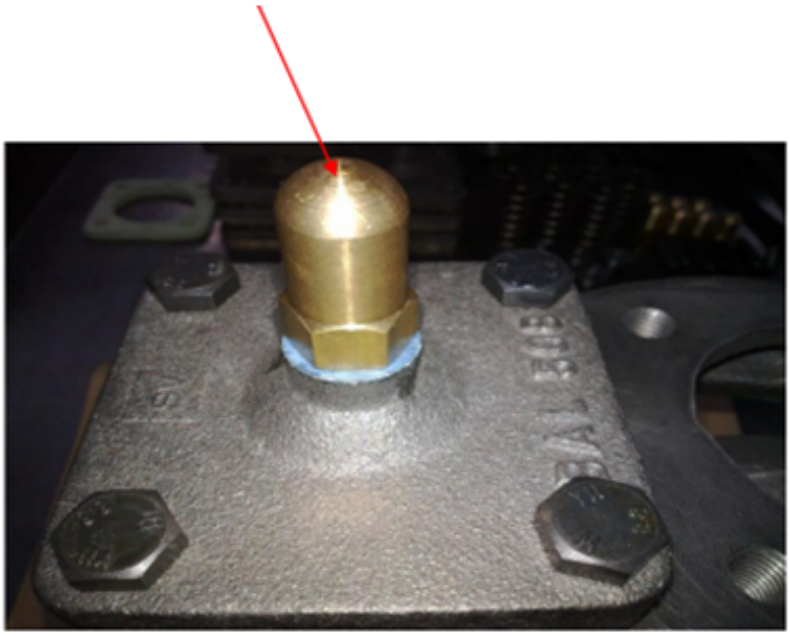
Then fit the **grille, number 10,** as shown in the following photograph.

Then the fit the gasket **for the tensor cap, number 8/1.**

Fit the **tensor cap, number 8,** with the fixing bolts and fit the **tensor stud, number 9.**

Then fit the gasket for the **cap nut, number 17/1.**

Finally, thread the **cap nut, number 17** onto the tensor stud.



Disassembly

- Start the pump disassembly by removing the bolts on the bearing cap (number 13).

- Remove the bearing cap and remove the locknut (number 18/1) and the lock washer (number 18/2).

- Remove the bolts on the cover (number 2D) carefully to avoid damaging the piece.
Use two screwdrivers to lever it out of the pump body (number 1),
carefully to avoid damaging the O-ring (number 27) which remains in the cover (number 2D).

- The mechanical rotary seal (number 38/2) is removed from the shaft (number 11) by turning it by hand.

- Then remove the vanes (number 6) and start to disassemble the other part of the pump

- Remove the bolts (number 40) from the cover (number 2D) and position the rods (number 7) -
so that on removing the assembly they do not fall and damage the body (number 1).

- Grasp the shaft (number 11) being removed with one hand and tap the
other part with a plastic mallet, taking great care not to hit the rotor (number 5) against the body.

Remove the remaining assembly from the pump body in this way then remove the bolts from the bearing cover (number 13) and loosen and remove the locknut and lock washer.

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Then tap the shaft with a plastic mallet to remove the rotor (number 5) and the cover (number 2D).
Remove the bearing (number 18) and the fixed part of the mechanical seal (number 39/2)
from the cover by turning it by hand towards you.
To remove the bypass built into the body, remove the cap nut (number 17) and turn the tensor
stud (number 9) anti-clockwise until the spring (number 16) no longer presses against it.
Then remove the bolts on the tensor cap (number 8) to obtain access to the rest of the bypass parts
With the pump fully disassembled, check the parts.

Clean all the parts with Diesel fuel and then replace any that require it