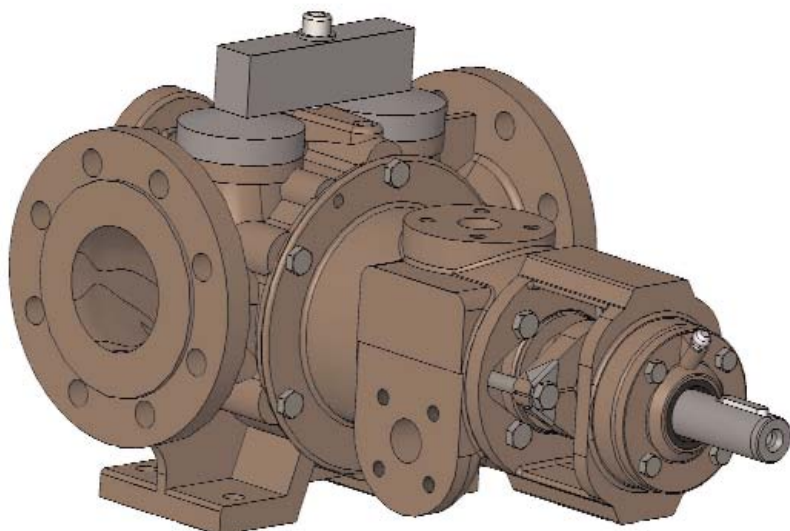




INSTRUCTIONS 1008-B00 e

Section	1008
Effective	December 2004
Replaces	August 2004

BC P Serie Chocolate P40 - P60 - P100



INSTALLATION

OPERATION

MAINTENANCE

**BLACKMER
ZI PLAINE DES ISLES
F- 89000 AUXERRE**

Tel. : +33 3.86.49.87.16

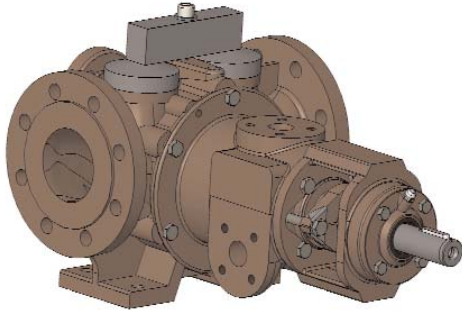
Fax : +33 3.86.49.87.17

e-mail : contact@blackmer-mouvex.com

Your distributor :

VANE PUMP

SAFETY, STORAGE, INSTALLATION AND MAINTENANCE INSTRUCTIONS MODELS : P40 - P60 - P100 BC P SERIE CHOCOLATE



Pump n° :

Date of bringing into service :

SAFETY INFORMATIONS



This is a SAFETY ALERT SYMBOL

When you see this symbol on the product, or in the manual, look for one of the following signal words and be alert to the potential for personal injury, death or major property damage.



Warns of hazards that WILL cause serious personal injury, death or major property damage



Warns of hazards that CAN cause serious personal injury, death or major property damage



Warns of hazards that CAN cause serious personal injury, death or major property damage.

NOTICE :

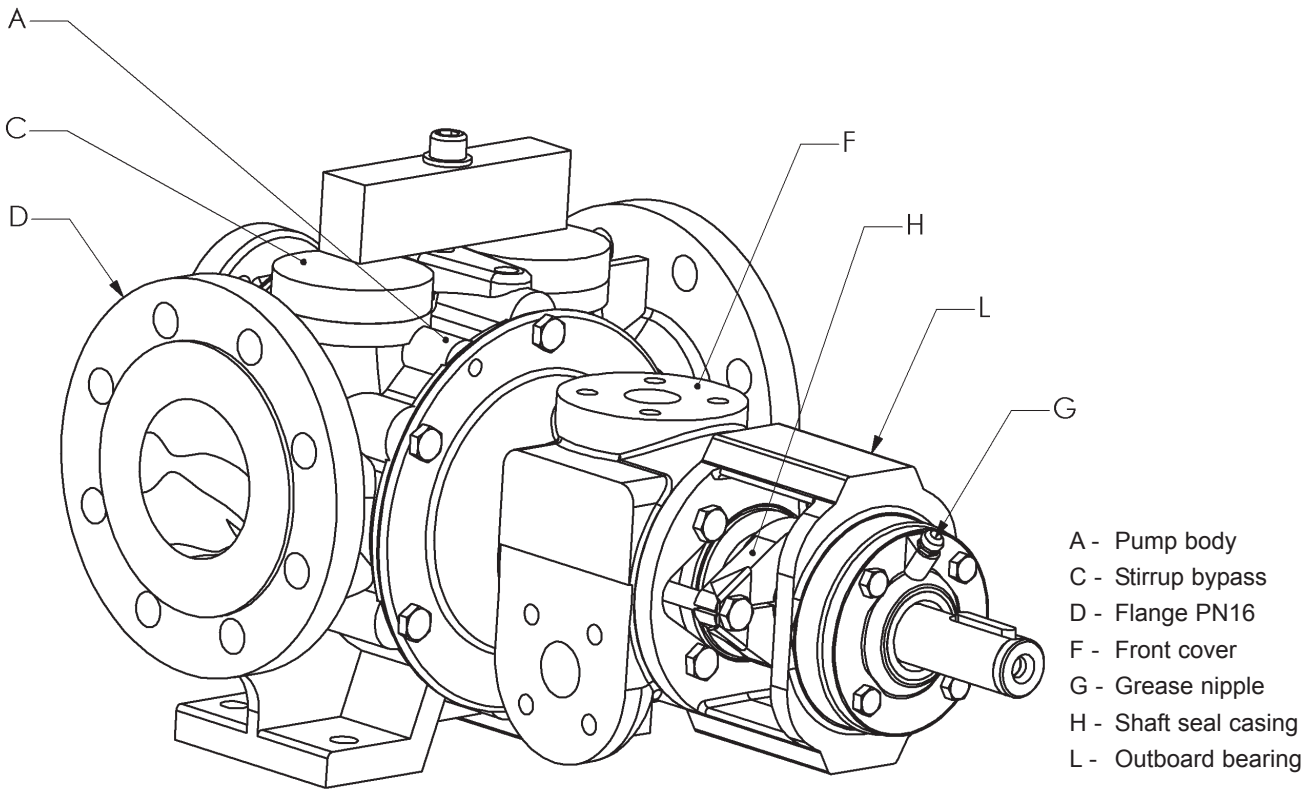
Indicates special instructions which are very important and must be followed.

SUMMARY

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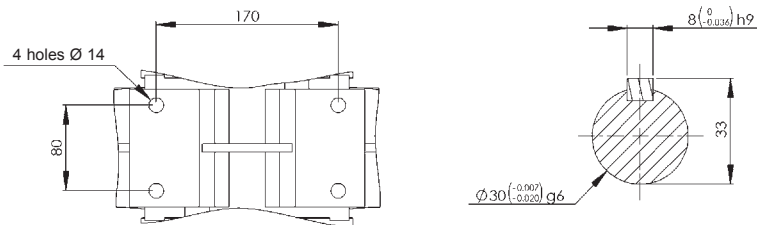
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1. PRESENTATION

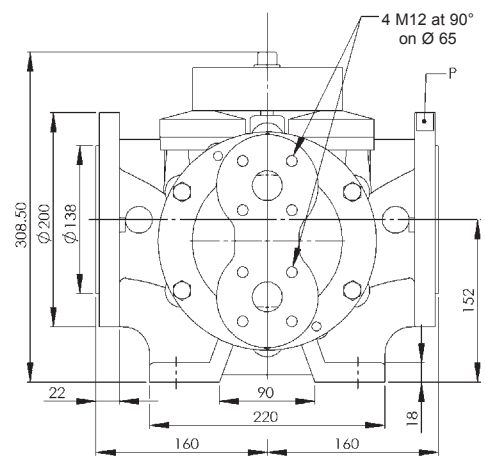
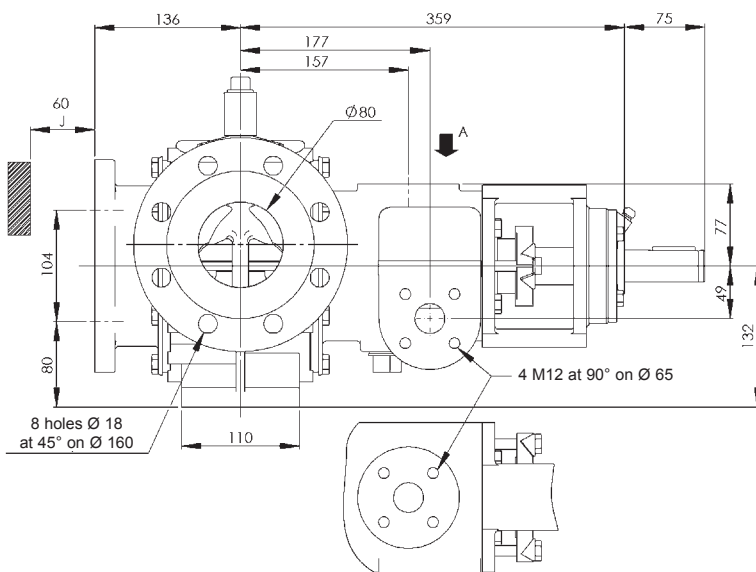


2. OVERALL DIMENSIONS

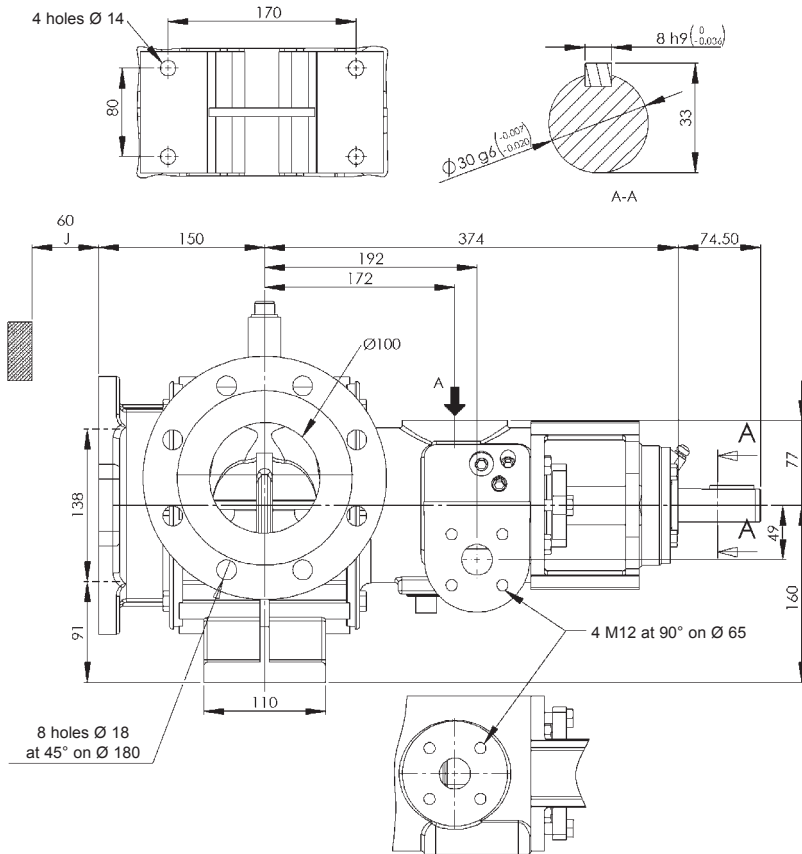
P40



J	Space required for removing front cover.
P	Pump plate.

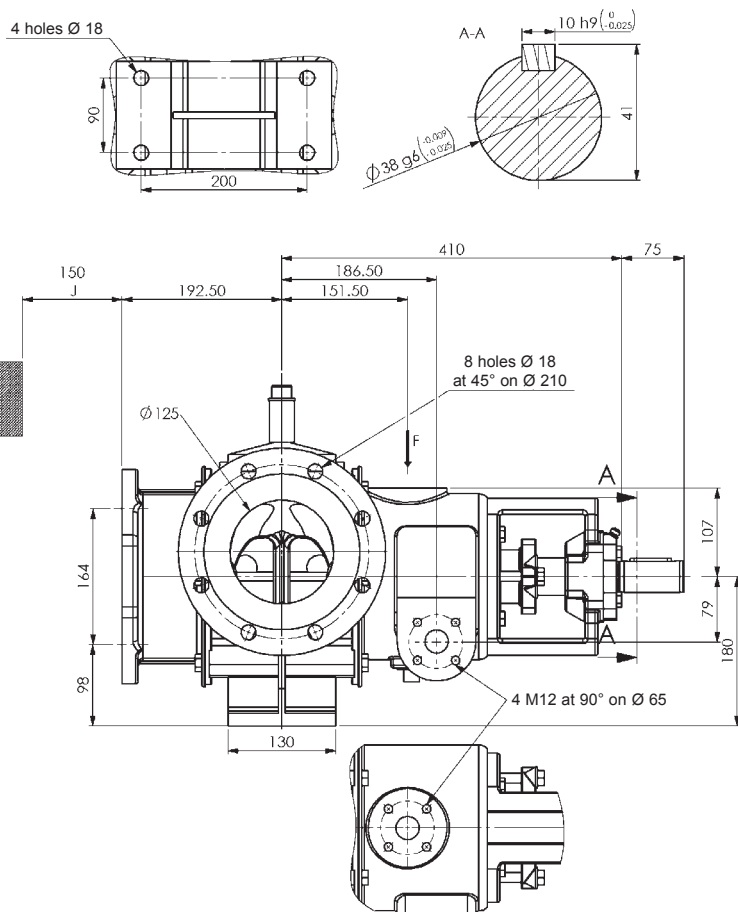
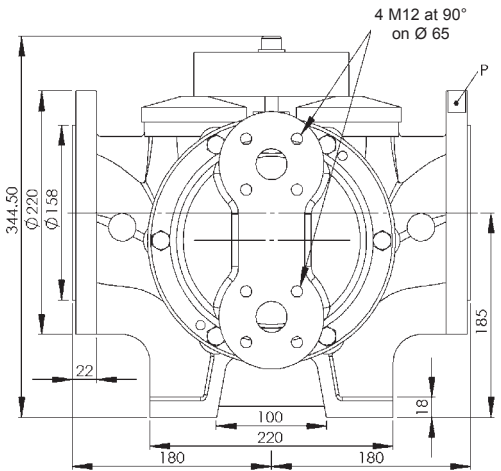


2. OVERALL DIMENSIONS (continuous)



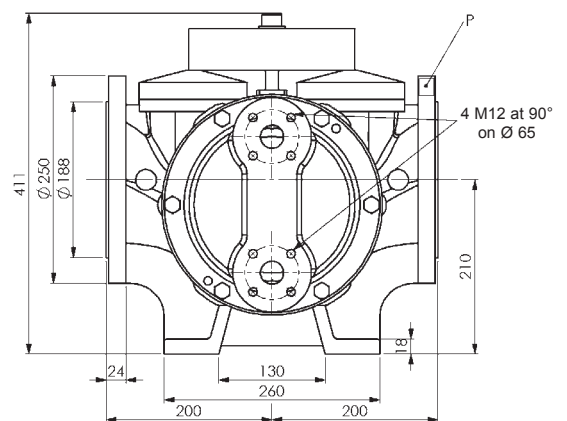
P60

J	Space required for removing front cover.
P	Pump plate.



P100

J	Space required for removing front cover.
P	Pump plate.



3. INSTALLATION

3.1 CHOICE OF PUMP

To obtain the service expected from a BSP P serie BLACKMER pump, regarding both performance and longevity, it is vital that the type of pump, its speed and the materials used for its construction are determined as a function of the pump output, its installation and operating conditions.

You can contact our Technical Services at any time to ask for the information you require.

3.2 PIPE DIAMETERS

The location of the pump in the transfer or recycling circuit should always be determined so as to reduce the height and length of the piping as much as possible.

The diameter of the pipes must be determined as a function of their length on the one hand, and the flow and viscosity of the product on the other, so that head loss remains within design limits. Therefore it is difficult to give general and precise directions.

However, we recall that it is never prejudicial to plan for wide diameters, particularly regarding the intake.

For fluids being pumped, it is also possible to plan, on the discharge, a diameter equal to that of the pump's orifices, and on the intake, for a wider diameter if suction is very strong.

Concerning viscous products, the determination of this diameter is very important since the variation of head loss is proportional to the viscosity and inversely proportional to the power of 4th of the diameter. Therefore a small reduction of piping diameter can have major consequences. Our Technical Services are always available to provide you with precise data if you give them accurate information or, better still, the installation plans.

The stresses exerted by the piping on the pump can deform the pump parts, increase wear, misalign the bearings and even cause parts to break.

The pipes must be designed to allow thermal expansion and contraction and be firmly secured (the use of flexible hoses and expansion loops is recommended).

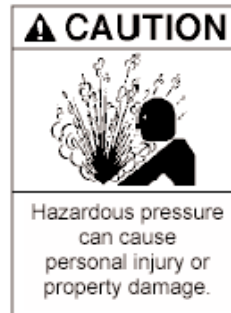
We recommend placing valves close to the pump flanges to permit dismantling or replacement without having to drain the installation. These valves should have the same diameter as the pipes and, by preference, be a full bore model.

A strainer should be fitted in the suction line to prevent the introduction of foreign bodies into the pump.

If the liquid may freeze or solidify, prepare for draining the piping by installing drain taps at the low points and air vents at the high points.

In the case of a very high intake or if you wish to prevent the piping from emptying at shutdown, you can install a foot valve. It should have a large diameter so as not to generate additional head loss.

3.4 DIRECTION OF ROTATION



FAILURE TO RELIEVE THE SYSTEM PRESSURE PRIOR TO PERFORMING ANY WORK ON THE PUMP OR THE INSTALLATION CAN CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

3.3 PIPING ASSEMBLY



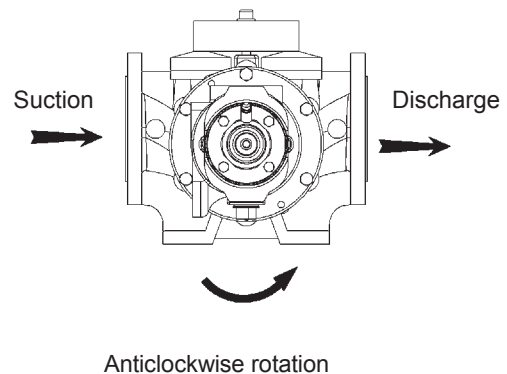
FAILURE TO RELIEVE THE SYSTEM PRESSURE PRIOR TO PERFORMING ANY WORK ON THE PUMP OR THE INSTALLATION CAN CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

Wherever possible, siphons and reverse slopes in the suction piping must be avoided and all the gaskets must be installed with great care to avoid air from entering the piping.

The elbows must always have a large radius and must not be assembled too close to the pump flanges, at the inlet as well as the outlet side.

The BC P serie BLACKMER pump is not reversible. Except opposite specification before order, the direction of rotation is systematically anti-clockwise (observer face the shaft).

The intake and discharge side is bound at the direction of rotation by the next rule : when an observer faces the shaft, if rotation takes place anticlockwise, the intake is on the left.



3. INSTALLATION (continuous)

3.5 CLEANING

Since the pumps are delivered well greased, they must be cleaned before starting them up (especially when transferring food products, for example).

Cleaning can be done either by circulating an appropriate liquid, or by removing the front cover of the pump and carefully cleaning the internal parts. (cf. § OPENING OF THE NON-DRIVE SIDE BASE).

3.6 ANCHORING THE PUMP UNITS

The correct seating of the pump is vital for its efficient operation and its longevity.

The surface must be resistant enough to absorb the stresses due to the pump unit without deformation.


In the case where the unit is fastened by anchor lugs or bolts, it must be carefully wedged to prevent any deformation of the chassis when tightening the bolts. Deformation of the chassis will cause stress prejudicial to the pump and the drive device and put the coupling out of true, thereby causing vibrations, noise and premature wear. Care must be taken so that the chassis is clear of the ground, apart from the base plates.

The chassis is equipped with a ground connection that must be used.

We recommend leaving an unoccupied space of about 50 cm, on either end of the chassis, to permit access to the bolts fastening the pump, reduction gear and motor together.

3.7 ALIGNMENT OF MOTOR/PUMP AND

▲ WARNING



Hazardous machinery can cause serious personal injury.

OPERATION WITHOUT THE SHAFT PROTECTOR CAN CAUSE SERIOUS PERSONAL INJURY, MAJOR PROPERTY DAMAGE, OR DEATH.

▲ WARNING





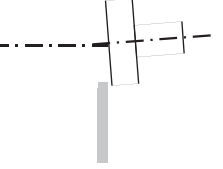
Dangerous voltage. Can cause injury and death.

DISCONNECT THE ELECTRICITY SUPPLY BEFORE ANY MAINTENANCE OPERATION.

The motor and pump shafts are perfectly aligned in the factory before shipment, but they must be checked and realigned after installation if necessary.

To check the alignment and coupling, use a set square to control the axial misalignment, and feeler gauges for angular misalignment.

The 3 figures below show the operation clearly.

<i>Carry out a control on 4 points : At the top - at the bottom - on the left - on the right</i>	
	<i>Correct</i>
	<i>Axial alignment out of true</i>
	<i>Angular alignment out of true</i>

It is important to control the alignment at every step of installation in order to ensure that none of these steps generates stress on the pump unit or the pump itself :

- after fastening on foundations
- after fastening the piping
- after the pump has operated at normal operating temperature.

REMINDER :

Do not rely on the flexible coupling to compensate for misalignment.

3. INSTALLATION (continuous)

3.8 ELECTRIC MOTORS



DISCONNECT THE ELECTRICITY SUPPLY BEFORE ANY MAINTENANCE OPERATION.

Check that the supply voltage matches the indications on the motor rating plate.

Comply with the wiring diagram, make sure the wires are rated for the power and take care with the contacts which must be thoroughly tightened.

The motors must be protected by appropriate circuit breakers and fuses.

Connect the regulatory ground connections.

Check the direction of rotation.

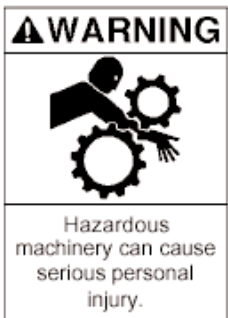
3.9 DIESEL ENGINE DRIVE



THE SURFACES CAN BE AT A TEMPERATURE LIABLE TO CAUSE INJURY OR SEVERE DAMAGE.

Do not forget that these engines are not reversible. It is therefore vital to carefully check the inlet and outlet sides of the pump before connecting the pump unit to the piping.

The use of diesel engines is now well known. Nevertheless, we strongly recommend that you carefully read the technical manuals concerning them.



OPERATION WITHOUT THE SHAFT PROTECTOR CAN CAUSE SERIOUS PERSONAL INJURY, MAJOR PROPERTY DAMAGE, OR DEATH.



INCORRECT SETTINGS OF THE PRESSURE RELIEF VALVE CAN CAUSE PUMP COMPONENT FAILURE, PERSONAL INJURY, AND PROPERTY DAMAGE.

This fundamental checking of the pump must be done without any product, with the inlet and outlet circuit open to the air, for example, to avoid any risk of an unexpected pressure rise. Start the pump empty to check the correct operation of the connections and check that the direction of rotation corresponds to installation's inlet and outlet direction. Follow the instructions below if necessary to change the direction of rotation.

Three phase motor : switch any two wires of the current supply.

Two phase motor : switch the two wires of the same phase.

Single phase motor : comply with the instructions of the manual supplied with the motor.

4. USE

4.1 STORAGE

In the case of prolonged shutdown or storage, we recommend dismantling the pump and greasing it thoroughly. If it cannot be dismantled, it should be filled with oil via its orifices (inlet and outlet) and rotated slowly by hand to allow the oil to penetrate. The flange seal surfaces should be thoroughly greased to protect them against atmospheric oxidation.

4.2 PUMPING HOT PRODUCTS



THE SURFACES OF THE PUMP CAN BE AT A TEMPERATURE LIABLE TO CAUSE INJURY OR SEVERE DAMAGE.

When pumping products at high temperatures, take care when starting the pump for the first time, tighten the bolts to compensate for expansion effects.

4.3 PUMP WITH HEATING JACKET



THE SURFACES OF THE PUMP CAN BE AT A TEMPERATURE LIABLE TO CAUSE INJURY OR SEVERE DAMAGE.

The circuit must be designed so that the expansion of the product in the pump can be absorbed via the piping. Therefore the product in the pipes must be heated before the product in the pump. Care must also be taken that the product being heated is not trapped between closed valves.

4.4 PUMP FILLED WITH PRODUCT AT SHUTDOWN



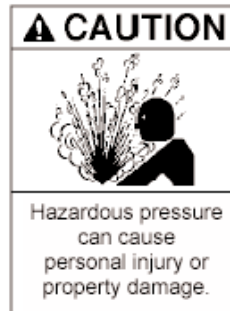
FAILURE TO INSTALL ADEQUATELY SIZED PRESSURE RELIEF VALVE(S) CAN CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

In the case where the pumping circuit is situated between isolating valves and/or has a check valve, you must bear in mind the variations in temperature that can occur, leading in particular to the expansion of the product in the circuit. In this case, provide a means of releasing the expansion volume.

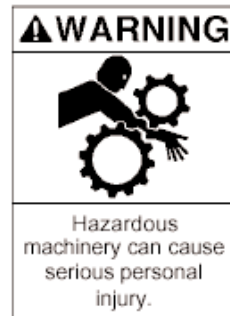
The use of a relief valve can suffice for this function. The opening pressure of this valve must be compatible with the pressure allowed by the parts composing the circuit.

With products including particles that settle at shutdown, it is necessary to ensure that the consistency of the deposited products will not affect the start-up of the pump.

4.5 STARTING-UP THE PUMP



FAILURE TO RELIEVE THE SYSTEM PRESSURE PRIOR TO PERFORMING ANY WORK ON THE PUMP OR THE INSTALLATION CAN CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.



OPERATION WITHOUT THE SHAFT PROTECTOR CAN CAUSE SERIOUS PERSONAL INJURY, MAJOR PROPERTY DAMAGE, OR DEATH.

Before starting up the pump, always ensure that the pumping conditions are correct, with the corresponding valves open, especially the inlet valve. For products requiring heating, they must be brought to their pumping temperature before starting the pump.

4.6 SHUTTING DOWN THE PUMP

When shutting down the pump, we recommend waiting for the pump to stop completely before closing the valves, especially the inlet valve.

5. NECESSARY TOOLS AND ASSEMBLY TORQUES

5.1 NECESSARY TOOLS

- 13 - 16 - 19 - 24 open-end spanner
- 10 - 16 socket spanner
- Opening circlip pliers
- Screwdriver
- Extractor (e.g. FACOM U-35L)
- Torque wrench
- Wrench for hexagonal hollow of 8

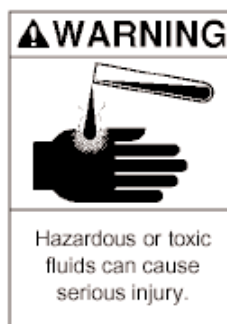
5.2 ASSEMBLY TORQUES

- M10 ⇒ 30 N.m
- M8 ⇒ 16 N.m
- M6 ⇒ 7 N.m

6. OPENING OF THE NON-DRIVE SIDE BASE



DISCONNECT THE ELECTRICITY SUPPLY BEFORE ANY MAINTENANCE OPERATION.



IF PUMPING HAZARDOUS OR TOXIC FLUIDS, THE SYSTEM MUST BE FLUSHED PRIOR TO PERFORMING ANY SERVICE OPERATION.



FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING MAINTENANCE CAN CAUSE SHOCK, BURNS OR DEATH.



THE PUMP LUBRICANT IS VERY SLIPPERY AND MAY CAUSE SERIOUS INJURY. ANY SPILLS MUST BE CLEANED UP.



BE CAREFUL WITH THE WEIGHT OF THE PARTS WHEN THEY ARE BEING REMOVED.



TAKE ALL NECESSARY MEASURES TO RENDER ANY START-UP, EVEN ACCIDENTAL, OF THE PUMP DURING THE WORK IMPOSSIBLE.



DISCONNECTING THE FLUID OR PRESSURE CONTAINMENT COMPONENTS DURING PUMP OPERATION CAN CAUSE SERIOUS PERSONAL INJURY, DEATH OR MAJOR PROPERTY DAMAGE.

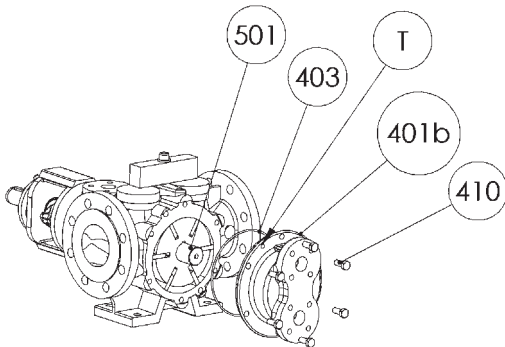
Before any disassembly, makes sure that the pump has been drained and take all the necessary precautions to prevent it from starting up. The pump must not start up, even accidentally.

6. OPENING OF THE NON-DRIVE SIDE BASE (continuous)

6.1 OPENING OF THE NON-DRIVE SIDE BASE

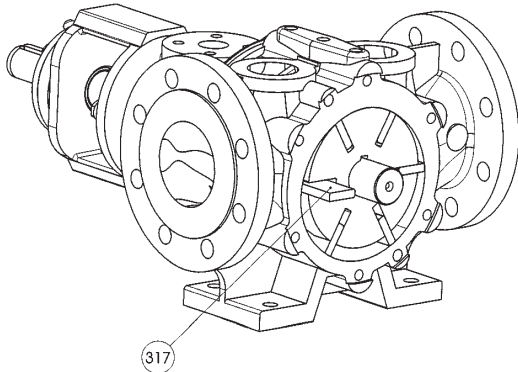
Dismantling :

1. Loosen the 6 bolts **410**.
2. Place 2 bolts **410** in the 2 tapped holes T.
3. Detach the front cover **401b** of the body by screwing the 2 bolts at the same time.
4. When the cover is free on the shaft, withdraw it manually while supporting it.
5. Check the seal **403**.



6.2 CHECKING OF THE VANES

Remove a vane **317** situated in an horizontal plane.



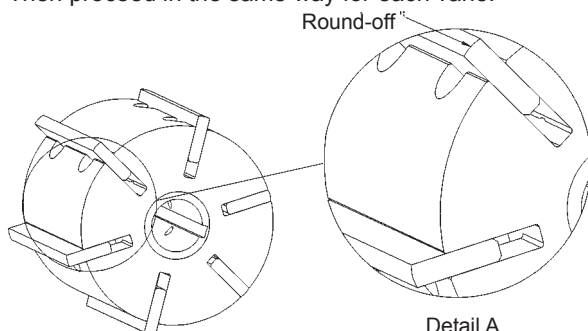
Check it for wear (see § MAINTENANCE).

In the case of abnormal wear, check the state of the body and front cover faces.

Replace the vane (with a new one if necessary) making sure it is fitted in the right direction and making sure it slides properly in its slot.

By hand, turn the pump shaft to bring the next vane into a horizontal plane.

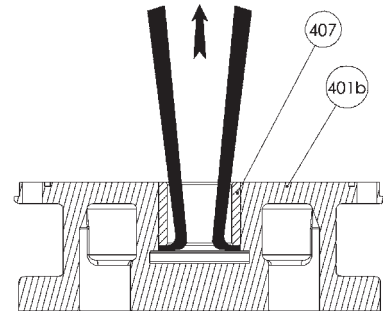
Then proceed in the same way for each vane.



6.3 CHANGING OF THE BUSHING

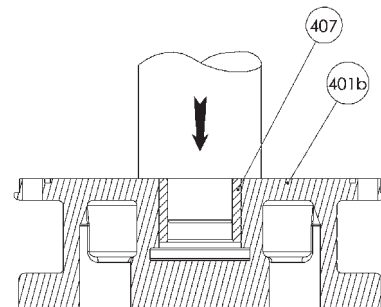
Dismantling :

1. Place the front cover **401b** vertically side jacket.
2. Insert the extractor inside the ring **407**, as far as the front cover **401b**.
3. When the extractor is in place, remove the ring **407**.



Reassembly :

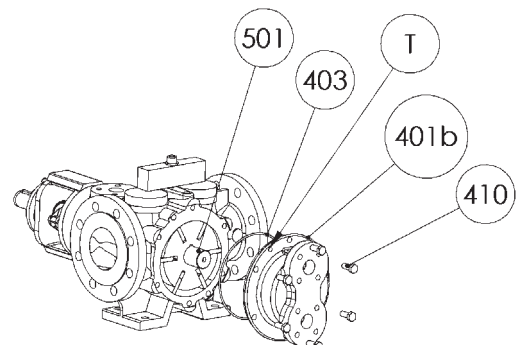
1. Place the front cover **401b** vertically side jacket.
2. Offer up the ring **407** on the hole.
3. Fit the ring by pushing it on with a sleeve using a press. The face of the ring **407** must be in line with that of the front cover **401b**.



6.4 CLOSING OF THE NON-DRIVE SIDE BASE

Reassembly :

1. Check the seal **403**, change it if necessary.
2. Mount the front cover **401b** on the shaft **501** and tighten it as much as possible by hand.
3. Screw the 6 bolts **410**.

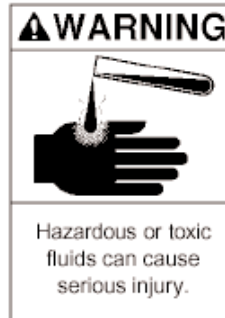


4. Turn the shaft as you tighten the bolts **410**.

7. OPENING OF THE DRIVE SIDE BASE



DISCONNECT THE ELECTRICITY SUPPLY BEFORE ANY MAINTENANCE OPERATION.



IF PUMPING HAZARDOUS OR TOXIC FLUIDS, THE SYSTEM MUST BE FLUSHED PRIOR TO PERFORMING ANY SERVICE OPERATION.



FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING MAINTENANCE CAN CAUSE SHOCK, BURNS OR DEATH.



THE PUMP LUBRICANT IS VERY SLIPPERY AND MAY CAUSE SERIOUS INJURY. ANY SPILLS MUST BE CLEANED UP.



BE CAREFUL WITH THE WEIGHT OF THE PARTS WHEN THEY ARE BEING REMOVED.



TAKE ALL NECESSARY MEASURES TO RENDER ANY START-UP, EVEN ACCIDENTAL, OF THE PUMP DURING THE WORK IMPOSSIBLE.



DISCONNECTING THE FLUID OR PRESSURE CONTAINMENT COMPONENTS DURING PUMP OPERATION CAN CAUSE SERIOUS PERSONAL INJURY, DEATH OR MAJOR PROPERTY DAMAGE.

Before any disassembly, make sure that the pump has been drained and take all the necessary precautions to prevent it from starting up. The pump must not start up, even accidentally.

Uncouple the pump by removing the coupling sleeve.

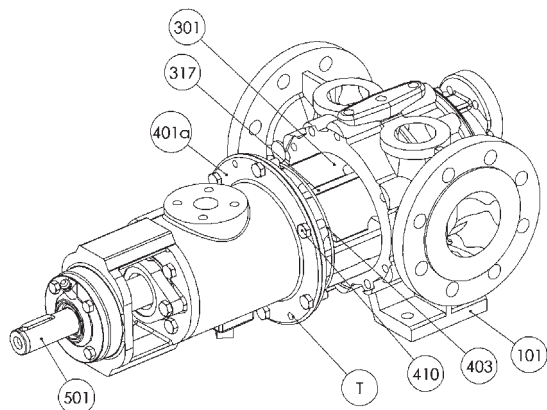
Remove the pump mounting bolts.

Place it on a workbench or on a flat surface free from obstructions.

7. OPENING OF THE DRIVE SIDE BASE (continuous)

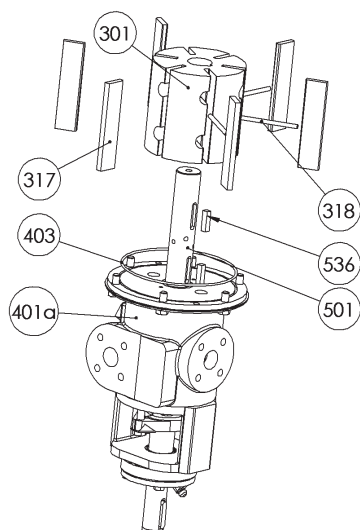
7.1 OPENING OF THE DRIVE SIDE BASE

1. Loosen the 6 bolts **410**.
2. Place 2 bolts **410** in the 2 tapped holes T.
3. Detach the front cover of the body by screwing the 2 bolts at the same time.
4. Withdraw the base **401a** in such a way as to release the rotor **301** from a little more than half of the pump body **401a**.
5. Hold the vanes **317** in place by means of suitable straps (elastic, bracelets, ...).
6. Check the seal **403**.



7.2 DISMANTLING OF THE VANES AND PUSHRODS

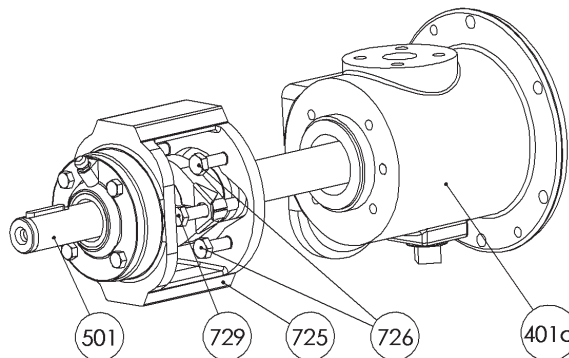
1. Place the front cover **401a**, rotor **301** assembly on a bench. remove the straps and the vanes
2. Remove the straps and the vanes.
3. Pull out the pushrods **318** by pushing them, if necessary, with a screwdriver.
4. Pull out the rotor **301**.
5. Check the pushrods **318** for wear (see § MAINTENANCE), change them as necessary.
6. Refit the keyways **536**.
7. Check the wear of the keyways and of the 2 keys **536**.



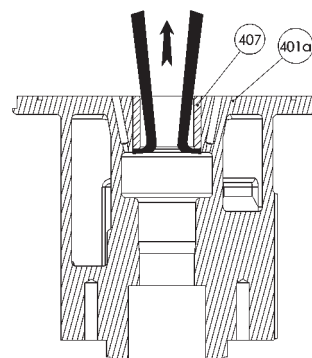
7.3 CHANGING OF THE BUSHING

Dismantling :

1. Loosen the 2 bolts **729**.
2. Loosen the 4 bolts **726**.
3. Remove the front cover **401a** from the strainer **725** by sliding it along the shaft **501** (take care not to drag the gasket or subject it to any impact).

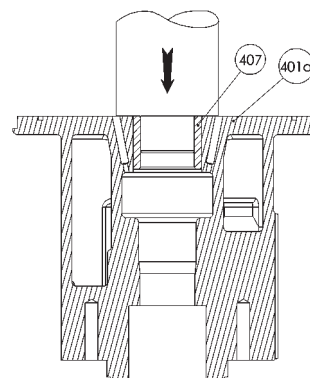


4. After carefully removing the jacket **622**, place the front cover **401a** vertically on the smaller surface.
5. Insert the extractor inside the ring **407**, as far as the front cover **401a**.
6. When the extractor is in place, remove the ring **407**.



Reassembly :

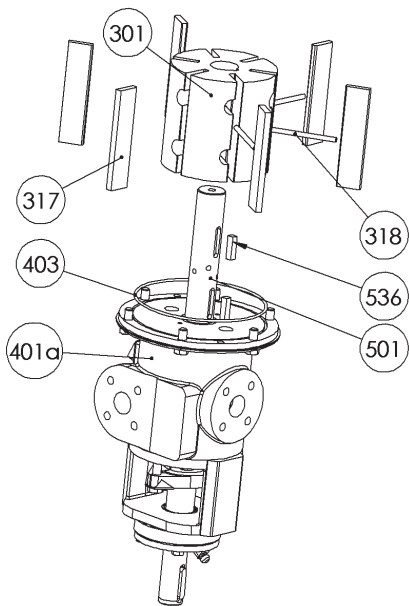
1. Place the front cover **401a** vertically on the smaller surface.
2. Offer up the ring **407** on the hole.
3. Fit the ring by pushing it on with a sleeve using a press. The face of the ring **407** must be in line with that of the front cover **401a**.
4. Fit the front cover **401a** on the strainer **725**.
5. Screw the 4 bolts **726**.



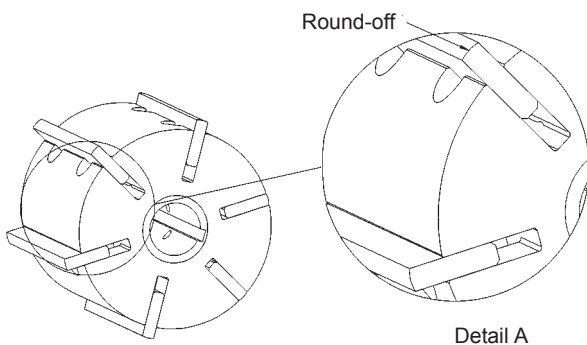
7. OPENING OF THE DRIVE SIDE BASE (continuous)

7.4 REASSEMBLY OF THE VANES AND PUSHRODS

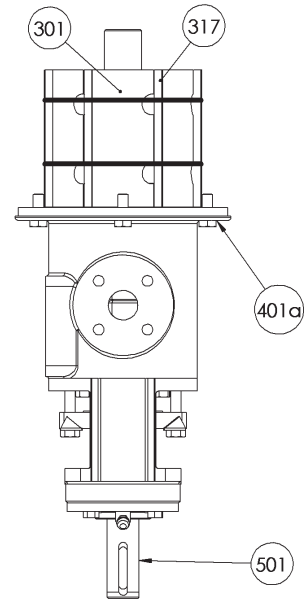
1. Position the shaft **501** vertically with the front cover **401a** facing down.
2. Check the seal **403**, changer it as necessary.
3. Fit the seal **403** in the front cover **401a**.
4. Fit the keyways **536**.
5. Insert the rotor **301** on the shaft **501**.
6. Check that the holes of the shaft coincide with the pushrods holes, if they do not, re-insert the rotor **301** in the other direction.
7. Insert the pushrods **318** in the rotor holes **301**.



8. Insert the vanes **317** making sure they are fitted in the right direction (see detail A) and check that they slide freely.



9. Hold them in place using suitable straps (elastic, bracelets...).
10. Insert this assembly into the body **101**, removing the straps at an opportune moment.



7.5 CLOSING OF THE DRIVE SIDE BASE

1. Refit the front cover **401a** on the pump body **101**.
2. Screw the 6 bolts **410**.
3. Check that the pump rotates freely when turned by hand.

Replace the pump mounting bolts.

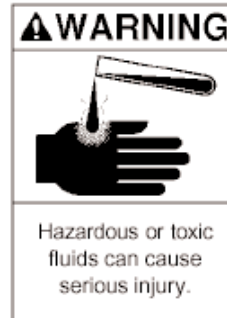
Couple the pump by placing the coupling sleeve.

Check the pump alignment (see § ALIGNMENT OF MOTOR/PUMP AND REDUCTION GEARBOX/PUMP SHAFTS).

8. CHANGING OF THE BALL BEARING



DISCONNECT THE ELECTRICITY SUPPLY BEFORE ANY MAINTENANCE OPERATION.



IF PUMPING HAZARDOUS OR TOXIC FLUIDS, THE SYSTEM MUST BE FLUSHED PRIOR TO PERFORMING ANY SERVICE OPERATION.



FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING MAINTENANCE CAN CAUSE SHOCK, BURNS OR DEATH.



THE PUMP LUBRICANT IS VERY SLIPPERY AND MAY CAUSE SERIOUS INJURY. ANY SPILLS MUST BE CLEANED UP.



BE CAREFUL WITH THE WEIGHT OF THE PARTS WHEN THEY ARE BEING REMOVED.



TAKE ALL NECESSARY MEASURES TO RENDER ANY START-UP, EVEN ACCIDENTAL, OF THE PUMP DURING THE WORK IMPOSSIBLE.



DISCONNECTING THE FLUID OR PRESSURE CONTAINMENT COMPONENTS DURING PUMP OPERATION CAN CAUSE SERIOUS PERSONAL INJURY, DEATH OR MAJOR PROPERTY DAMAGE.

Before any disassembly, make sure that the pump has been drained and take all the necessary precautions to prevent it from starting up. The pump must not start up, even accidentally.

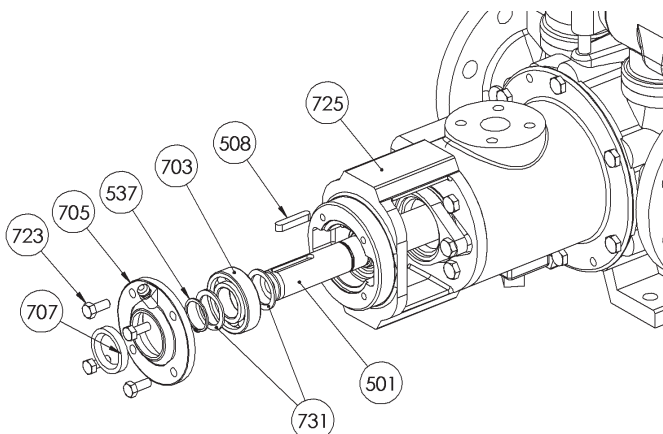
Uncouple the pump by removing the coupling sleeve.

Remove the pump mounting bolts.

Place it on a workbench or on a flat surface free from obstructions.

Dismantling :

1. Remove the key **508**.
2. Carefully clean the shaft end to remove any trace of paint, oxidation, burrs..... with No.320 grained paper.
3. Loosen the 4 bolts **723**.
4. Remove the cover **705** taking care not to damage the lip seal **707**.
5. Remove the circlips **537**.
6. Remove the washer **731**.
7. Remove the ball bearing **703** using the extractor : pass the grippers behind the ball bearing while sliding them into the holes of the strainer **725**, using the shaft end **501** as a support.
8. Keep the washer in place **731**.



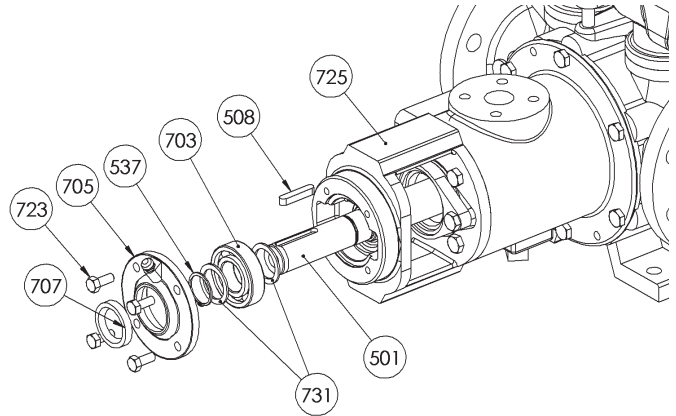
8. CHANGING OF THE BALL BEARING (continuous)

Reassembly :

1. Check that the washer **731** is pressed against shoulder of the shaft **501**.
2. Couple the ball bearing **703** on to the shaft by hand (see § GREASING OF THE BALL BEARING).
3. Push it on with a sleeve until it comes to bear against the washer **731**. **In no case must the ball bearing be pushed on to the shaft without support for the shaft 501.**

FAILURE TO FOLLOW THIS PROCEDURE CAN SERIOUSLY DAMAGE THE INTERIOR OF THE PUMP.

4. Place the washer **731** against the ball bearing **703**.
5. Fit the circlips **537**.
6. Check the lip seal **707**, change it as necessary.
7. Clean the sides of the cover **705** and of the strainer **725** with a clean rag.
8. Fit the lip seal **707** in the cover **705**.
9. Fit the cover **705** on the strainer **725**.
10. Screw the 4 bolts **723**.
11. Check that the pump rotates freely when turned by hand.



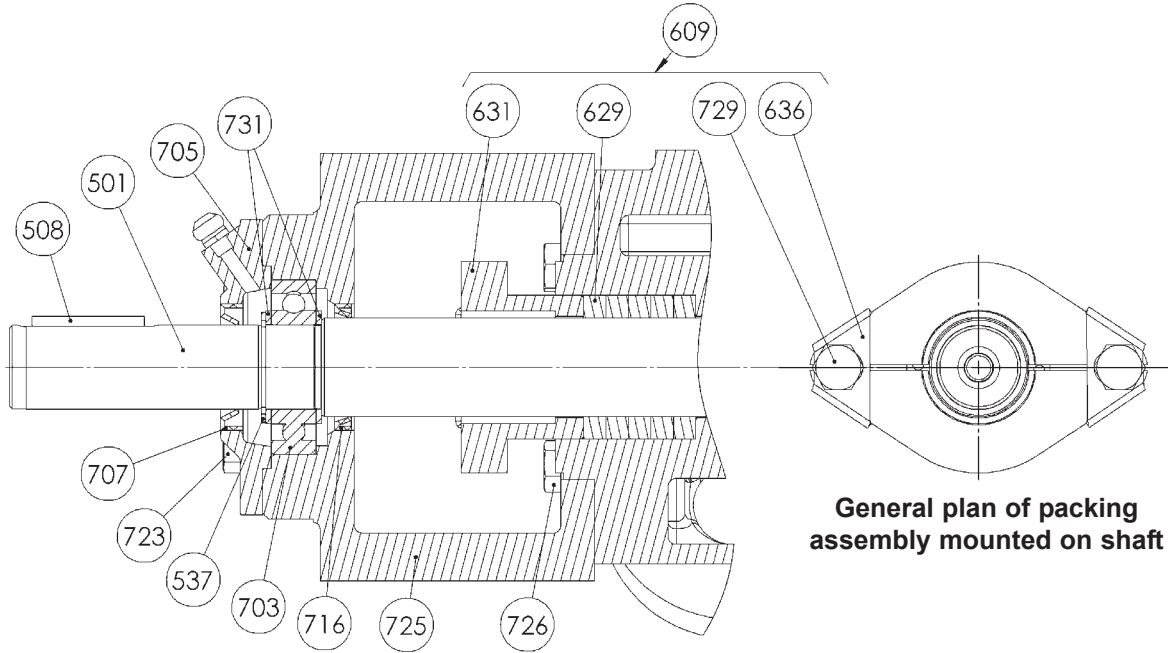
Put the pump on the installation.

Replace the pump mounting bolts.

Couple the pump by placing the coupling sleeve.

Check the pump alignment (see § ALIGNMENT OF MOTOR/PUMP AND REDUCTION GEARBOX/PUMP SHAFTS).

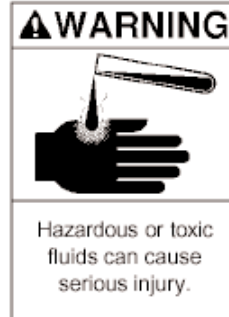
9. PACKING



General plan of packing assembly mounted on shaft



DISCONNECT THE ELECTRICITY SUPPLY BEFORE ANY MAINTENANCE OPERATION.



IF PUMPING HAZARDOUS OR TOXIC FLUIDS, THE SYSTEM MUST BE FLUSHED PRIOR TO PERFORMING ANY SERVICE OPERATION.



FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING MAINTENANCE CAN CAUSE SHOCK, BURNS OR DEATH.



THE PUMP LUBRICANT IS VERY SLIPPERY AND MAY CAUSE SERIOUS INJURY. ANY SPILLS MUST BE CLEANED UP.

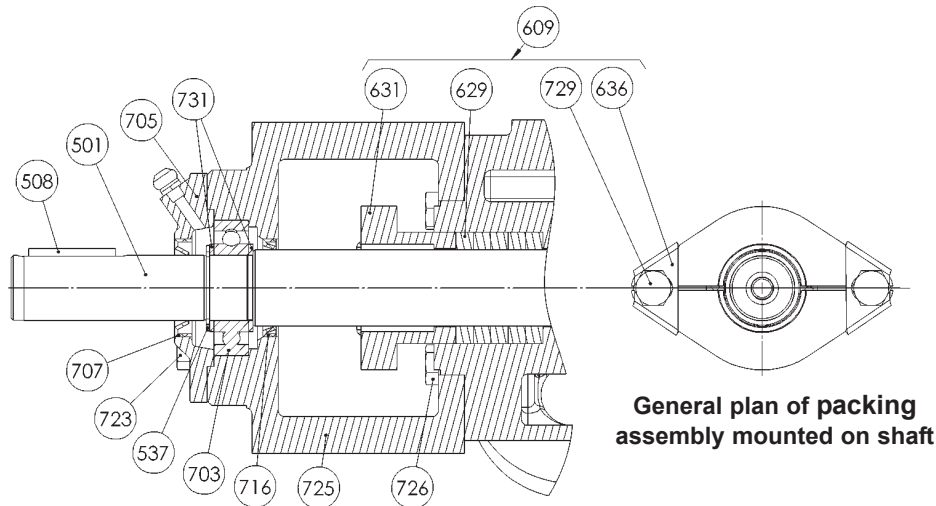


DISCONNECTING THE FLUID OR PRESSURE CONTAINMENT COMPONENTS DURING PUMP OPERATION CAN CAUSE SERIOUS PERSONAL INJURY, DEATH OR MAJOR PROPERTY DAMAGE.



TAKE ALL NECESSARY MEASURES TO RENDER ANY START-UP, EVEN ACCIDENTAL, OF THE PUMP DURING THE WORK IMPOSSIBLE.

9. PACKING (continuous)



General plan of packing assembly mounted on shaft

9.1 Packing

9.1.1 Function

The rings **629** have a static seal at the strainer **725** side and a hydrodynamic seal at the shaft **501** side.

The packing gland **631** must compress the rings **629** by tightening the bolts **729** while providing a slight leakage to the outside.

BE CAREFUL :

Packing must always seep slightly in order to reduce the friction between shaft **501** / rings **629** and to remove the frictional heat which can cause the packing to overheat.

The sealing is achieved by the rings **629** between the front cover **401a** and the shaft **501**.

The packing must be replaced when the gland follower **631** cannot be tightened any further.

LEAKING PACKING :

If the shaft **501** is worn under the packing the rings **629** are not suitable for the product being pumped resulting in chemical and/or mechanical attack.

9.1.2 Replacement

Before any disassembly, make sure that the pump has been drained and take all the necessary precautions to prevent it from starting up. The pump must not start up, even accidentally.

Uncouple the pump by removing the coupling sleeve.

Remove the pump mounting bolts.

Place it on a workbench or on a flat surface free from obstructions.

Dismantling :

1. Loosen the 2 bolts **729**.
2. Remove the 2 stirrups **636**.
3. Free the ram **631** by sliding it along the shaft **501**.
4. Carefully remove the worn gasket **629**.

Reassembly :

1. Cut 5 rings with the diameter of the shaft from the replacement packing.
2. Insert them, one after another, into the stuffing Box , arranging them in such a way that the joints of the rings **629** do not merge into one another. The last ring must not protrude from the stuffing Box.
3. Put back the packing gland **631**.
4. Put the washer **636** in place.
5. Gently re-tighten the 2 bolts **729** taking care to balance up the tightening so that the packing gland enters straight into the stuffing box.
6. Push in the packing gland **631** just enough to prevent substantial leakage.

Replace the pump on the installation.

Replace the pump mounting bolts.

Couple the pump by placing the coupling sleeve.

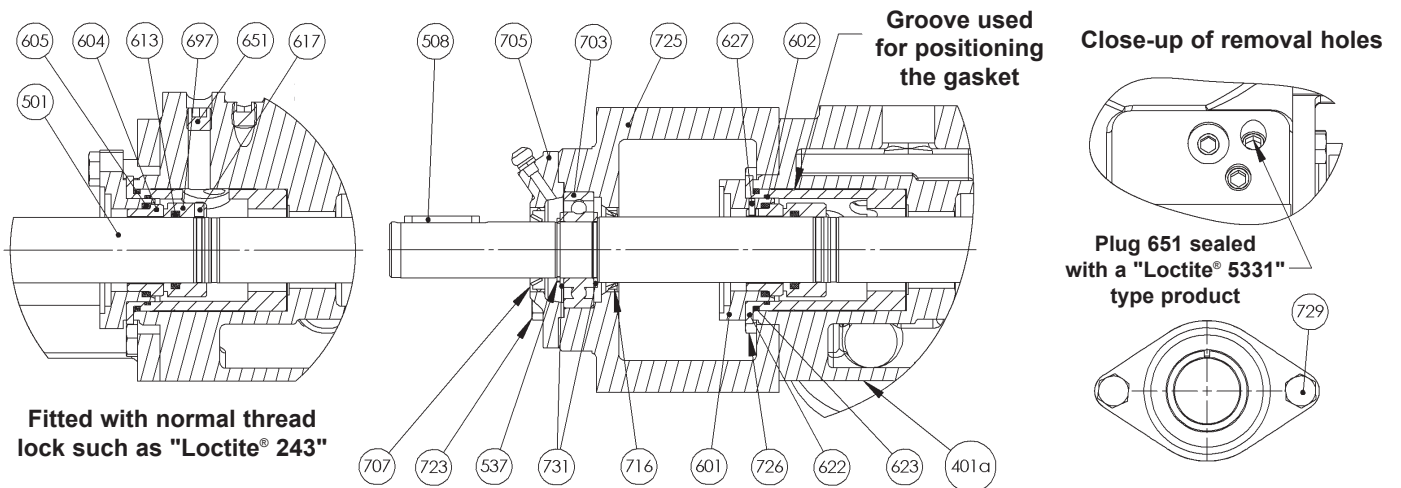
Check the pump alignment (see § ALIGNMENT OF MOTOR/PUMP AND REDUCTION GEARBOX/PUMP SHAFTS).

1. Start up the pump.
2. Keep tightening the bolts **729**, tightening as the new packing settles. Allow slight seepage of liquid necessary for the lubrication and the cooling of the packing.
3. Ascertain manually that there is no abnormal heating of the stuffing Box due to overtightening of the Packing Gland **631**. If this happens, release the packing by loosening the 2 bolts **729**.

9.1.3 Maintenance

The packing must be replaced when the packing gland **631** cannot be tightened any further.

9. SINGLE MECHANICAL SHAFT SEAL



⚠ WARNING

Dangerous voltage. Can cause injury and death.

DISCONNECT THE ELECTRICITY SUPPLY BEFORE ANY MAINTENANCE OPERATION.

⚠ WARNING

Hazardous or toxic fluids can cause serious injury.

IF PUMPING HAZARDOUS OR TOXIC FLUIDS, THE SYSTEM MUST BE FLUSHED PRIOR TO PERFORMING ANY SERVICE OPERATION.

⚠ CAUTION

Hazardous pressure can cause personal injury or property damage.

FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING MAINTENANCE CAN CAUSE SHOCK, BURNS OR DEATH.

⚠ CAUTION

Slippery lubricant. Spills should be cleaned up.

THE PUMP LUBRICANT IS VERY SLIPPERY AND MAY CAUSE SERIOUS INJURY. ANY SPILLS MUST BE CLEANED UP.

⚠ WARNING

Hazardous pressure can cause personal injury or property damage.

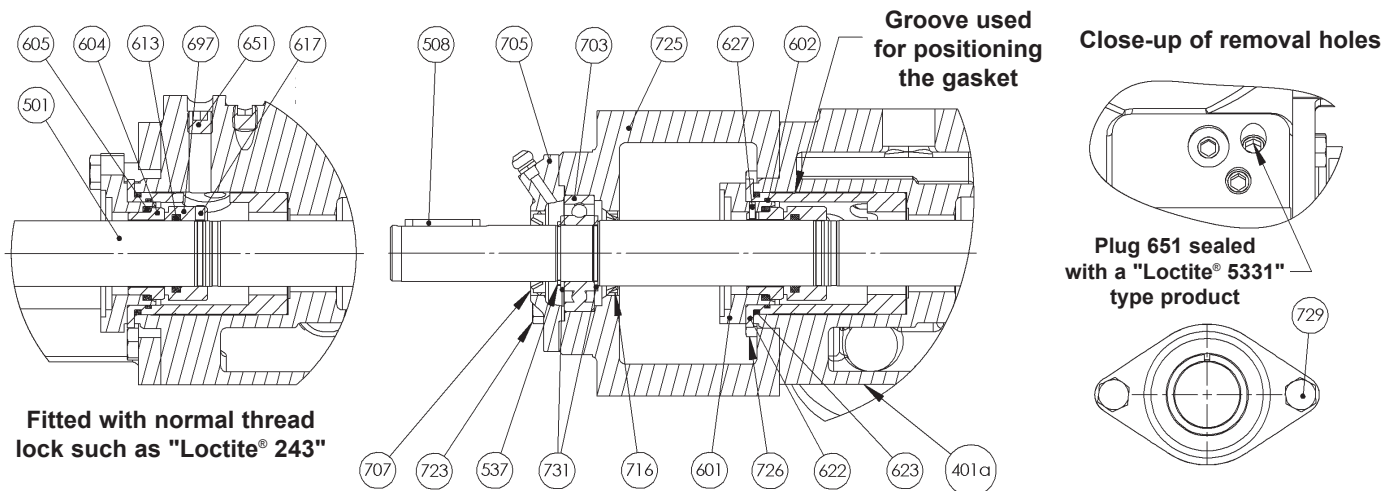
DISCONNECTING THE FLUID OR PRESSURE CONTAINMENT COMPONENTS DURING PUMP OPERATION CAN CAUSE SERIOUS PERSONAL INJURY, DEATH OR MAJOR PROPERTY DAMAGE.

⚠ WARNING

Any unforeseen start-up can provoke serious injuries or important material damages.

TAKE ALL NECESSARY MEASURES TO RENDER ANY START-UP, EVEN ACCIDENTAL, OF THE PUMP DURING THE WORK IMPOSSIBLE.

9. SINGLE MECHANICAL SHAFT SEAL (continuous)



9.2 SINGLE MECHANICAL SHAFT SEAL

9.2.1 Functioning of a single mechanical shaft seal

Shaft **501** drives the one-piece rotating part **697**, by means of the screw **617**. The counterpart **604** is integral - one with the shaft seal holder **601** by means of the ring seal **605** and the pin **627**.

THE SEALING IS ACHIEVED :

- On the shaft, by ring seals **613** of rotating part **697**.
- By the contact surface between the one-piece rotating part **697** and fixed counterpart **604**.
- Between the immobile counterpart **604** and shaft seal holder **601** by ring seal **605**.
- Between the shaft seal holder **601** and jacket **622** by seal **602**.
- Between the jacket **622** and front cover **401a** by seal **623**.

Fluid tightness therefore depends on the condition of the friction faces and ring seals.

REASONS FOR LEAKING SHAFT SEAL :

- Seal damaged during assembly (scratching on friction faces...).
- Seal unsuited to product (chemical or mechanical attack against seals and counterparts).
- Normal wear of the seal.

9.2.2 Replacement of a single mechanical shaft seal

Before undertaking disassembly, make sure that the pump has been drained, and take the precautions necessary to prevent commencement of rotation. No accidental start-up should be possible.

Uncouple the pump by removing the coupling sleeve.

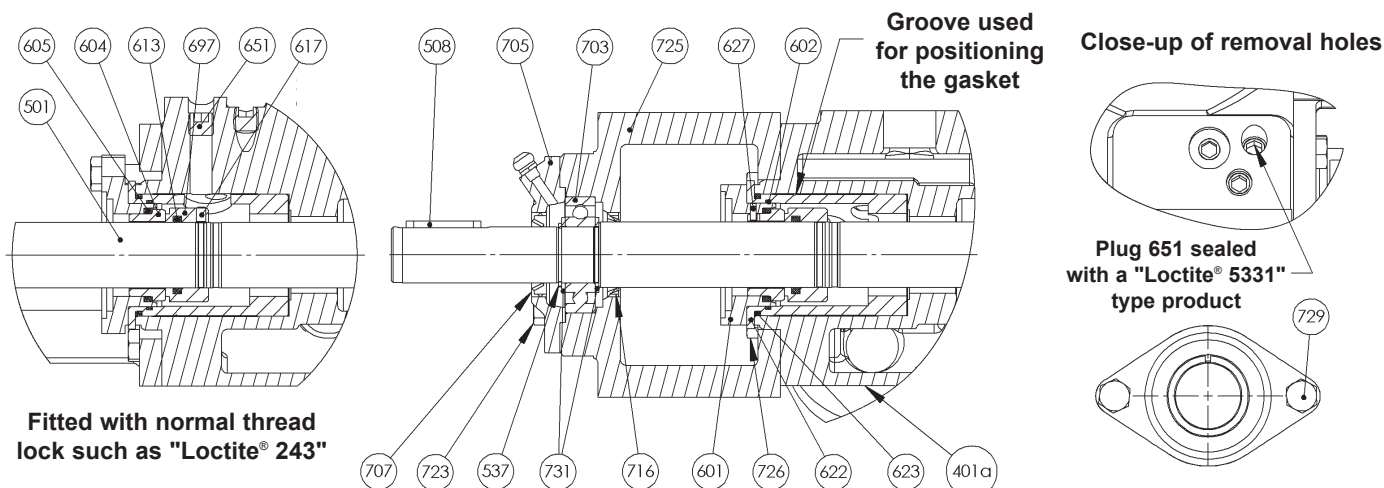
Remove the pump mounting bolts.

Place it on a workbench or on a flat surface free from obstructions.

Dismantling :

1. Remove the shaft key **508**.
2. Carefully clean the end of the shaft, so as to remove any traces of paintwork, oxidization, splashes and seepage..., with No.320 grained paper.
3. Unscrew the 4 bolts **723**.
4. Remove the cover **705** without damaging the seal **707**.
5. Remove the circlip **537**.
6. Remove the washer **731**.
7. Using the bearing puller, remove the bearing **703** : position the claws behind the bearing, sliding them into the openings in the housing **725** and pressing against the shaft end **501**.
8. Remove the second washer **731**.
9. Unscrew the 4 bolts **726**.
10. Slide the entire strainer **725** along the shaft **501**.
11. Unscrew the 2 bolts **729**.
12. Remove the shaft seal holder **601**.
13. Remove the counterpart **604** and its ring seal **605** remaining on the shaft seal holder **601**.
14. Unscrew the plug **651**.
15. Untighten the bolt **617** via the hole provided for this purpose in the base **401a** (turn the shaft **501** slowly to bring them into line).
16. Remove the entire jacket **622** and rotating part **697** by sliding them along the shaft **501**.

9. SINGLE MECHANICAL SHAFT SEAL (continuous)



Fitted with normal thread lock such as "Loctite® 243"

Reassembly :

1. Check that the surfaces in contact with the counterpart **604** and rotating part **697** is in good condition.
 2. Check the ring seal **605**, change it as necessary.
 3. Use a clean cloth to clean the surfaces in contact with the shaft seal.
 4. Mount the second counterpart **604** with its ring seal **605** in the shaft seal holder **601**, fitting the dowel pin **627** into the notch in the counterpart.
 5. Check the ring seals **602** and **623**, change them as necessary.
 6. Lightly lubricate the shaft **501**.
 7. Check the ring seal **613**, change it as necessary.
 8. Insert the jacket **622**, with its seals **602** and **623** inside the front cover **401a**.
 9. Slide the rotating part **697** with its seal **613** on the shaft **501** until it comes to against the end of the jacket **622**.
 10. Slowly remove the jacket **622** until the groove used for positioning the gasket is aligned on the surface of the base **401a**. When one of the bolts **617** is opposite the holes provided for this purpose in the base **401a** and in the jacket **622**, tighten it (turn the shaft **501** slowly to align them and do not forget to tighten the second bolt **617**).
 11. Refit the jacket **622**: the 2 M5 threads must be positioned horizontally, with the biggest hole providing access to the bolt **617** via the base **401a**.
 12. Screw the plug **651**.
 13. Mount the entire gasket holder **601** and the counterpart **604** onto the shaft **501** (taking care not to hit the edge of the counterpart **604** on the gasket).
 14. Screw the 2 bolts **729**.
 15. Check the lip seal **716**, change it as necessary.
 16. Slide the strainer **725** assembly onto the shaft **501** until it comes to abut the front cover **401a**.
 17. Screw the 4 bolts **726**.
 18. Position the washer **731** against the shoulder of the shaft **501**.
 19. Fit the bearing **703** on the shaft by hand.
 20. Push it on with a casing until it comes to bear against the washer **731**. **Under no circumstances should you push the bearing onto the shaft without holding the shaft 501.**
- FAILURE TO FOLLOW THIS INSTRUCTION CAN CAUSE SERIOUS DAMAGE TO THE INTERIOR OF THE PUMP.**
21. Position the second washer **731** against the bearing **703**.
 22. Fit the circlip **537**.
 23. Check the lip seal **707**, change it as necessary.
 24. Clean the surfaces of the cover **705** and of the housing **725** with a clean cloth.
 25. Fit the lip seal **707** in the cover **705**.
 26. Fit the cover **705** on the strainer **725**.
 27. Screw the 4 bolts **723**.
 28. Check that the pump rotates freely when turned by hand.

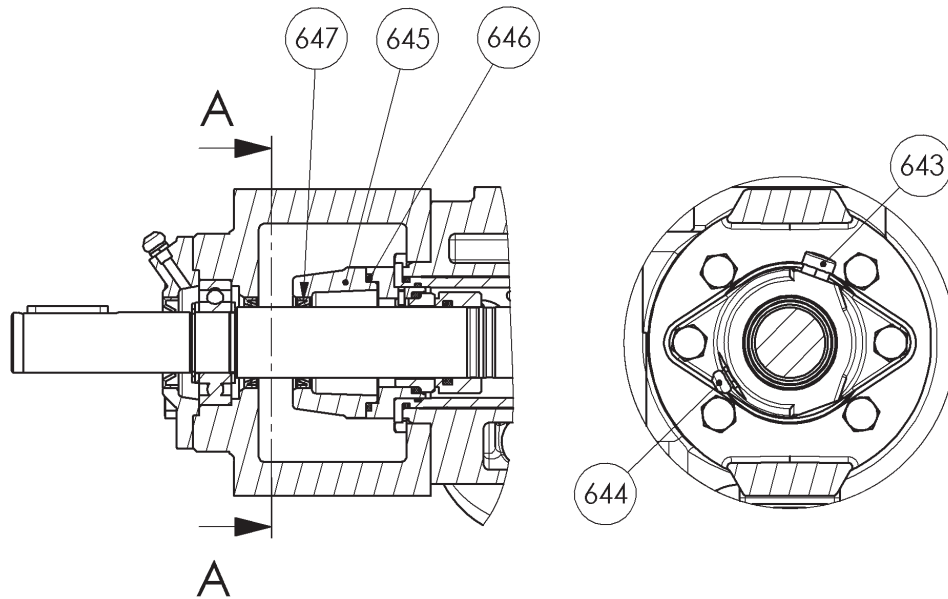
Replace the pump on the installation.

Replace the pump mounting bolts.

Couple the pump by placing the coupling sleeve.

Check the pump alignment (see § ALIGNMENT OF MOTOR/PUMP AND REDUCTION GEARBOX/PUMP SHAFTS).

9. SINGLE MECHANICAL SHAFT SEAL (continuous)



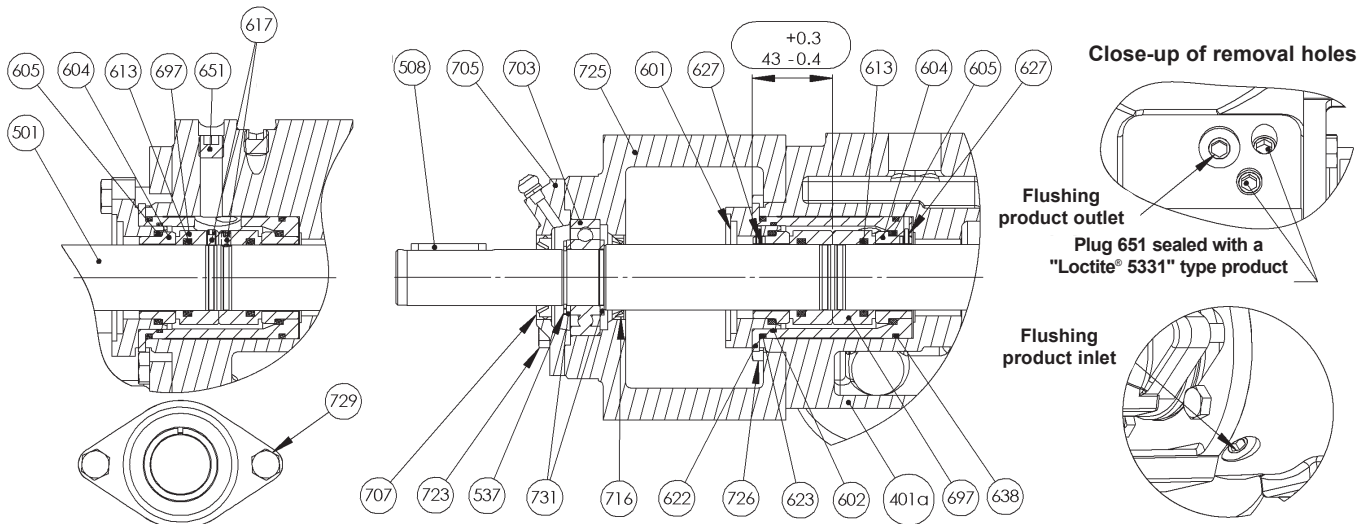
9.2.3 Re-assembly of a single mechanical shaft seal with lubricant reservoir

- In the case of an assembly with lubricant reservoir, carry out operations No.1 to 13 of § RE-ASSEMBLY.
- Check the seals **646** and **647** and change them if necessary. Take care when fitting seal **647** to have the lips pointing towards the shaft output.
- Slide the cover **645** with its seals **646** and **647** on the shaft **501** while locating the thread lubricator **644** towards the bottom and the valve **643** towards the top. Then, screw the 2 bolts **729** without tightening.
- Carry out operations No.15 to 28 of § RE-ASSEMBLY.
- Fit the lubricator **644** and the valve **643**.
- Unscrew the 2 bolts **729** and push the cover **645** outwards.
- Use a grease gun to pump grease into the internal volumes of the gasket holder **601** and the cover **645** so as to prevent air from getting into the grease as far as possible, then tighten the 2 bolts **729**.
- Fill the lubricant reservoir with the lubricator **644** until the grease overflows through the snifter valve **643**.

9.2.4 Topping up the lubricant reservoir 645 (for pumps equipped)

- Every 500 operating hours the lubricant reservoir must be filled to overflowing by means of the snifter valve **643**.

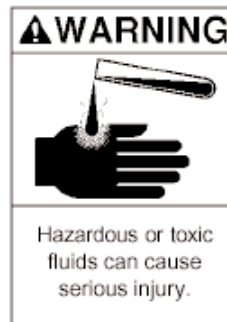
9. DOUBLE MECHANICAL SHAFT SEAL



Fitted with normal thread lock such as "Loctite® 243"



DISCONNECT THE ELECTRICITY SUPPLY BEFORE ANY MAINTENANCE OPERATION.



IF PUMPING HAZARDOUS OR TOXIC FLUIDS, THE SYSTEM MUST BE FLUSHED PRIOR TO PERFORMING ANY SERVICE OPERATION.



FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING MAINTENANCE CAN CAUSE SHOCK, BURNS OR DEATH.



THE PUMP LUBRICANT IS VERY SLIPPERY AND MAY CAUSE SERIOUS INJURY. ANY SPILLS MUST BE CLEANED UP.

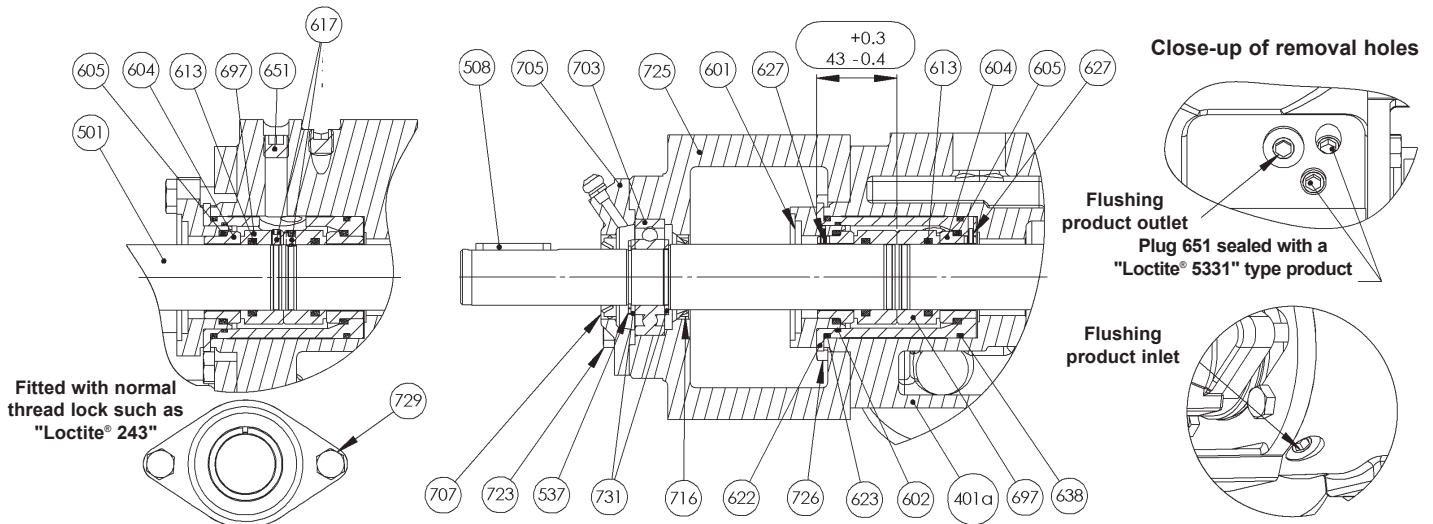


DISCONNECTING THE FLUID OR PRESSURE CONTAINMENT COMPONENTS DURING PUMP OPERATION CAN CAUSE SERIOUS PERSONAL INJURY, DEATH OR MAJOR PROPERTY DAMAGE.



TAKE ALL NECESSARY MEASURES TO RENDER ANY START-UP, EVEN ACCIDENTAL, OF THE PUMP DURING THE WORK IMPOSSIBLE.

9. DOUBLE MECHANICAL SHAFT SEAL (continuous)



9.3 DOUBLE MECHANICAL SHAFT SEAL

9.3.1 Functioning of a double mechanical shaft seal

Shaft **501** drives the one-piece rotating parts **697**, by means of the set screws **617**. The counterparts **604** are integral, one with the shaft seal holder **601** by means of the ring seal **605** and the retainer **627**, and the other with the front cover **401a** via the ring seal **605** and retainer **627**.

Circulation of a buffer product between the two shaft seals prevents any contact of the pumped product with air (problem of crystallisation) and prevents any exterior leakage of the pumped product (dangerous product).

FLUID TIGHTNESS IS PROVIDED :

- On the shaft, by ring seals **613** of rotating parts **697**.
- By the contact surfaces between the one-piece rotating parts **697** and fixed counterparts **604**.
- Between the immobile counterpart **604** and shaft seal holder **601** by ring seal **605**.
- Between the immobile counterpart **604** and the jacket **622** by ring seal **605**.
- Between the shaft seal holder **601** and the jacket **622** by ring seal **602**.
- Between the jacket **622** and the front cover **401a** by seals **623** and **638**.
- Fluid tightness therefore depends on the condition of the friction faces and ring seals.

RINSING OF SHAFT SEALS :

Two 1/4" BSP tapped orifices are provided for this purpose. In order to prevent any air pockets in the housing, the buffer product should enter via the lower orifice and should exit via the upper orifice.

LEAKING SHAFT SEAL :

- Seal damaged during assembly (scratching on friction faces...),
- Seal unsuited to product (chemical or mechanical attack against seals and counterparts).
- Normal wear of the seal.

9.3.2 Replacement of a double mechanical shaft seal

Before undertaking disassembly, make sure that the pump has been drained, and take the precautions necessary to prevent commencement of rotation. No accidental start-up should be possible.

Uncouple the pump by removing the coupling sleeve.

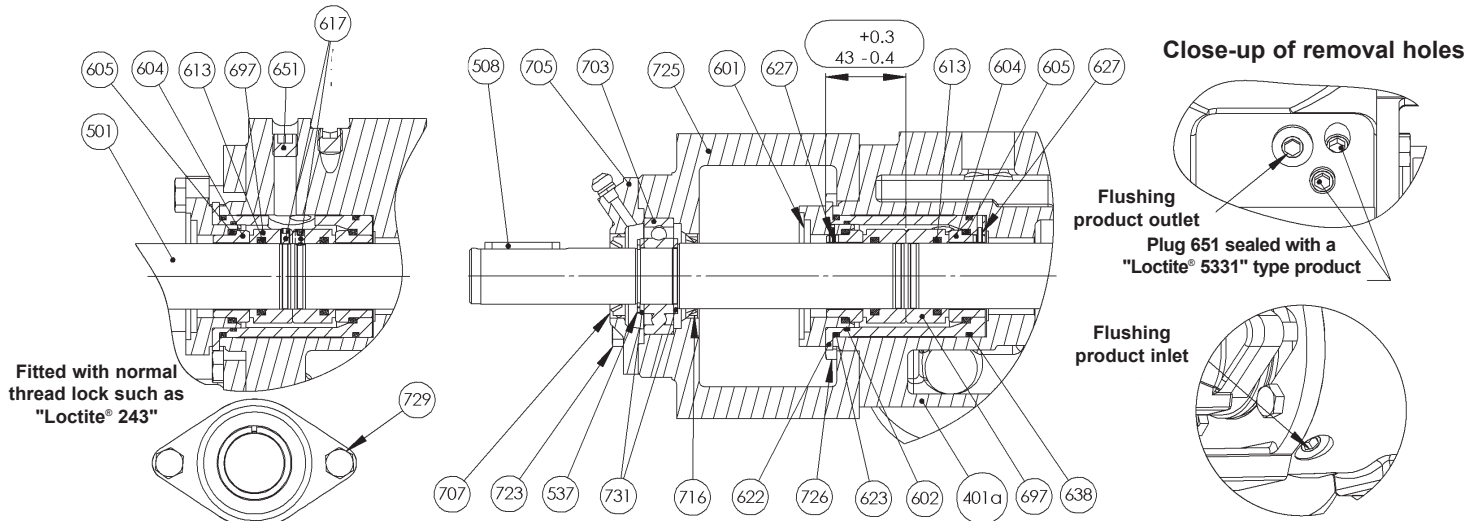
Remove the pump mounting bolts.

Place it on a workbench or on a flat surface free from obstructions.

Dismantling :

1. Remove the shaft key **508**.
2. Carefully clean the end of the shaft, so as to remove any traces of paintwork, oxidization, splashes and seepage..., with No.320 grained paper.
3. Unscrew the 4 bolts **723**.
4. Remove the cover **705** without damaging the seal **707**.
5. Remove the circlip **537**.
6. Remove the washer **731**.
7. Using the bearing puller, remove the bearing **703** : position the claws behind the bearing, sliding them into the openings in the housing **725** and pressing against the shaft end **501**.
8. Remove the second washer **731**.
9. Unscrew the 4 bolts **726**.
10. Slide the entire strainer **725** along the shaft **501** (do not remove the front cover **401a** from the body pump).
11. Unscrew the 2 bolts **729**.
12. Remove the shaft seal holder **601**.
13. Remove the counterpart **604** and its ring seal **605** remaining on the shaft seal holder **601**.
14. Unscrew the 2 plugs **651**.

9. DOUBLE MECHANICAL SHAFT SEAL (continuous)



15. Untighten the 2 bolts **617** via the 2 holes provided for this purpose in the base **401a** (turn the shaft **501** slowly to bring them into line).
16. Remove the entire jacket **622** and rotating parts **697** by sliding them along the shaft **501**.
17. Remove counterpart **604** and its ring seal **605** stayed inside the jacket **622**.

Reassembly :

1. Check that the surfaces in contact with the counterparts **604** and rotating parts **697** are in good condition.
2. Check the ring seal **605**, change it as necessary.
3. Use a clean cloth to clean the surfaces in contact with the shaft seal.
4. Mount the counterpart **604** with its ring seal **605** in the jacket end **622**, fitting the dowel pin **627** into the notch in the counterpart.
5. Check the ring seals **602**, **623** and **638**.
6. Lightly lubricate the shaft **501**.
7. Insert the entire jacket **622**, with its seals **602**, **623** and **638** inside the front cover **401a**. Make sure the jacket is correctly positioned: the 2 M5 threads must be positioned horizontally, the biggest hole providing access to the bolts **617** and the 2 others must be aligned with the washing holes provided for this purpose on the front cover **401a**.
8. Check the ring seal **613**, change it as necessary.
9. Bring the first rotating part **697** with its seal **613** into position. Maintain it in the quotation indicated above and screw the 2 bolts **617** via the hole provided for this purpose (turn the shaft **501** slowly to align them).
10. Check the second ring seal **613**, change it as necessary.
11. Bring the second rotating part **697** with its seal **613** into position, back to back against the other rotating part **697**.
12. Check the ring seal **605**, change it as necessary.
13. Mount the second counterpart **604** with its ring seal **605** in the shaft seal holder **601** fitting the dowel pin **627** into the notch in the counterpart.
14. Mount the shaft seal holder **601** with its seal **602** onto the shaft **501** (taking care not to hit the edge of the counterpart **604** on the shaft seal).
15. Screw the 2 bolts **729**.
16. Screw the 2 bolts **617** for the last gasket rotating part via the hole provided for this purpose on the base **401a** (turn the shaft **501** slowly to bring them into line).
17. Check the lip seal **716**, change it as necessary.
18. Slide the strainer **725** assembly onto the shaft **501** until it comes to abut the front cover **401a**.
19. Screw the 4 bolts **726**.
20. Position the washer **731** against the shoulder of the shaft **501**.
21. Fit the bearing **703** on the shaft by hand.
22. Push it on with a casing until it comes to bear against the washer **731**. **Under no circumstances should you push the bearing onto the shaft without holding the shaft 501.**
23. Position the second washer **731** against the bearing **703**.
24. Fit the circlip **537**.
25. Check the lip seal **707**, change it as necessary.
26. Clean the surfaces of the cover **705** and of the housing **725** with a clean cloth.
27. Fit the lip seal **707** in the cover **705**.
28. Fit the cover **705** on the strainer **725**.
29. Screw the 4 bolts **723**.
30. Check that the pump rotates freely when turned by hand.
31. Replace the pump on the installation.
32. Replace the pump mounting bolts.
33. Couple the pump by placing the coupling sleeve.
34. Check the pump alignment (see § ALIGNMENT OF MOTOR/PUMP AND REDUCTION GEARBOX/PUMP SHAFTS).

10. HEATING JACKET



THE SURFACES OF THE PUMP CAN BE AT A TEMPERATURE LIABLE TO CAUSE INJURY OR SEVERE DAMAGE.



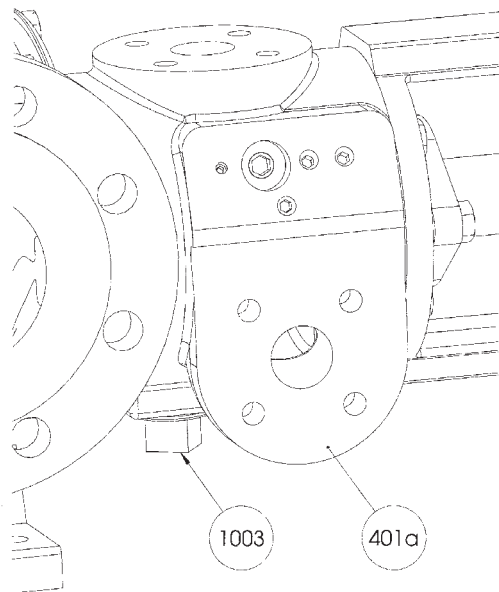
FAILURE TO RELIEVE THE SYSTEM PRESSURE PRIOR TO PERFORMING PUMP SERVICE OR MAINTENANCE CAN CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

10.1 HEATING JACKET DRIVE SIDE

The jacketed front cover **401a** permits the circulation of steam or liquid at 250°C and up to 12 bar (maximum values).

The heating circuit is connected via a flange PN16 DN15.

The plug **1003** permits the draining of the heating jacket.

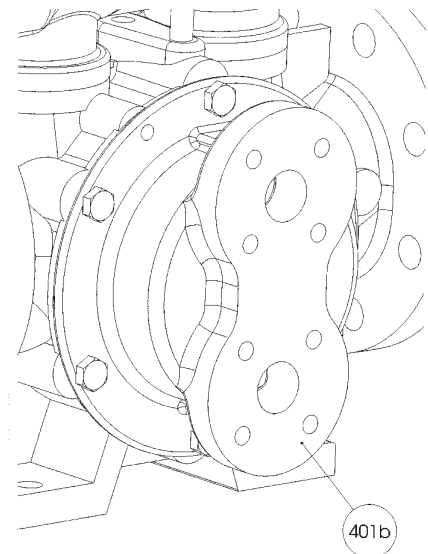


10.2 HEATING JACKET NON-DRIVE SIDE

The jacketed front cover **401b** permits the circulation of steam or liquid at 250°C and up to 12 bar (maximum values).

The heating circuit is connected via a flange PN16 DN15.

The heating jacket is drained by removing the heating circuit lower connection.



CAUTION :

Before draining the heating jacket, it is essential to make sure that the pump heating circuit and heating jacket are no longer pressurised.

Draining the product when hot could cause serious injuries or damage.

The direction of the heating circuit connection to the jacket depends on the nature of the heating fluid :

- If using steam, the inlet will be on the upper opening and outlet will be on the lower opening.
- If using liquid, the inlet will be on the lower opening and outlet will be on the upper opening.

11. MAINTENANCE

11.1 LUBRICATION OF THE BEARING

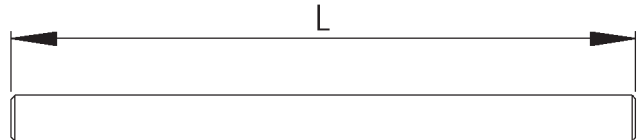
Except for special cases, the BLACKMER P serie pump only requires lubrication of the shaft inlet bearing.

Use a grease for good quality ball bearings, for pumps operating at high temperatures (in principle from 100°C upwards) use a grease with a high drop point.

For pumps working at ambient temperature and sheltered from bad weather, the lubrication must be done every **1,000 hours** of operation or at least once a year.

In other cases, the , the lubrication must be done every **500 hours** of operation.

Pump	DIMENSIONS OF THE PUSHRODS - mm	
	Original height « L »	Change when « L » <
P40	82,5	82,0
P60	85,4	84,5
P100	103,5	103,0

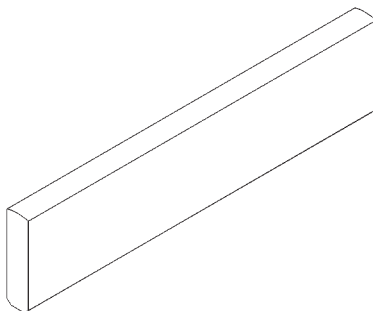
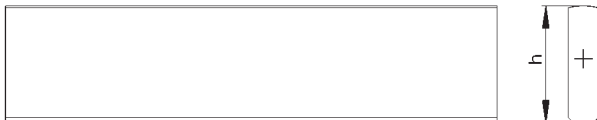


11.2 INSPECTION OF THE VANES AND THE PUSHRODS

It is recommended that the condition of the vanes and the pushrods should be checked every **700 hours** of operation.

In the case of excessive wear vanes and pushrods should be replaced by a complete set.

Pump	DIMENSIONS OF THE VANES - mm	
	Original height « h »	Change when « h » <
P40	31,0	29,0
P60	35,3	33,3
P100	42,5	40,0



11.3 PACKING

The packing must be replaced when the ram **631** cannot be tightened any further (see § PACKING).

11.4 MECHANICAL SEAL

The mechanical seal must be replaced when there a leak at the surfaces in contact (see § SINGLE MECHANICAL SEAL or § DOUBLE MECHANICAL SEAL).

12. TROUBLESHOOTING

ZERO OR INSUFFICIENT FLOW		
1		PRELIMINARY CHECKS
	1-1	Make sure that the plastic plugs have been taken away from the ports of the pump and that the pump is running (defective drive, damaged motor, etc., faulty transmission : broken coupling, worn or poorly coupled clutch, etc.).
	1-2	Make sure that the pump rotates in the correct direction corresponding to the direction in which the liquid circulates in the installation (cf. the pump plate). If necessary, change the electric motor connections or adjust the piping as necessary (diesel engine drive).
	1-3	Make sure that there is liquid in the tank from which the pump draws and that the end of the inlet piping is constantly submerged.
	1-4	Make sure that the pump rotation speed is sufficient. Determine this by checking the speed of the pump motor (see motor plate) and the speed reduction ratio (see reduction gearbox plate) or use a rev. counter.
		If these checks do not highlight the problem :
2		MEASURE THE DISCHARGE PRESSURE (as close to the outlet of the pump as possible, with a minimum distance of 5 pipe diameters).
	2-1	If the pressure is lower than the figures given for the material, or null, this could be due to :
	2-1-1	A poorly adjusted bypass, the valve setting is lower than the discharge pressure (tighten the set screw or replace the spring after checking that the electric motor is suitably protected).
	2-1-2	The bypass valve is not closed ; either the plunger has not returned to its initial position, or there is dirt on the valve seat.
	2-1-3	The pump is worn, this will also affect the suction capacity of the pump (cf 3-2-2 c).
	2-2	If the pressure complies with the equipment data (pump speed and motor output) it is possible that :
	2-2-1	The pressure required for the given installation to obtain the required flow rate is too high and the flow is partially or totally circulating via the bypass, or : <ul style="list-style-type: none"> a. the height of the discharge is too great (reduce it by bringing the discharge tank to the level where the pump is). If suction conditions are favourable, the pump can also be moved closer to the discharge tank. b. that head losses are too high because : <ul style="list-style-type: none"> - the piping is unsuitable (too many "bends", too long or the diameter is too narrow) for the process conditions : Flowrate, Specific Gravity, Viscosity (this can change considerably with temperature). Reduce the head losses by simplifying the circuit : reduce of the number of fittings, valves, elbows, etc... Move the pump closer to the discharge tank or vice versa, if conditions permit. Increase the diameter of the piping, etc... Reduce the product viscosity via heating. Reduce the flow, etc... - of partially blocked piping (valve partially closed, tap partially shut, cloth obscuring flow, etc.).
	2-2-2	The discharge piping is completely blocked (valve fully closed, tap completely closed, cloth plugging flow, full protection seal left by carelessness, etc...), in this case, all the liquid passes via the bypass.

12. TROUBLESHOOTING (continuous)

3			MEASURING THE VACUUM PRESSURE (as close as possible to the pump inlet, inlet side).
	3-1		If the vacuum is high, e.g. higher than or equal to 6 to 7 metres WC (0.6 to 0.7 bara i.e. about 45 or 50 cm of mercury), this can result in pump noise. The cause could be :
		3-1-1	<ul style="list-style-type: none"> a. the suction lift is too high (reduce it by taking the pump down closer to the level of the liquid) b. the dynamic suction losses are too high : <ul style="list-style-type: none"> 1. cf 2-2-1 b 2. the inlet piping orifice is too close to the bottom of the tank.
		3-1-2	The inlet piping is completely blocked (valve, tap, filter, cloth, full seal forgotten, etc.)
		3-1-3	The liquid vapour pressure is too high (or has become too high following, for example, a change of temperature). Bring the pump closer to the level of the liquid, install the pump closer to the feed or cool the liquid to reduce the vapour pressure.
	3-2		If the vacuum is low, for example, less than 3 metres WC (i.e. about 20 cm of mercury), check for leaks on the inlet pipe, isolate the pump from the inlet piping (by closing the valve nearest the pump or by inserting a full flange seal) and measuring the vacuum once again.
		3-2-1	<p>If the vacuum is high with the isolating valve closed on suction line, e.g. higher than or equal to 6 or 7 metres WC (i.e. about 45 to 50 cm of mercury), the pump is not the cause :</p> <ul style="list-style-type: none"> a. there must be an air inlet upstream of the pump isolating valve. b. the liquid vapour pressure is or has become too elevated due to a change of temperature (cf 3-1-3).
		3-2-2	<p>If the vacuum is low or non-existent, the reason could be :</p> <ul style="list-style-type: none"> a. that the bypass valve is not closing properly, due to dirt on the valve seat. b. air is entering the pump (check the front cover seals, flanges, etc...) c. the pump is worn and the internal tightness is out of specification (the piston bushings are worn, worn piston and cylinder, broken piston wear compensation springs, worn partition, broken shaft).
ABNORMAL HEATING OF BEARINGS			
4			This heating can be caused by :
	4-1		- excessive pulling on the pump flanges by the piping (in this case, it must have been necessary to force the piping into position to connect it to the pump).
	4-2		- poor alignment of the pump - due for example to 4-1 (the pump is partially or totally uncoupled, the pump shaft and drive shaft are not aligned with each other).
	4-3		- inadequate anchoring of the pump unit leading to deformation of the chassis (make sure that the chassis is clear of the ground except for the 3 anchoring points).
	4-4		- seizing of the bushings (cured product preventing lubrication and cooling, excess power, etc...).
LEAKING SEALS			
5			<p>The seal may leak if :</p> <ul style="list-style-type: none"> a. it was damaged during assembly (scratching on the shaft), damage to 'O' rings in seal, b. it is incompatible with the product (chemical and mechanical aggression / abrasion of 'o' rings and seal faces), c. it is worn through normal use.
6			The shaft is worn at the seal or does not rotate correctly due to poor alignment, excessive tension on the transmission belts, chains, etc...

12. TROUBLESHOOTING (continuous)

ABNORMAL NOISES			
			These noises can be caused by hydraulic and mechanical sources. They can be distinguished by the fact that only the former disappear (or at least lessen) when air is allowed into the inlet pipe.
7			HYDRAULIC NOISES
			These noises can come from insufficient product being supplied to the pump, or :
	7-1		- the rotation speed is too high for the installation conditions (increase of viscosity due to a change of product or a reduction of temperature, etc.).
	7-2		- that the suction head is too high or has become too high due to excessive head losses following clogging of the piping or filter, a change of viscosity of the liquid, etc.,
	7-3		- an increase of the vapour pressure with a rise of temperature.
8			MECHANICAL NOISES
			These can stem from :
	8-1		- the bypass valve knocking on the seat when the discharge pressure is close to the bypass adjustment pressure (turn the adjustment screw after making sure that the electric motor is suitably protected).
	8-2		- abnormal stress on the pump : the transmission is pulling on the shaft, pulling on the flanges by the piping.
	8-3		- a broken part or foreign body has entered the pump.
EXCESS POWER CONSUMPTION			
9			The most spectacular event occurs when a diesel engine stalls or the power to an electric motor is shut off.
	9-1		If this incident occurs when closing the discharge line, the cause may be : a. the bypass is assembled back to front. b. the bypass is adjusted too tight. c. the motor protection is adjusted too low or wrong circuit breaker have been fitted.
	9-2		If the incident occurs during operation, the cause could be : a. an inadequate motor (in this case, the discharge pressure complies with what was expected). b. head losses higher than expected - following higher viscosity or specific gravity than planned initially (in this case, the discharge pressure is higher than that planned. The pressure can be reduced by loosening the bypass adjustment screw - the flow is decreased). c. excessive speed of rotation. d. a fault of the equipment (faulty alignment, deformation of the chassis, stress exerted by the piping on the flanges, seizing, etc.).
			Excessive consumption of electricity can also be due to a poor motor connection (e.g. a 3 phase motor operating on 2 phases).