



**INSTRUCTIONS 1009-E00 e**

Section	1009
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Original instructions

# ***Blackmer transport food grade pump CCL50I***



**INSTALLATION**

**OPERATION**

**MAINTENANCE**

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**Your distributor :**

# BLACKMER TRANSPORT FOOD GRADE PUMP

## SAFETY, STORAGE, INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

### MODEL : CCL50I

#### SAFETY DATA

**NOTICE :**

Blackmer pumps SHALL ONLY be installed in systems which have been designed by qualified engineers. Said systems SHALL comply with all current national and local safety regulatory provisions and standards.

This instruction manual is intended to make the installation and use of Blackmer pumps easier and SHALL be kept with the pump. Blackmer pump servicing and maintenance operations SHALL ONLY be carried out by qualified technicians. Said servicing and maintenance operations shall comply with current national and local safety regulatory provisions and standards.

Read this manual together with all instructions and warnings relating to risks carefully PRIOR to carrying out any servicing or maintenance operations on Blackmer pumps.

Keep ALL labels concerning warnings relating to risks and how to use both the systems and Blackmer pumps.

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.

**NOTICE**

The numbers that follow the names of the parts correspond to the reference numbers present on the spare parts lists 1009-E01.

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# 1. SAFETY DATA

## SAFETY CHECK LIST

**WARNING**



Hazardous fluids can cause fire, serious personal injury or property damage.

COMPRESSING GASES INTO A VESSEL CONTAINING FLAMMABLE OR EXPLOSIVE GASES, OR COMPRESSING FLAMMABLE OR EXPLOSIVE GASES, CAN CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

**WARNING**



Hazardous machinery can cause severe personal injury or property damage.

THE LORRY EMERGENCY BRAKE MUST APPLIED AND ITS WHEELS CHOCKED PRIOR TO ANY INTERVENTION TO AVOID CAUSING SEVERE PERSONAL INJURY OR PROPERTY DAMAGE.


**CAUTION**



Hazardous pressure can cause personal injury or property damage.

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

**WARNING**



Toxic or hazardous fluids can cause serious injury.

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

**CAUTION**



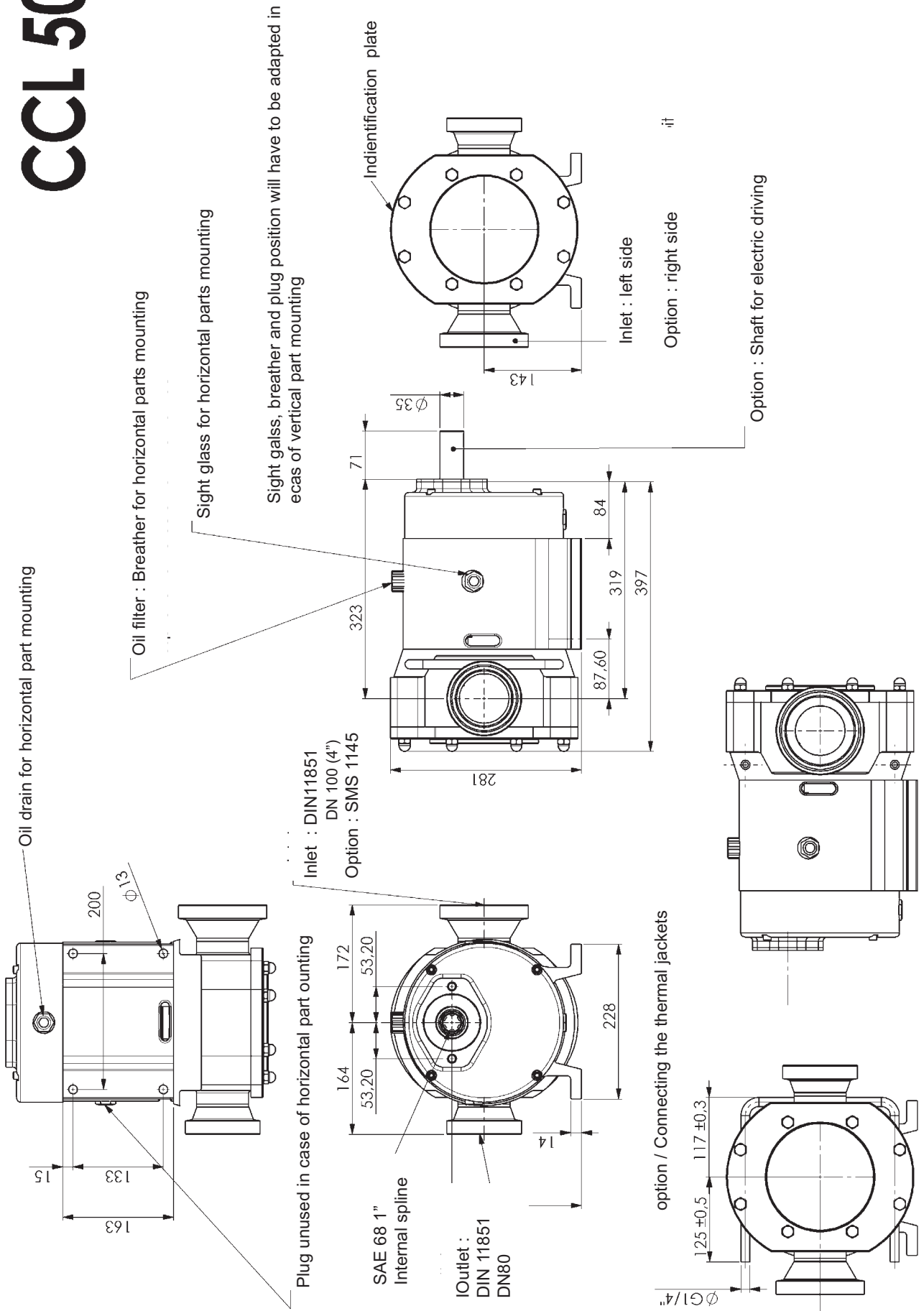
Excessive temperature can cause injury or severe damage.

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

1. Before operating the pump, ensure the vessel to which it is connected is certified to withstand the pressure and/or vacuum produced.
2. Gas/air mixtures which are potentially volatile/explosive must not be introduced or allowed to be introduced into the pump.
3. Always make sure that the motor is disconnected and the pump turned off prior to carrying out maintenance or adjustment operations.
4. A pump contains rotating parts. Never put hands or fingers into a pump whilst it is in operation.
5. Always make sure that all pipe connections are fitted and tightened properly before the pump is turned on. Special safety measures must be taken if the pump is used for hot and / or hazardous liquids. Follow current, local regulations for personal safety when working with such products.
6. Remove all assembly tools from the pump before starting it up.
7. Always make sure that no debris of any kind is in the pump before starting it up.
8. This pump is not self-priming; it is primed by liquid filling the pump naturally when the valves are opened.
9. In the case of an external coupling, always make sure that the pump and motor shafts are aligned.
10. Always make sure that the suction and discharge valves isolating the pump are fully open before starting the pump.
11. Always use securely fitted lifting straps when lifting the pump with a hoist or similar lifting gear. Check whether there are any special lifting instructions.
12. Always make sure that the pump gear box is filled with a Blackmer recommended oil to the specified level.
13. Never close or obstruct the outlet of the pump as the pressure in the system will increase, exceed the specified maximum pressure for the pump and cause damage to the pump.
14. Never drop parts, especially rotors and front covers, on the floor.
15. Never exceed the maximum operating temperature.
16. Never exceed the maximum operating pressure.
17. Never exceed the maximum differential pressure. This pump is not fitted with a bypass. Make sure to use a suitable protective device in accordance with the type of drive. For example, hydraulic pressure relief valve, electric fuse, external bypass, etc.
18. Never exceed the maximum pump rotation speed.
19. All pressurized tanks and pipes connected to the pump must be leak tight and in a condition that allows them to operate safely.
20. Certain parts of the pump are heavy and can cause injury if they are not handled correctly. Use suitable lifting gear where necessary.
21. The pump must be earthed where necessary to avoid any effects of static electricity.
22. The assembly for the pump must be correctly designed and the pump correctly fitted. Please refer to the "ASSEMBLING THE PUMP" section in this manual.
23. For pumps fitted with the heating device:
  - beware of the risk of burning through contact with the pump and the pipes
  - switch off the heating device and wait until the pump has cooled down sufficiently before working on it
  - heating up should take place sufficiently in advance to reach the temperature required before starting up the pump.

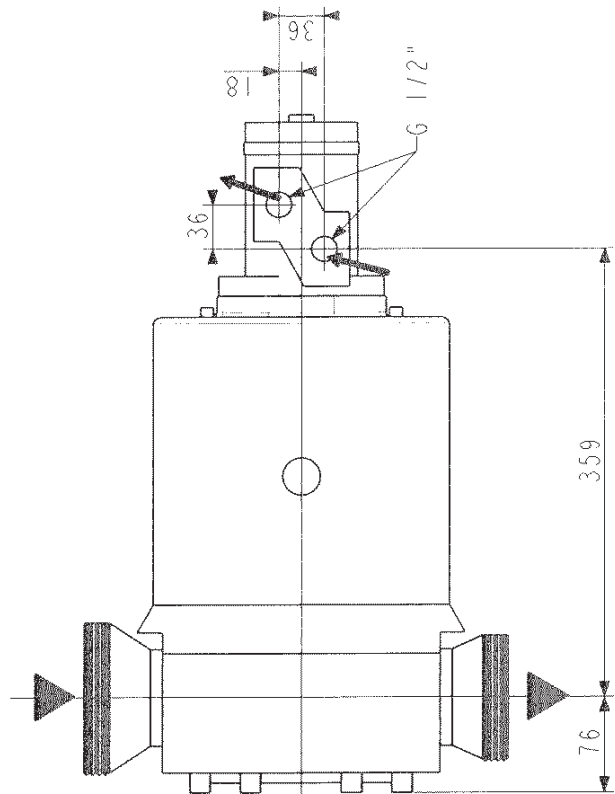
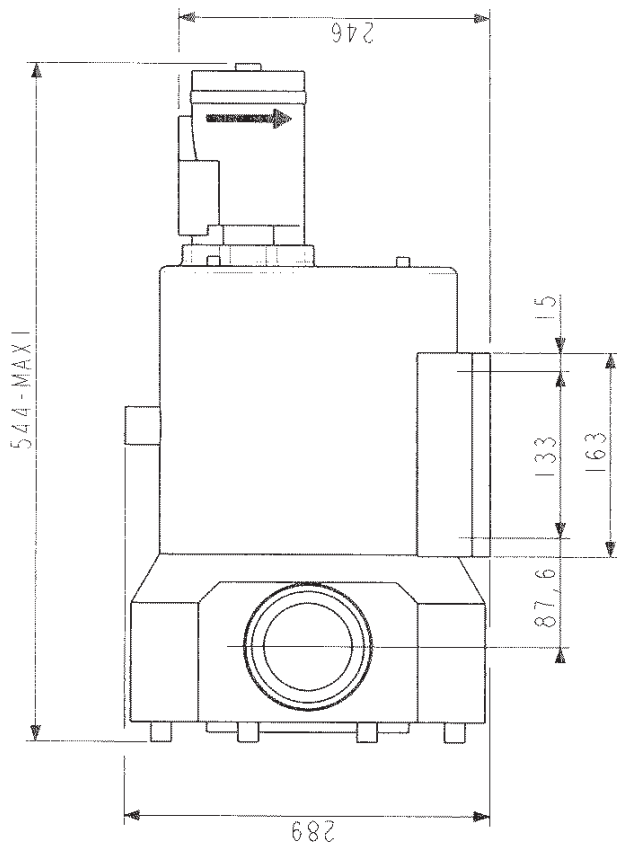
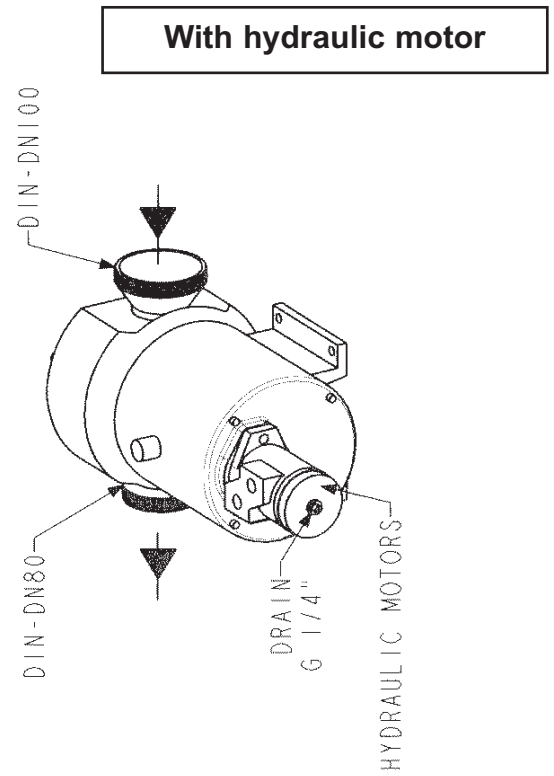
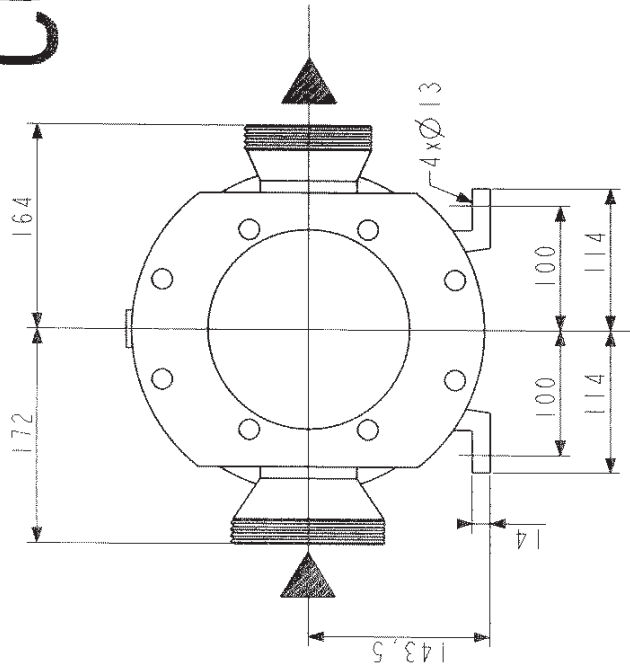
# CCL 50

## 2. OVERALL DIMENSIONS



## 2. OVERALL DIMENSIONS (continued)

# CCL50i



### 3. CCL50 I PRESENTATION

The CCL50I pump is a positive displacement lobe pump specially designed for unloading liquid food and cosmetic products. All wet parts are made of 316L stainless steel.

The standard pump configuration includes :

- A drive shaft specially designed for a hydraulic drive unit.
- Bi-lobe rotors designed for maximum product temperatures of 110°C. Said lobes/rotors can be changed without dismantling the transmission.
  - EPDM static seals
  - PTFE triple lip seals
- The inlet and outlet ports can be horizontal or vertical by rotating the pump
- 1 x DIN 11851 3" connector and 1 x DIN 11851 4" connector can be interchanged by rotating the pump housing. The 4" port is to be mounted on the suction side

The pump comes supplied with a rotor blocking and extraction tool required for most of the cleaning and maintenance operations.

The construction of the pump is identified by its designation, as shown in the diagram below :

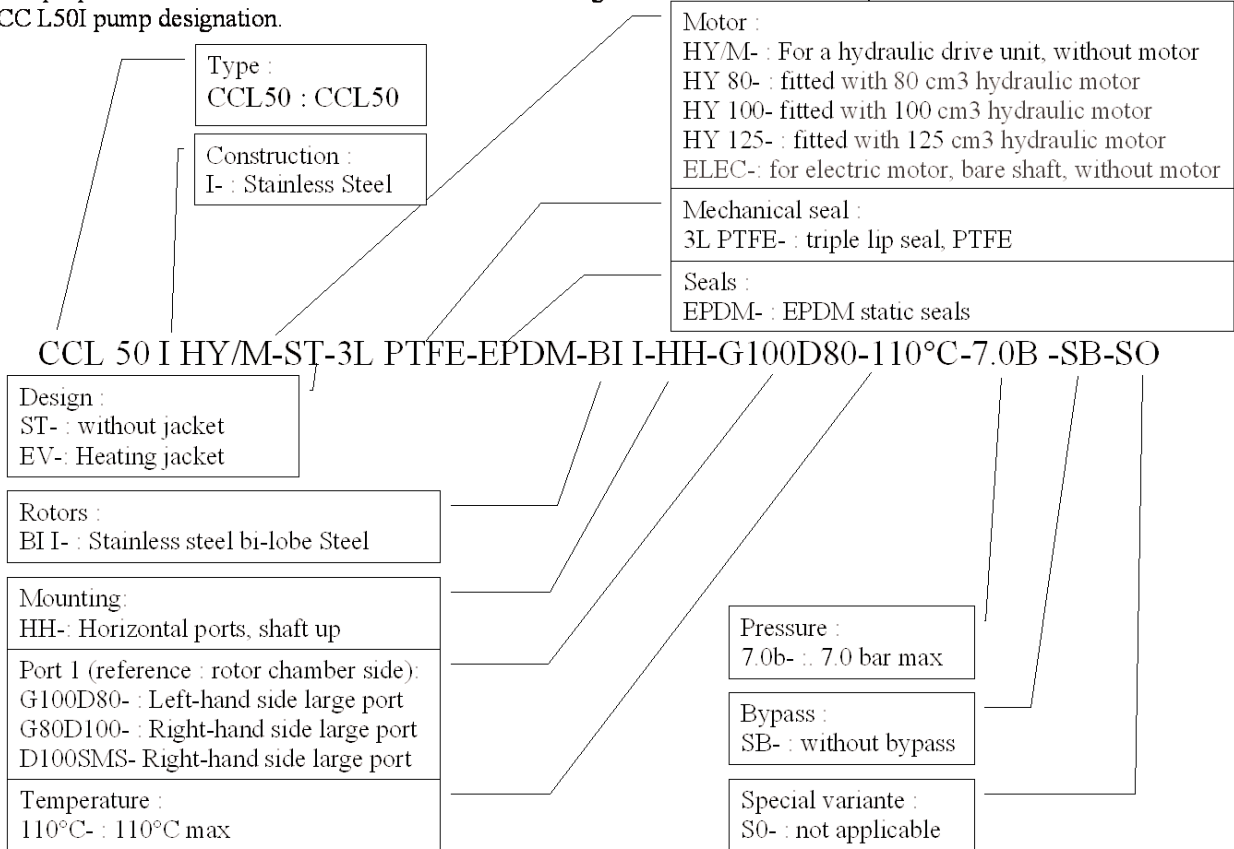
#### PUMP PERFORMANCES

	CCL50I
Maximum temperature pumped product	110°C
Maximum temperature reheating fluid	150°C
Maximum pressure reheating fluid	1000 kPa
Permitted maximum instantaneous temperature difference of the product pumped	80 (°C)
Maximum shaft rotation speed	1000 rpm
Max. differential pressure	700 kPa
Maximum operating pressure	1600 kPa
Weight	70 kg

#### START-UP PERFORMANCES

Model no.	_____
Serial Nbr	_____
Date of installation	_____
Discharge pressure	_____
Suction pressure	_____
Flow rate (unit)	_____
Overpressure protection system activation threshold	_____

The purpose of this document is to summarize the meaning of each of the technical specifications for the automatic CCL50I pump designation.



### 3. CCL50 I Presentation (continued)

#### TECHNICAL PERFORMANCES

	Sound rating in dbA at 1m from the pump, at 1.6m high in accordance with guideline 98/37/EC						Radiated sound power in dbA					
	7,0			3,5			7,0			3,5		
Differential pressure (bar)	7,0			3,5			7,0			3,5		
Rotational speed (rpm)	1000	500	250	1000	500	250	1000	500	250	1000	500	250
CCL50I	73	66	62	67	63	61	84	77	73	78	74	72

### 4. PUMP INSTALLATION

#### 4.1 SITE AND PIPE SYSTEM

A poorly designed pipe system or pump installation will lead to a significant reduction in the operational life of the pump and its performances. Blackmer recommends that the following precautions should be observed :

1. Install the pump as close to the source of the product to be pumped as possible in order to minimize any drop in suction pressure.
2. The pipe system must not exert any mechanical constraint on the pump. It must, therefore, be properly aligned and supported.
3. The 4" connector is best mounted on the suction side. The pipe-run must have a minimum diameter greater than the connector by which they are governed.
4. Keep the number of connections (valves, bends, etc.) and joints in the pump suction pipe system to an absolute minimum.
5. The suction and discharge piping must be free of any leaks.
6. The pump feed pipe-run must not contain any product retention areas, or any areas that can constitute a siphon. Said pipe-run has to have a continual down slope of at least 3%.
7. The installation has to allow sufficient access space for servicing operations.

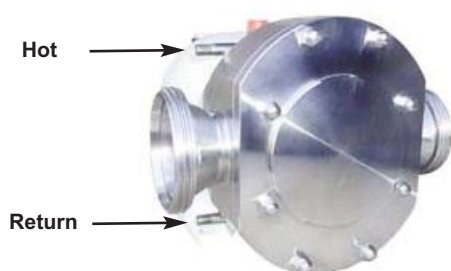
#### 4.2 INSTRUCTIONS FOR THE HEATING DEVICE

##### 4.2.1 Role

The heating device is used to increase the pump's temperature and maintain it.

##### 4.2.2 Connection

The thermal fluid must arrive through the upper pipe and leave through the bottom pipe



#### 4.2.3 Thermal fluids usable

Steam, oil, water

#### 4.2.4 Heating up time

Heating up must take place sufficiently in advance to reach the temperature required before starting up the pump.

#### 4.3 HANDLING PROCEDURE

Use the handling equipment suited to the weight of the pump. Observe the regulatory obligations that apply to the transporting of the pump.

When lifting the pump, tighten the lifting strap just behind the rotor chamber as shown in figure 1.

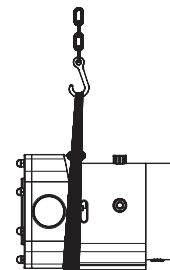
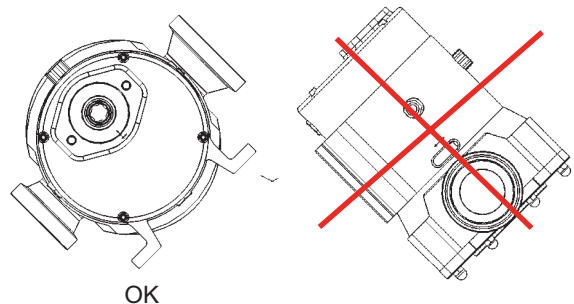


Figure 1

#### 4.4 INSTALLING ON A LORRY

The pump will operate correctly if the drive shaft is horizontal. Special attention is required when the pump is mounted on a tanker body that tilts; the installation must guarantee that the pump drive shaft stays horizontal in every tanker body position.



The pump has 4 holes for securing it to the structure of the lorry. Use a minimum of class 8/8, M12 screws.

## 4. PUMP INSTALLATION (continued)

### 4.5 CLEANING PRIOR TO THE INSTALLATION

Any foreign particules in the pump will cause considerable damage to the pump. The feed tank and pipe-runs must have been drained and cleaned prior to beginning the pump installation and start-up.

In the event that it was not possible to drain the pump beforehand, dismantle the rotors so that it can be drained; take particular care when reassembling that there are no particles in the rotor chamber.

### 4.6 MAKING SURE THAT THERE ARE NO FOREIGN PARTICULES IN THE PUMP

Before starting the pump, remove any dirt, debris or foreign particules which may have collected in the rotor chamber.

The rotors should be removed from the pump during the system cleaning operations prior to start-up. The references shown in bold print correspond to the part identification numbers on the spare parts list (PL 1009-E01).

#### Checking the pump for foreign particules :

1. Disconnect the power supply.
2. Undo and remove bolts **2**, **3** and **4** from the front cover **1**.
3. The front cover is removed by undoing each of the bolts one turn at a time so as to be able to remove it in an even manner. Remove the front cover **1**.
4. Rotate the rotors manually using a wrench on the rotor screw-nuts **25** to check whether there are any foreign particules behind the rotors.
5. Any foreign particules in the pump must be removed. Clean with air or water, removing the rotors if necessary. See § 6.4.
6. Insert the front cover gasket **5** in the rotor case **9**.
7. Replace the front cover **1** by positioning it on the studs **8** in the rotor case **9**. Tap it gently into position with a plastic mallet and tighten the front cover bolts **2**, **3** and **4** to the specified torque setting. See § 7.1.
8. Carefully rotate the rotors **27** manually in order to ensure that the rotors have freedom of movement inside the pump.

### 4.7 INSTRUCTIONS FOR INSTALLATION OF A UNIT WITH ELECTRIC DRIVE

Optionnally, the pump can be driven by an electric engine. The group unit can be, on inquiry, assured by Blackmer, in factory.

Correct seating of a pump unit is essential for its efficient operation and long working life

**WARNING :** Alignment of motor and pump shafts

The motor and pump shafts are aligned before dispatch ; however, check them systematically after installation and carry out realignment if needed.

Any alignment defects must be compensated for solely as indicated below. Never readjust the pump and gear motor.

- Secure the pump with its feet on a flat base.

- Check the alignment of the coupling (see Fig. A). If the alignment is outside the tolerance range (0.2 mm and 1°) take up the flatness of the base using the adjustable foot (see Fig. B) to restore the factory setting..

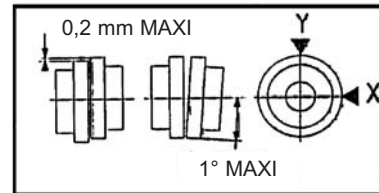


Figure A

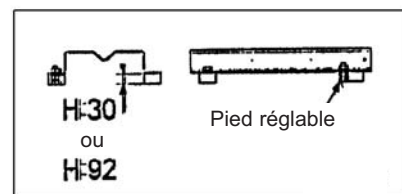


Figure B

Checking the alignment at each stage of installation is important to be sure that none of these steps have caused stresses on the unit or pump :

- After securing the pipes (without stresses)
- After securing on the foundations
- After the pump has operated at normal operating temperature..

#### REMIIND :

**NOTE :** Never rely on the flexible coupling to compensate for misalignment

**NEVER START A UNIT IF THE COUPLING ALIGNMENT IS INCORRECT. OTHERWISE OUR WARRANTY MAY BE INVALIDATED**

### ELECTRIC MOTORS

Check motor plate and tension supplied.

Check wiring diagram.

Use large wire. Connections should be securely tightened.

Plug in earth connection.

Electric motors should be protected by suitable circuit breakers and fuses.

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.

Check direction of rotation. To change rotation :

On 3 phases motor : interchange two of lead wires

On 2 phases motor : interchange two wires of same phase

On 1 phase motor : follow instructions accompanying motor.



## 4. PUMP INSTALLATION (continued)

### 4.8 PUMP DRIVEN BY A HYDRAULIC MOTOR

OPTIONNALLY, the pump is designed to be driven by a hydraulic motor secured directly to the pump.

The shaft complies with standard SAE6B, 1" internal groove.

### 4.9 PUMP'S DIRECTION OF ROTATION

The pump CCL 50 may rotate in both directions of rotation. It may therefore be used to load or unload the tank. Before using the pump, check that the motor's main drive direction corresponds to the required direction of the liquid's flow. .

**Note: The suction / discharge diameter is different (suction 4" and discharge 3").**

### 4.10 POSITION OF THE PORTS

The 4" suction port and the 3" discharge port can be interchanged by rotating the rotor case 9, see § 6.19. In the event that the ports are to be mounted vertically, the entire pump has to be rotated, see § 6.18.

### 4.11 LUBRICATION

Special lubricants for food industries					
Oil temperature (°C)	Pump / ambient temp.	Lubricant type		Type	Approval
		Mineral	Synthetic		
-20- +120 °C	Ambient temp. < 40°C and all CCL pumps with product temp. < 110°C		X	Castrol : Vitalube GS 220	USDA (H1)
			X	Klüber : Klüberoil 4UH- 220	USDA (H1)
			X	Mobil : DTE FM 220	FDA 178.3570 178.362 USDA (H1)a
Blackmer recommends that the oil be changed every year.					

#### NOTICE

**SYNTHETIC AND MINERAL LUBRICANTS MUST NOT BE MIXED.**

### 4.12 OTHER CHECKS TO BE CARRIED OUT PRIOR TO START-UP

Before completing installation operations, check :

- that the oil level of the pump is visible in the oil level window 25, as shown in figure 2. The oil tank holds approx. 3 litres.



Figure 2

The oil level must be checked after a 1 hour non-operative, stabilization period. The oil filler window must be vertical and perpendicular to the oil level in order to obtain an accurate check on the level.

- that the oil used complies with Blackmer recommendations.
- that the pump shaft 29 and the motor shaft are properly aligned.
- that the pump port connections are tight.
- that the pump rotates freely.
- that all suction and discharge valves are open.
- that nothing obstructs the flow and that liquid has free access to the pump.
- that the pump is free from dirt, weld spatter and any foreign particules.

## 5. STARTING THE PUMP

### 5.1 POINTS TO BE CHECKED BEFORE START-UP

1. Check on the alignment of the pipes with the pump inlets and outlets. The pipes have to be correctly supported so as to prevent them falling or moving when the pump/pipe couplings are dismantled.
2. Install pressure gauges for the pump suction and discharge on a temporary basis. Said pressure gauges will be used to determine actual suction and discharge conditions once the pump is started up.
3. Fully inspect the pipe system to make sure that it does not exert any constraints on the pump.
4. Check all the pipe connections.

### 5.2 START-UP PROCEDURES



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

## 5. STARTING THE PUMP (continued)



**OPERATING A PUMP WITH THE DISCHARGE BLOCKED CAN LEAD TO THE RUPTURE OF A SYSTEM COMPONENT, PERSONAL INJURY OR PROPERTY DAMAGE.**

### NOTICE :

**PLEASE CONSULT THE "GENERAL FAULT FINDING PROCEDURE" SECTION IN THIS MANUAL IF PROBLEMS ARE ENCOUNTERED AT START-UP.**

- 1.If the pump is fitted with a heating device, start it up sufficiently in advance to reach the temperature required.
- 2.Start the pump. The flow rate should start up in less than one minute.
- 3.Note the suction and discharge pressures to make sure that the pump is operating in line with expected conditions. Record the readings from the pressure gauges in the "START-UP PERFORMANCES" section to maintain traceability.
- 4 Inspect the pipe system, couplings and all associated equipment to detect any leak, noise, vibration or overheating.

### Immediately after starting up the pump :

- 1.Listen for unusual noises.
- 2.Check for leaks.
- 3.Make sure that liquid is flowing through the pump.

### 5.3 CONTROLLING THE ROTATIONAL SPEED

Any installation driving the pump via a power take off unit or hydraulic motor must have a rotational speed control system to prevent the pump exceeding its maximum rotational speed, whatever the lorry motor rotational speed.

In the event that the flow rate of the liquid is considerably less than that expected, please refer to the "General fault finding procedure" section.

### 5.4 ROTATING IN REVERSE

This pump is bi-directional and maintains all its performances whatever the rotation direction. If it is used in both directions, it must be protected in both pumping directions.

Notice : The inlet / outlet diameter is different (Inlet 4" and outlet 3").

### 5.5 SETTING THE SAFETY DEVICES

The safety devices must operate efficiently in both pumping directions if the pump is used bi-directionally.

It is essential for the pump to be protected against overpressure as it is not possible to guarantee that it will not operate against a closed valve.

There are several ways of ensuring this protection :

- Use of an external bypass to be installed by the maker of the tanker body.

- Limitation of available torque on the pump drive shaft (for example, hydraulic pressure relief valve).

The procedure for setting the safety device is as follows:

- Install a pressure gauge on the pump suction and discharge.
- Install a shut-off valve downstream from the pressure gauge.
- Feed liquid to the pump.
- Progressively close the shut-off valve whilst monitoring the differential pressure at the pump terminals. DO NOT LET THE DIFFERENTIAL PRESSURE EXCEED THE MAXIMUM AUTHORIZED VALUE FOR THE PUMP.
- If the safety device is activated before the maximum differential pressure is reached, note the value of this pressure in the manual.
- In the contrary situation, re-set the safety device and repeat the check on the compliance of the safety device activation threshold. ATTENTION, for safety reasons, it might be necessary to shut the pump down in order to set the safety device. Observe current regulations.

### 5.6 DRAINING AND CLEANING THE PUMP

#### NOTICE :

**IN THE EVENT THAT A LIQUID HAS TO REMAIN IN THE ROTOR CASE FOR A PROLONGED PERIOD, SAID LIQUID MUST HAVE LUBRICATING PROPERTIES, NOT BE CORROSIVE AND NOT SOLIDIFY. IN THE EVENT THAT THE CLEANING OF THE PUMP IS TO BE CARRIED OUT WITH A NON-LUBRICATING AND/OR CORROSIVE LIQUID, SAID LIQUID MUST BE DRAINED OUT OF THE PUMP IMMEDIATELY.**

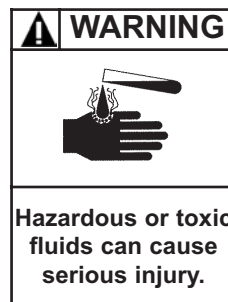
#### Use the following procedure when cleaning the pump:

- 1.Drain a maximum of the working fluid out of the pump.
- 2.Feed the pump with the cleaning liquid. The cleaning liquid has to be compatible with the material used for the rotors and the material used for the static and dynamic seals. In the event that a viscous liquid, able to solidify inside the pump (i.e. wax, glues, resins, etc.) is handled, use a cleaning fluid that prevents the pumped liquids from solidifying and makes cleaning easier.
- 3.Alternatively, open the cover protecting the rotor chamber and spray the inside of the rotor chamber with cleaning liquid. The rotors need to be removed so that the rotor chamber and the rotors can be cleaned properly. The removing of the rotors and the cleaning operations must be carried out before the product in the pump can solidify.

## 6. MAINTENANCE



FAILURE TO SET THE VEHICLE EMERGENCY BRAKE AND CHOCK WHEELS BEFORE PERFORMING SERVICE CAN CAUSE SEVERE PERSONAL INJURY OR PROPERTY DAMAGE.



ANY PUMP HAVING BEEN IN CONTACT WITH TOXIC OR CORROSIVE PRODUCTS MUST BE RINSED AND CLEANED OF ALL POLLUTION, INSIDE AND OUT, PRIOR TO ANY INTERVENTION.



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



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

### NOTICE :

MAINTENANCE MUST ONLY BE CARRIED OUT BY TECHNICALLY QUALIFIED STAFF IN ACCORDANCE WITH THE PROCEDURES SPECIFIED AND THE WARNINGS CONTAINED IN THIS MANUAL.

### 6.1 MAINTENANCE SCHEDULES

#### EACH TIME THE PUMP IS EMPTIED:

Fully clean the pump to prevent any products from crystallizing in the sealing areas (lip seals, etc.).

#### Daily :

Check that the pump is rotating correctly.

#### Weekly :

1. Check the oil level and top it up where necessary.
2. Check on the clogging of the installation filters.

#### Monthly :

- Open the pump and visually check on the condition of the rotors.
- Remove the lobes to clean them fully and check for any traces of the lobes and the body of the pump touching. Deburr the lobes and the pump body if required.

#### Yearly :

- Make sure that the rotor shimming is in line with the recommendations in this manual.

A certain number of basic operations have to be carried out in order to maintain the pump. Said operations are described in the following sections. The numbers identifying the parts refer to the sectional drawing for the spare parts list 1009-E01.

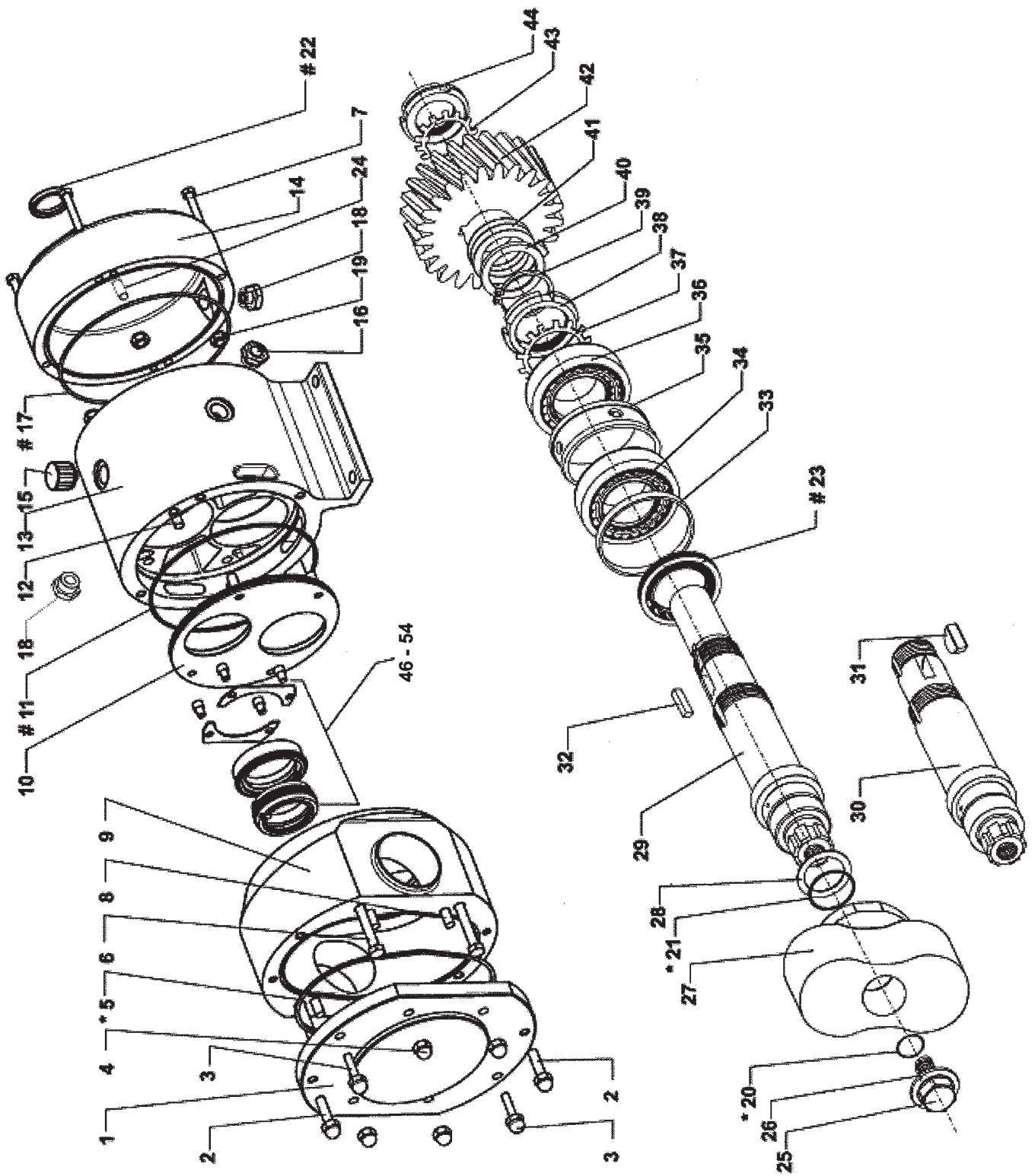
Remove the lobes and the pump body. Clean any product residue from the lip seals with a jet of hot water. Reload the housing of the triple lip seals with food safe grease (for example UNLOCK 2000 from Kernete). Refit the body and the lobes. If leaks of non-viscous liquids (water, wine) are noted, replace the lip seals reference 105 and the wear ring reference 106.

### 6.2 DISMANTLING THE FRONT COVER

The procedure described below must be followed when removing and replacing the front cover 1.

1. Disconnect the pump drive.
2. Shut-off the flushing liquid supply where necessary.
3. Close the pump feed and discharge isolating valves where necessary.
4. Undo the front cover bolts/screw-nuts 2, 3 and 4. Special safety measures must be taken if the pump is used for hot and / or hazardous liquids. In such cases, observe the current, local regulations for the safety of the operating personnel working with these products.
5. Where necessary, use the two large bolts 2 as jacking screws in the threaded holes in the front cover 1. The front cover is removed by undoing each bolt one turn at a time, thus making it possible to remove the front cover 1 from the rotor case 9 without exerting any mechanical constraint.
6. Remove the front cover 1, supporting it via the two large bolts with full length thread 2
7. Make sure that the static seal 5 is in good condition. Replace it where necessary.

## 6. MAINTENANCE (continued)



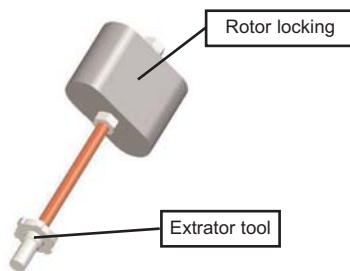
## 6. MAINTENANCE (continued)

### 6.3 REPLACING THE FRONT COVER

1. Insert the front cover seal **5** in the rotor case **9**.
2. Replace the front cover **1** by positioning it on the heads of the screws **6** positioned in the rotor case. Tap it gently into position with a plastic mallet and tighten the front cover bolts **2**, **3** and **4** to the specified torque setting. See § 7.1.
3. Carefully rotate the rotors **27** to make sure that they have freedom of movement in the rotor chamber.

### 6.4 DISMANTLING THE ROTORS

The procedure for dismantling the rotors uses the rotor locking and extraction tool which comprises 2 main parts :



Reference is only made to the tool part required for the operation in the rest of the manual.

Observe the procedure below when dismantling the rotors.

1. Remove the front cover **1** (see § 6.2).
2. Position the rotors **27** and insert the rotor locking tool as shown in figure 3.

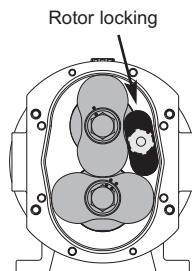


Figure 3

3. Undo and remove the top or right-hand screw **25** from the rotor **27**. During the unscrewing operation, the rotor in question must be supported by the rotor case via the rotor locking tool **111** and not by the other rotor.

Please note that this rotor and its corresponding screw are identified by a single centre punched mark (figure

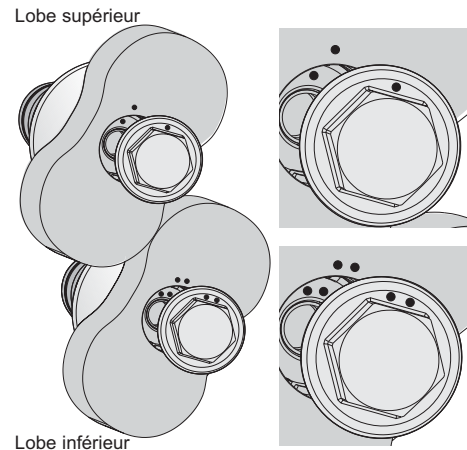


Figure 4

4. Remove the rotor locking tool **111**. Ensure that the blades of the other rotor are not overlapping the hub of the rotor being removed. Said rotor can be removed by hand or by using the extraction tool **111**. Said tool has been inserted at the base of the rotor (figure 5), and then turned until it locks. The rotor is then removed, either by pulling on the tool, or by using the rotor locking tool **111** or the lock nut at the end of the spindle as an extraction tool.

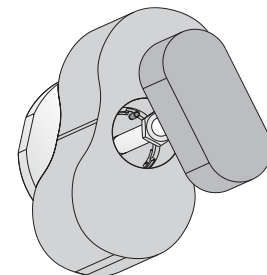


Figure 5

5. Position the rotor locking tool **111** as shown in figure 6.

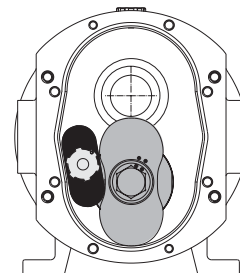


Figure 6

6. Undo and remove the bottom or left-hand rotor screw **25**.
7. Remove the rotor **27** as before by pulling it off the shaft **30** by hand or using the extraction tool **111** supplied with the pump.

## 6. MAINTENANCE (continued)

### 6.5 REASSEMBLING THE ROTORS

Make sure that there are no foreign particules or scratches on the surfaces of the shaft seals.

1. Replace the top or right-hand rotor **27** on the shaft **29**.
2. Position the indexed rotor **27** on the shaft (only one position) and the rotor locking tool **111** as shown in figure 7, and tighten the screw **25** to the specified torque (see § 7.1). If no torque wrench is available, tighten the rotor until the mark on the rotor is aligned with the mark on the screw. Remove the rotor locking tool **111**.

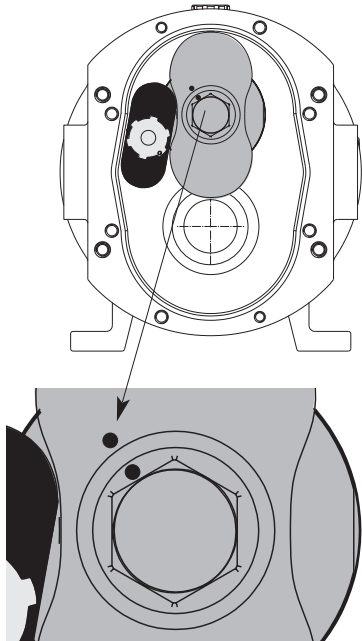


Figure 7

3. Replace the other rotor **27** on the shaft **29**.
4. Position the indexed rotor **27** on the shaft (only one position) and the rotor locking tool **111** as shown in figure 8 and tighten the screw to the specified torque (see § 7.1). If no torque wrench is available, tighten the rotor until the marks on the rotor are aligned with the marks on the screw. Remove the rotor locking tool **111**.

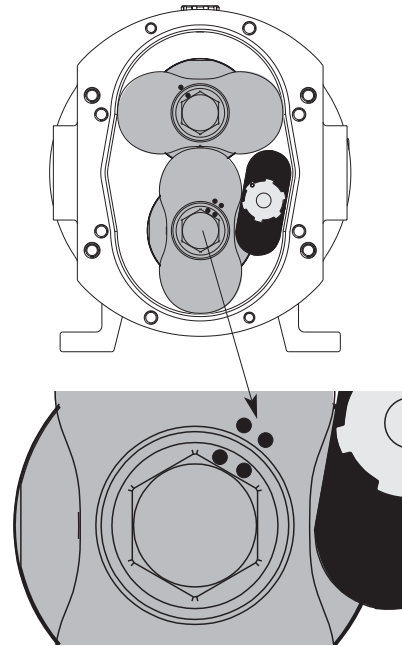


Figure 8

5. Rotate the rotors **27** manually in order to ensure that the rotors have freedom of movement inside the pump.
6. Check on the shimming and the synchronization of the rotors. Correct it where necessary, following the procedure for SHIMMING THE ROTORS as described in section 6.14.

### 6.6 REMOVING THE ROTOR CASE

The procedure described below must be followed when removing and replacing the rotor case :

1. Dismantle the front cover **1** (see § 6.2).
2. Dismantle the rotors **27** (see § 6.4).
3. Disconnect the pump inlet and outlet ports.
4. Undo the bolts **6** that attach the rotor case **9** to the chassis **13**.
5. Remove the rotor case **9** (identify the position of the ports) by placing 2 x CHC M12\*140 screws (not supplied) diagonally opposite one another in the 2 tapped holes and by alternately turning each bolt one turn at a time. Take great care not to damage the lip seals during dismantling. Inspect the lip seals and replace them where necessary.

### 6.7 REASSEMBLING THE ROTOR CASE

1. Position the rotor case **9** with the ports in their original position on the dowels mounted in the chassis **13**. Use a plastic mallet to tap the rotor case back into position. Coat the shaft with food grade grease. The triple lip seals are extremely fragile. Take great care not to damage them during the assembly operation.
2. Replace and tighten the bolts **6** between the rotor case **9** and the chassis **13** to the specified torque. See § 7.1.

## 6. MAINTENANCE (continued)

### 6.8 DISMANTLING THE CAN

The procedure described below must be followed when removing and replacing the can **14**.

1. Cut the power supply to the motor.
2. Disconnect the pump from the hydraulic motor. If possible, remove the pump from the pipe system and put it on a work bench.
3. Drain the oil from the pump by undoing the oil drain plug **18** situated in the bottom of the can **14**.
4. Remove the screws **7**.
5. Remove the can **14**, taking care not to damage the lip seal **22**.
6. Inspect and replace the lip seal **22** if necessary.
7. Inspect and replace the O-ring seal **17** if necessary.

### 6.9 REASSEMBLING THE CAN

1. Check that the O-ring seal **17** is fitted correctly.
2. Position the can **14** over the shaft **29** and tighten the screw **7** to the specified torque (see § 7.1).
3. Replace the oil drain plug **18**, (see figure 9).

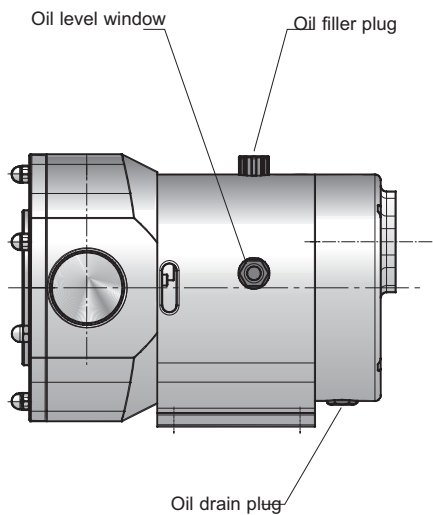


Figure 9

4. Fill the gearbox with the recommended oil to the specified level as shown in figure 2. Check for any leaks. See § 4.9 for required oil quantities.



Figure 2

### 6.10 DISMANTLING THE TIMING GEARS

The procedure described below must be followed when dismantling the timing gears :

1. Remove the can **14** (see § 6.8).
2. Remove the front cover **1** in accordance with the above procedure.
3. Position the rotors **27** and insert the rotor locking tool **111** as shown in figure 10.

Rotor locking

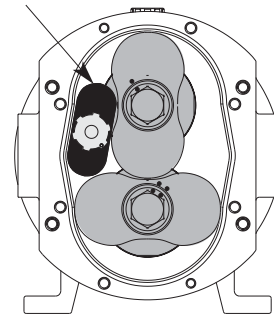


Figure 10

4. Straighten the locking tab **43** on the SKF washer for the top or right-hand gear **42**. Undo the corresponding SKF screw-nut **44**.
5. Re-position the rotor locking tool **111** as shown in figure 8.

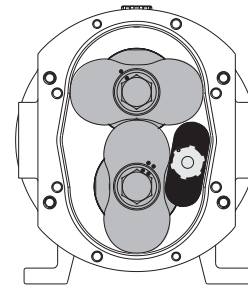


Figure 8

6. Straighten the locking tab **43** on the SKF washer for the bottom or left-hand gear **42**. Undo the corresponding SKF screw-nut **44**.
7. Undo the bottom or left-hand gear nut **44**.
8. Dismantle the rotor locking tool **111** and the rotors **27** in accordance with the above description.
9. Then pull the gears **42** off the shafts **29**, **30** with an extraction tool. Do not forget to note which gear came from which shaft using the centre punch marks and which gear teeth were opposite one another during the dismantling operation (see figure 11).

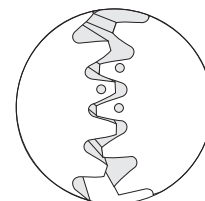


Figure 11

10. Inspect each gear and replace them where necessary.

## 6. MAINTENANCE (continued)

### 6.11 REPLACING THE TIMING GEARS

1. Position the timing gears **42** on shafts **29** and **30**. Check that each gear is fitted on to the correct shaft. Check that the correct teeth are meshed (see figure 11).
2. Position the rotors **27** in accordance with the procedure described above.
3. Position the rotor locking tool **111** as shown in figure 3.

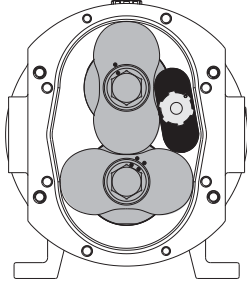


Figure 3

4. Position the SKF screw-nut **44** and its associated washer **43** on the main shaft **29** and tighten the gear nut to the specified torque. See § 7.1.
5. Position the rotor locking tool **111** as shown in figure 12.

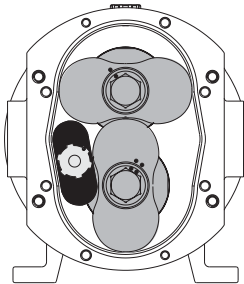
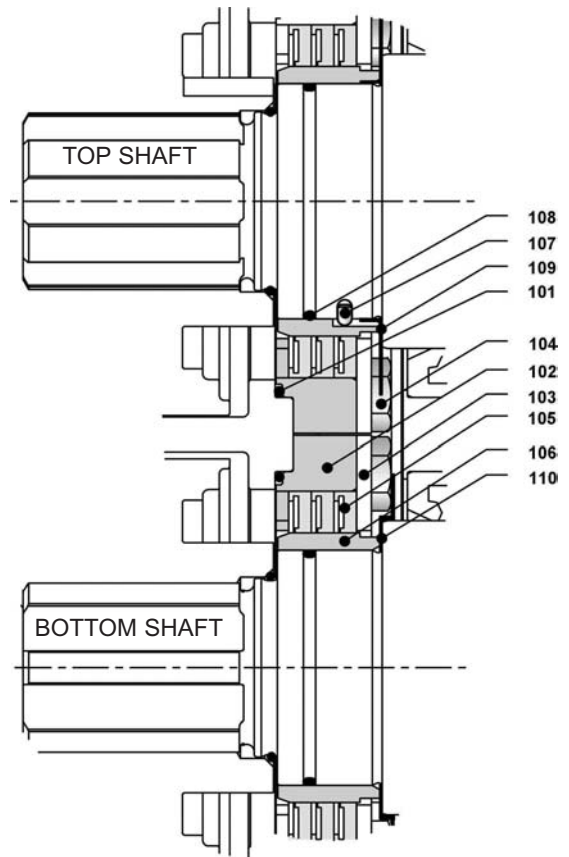


Figure 12

6. Position the SKF screw-nut **44** and its associated washer **43** on the auxiliary shaft **30** and tighten the gear nut to the specified torque. See § 7.1.
7. Bend the locking tabs on the SKF washers **55**.

### 6.12 REMOVING THE OILSEAL PLATE FROM THE CHASSIS



The procedure described below must be followed when removing the sealing plate from the oil sump.

1. Remove the front cover **1** (see § 6.2).
2. Remove the rotors **27** (see § 6.4).
3. Remove the rotor case **9** (see § 6.6).
4. Remove the shims **28**. Identify which shaft corresponds to which set of shims.
5. Remove the seal **21**.
6. Remove the wear rings **106**. Use an extraction tool if necessary. It is possible for the driver pins **107** to fall and get lost during this operation. Position each shaft so that the driver pin **107** is at the top when the ring **106** is removed. Inspect the wear rings and replace them where necessary.
7. Retrieve and store the driver pin **107** every time a shaft is removed.
8. Remove the seals **108**, inspect and replace them where necessary.
9. Remove the baffles **109** and **110** from each shaft.
10. Remove the can **14** (see § 6.8).
11. Undo the bolts **19** securing the sealing plate.
12. Remove the sealing plate **10** taking special care not to damage the lip seals.
13. Inspect the seals **23** and **11**. Replace them where necessary.



## 6. MAINTENANCE (continued)

### 6.13 REPLACING THE OILSEAL PLATE ON THE CHASSIS

1. Position the O-ring seal **11** in its recess in the chassis.
2. Position the lip seals **23** in their recess in the sealing plate **10**.
3. Refit the sealing plate **10** on to the shafts, taking care not to damage the O-ring seal **11** or the lip seals **23**.
4. Tighten the screw-nuts **19** to the specified torque. See § 7.1.
5. Reassemble the baffles **109** and **110** on the corresponding shaft (see figure 15).

#### CAUTION

Non-compliance with the assembly shaft or the assembly directions shown in figure 15 will result in the jamming of the pump.

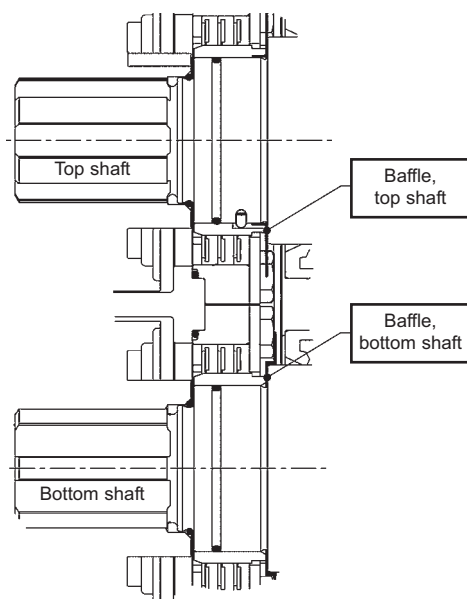


Figure 15

6. Reassemble the seals **108**.
7. Reassemble each driver pin **107**, then each wear ring **106**. The ring has to be fully pushed on so that it comes into contact with the baffles.
8. Reassemble the seal **21**.
9. Reassemble the shims **28** on the correspond shaft.

### 6.14 SHIMMING AND SYNCHRONIZING THE ROTORS

If the pump is to be operated effectively and safely, the shimming procedure needs to be carried out for the rotors whenever the pump has been dismantled and reassembled. Actual shimming values should be adjusted so that they are as close as possible to those in § 7.2 for maximum efficiency.

This procedure breaks down into 2 stages :

- Axial clearance
- synchronization

### 6.15 SHIMMING THE AXIAL CLEARANCE FOR THE ROTORS

1. Measure the difference in depth between the rotors **27** and the side of the rotor case **9** using a depth micrometer. The points at which you should measure the depths are shown in figures 13 and 14. The rotors are, then, turned 180° and measured again, making a total of 12 measurements.

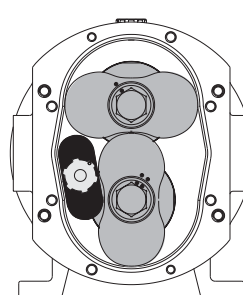


Figure 12

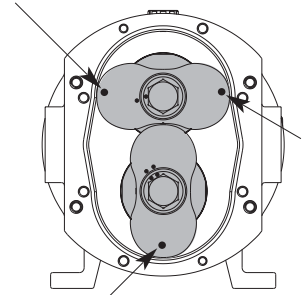


Figure 13

2. Measure the rear clearance using a standard feeler gauge set (figure 14). 12 measurements should be taken in the same rotor positions as the preceding point.

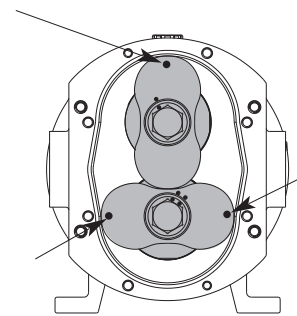


Figure 14

3. Measure the radial clearance between the rotor **27** and the rotor case **9** using a standard feeler gauge set. The clearance should be measured in the same rotor positions as above, making a total of 12 measurements.
4. If the measurements are not within the limits stated in § 7.2, or if the distances measured can be closed tighter to the mean values given in § 6.8, remove the rotors **27** in accordance with the above procedure.
5. Remove the O-ring seals **21** situated on the shafts **29**, **30**.
6. Remove the shims **28** from the shaft **29**, **30**, measure the total thickness of the shims using a micrometer and add or subtract the appropriate value. (for example, if the front clearance is 0.1 mm too wide, add 0.1 mm to the total thickness of the shims).
7. Replace the shims **28** on the shafts **29**, **30**. The thinnest shims must be installed first.
8. Replace the O-ring seals **21** on the shafts.
9. Replace the rotors **27** (see § 6.5).
10. Measure front and rear clearance again. If the clearances are still outside the limits, or if they can be closed tighter to the mean values shown in § 6.8, repeat the shimming procedure until the measured clearances are correct.
11. When the front and rear clearances are correct, check that the rotors **27** turn freely.

## 6. MAINTENANCE (continued)

### 6.16 SYNCHRONIZING THE ROTORS

If the pump is to be operated effectively and safely, the synchronization of the rotors needs to be reset whenever the pump has been dismantled and reassembled.

The synchronization procedure is described below :

1. Measure the interlobe clearances using a feeler gauge set in the positions shown in figure 16. If these clearances are outside the tolerances given in § 7.2 ("interlobe" column), the rotor synchronization needs resetting.

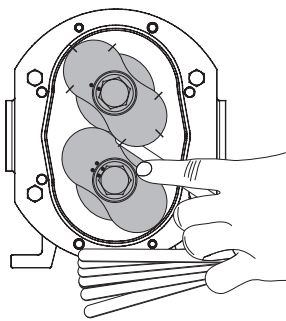


Figure 16

2. Remove the can 14 in accordance with the description in § 6.8.
3. Put the rotors in a position where the clearance needs to be increased in order to improve the synchronization. Select which one of the shafts you want to work on. You should select the shaft where removing the gear increases the clearance.
4. Straighten the locking tab on the SKF screw-nut washer 43 for the gear 42 and undo the SKF screw-nut 44 from the shaft. Pull the gear 54 approx. 1 mm.

#### CAUTION

It is important not to pull the gear more than 1 mm as this could damage the rotors.

5. Check the direction in which the clearance has changed.
6. If the clearance has been increased, continue from point 8.
7. If the clearance has been reduced, tighten the gear nut 44 on the selected shaft in accordance with the specified torque setting in § 7.1. Bend the tab washer 43 down in the screw-nut for the gear 42, and repeat the procedure from § 3 above, working on the other shaft.
8. Continue by undoing the screw-nut 44 and pulling the gear 42 until the clearance specified in § 7.2 is obtained.
9. Measure the distance between the spacer 40 and the gear 42 using a standard feeler gauge set. Prepare a set of shims corresponding to the measured distance.
10. Remove the gear 42 (see § 6.10). Remove the gear drive key 32. Fit the shims 41 on the shaft.
11. Replace the gear drive key 32 and the gear 42 in accordance with the description in § 6.11.
12. Measure the interlobe clearance - if the interlobe clearances are not within the tolerances given in section 6.8, repeat the procedure for resetting the rotor synchronization until the interlobe clearances are within said tolerances.

13. Check that the rotors can turn freely.
14. Replace the can 14 in accordance with the description in § 6.9.

### 6.17 REPLACING THE TRIPLE LIP SEALS

The procedure described below must be followed when changing the triple lip seals :

1. Dismantle the front cover 1 as described in § 6.2.
2. Dismantle the rotors 27 as described in § 6.4.
3. Dismantle the chassis 13 as described in § 6.6.
4. Undo the screws 104 securing the packing retaining plates 103 to the chassis 13.
5. Check on the wear rings 106. They should be clean and free of any marks, scratches and signs of excessive wear. Replace them as necessary as described in § 6.12.
6. Remove the baffles as described in § 6.12. Make sure that they are clean and free of any marks. Replace them where necessary.
7. Dismantle the packing retaining plates 103 and the packing housing 102.
8. Dismantle the lip seals 105 from the packing housing 102. Make sure that they are clean and free from scratches and any other signs of wear. Replace them where necessary.
9. Coat the inside of the packing housing with the specialized glue (such as Loctite® 574) and, using the specialized tool 112, press the lips seals 105 into the packing housing. If necessary, Blackmer supplies assembled lip seals.
10. Completely fill the lip seals with a food grade grease (such as Unlock 2000 made by Kernte). Make sure that the lips seals are correctly positioned (see figure 17).

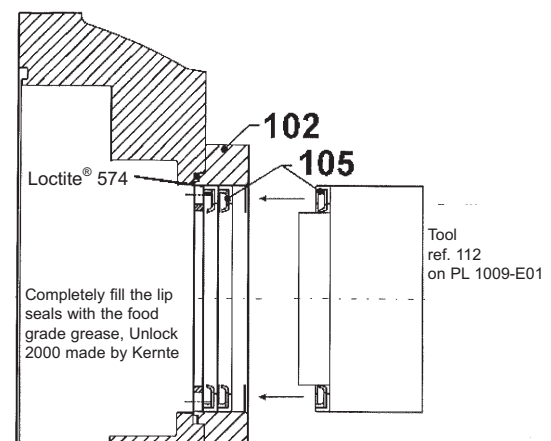


Figure 17

11. Assemble the seal for the packing housing 101 on the housing 13, the packing housing 102 on the chassis 13 and secure everything using the packing retaining plates 103. Tighten the screws 104 to the specified torque § 7.1.
12. Insert the baffles 109 and 110 on to the corresponding shafts (see § 6.13).
13. Insert the wear rings 106 on the shafts 29 and 30 (see § 6.13).

## 6. MAINTENANCE (continued)

14. Reassemble the rotor case as shown in § 6.7.
15. Reassemble the rotors as shown in § 6.5.
16. Reassemble the front cover as shown in § 6.3.
17. Check that the rotors turn freely.

### 6.18 CHANGING THE ORIENTATION OF THE PORTS FROM HORIZONTAL TO VERTICAL

It is possible to change the orientation of the suction and discharge ports from a horizontal position to a vertical position and vice versa, without making any modifications to the pump.

The pump has to be fitted to a vertical right angle bracket. It is not possible to change the position of the feet in relation to the suction and discharge ports.

The procedure described below must be followed when changing the orientation of the ports.

1. Cut the power supply to the motor.
2. Disconnect the pump from the motor. If possible, remove the pump completely from the pipe system and put in on a work bench.
3. Drain the oil from the pump by undoing the oil drain plug **18** situated in the bottom of the can **14**.
4. Change the plugs over on the chassis **13**. The oil filler window **15** has to be fitted in the place of the oil filler plug. The oil filler plug **16** has to be fitted in the top vertical position; the oil drain plug **18** has to be in the bottom vertical position.
5. Mount the pump on its installation bracket.
6. Fill the gear box with oil up to the level shown in figure 2 and check that there are no leaks. See § 4.9 for required oil quantities and the positioning of the oil level window.



Figure 2

### 6.19 CHANGING THE HORIZONTAL ORIENTATION OF THE PORTS

The procedure described below must be followed when inverting the positions of the DIN 80 and DIN 100 ports.

1. Dismantle the front cover **1** as described in § 6.2.
2. Dismantle the rotors **27** as described in § 6.4.
3. Dismantle the rotor case **9** as described in § 6.6.
4. Rotate the rotor case **9** by 180° to invert the position of the ports.
5. Reassemble the rotor case as described in § 6.7.
6. Reassemble the rotors as described in § 6.5.

7. Check on the shimming and the synchronization of the rotors as described in § 6.15 and 6.16. Make any necessary adjustments to the shimming and the synchronization.
8. Reassemble the front cover as described in § 6.3.
9. Check that the rotors turn freely.

### 6.20 REPLACING THE BEARINGS 34, 36

The procedure described below must be followed when replacing the bearings.

1. Remove the timing gears **42** in accordance with the description in § 6.10.
2. Remove the gear drive key **32**, shims **41**, spacer **40** and the thrust ring circlips **39**.
3. Straighten the locking tab on the SKF screw-nut **37**.
4. Position the rotor locking tool **111** as shown in figure 10, and then undo the bearing lock nut **38** from the drive shaft **29**.

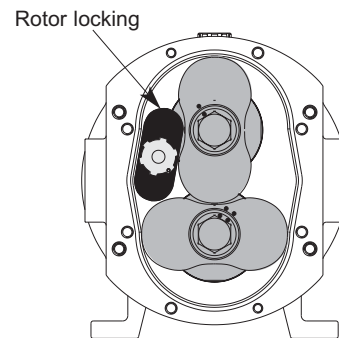


Figure 10

5. Reposition the rotor locking tool **111** as shown in figure 8.

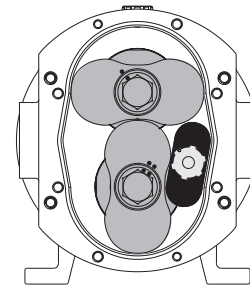


Figure 8

6. Undo the bearing lock nut **38** from the auxiliary shaft **30**.
7. Remove the bearing lock nut **38** and the SKF washer **37**.
8. Remove the rotors **27** in accordance with the description in § 6.4.
9. Where necessary, remove the shims and the O-ring seal from the shaft. Keep the shims and the O-ring seal together as a set for each shaft. Mark each set in order to guarantee that each part is reassembled on the correct shaft.
10. Remove the rotor case **9** and the oil seal plate **10** in accordance with the instructions in § 6.6 and 6.12.
11. Dismantle the shafts **29** and **30** from the chassis **13** by pressing down on the rear of the shafts. The bearings should be freed during this operation. Remove the shafts and the bearings.

## 6. MAINTENANCE (continued)

12. Remove the outer bearing races 34b, 36b from the chassis and the inner bearing races 34a, 36a from the shafts 29 and 30. Check that the shafts are clean and free of any marks and abnormal signs of wear. Using a comparator, check that the shafts are not warped. Replace the shafts where necessary.
13. Clean the bearing seats for the chassis 13 and the shafts 29 and 30.
14. Fit the outer bearing races 34b, 36b and the washer 35 in the chassis 13.
15. Fit the inner bearing races 34a on the shafts 29 and 30 after having heated them.
16. Position both shafts 29 and 30 in the chassis bore holes.
17. Fit the inner bearing race 36a, the washer 37 and the SKF nut 38 on to the shafts 29 and 30.
18. Position the shims 41 and fit the oil seal plate 10 without the lip seals 23.
19. Fit the rotor case 9 in accordance with the description in § 6.7.
20. Put the rotors 27 in place on the shafts 29 and 30 (without the shaft seal) in accordance with the description in § 6.5.
21. Position the rotor locking tool 111 in accordance with figures 3 and 12 respectively and tighten the bearing lock nuts 50 until there is no more backlash in the bearing assembly.

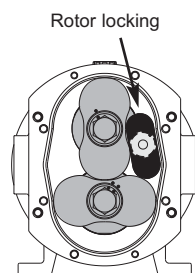


Figure 3

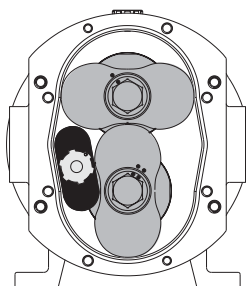


Figure 12

22. Remove the rotors 27 from the shafts in accordance with the description in § 6.4.
23. Check that the shafts 29 and 30 turn freely.
24. Check that the running torque of both the main shaft 29 and the auxiliary shaft 30 corresponds to the specifications in the table in § 7.1. Measure said running torque without lip seals. During the measuring the bearings must be lubricated with a very thin oil such as WD40. Check that the shafts can turn freely.

25. If the running torque is not within the tolerances specified in § 7.1, adjust the screw-nuts 38 and repeat the procedure until the specified torque is obtained.
26. Bend the locking tab on the SKF washer 37.
27. Replace the circlips 39, the spacers 40 and the keys 32 on the shafts 29 and 30.
28. Reassemble the gears 42 in accordance with the description in § 6.11.
29. Replace the oil seal plate 10 with the lip seals 23 in accordance with the description in § 6.13 and the rotor case 9 in accordance with the description in § 6.7.
30. Fit the rotors 27 in accordance with the description in § 6.5.
31. Replace the can 14 in accordance with the description in § 6.9.
32. Fit the front cover 1 in accordance with the description in § 6.3.
33. Check that the rotors turn freely.

### 6.21 RECOMMENDED LIST OF SPARE PARTS TO BE HELD IN STOCK

We recommend having leak and maintenance kits in stock.

See the spare parts list PL 1009-E01 for the composition of these spare parts kits.

The table opposite presents the stock of spare parts recommended for normal operation and for applications with special requirements – for example, 24h continuous duty operation, operation with abrasive materials or very sensitive operations, even with short production stoppages

nbre of operating-pumps	Leak kits			Maintenance kit		
	0 - 5	5 - 20	> 20	0 - 5	5 - 20	> 20
	Set	Set	Kits / 10 operating pumps	Set	Set	Kits / 10 operating pumps
Normal use	1	2	1	0	1	1
Specials exigences	2	3	2	1	2	1

## 7. PERMISSIBLE TORQUES AND CLEARANCES

### 7.1 PERMISSIBLE ASSEMBLY TORQUES

The table below specifies the torque settings applicable to screw-nuts, screws and bolts used in the pump.

The sizes of the metric wrenches to be used for tightening the screws and screw-nuts are specified in brackets [mm].

The sizes of the tools to be used for the SKF nuts and the bearings are specified in brackets {...} in the table below.

	Front cover bolts/nuts Large	Front cover bolts Small	Rotor bolts	Rotor case/Chassis Bolts	Seal housing Screws	Oilseal plate. Nut	Running torque, bearings, approx. 100 rpm. Shaft	Can. Screw	Gear nut
REF.	2	3	24	6	104	19		7	44
	Nm								
	20 [17]	20 [19]	220 [30]	40 [17]	20 [13]	40 [17]	4.1-5.0 {HN09}	22	100 {HN08}

### 7.2 PERMISSIBLE ROTOR CLEARANCE RANGES

	Rotor/Rear	Rotor/Front	Rotor/Rotor case	Interlobe
Min. (mm)	0,19	0,17	0,25	0,19
Max. (mm)	0,25	0,25	0,31	0,39

## 8. GENERAL FAULT FINDING PROCEDURE

Symptoms	Possible causes
Motor overheats.	6, 7, 14, 15, 17, 19
Pump under capacity.	2, 7, 8, 9
No flow from pump.	1, 3, 5
Unsteady flow.	2, 4, 5, 7
Noise and vibration.	2, 4, 5, 6, 7, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20
Stall on start-up.	6, 7, 21
Pump overheating.	7, 14, 15, 17, 19
Excessive rotor wear.	2, 10, 13, 14, 15, 18, 19
Excessive power absorbed.	6, 7
Pump seizure.	6, 10, 13, 14, 15, 18, 19
Shaft seal leakage.	11, 12, 13

Causes		Possible remedies
1	Incorrect rotation.	Reverse direction of motor.
2	Insufficient N.P.S.H. and, as a result of this, cavitation : N.P.S.H.	Increase N.P.S.H., raise suction vessel, lower pump, reduce speed, increase suction pipe diameter, simplify and shorten suction pipe run, remove bends and other components which produce pressure loss..
3	There is no liquid in the pump.	Introduce liquid - vent air.
4	Air entering pump.	Check pump suction and system connections.
5	Blocked or restricted suction pipe.	Check pipe system, clean any filter if necessary.
6	Discharge pressure exceeds the allowable.	Check for obstruction, lower pressure by increasing pipework diameter.
7	Product viscosity too high.	Decrease speed - increase product temperature.
8	Product viscosity too low.	Increase speed - reduce product temperature - reduce clearance between rotor, rotor case and front cover.
9	Worn rotors.	Renew.
10	Shaft bearing wear.	Replace bearing or return pump to BLACKMER for overhaul, if necessary.
11	Worn mechanical seal.	Renew.
12	O-ring incompatible with product.	Check chemical compatibility chart, or contact BLACKMER for alternative elastomers.
13	Worn timing gears.	Replace gears and retime rotors.
14	Insufficient lubricating oil.	Top up with correct grade of lubricant.
15	Incorrect grade of lubricating oil.	Check that the lubricant used is recommended by BLACKMER.
16	Rotor contact with rotor case or front cover.	Drop discharge pressure, check clearances between rotors, front cover and rotor case. Check that temperature shifts are as recommended in section 6.4.
17	Pump and motor misalignment.	Correct alignment.
18	foreign particules in product.	Fit strainer prior to its arrival in the pump.
19	Loose bolts between pump, motor and base frame.	Tighten bolts. Then check that pump and motor are lined up correctly.
20	Loose bolts between gearcase and foot.	Tighten bolts. Then check that pump and motor are lined up correctly.
21	Rotors stuck by hardened product.	Clean the pump, operate the device of reheating if the pump is equipped with it.