



Pratissoli

KE Series



Use and Maintenance Manual

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1. INTRODUCTION

Please read this manual carefully before using your pump. It contains the necessary information for correct installation, use and maintenance as well as some practical suggestions for trouble shooting.

Providing Pratissoli KE high pressure water plunger pumps are correctly installed and maintained, they will give trouble free operation for a long time.

The manufacturer declines all responsibility for damages arising from the misuse and non-observance of the instructions indicated in this manual.

On receiving the pump, please check that it is complete and in good state.

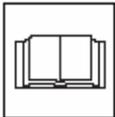
Should you find anything out of order, please contact Pratissoli before installing and starting the pump .

2. SYMBOL DESCRIPTION



Warning

It indicates a potential danger.



Please read the indications of this manual carefully before operating the pump.



Danger

Electrocution danger



Danger

Use face shield



Danger

Use protective glasses



Danger

Use adequate hand protections.



Danger

Use suitable boots.

3. SAFETY

3.1 General safety instructions

The misuse of high pressure water pumps and units and the non-observance of the pump installation and maintenance instructions may cause damages and/or injuries to people or property or both. Any Manufacturer/Operator requested to assemble/use a high pressure water unit should be competent to do so, should have the necessary knowledge on every high pressure component installed in the unit and on the precautions to be taken in order to guarantee the largest safety margins during operation. No precaution, so far as is reasonably practicable, should be left out in the interest of safety, both from the Manufacturer and the Operator.

3.2 High pressure unit safety requirements.

1. A maximum pressure setting valve should be installed in any delivery line and should be sized to discharge the entire flow rate.
2. High pressure unit components, with particular regard for those units working outside, should be adequately protected against rain, frost and heat.
3. Electric components and wirings should be provided with an adequate degree of protection, able to protect them against spray coming from any direction. They should also be suitable for working in a wet environment.
4. High pressure hoses and any other accessory under pressure should be sized in accordance with the max unit working pressure and must always work within the safety margins indicated by the hose/accessory Manufacturer.
5. High pressure hose ends should be fastened to a steady body in order to prevent them from dangerous sweeping around, should they burst or come off their end fittings.
6. Proper safety guards should be provided to adequately cover transmission joints, pulleys, belts, auxiliary drives.



3.3 Safety of operation.

The access into the area where a high pressure unit is working should be strictly prohibited to unauthorised personnel. The area should be suitably enclosed and its perimeter, so far as is reasonably practicable, cordoned off and proper warning notices displayed in prominent positions. Personnel authorised to enter that area should have been previously trained to do so and informed of the risks arising from failures, misuse and any unforeseeable circumstance which may occur during operation.

Before starting the pump unit and bringing it up to pressure the Operator is requested to carry out the following checks:

1. Make sure that a correct water supply to the pump is provided.
2. Make sure that water inlet filters are properly clean.
3. Electrical components and wire, with special emphasis on connections, junction boxes, switches and supply cables should be free from external damages (i.e. exposed and broken wires) and adequately protected against water.
4. high pressure hoses should not show apparent external wear and the fitting at both ends should be free from signs of erosion or corrosion.

The work should stop immediately and the pressure must be released in the event that leakages become apparent or if any person becomes aware of any change in condition or any hazard existing or being introduced. Any failure must be promptly reported and then checked by competent personnel.



3.4 General procedures for high pressure guns/lances use.

1. The Operator should take reasonable care for the safety of himself and of other persons who may be affected by his acts or omissions at work; his actions should be always governed by his good sense and responsibility.
2. The Operator should wear suitable waterproof protective clothing, having regard to the type of work being undertaken. The clothing set should include adequate hand protections, suitable boots able to ensure proper grip on wet floors, helmet provided with full face shield, water proof garment providing full cover to the Operator, including his arms.

Note: it must be emphasised that whereas protective clothing provides adequate protection against spray and flying particles, it does not constitute complete protection against the direct impact of the water jet. Additional protections in the form of suitable metal shields or barriers may be necessary for certain jetting operations.

3. In most jetting operations it is an accepted practice to employ a team of Operators consisting of two members at least, in order to provide mutual assistance in case of need and to rotate their duties in case of long and heavy work.

4. The area in which the work is to proceed should be clear of loose items and debris to prevent tripping and slipping hazards.
5. The water jet should be directed only and always against the work piece, even during preliminary operating tests prior to starting work.
6. Where applicable, proper side shields should be suitably placed to safeguard personnel and equipment against contact with grit or particles removed by the water jet.
7. On no account must the Operator be distracted during operation until the jet has been stopped. Personnel having reason to enter the water jetting area should wait until the jet is stopped and his presence known.
8. Each team member must always be aware of the actions and intentions of other team members in order to prevent any dangerous misunderstanding occurring during jetting operation.
9. The pump unit should not be started and brought up to pressure unless each team member is in his designated position, the nozzle directed to the work piece and the lance or gun securely held.

3.5 Safety of maintenance

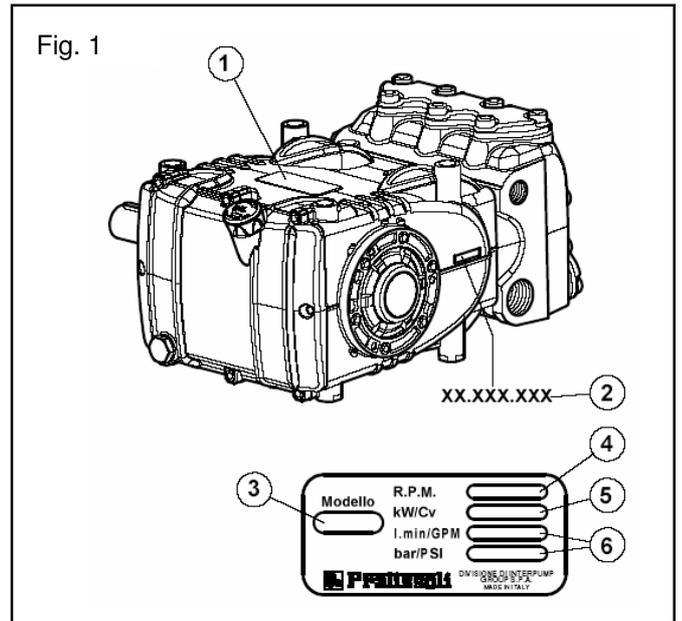
1. The high pressure water unit should be maintained in accordance with the Manufacturer's instructions.
2. The high pressure water unit should be maintained only by competent personnel.
3. Service and maintenance should be carried out with proper tools in order to prevent any damage on high pressure connections and fittings.
4. Use of other than original spare parts is strictly forbidden.

4. PUMP IDENTIFICATION

Each pump is fitted with a rating plate 1 Fig.1 containing the following information:

2. Serial number
3. Pump model and version.
4. max rpm
5. Power absorbed
6. max flow rate (l/min) and pressure (bar).

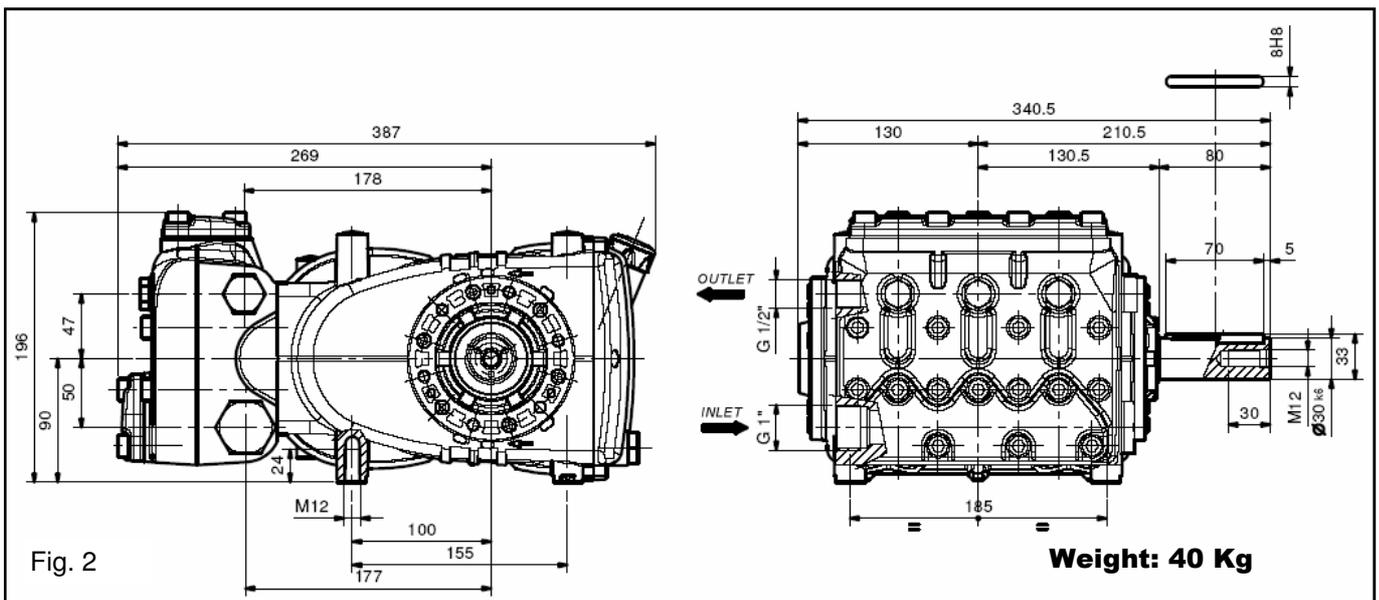
Pump model, pump version and serial number should be specified when ordering spare parts. Should the pump be modified (i.e. by changing the original version) then the rating plate should be changed for future reference.



5. TECHNICAL FEATURES

Model	RPM	Flow rate		Pressure		Power	
		l/min	Gpm	bar	psi	kW	Hp
KE 20	1450	31.42	8.3	300	4350	18.00	24.5
KE 22	1450	38.0	10.0	250	3625	18.16	24.7
KE 24	1450	45.2	11.9	210	3045	18.16	24.7
KE 28	1450	61.6	16.3	150	2175	17.64	24.0
KE 30	1450	70.7	18.5	130	1885	17.57	23.9

6. OVERALL DIMENSIONS AND WEIGHT



7. INFORMATION ABOUT THE PUMP USE



The KE pump has been designed to pump fresh and filtered (360 micron max) water at room temperature (40°C max).

Special versions are available for pumping water up to 85°C (185°F) and for reverse osmosis units.

7.1 Water Temperature

The water temperature is critical for the pump life: the higher the water temperature is, the more likely it is to create cavitation, resulting in premature seal and valve failures .



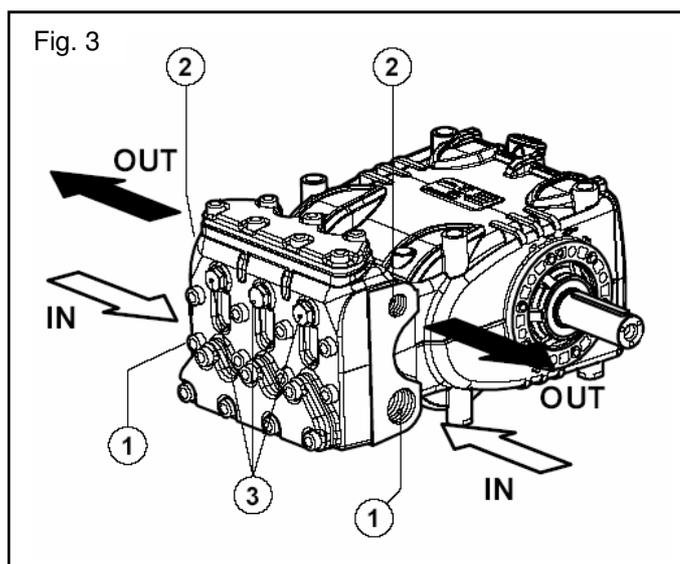
For such conditions, use HT series pumps.

7.2 Pump performances

The performance data indicated in the catalogue (or on the rating plate) refer to the maximum performance of the pump. The use of the pump below the rated performances does not allow the drop in power absorbed to be balanced by altering the pressure or volume of the pump **above** its maximum value unless especially authorised by our technical Department.

7.3 Lowest rpm

The lowest speed of rotation of **KE** pumps is 500 rpm (on crankshaft).



8. CONNECTIONS AND PLUGS

The KE pump is provided with (Fig.3):

1 - N°2 inlet ports " IN " Ø G1".

Either inlet port can be used; the one not being used must be plugged.

2 - N°2 outlet ports " OUT " Ø G 1/2".

3 - N°3 ports Ø G1/4"

(usually used for the pressure gauge).

9. PUMP INSTALLATION

9.1 Positioning

The pump must be installed on a rigid and perfectly flat and horizontal base by means of the proper four M 12 threaded feet. The base should be rigid enough to avoid any misalignment or flexing on the pump/transmission coupling axis due to the torque involved during operation. The unit should not be rigidly fixed on the floor but be installed upon vibration dampers. For special applications contact our **Technical Dept.**

The oil plug must absolutely be replaced by the oil stick and the oil level checked.

Make sure that you can easily reach the oil stick even after the unit has been assembled.

Never use rigid coupling on the shaft.

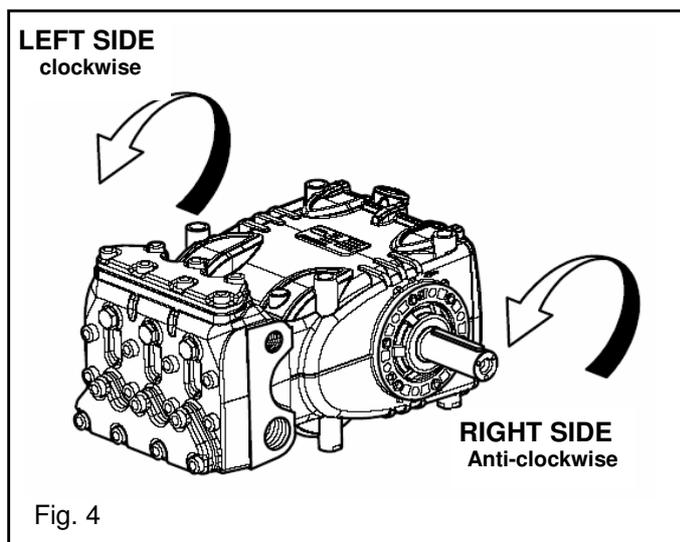
The following transmission types are suggested:

- Hydraulic by means of a flange.
- Pulleys.
- Cardan joint (within the max working angles indicated by the manufacturers)

9.2 Direction of rotation

An arrow situated on the crankcase near the shaft indicates the correct direction of rotation.

The fig. 4 shows the direction of rotation looking at the pump from the fluid end side.



For hydraulic drive, contact our **Technical Dept.**

9.3 Water connections

In order to isolate the high pressure equipment from the pump vibrations it is suggested, where applicable, to use flexible hoses for both suction and delivery line at least for the first length. The flexible hose must be rigid enough to prevent it from collapsing during the suction stroke, when a partial vacuum may occur.

9.4 Suction line

The pump life is considerably influenced by the effectiveness of the suction line which must have the following characteristics:

1. The internal diameter of the suction line should be at least ... mm (see the diagram on point 9.7) in any point, possibly larger depending on the drop in pressure due to the length and shape of the line.
2. It should be as straight as possible minimizing changes in size and direction and positioned in such a way to allow air pockets and bubbles to escape.
3. It should be perfectly airtight.
4. It should be completely free from 90° elbows, diameter reductions, counter slopes, "T" connections and should not be connected with other pipelines.
5. It must be positioned in such a way to prevent the pipe emptying after the pump stops.
6. Do not use high pressure hydraulic fittings like 90° elbows, high pressure adaptors, high pressure 3 or 4 way nipples, and so on.
7. Do not install any kind of detergent injector along the suction line
8. Do not install standing valves, check valves or other kind of one-way valves.
9. In the case of a feed tank, make sure that dimensions of the tank and the water minimum level do not give rise to turbulence at the tank outlet port, which, in turn, might create cavitation at the pump.
10. Do not connect the by-pass line from the valve directly to the pump suction line.
11. Connect the by-pass line from the valve directly to the feed tank and make sure that both the by-pass and tank feeding flows could not give rise to turbulence at the tank outlet port, which, in turn, might create cavitation at the pump. Proper baffle plates should be provided inside the tank.
12. Before connecting the suction line to the pump inlet port make sure the pipe is perfectly clean inside.

9.5 Filtration

All pumps require a suitable filter. The filter should be installed as close as possible to the pump, should allow easy inspection and have the following characteristics:

1. The filter capacity must be at least 3 times the rated pump volume.
2. Filter port diameters must not be smaller than the pump inlet ports.
3. Filtration degree in between 50 and 80 mesh (360 - 200 microns).

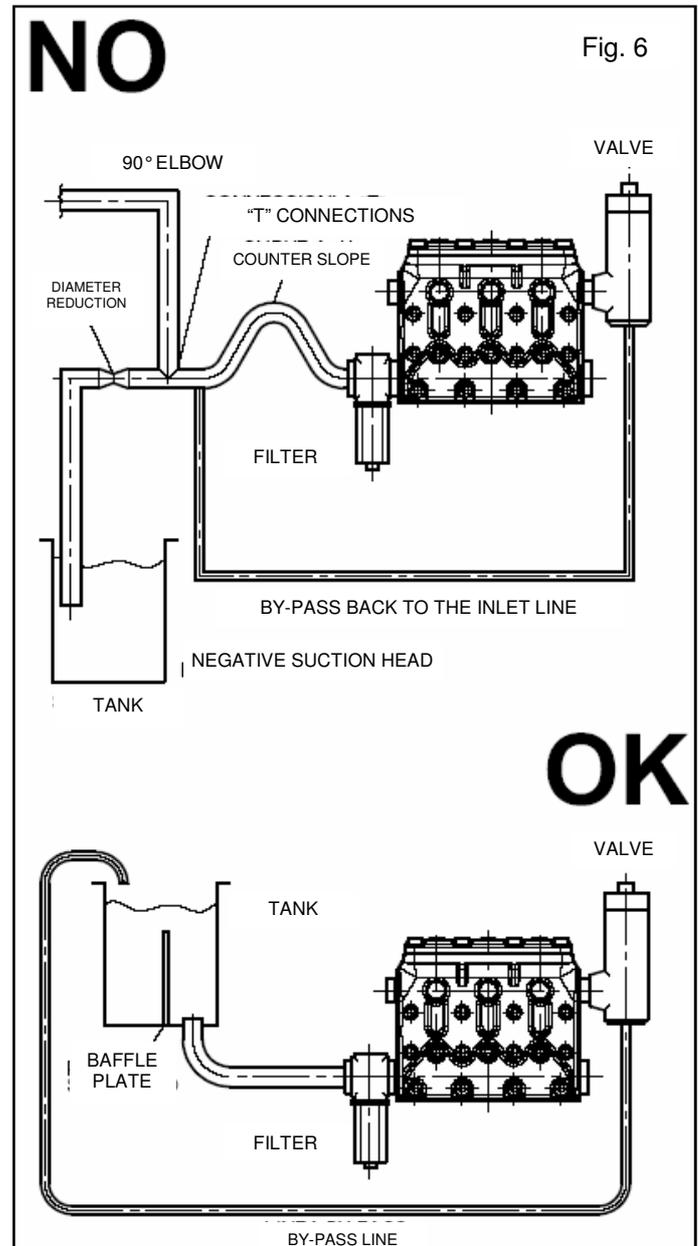
IMPORTANT NOTE: In order to properly safeguard the pump it is very important to plan cleaning of the filter, **with a frequency depending on the water quality, filtration degree and number of hours of each application.**

It is recommended to use filters with a clogging signaling device.

9.6 Delivery line

For a correct delivery line, comply with the following instructions:

1. The first length of delivery hose must be flexible in order to isolate the pump vibrations from the rest of the system.
2. Use only high pressure hoses and fittings able to guarantee the largest possible safety margins in any working condition.
3. A suitable relief valve must be installed on the delivery line.
4. Always use glycerine pressure gauges, as they are the most suitable for pulsating loads.
5. When designing the delivery line, take into proper account the unavoidable drop in pressure due to its length and size.
6. If necessary, the effects of the pump pulsations can be reduced by installing a proper pulsation dampener on the pressure line.



9.7 Internal diameter of pipeline (suction)

To determine the internal diameter of the piping, follow the following diagram.

Example 1 (_ _ _)

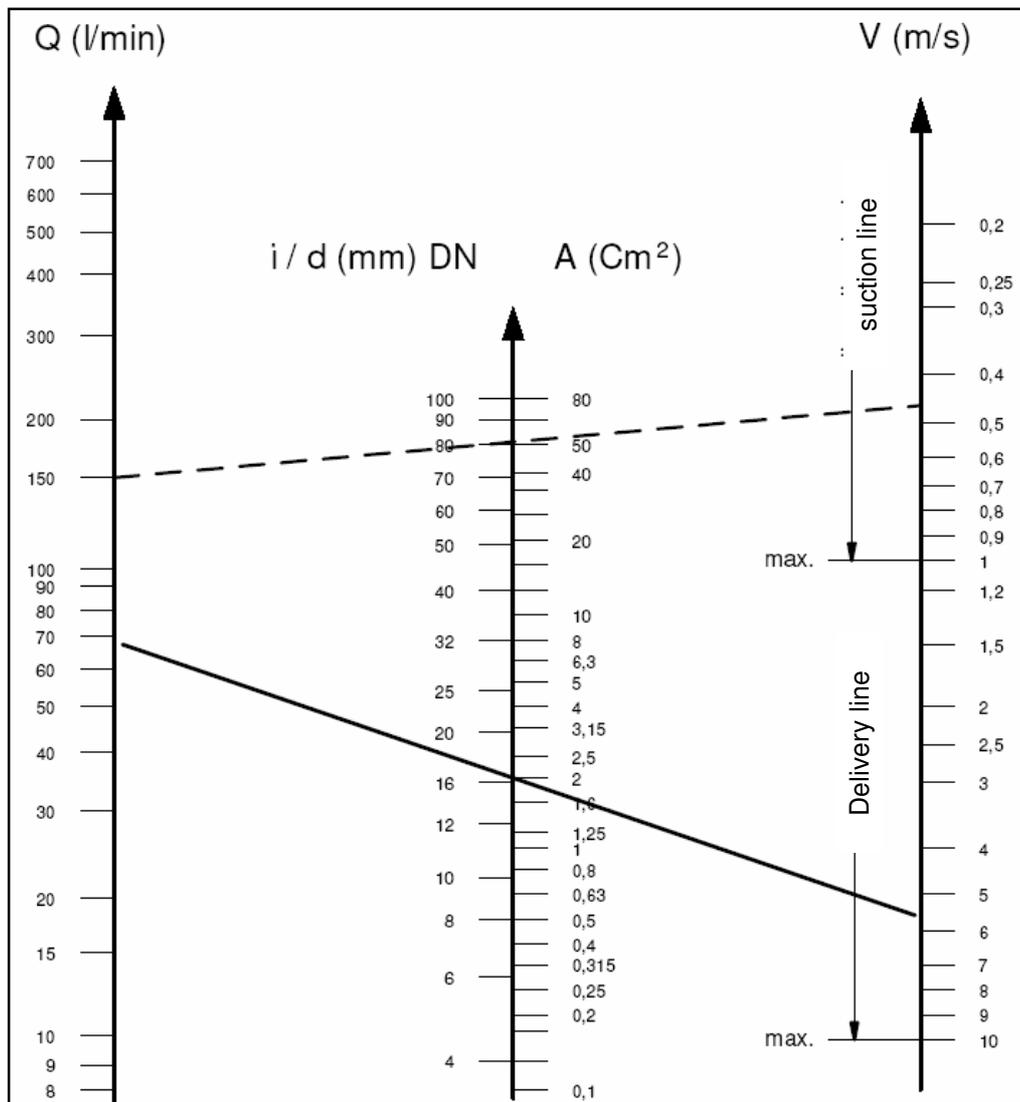
With a flow of 150 l/min and a water speed of 0,45 m/sec, the diagram line joining the 2 scales intersects the central scale, indicating the diameters, at a value of 80mm.

Example 2 (———)

With a flow of 70 l/min and a water speed of 5,5 m/sec. The diagram line joining the 2 scales intersects the central scale, indicating the diameters, ad a value of 16mm.

Optimal speeds:

- suction: 0,5 m/sec.
- delivery: 5 m/sec.



10.

The diagram does not take into consideration the pipe and valve resistance, drop in pressure, due to the pipe length, the viscosity of the pumped fluid, its temperature, etc.

*If necessary, contact our **technical department**.*

STARTING UP AND RUNNING PROCEDURES

10.1 Before start up

Before starting up the pump, make sure that the following conditions have been complied with:

1. Suction line should be connected to the pump, **the pump must never run dry.**
2. Suction line must be perfectly airtight.
3. Any ON-OFF valve in between pump and water source must be open and make sure the water gets into the pump freely.
4. Set the pressure line in dump mode in order to let the air in the pump get out easily thus facilitating the pump priming.
5. Make sure all suction/delivery connections are fully tightened.
6. Joint alignment, belt tightening and P.T.O. shaft inclination tolerances must be within the values indicated by the transmission Manufacturer.
7. Make sure of the correct oil level using the dipstick (position 1 fig. 7) and exceptionally the oil sight glass (position 2 fig. 7)

10.2 Starting up

1. When starting the pump up for the first time check for proper direction of rotation.
2. Pump and motor/engine must start offload: set the regulating valve to 'zero' or set the pressure line in dump mode by means of proper dumping devices.
3. During operation check the rotating speed does not exceed the rated value.
4. Before putting the pump under pressure let it run for at least 3 minutes.
5. Before stopping the pump release the pressure by operating the dump device or by releasing the regulating valve and reduce rpm to a minimum. (diesel applications).

Note: in case of feeding by a centrifugal pump, make sure that the plunger pump starts only when the correct inlet pressure is provided.

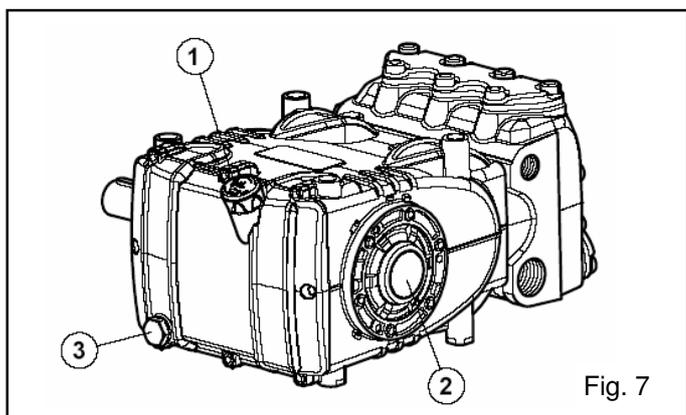


Fig. 7

Note: in case the pump has not run for a long period check the suction and delivery valves for scaling.

11. MAINTENANCE INSTRUCTIONS

Chart of recommended oils:



11.1 Crank mechanism maintenance.

Check oil level at least on a weekly basis Fig.8.

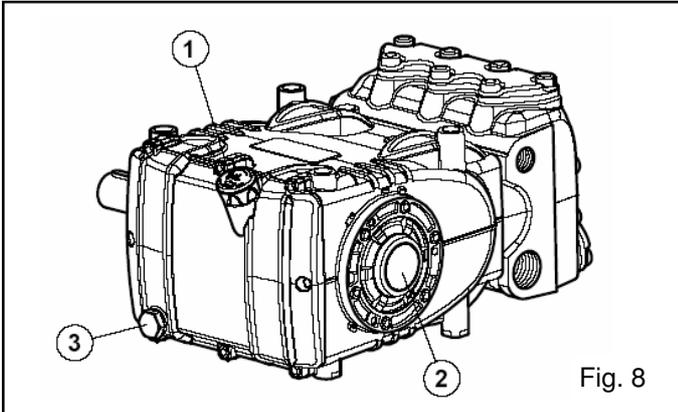


Fig. 8

If necessary add the missing oil through the oil plug pos.1, Fig.8. Check oil level when the pump is at room temperature. When changing the oil (removing plug pos.3. Fig.8), the pump should be at its working temperature.

Change oil every 1000 working hours, oil pump capacity is 2 litres.

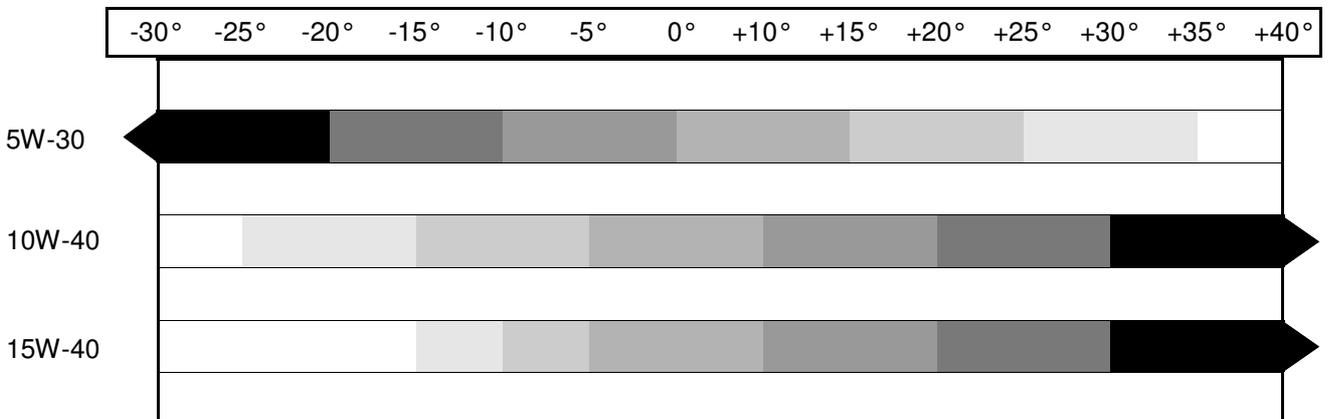
In any case the oil should be changed at least once a year, since oxidation deteriorates it.

BRAND	TYPE
INTERPUMP	X99 ORIGINAL
AGIP	F1 SUPERMOTOR OIL
BP	VISCO 2000
CASTROL	CWX
ELF	SPORT ST
ESSO	UNIFLO
FIAT (FL)	VS MAX
IP	AZZURRO SUPER OIL
MOBIL	SUPER
Q8	Q8 FORMULA RALLYE
ROLOIL	SUPERMULTIGRADE
SHELL	HELIX SUPER
TOTAL	QUARTZ 4000 - 5000

Mineral or synthetic oils can be used but they must be chosen according to the working environment temperature. Here below is a diagram indicating viscosity according to room temperature.

Oil grade SAE for engine oil

Recommended according to the room temperature (indicated in Celsius degrees)



11.1.1 Crank mechanism disassembling

Do as follows:

- A) Drain the oil from the pump and remove :
- shaft key
 - back cover
 - conrod cap
 - side covers. To do so, put N° 3 screws M6x50 wholly threaded into the holes drilled for that purpose. See fig. 9.

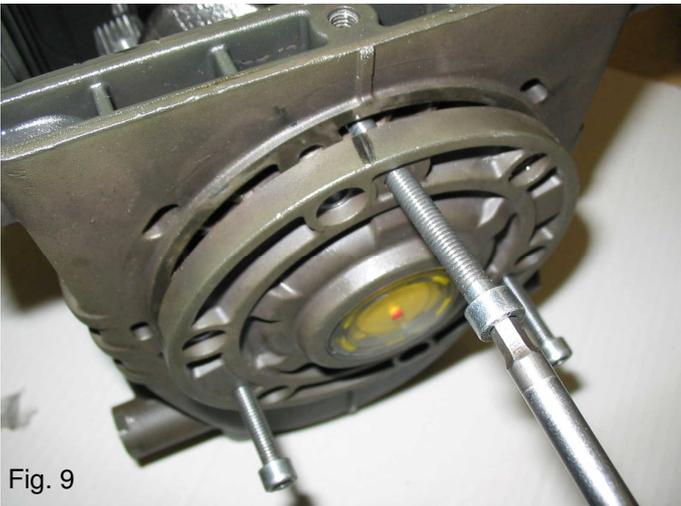


Fig. 9

- B) Push the piston guides and connecting rods forward so you can remove the pump crankshaft from the side.

NB: to extract the piston guide, it is necessary to remove the ceramic plunger and wiper first .

- C) Disassemble the crankshaft oil seals and the piston guides using standard tools.

11.1.2 Crank mechanism reassembling

After washing the crankcase, reassemble the power end as follows:

- A) Fit the piston guide seals into their seat thoroughly making sure they are correctly positioned.

- B) Introduce the units piston guide/conrod into their seats (to facilitate the tightening of the conrod cap position the connecting rod so you can easily read the number). To install the crankshaft, without key, it is necessary to push the unit piston guide/conrod backward.



Fig. 10

- C) Before reassembling the side covers, check the seal lips for wear. If they need replacing, fit the new ring following the indications in fig. 11.

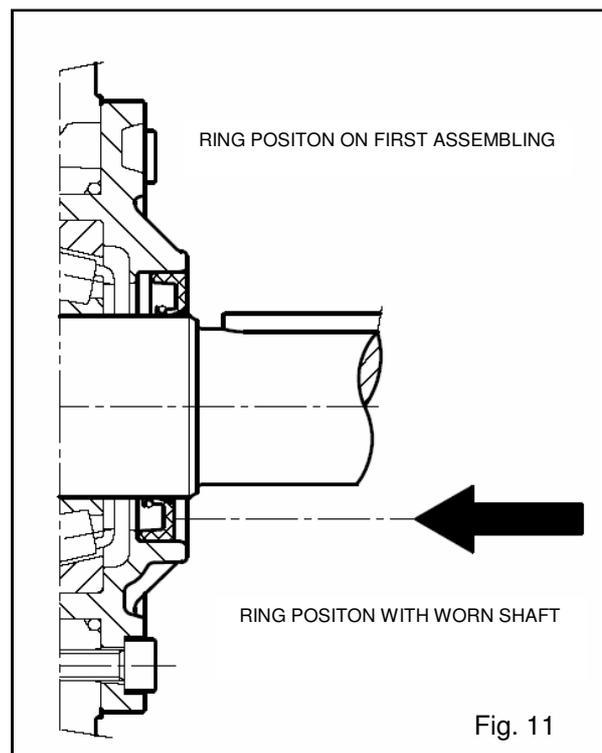


Fig. 11

NB : Should the shaft show diameter wear where there is the seal lip, it is possible to avoid grinding by fitting the seal further as indicated in fig.11. Before installing the cover, (sight glass side) check that the shim rings have been placed. To help the covers fit on the crankcase, you can use 3 screws M6 x 40, and then finish screwing them with the original bolts M16X16.

D) Install the connecting rod cap taking care the numbers match and tighten the relevant bolts in 3 different stages:



1. Approach torque 6-8 Nm
2. Presetting torque 25-28 Nm
3. Tightening torque 38 Nm

N.B. The screws must be greased on the thread and under the head.



Fig. 12



Fig. 13

The rolling couple of the crankshaft (with connecting rods coupled) must not exceed 8 Nm.

Disassembling / Reassembling of the crankshaft with replacement of the bearings

After disassembling the side covers, as indicated on point 11.11.1, remove the outer ring nut of the bearings from their covers and the inner ring nut, together with the remaining part of the bearing, from the 2 shaft ends by means of a standard pin extractor or similar tool. See Fig. 14-15

E) - Fit the back cover putting the dipstick hole upward.

11.1.3 Disassembling / Reassembling of the bearings and shims

The type of bearings (conical roller) ensures there is no end float on the crankshaft ; the shims must be determined to reach that purpose.
To disassemble, reassemble and if required replace them, it is absolutely necessary to do as indicated below.

Disassembling / Reassembling of the crankshaft without replacing the roller bearings

After removing the side covers, as indicated on point 11.1.1, check the rollers and races for wear; if they are in good state, accurately clean the components with suitable degreaser and grease them again evenly with oil (same as the pump oil).

The same shims can be used again taking care to fit them under the sight glass side cover.

After installing the complete unit (glass sight side flange + crankshaft + motor side flange), check that the rolling couple - with **connecting rods free** - is at least 4 Nm, max 6 Nm.

To position the 2 side covers on the crankcase use N°3 screws M6x40 first, and then the original screws to fix them.



Fig. 14



Fig. 15

The new roller bearings can be mounted at room temperature with a press; it is necessary to hold them on the side surface of the ring nuts with suitable rings. The driving operation can be facilitated by heating the parts at a temperature between 120 - 150 degrees C. (250 - 300° F) making sure that the ring nuts are correctly fitted in their seats.

N.B. take care not to invert the components of the 2 bearings (outer ring nut of bearing 1 instead of the one of bearing 2...).

To maintain the right axial load, the shim package has to be calculated again as follows:

- A) Install the crankshaft into the crankcase making sure that the PTO end comes out on the correct side.
- B) Fit the motor side flange on the crankcase with special attention to the seal lip as indicated on point 11.1.2
- C) Position the sight glass side flange using the 3 screws M6x16 until the crankshaft cannot be turned by hand freely.



Fig.16

- D) By means of a thickness gauge (see fig.16) determine the shim set as indicated in the table below
- E) Fit the shims under the sight glass side cover

measure	Shim type	N° pcs.
From: 0,05 a: 0,10		
From: 0,11 a: 0,20	0,1	1
From: 0,21 a: 0,30	0,1	2
From: 0,31 a: 0,35	0,25	1
From: 0,36 a: 0,45	0,35	1
From: 0,46 a: 0,55	0,35 0,10	1 1
From: 0,56 a: 0,60	0,25	2
From: 0,61 a: 0,70	0,35 0,25	1 1

tightening it on the crankcase with the screws, checking that the stall torque is between 4 Nm and 6 Nm.

- F) If the torque is correct, connect the rods to the



Fig.17

crankshaft, otherwise, calculate the shims again as per point "C".

11.2 Fluid end Maintenance

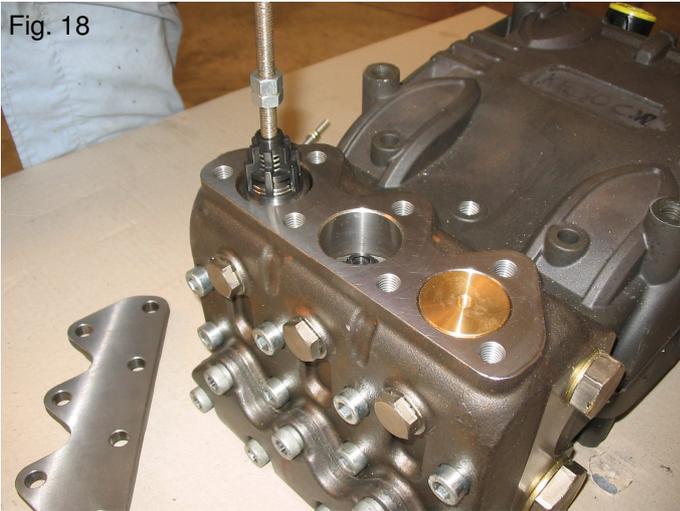
11.2.1 Pump head

The pump head does not require periodical maintenance.

Service operations are limited to the component inspection and/or replacement, when necessary.

Valve units:

Fig. 18



- A) Loosen the valve cover screws.
- B) Extract the valve plugs with an extractor or a M8 threaded rod .
- C) Extract the valve unit with the same tool (see Fig.18).

Valve components of each valve unit are pressed together and therefore they can be easily replaced and installed back in place by means of simple tools.

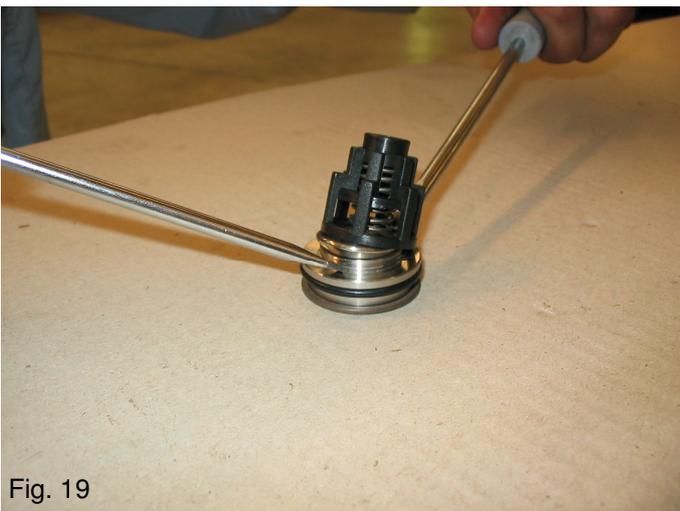


Fig. 19

Check the components for wear and replace if necessary.

Replace all O’Rings of the valve units and valve plugs, at each inspection.

IMPORTANT NOTE:



BEFORE REPOSITIONING THE VALVE UNITS AND O-RINGS CLEAN AND PERFECTLY DRY ALL VALVE HOUSINGS INSIDE THE FLUID END.

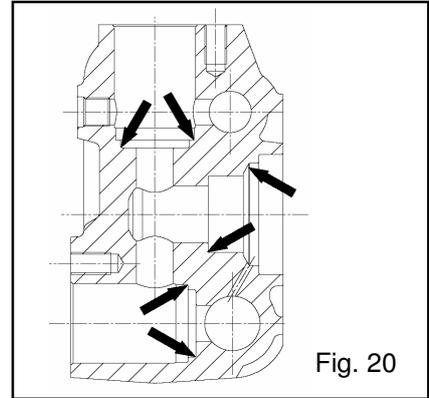


Fig. 20



D) To reassemble the valves proceed the other way round ,and tighten the cover screws with a torque wrench. Table on page 17 contains the screw tightening torque values and fig. 24 indicates the sequence.

11.2.2 Seals

The replacement of the seals is necessary when water drips through the holes provided on the crankcase.

For replacement, do as follows:

- A) Remove the fluid end by loosening the 8 bolts (see Fig.21).

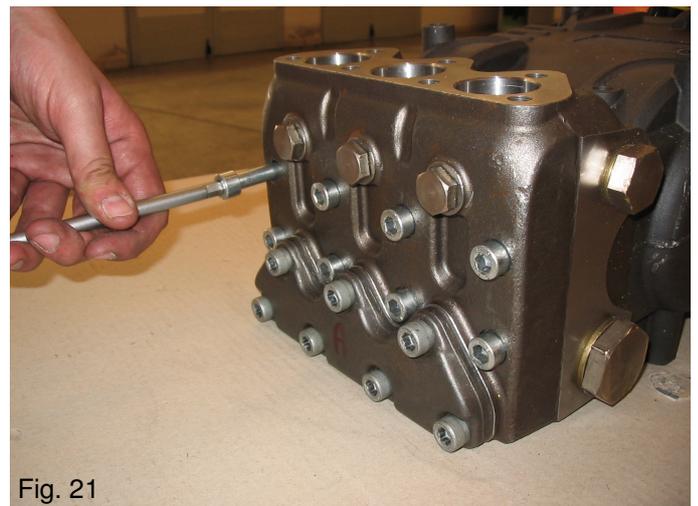


Fig. 21

B) Remove the high pressure packings from the fluid end and the low pressure ones from their support by means of standard tools, taking great care not to damage the seats. Fig. 22



Fig. 22

Take note of the correct order of the entire package components when disassembling (Fig. 23):

- 1. Head ring
- 2. HP packing
- 3. "Restop" ring
- 4. Middle ring
- 5. LP packing
- 6. Back packing
- 7. O-Ring

When reassembling, make sure of the correct order of the components.

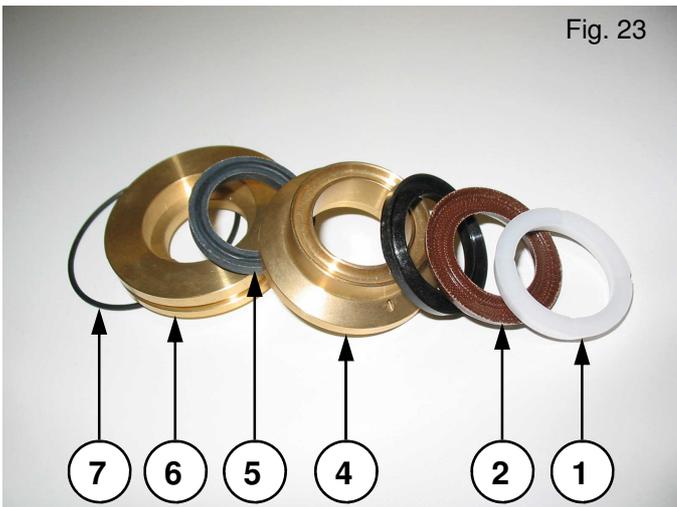


Fig. 23

C) Reassembling :
In order to carry out the replacement more easily, apply a very small quantity of silicone grease on the pressure packing lips and their seats on the fluid end. It is necessary to help the sealing lips settle on the plunger.



D) Fit the fluid end back in place and tighten the bolts with a torque wrench set for the value indicated in the table on page 17 and in the sequence indicated here below.

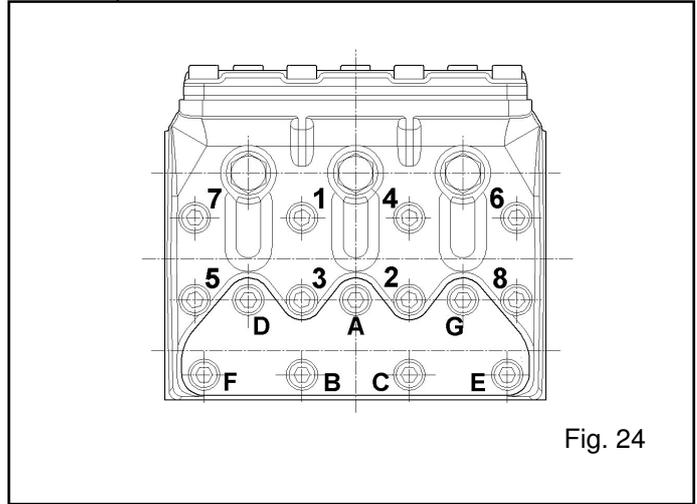


Fig. 24

11.2.3 Plunger

To replace the plunger, if necessary, do as follows:

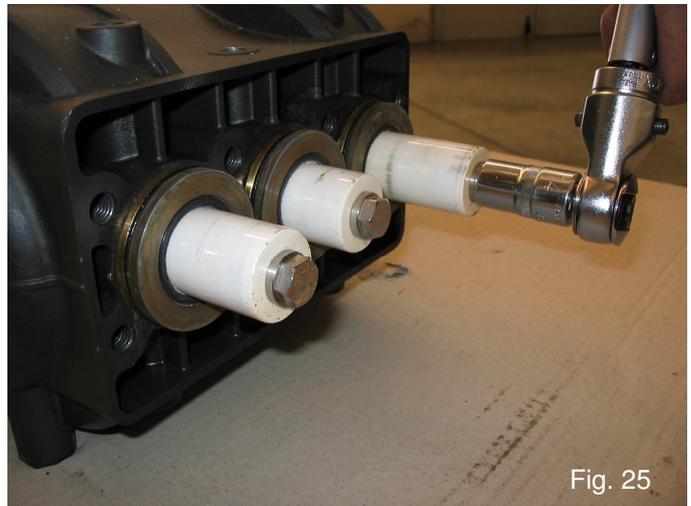


Fig. 25

A) - Loosen and remove the plunger screw 1, Fig.25.

When disassembling the pumping unit, the O-Rings should always be replaced.



B) To fit back the replaced components invert the order using a torque wrench set for the values indicated in the table.

12. SCREW CALIBRATION



The following table contains the screw tightening torque values, to be set by means of a torque wrench only:

Description	position Exploded view	Material class	Torque (Nm)
Valve cover screws	9	8.8	10
Plunger screws	28	8.8	20
Connecting rod screws	16	12 R	38*
Valve plate screws	42	12.9	80**
Fluid end bolts	41	8.8	40***
Suction plug	31	Nk plated brass	100
Delivery plug	29	Nk plated brass	120
Auxiliary plug	55	Nk plated brass	40

* The conrod screws must be tightened as indicated on point D) page 13.

** The valve plate must be tightened following the sequence as indicated on fig. 24.

*** The fluid end screws must be tightened in 2 periods following the sequence indicated by fig. 24.
 1° period = 20 Nm
 2° period = 40 Nm

13. MAINTENANCE TOOLS

Standard tools are required for the pump maintenance but to facilitate the mounting and dismounting operations of some pump components, you will find the drawings to make some tools on page 21 .

14. PUMP STOPPED FOR LONG PERIOD



Before starting the pump up for the very first time after a long period from the date of shipment check for the correct oil level, check the valves as indicated in the chapter 11 and then comply with the starting procedures indicated in the chapter 10. When a long inactivity is scheduled drain the entire suction and delivery line and then run the pump **only for a few seconds**, in order to drain out the water collected inside the fluid end.

15. PRECAUTIONS AGAINST FREEZING



Where and when there is risk of freezing the following precautions should be taken:

- after use drain the entire suction and delivery lines (filter included) by means of discharging devices, provided and positioned on the line specifically for this purpose.
- run the pump **only for a few seconds** to drain the water collected inside the fluid end. Or, when applicable,
- add a recommended amount of anti-freeze into the water tank and run the pump until the anti-freeze works all through the system.



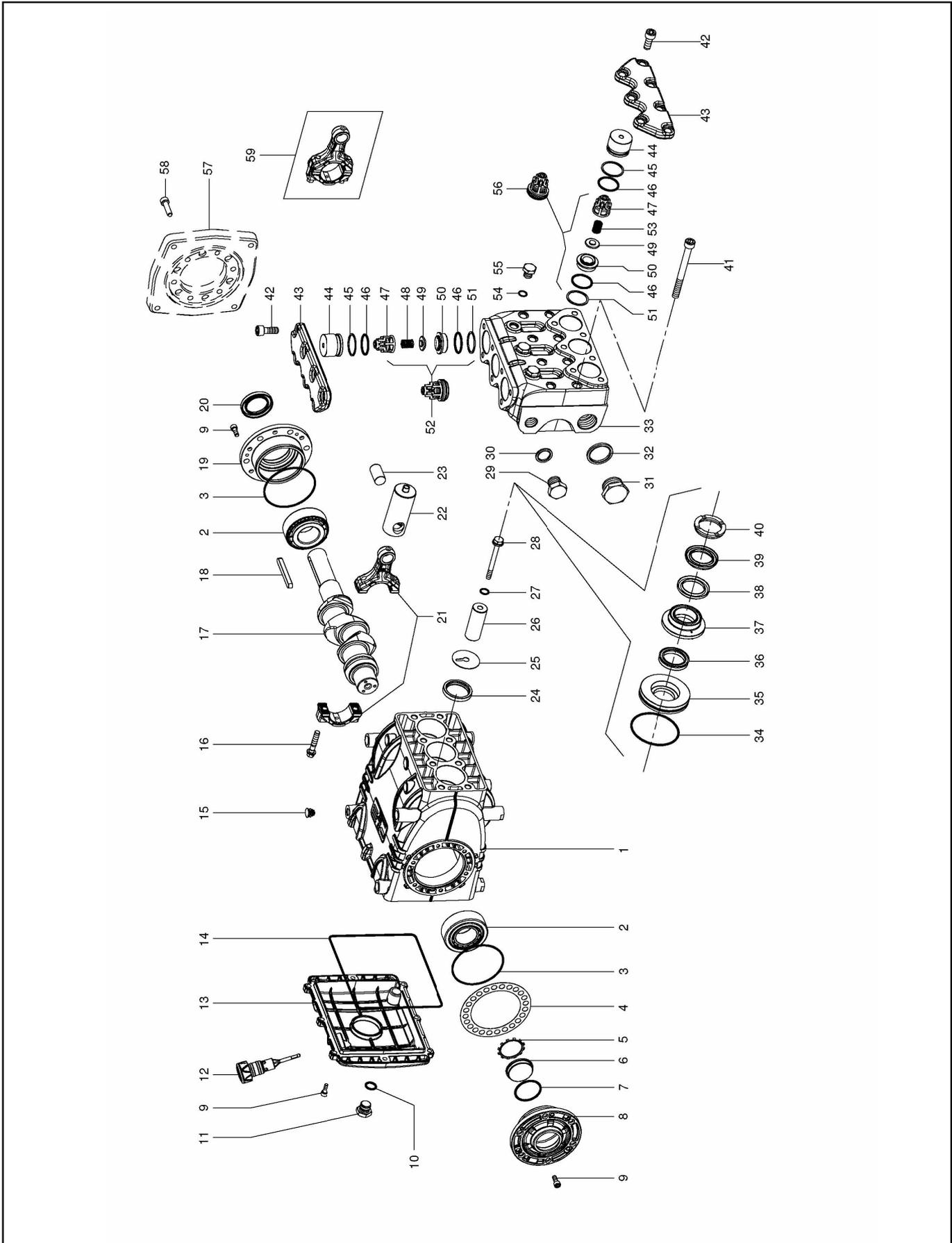
If the pump is frozen or appears frozen ON NO ACCOUNT MUST THE PUMP BE OPERATED until the entire system has been thawed out. The pump might get seriously damaged.

16. WARRANTY TERMS

Pratissoli products are warranted to be free from defects in workmanship and material for 12 months from the date of shipment. This warranty is limited to repairing or replacing parts which Manufacturer's investigation shows were defective at the time of shipment. All products subject to warranty shall be returned, freight prepaid, to Pratissoli Pompe, Division of Interpump group S.P.A. Via F. CAVALLOTTI 33, 42100 Reggio Emilia, ITALY.

The express warranty set forth herein is in lieu of all other warranties, express or implied, including without limitation any warranties of merchantability or fitness for a particular purpose and all such warranties are hereby disclaimed and excluded by the Manufacturer. Repair or replacement of defective products as provided above is the sole and exclusive remedy provided hereunder and the Manufacturer shall not be liable for any further loss, damages or expenses, including incidental or consequential damages, directly or indirectly arising from the sale or use of this product. For items not manufactured by Pratissoli Pompe, the warranty terms applied will be those of the original Manufacturer. The use of other than Pratissoli original spare parts voids the warranty.

17. EXPLODED VIEW AND PART LIST



POS.	CODE CODICE	DESCRIPTION DESCRIZIONE	N. PCS.	POS.	CODE CODICE	DESCRIPTION DESCRIZIONE	N. PCS.
1	70010022	Pump crankcase	1		90268800	Packing D.20 L.P. KIT 2002-2003	3
2	91847700	Roller bearing 33207/Q	2		90271300	Packing D.22 L.P. KIT 2004-2005	3
3	90391500	O-Ring D. 80,6x2,62	2	36	90273700	Packing D.24 L.P. KIT 2006-2007	3
	70220081	Shim 0,1			90275000	Packing D.28 L.P. KIT 2008-2009	3
4	70220381	Shim,25			90276000	Packing D.30 L.P. KIT 2010-2011	3
	70220581	Shim 0,35			70216070	Middle ring D.20 KIT 2003	3
5	90075600	Ring ZJ45	1		70216170	Middle ring D.22 KIT 2005	3
6	70211801	Oil level indicator	1	37	70216270	Middle ring D.24 KIT 2007	3
7	90387700	O-Ring D. 39,34x2,62	1		70216370	Middle ring D.28 KIT 2009	3
8	70150122	Oil level indicator side bearing cover	1		70216470	Middle ring D.30 KIT 2011	3
9	99185400	Screw TCEI M6x16 UNI 5931	20		90270400	Restop ring D.20 KIT 2002-2003	3
10	90383300	O-Ring D. 13,95x2,62	1		90273000	Restop ring D.22 KIT 2004-2005	3
11	98209900	Plug G3/8"	1	38	90274300	Restop ring D.24 KIT 2006-2007	3
12	98211500	Dipstick	1		90275500	Restop ring D.28 KIT 2008-2009	3
13	70160022	Crankcase cover	1		90277400	Restop ring D.30 KIT 2010-2011	3
14	90394400	O-Ring D. 196,52x2,62	1		90270500	Packing D.20 H.P. KIT 2002-2003	3
15	98200500	Plug for D.15 port	7		90272500	Packing D.22 H.P. KIT 2004-2005	3
16	99312300	Connecting rod screw	6	39	90274500	Packing D.24 H.P. KIT 2006-2007	3
17	70020035	Crankshaft	1		90275800	Packing D.28 H.P. KIT 2008-2009	3
18	91490000	Crankshaft key	1		90277000	Packing D.30 H.P. KIT 2010-2011	3
19	70150022	Motor side bearing cover	1		70100051	Front ring D.20 KIT 2003	3
20	90166800	Oil seal 35x52x7 Spec.	1		70100151	Front ring D.22 KIT 2005	3
21	70030043	Connecting rod	3	40	70100251	Front ring D.24 KIT 2007	3
22	70050015	Piston guide	3		70100351	Front ring D.28 KIT 2009	3
23	97742000	Pin D.18x36	3		70100451	Front ring D.30 KIT 2011	3
24	90167700	Seal 36x47x7	3	41	99381600	Screw TCEI M10x110 UNI 5931	8
25	96709900	Wiper	3	42	99367100	Screw TCEI M10x25 UNI 5931 Spec.	14
	70040009	Plunger KE20	3	43	70210036	Valve cover	2
	70040109	Plunger KE22	3	44	70211570	Valve plug	6
26	70040209	Plunger KE24	3	45	90518000	Back up ring D. 32,4x36,5x1,5	6
	70040309	Plunger KE28	3	46	90386500	O-Ring D. 29,82x2,62 KIT 2000-2001	12
	70040409	Plunger KE30	3	47	36204051	Suction/delivery valve guide KIT 2000-2001	6
27	90367100	O-Ring D. 11x2 Spec.	3	48	94740100	Delivery valve spring KIT 2001	3
28	70219566	Plunger bolt	3	49	36203966	Suction/delivery valve plate KIT 2000-2001	6
29	98218200	Plug G1/2"x18	1	50	36203866	Suction/delivery valve seat KIT 2000-2001	6
30	93197200	Washer D.1/2"	1	51	90517800	Back up ring D. 31x35,5x1,5 KIT 2000-2001	6
31	98232600	Plug G1"x17	1	52	36713401	Delivery valve assembly KIT 2001	3
32	93198500	Washer D.1"	1	53	94739700	Suction valve spring KIT 2000	3
	70120036	Manifold D.20	1	54	90358500	O-Ring D. 10,82x1,78	3
33	70120136	Manifold D.22-24	1	55	98204700	Plug G1/4"x13	3
	70120236	Manifold D.28-30	1	56	36713301	Suction valve assembly KIT 2000	3
34	90362600	OR D. 50,52x1,78 KIT 2002-3-4-5-6-7-8-9-10-11	3	57	10067320	Hydraulic motor flange	1
	70080070	Packing retainer D.20 KIT 2003	3	58	99308400	Screw TCEI M8x30 UNI 5931	6
	70080170	Packing retainer D.22 KIT 2005	3	59	70030001	Connecting rod (complete)	3
35	70080270	Packing retainer D.24 KIT 2007	3				
	70080370	Packing retainer D.28 KIT 2009	3				
	70080470	Packing retainer D.30 KIT 2011	3				

18. TROUBLE SHOOTING



THE PUMP DOES NOT PRODUCE ANY NOISE:

- the pump is not primed and is running dry!
- no water in the inlet line.
- the valves are blocked.
- the pressure line is closed and does not allow the air to get out the fluid end.



INSUFFICIENT PUMP PRESSURE :

- the nozzle is (or has become) too large.
- rpm are less than rated.
- leakage from pressure packings.
- excessive amount of water by-passed by the pressure regulating valve or faulty valve operation.
- worn out valves.



THE PUMP KNOCKS:

- air suction.
- insufficient feeding:
 - bends, elbows, fittings along the suction line throttle the amount of water which passes through.
 - too small inlet filter.
 - dirty inlet filter.
 - the feeding pump, where provided, supplies insufficient pressure or flow.
 - the pump is not primed due to insufficient feeding or the delivery line is closed during start up.
 - the pump is not primed because some valves are stuck (I.e. inactivity for long period).
- jammed or worn out valves.
- worn out pressure packings.
- the pressure regulating valve does not work properly.
- clearance in the drive system.
- rpm are higher than rated.



WATER LEAKAGE FROM THE PUMP:

- pressure packings are excessively worn out due to normal wear or excessive cavitation.
- worn out plungers.



OVERHEATED PUMP:

- the direction of rotation is not correct.
- pump is overloaded (pressure or rpm over the rated values).
- the oil level is too low or the oil is not of a suitable type or is too old.
- water in the oil.
- excessive belt tension or incorrect alignment of the joint or of the pulleys.
- excessive inclination of the pump during operation.



THE PUMP DOES NOT DELIVER THE RATED FLOW:

- insufficient feeding (due to the causes listed above).
- rpm are less than rated.
- excessive amount of water by-passed by the pressure regulating valve.
- worn out valves.
- leakage from pressure packings.



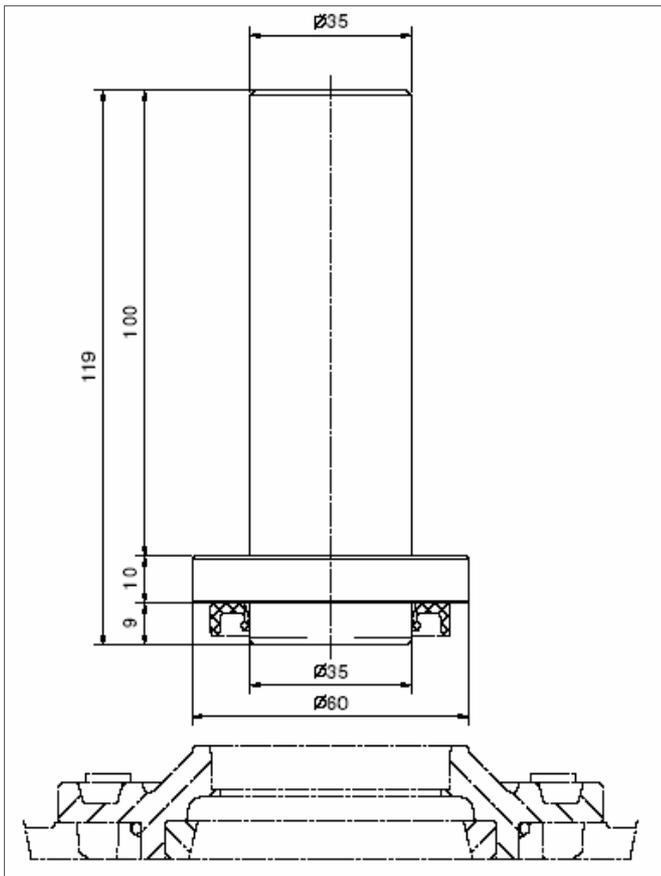
PIPE VIBRATIONS OR KNOCKING:

- air suction.
- the pressure regulating valve does not work properly.
- the by-pass line is undersized.
- jammed up valves.
- drive transmission motion is irregular.

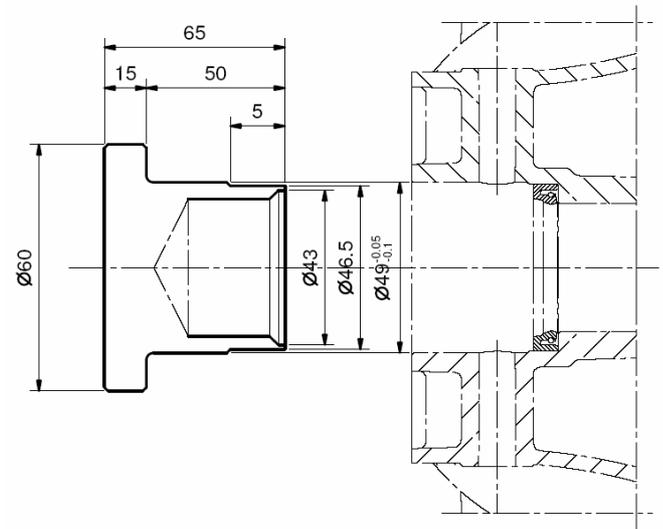
The pump maintenance can be carried out with simple tools for mounting and dismounting the components, but special tools can be made to facilitate these operations.

The drawings here below will help the operator make tools if he wants to.

19.1 . Crankshaft oil seal assembling.



19.2 Piston guide oil seal assembling.



Divisione di **INTERPUMP
GROUP S.p.A.**

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