Pratissoli

LH series

Instruction Manual

INDEX

1. INTRODUCTION

Pratissoli LH high pressure water plunger pumps have been designed for long life industrial duties and provided they are correctly installed and mantained will give long time trouble free operation. Read and understand this manual before using your pump: it contains the necessary information for the correct installation, use and maintenance as well as some practical suggestions for trouble shooting.

When receiving your pump make sure of the good state of the supply and that no items are missing.
Any missing item or damage should be reported before installing and starting the pump.

2. SYMBOLS DESCRIPTION

Warning
Potential danger

Read carefully and understand the manual before operating the pump

Danger
high voltage

Danger
Wear protective mask.

Danger
Wear goggles.

Danger
Wear protective gloves.

Danger
Wear safety boots

3. SAFETY

3.1 General warnings for safe operation

The misuse of an high pressure water unit and the non-observance of the pump installation and maintenance instructions may cause serious damages and/or injuries to people or properties or both.
Any Manufacturer/Operator requested to assemble/use an 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 safety valve should be installed in any delivery line and should be sized to discharge or by-pass the entire pump 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 an 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 on the risks arising from failures, misuse and any unforaseeable 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 wirings, 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 hose should not show apparent external wear and the fittings at both ends should be free from signs of erosion or corrosion.
5. make sure that all fluids (lubricating oil for pump and engine, cooling water, hydraulic fluids) are at proper level and in good condition.
6. make sure the safety guards are in good conditions.

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 operation.

1. the Operator should take reasonable care of the safety of himself and of other persons who may be affected by his acts or omission at work. His actions should be always governed by his good sense and responsability.
2. The Operator should wear suitable waterproof protective clothings, 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, waterproof garment providing full cover to the Operator, including his arms.
   As most of water jets produce noise levels in excess of 90 dB(A) suitable ear protection is advised.

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 operation.

3. in most jetting operations it is an accepted practise 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. While the first Operator holds the gun, the second Operator attends the pump unit, keeping close watch on the first Operator for signs of difficulties or fatigues, and watching the sorrounding area for intrusion by other persons or unsafe situations. If required, he will shut off the pressure until it is safe to continue.
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 workpiece, even during preliminar 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 occuring 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 workpiece and the lance or gun securely held.

3.5 Safety of maintenance.

Apart from the working pressure regulation no attempt should be made to adjust any nut, hose, fitting, ect, while that part of the system is under pressure. The pump should be stopped and any pressure in the line released prior to make any adjustment.

1. the high pressure water unit should be mantained in accordance with the Manufacturer's instructions.
2. the 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. pump model and version.
3. serial number.
4. max r.p.m.
5. max operating pressure (bar).
6. oil capacity (ltr.) and oil specification.
7. gear box ratio
8. max flow rate (l/min).

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 any change should be mentioned on the rating plate for future reference.

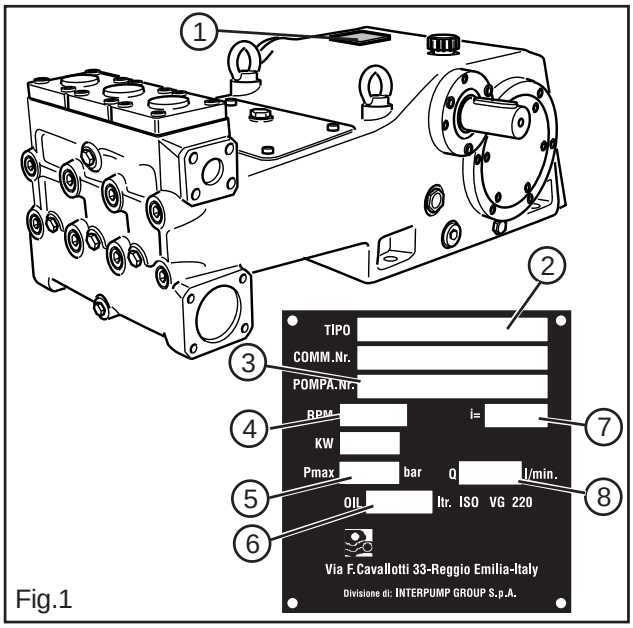


Fig.1

5. TECHNICAL FEATURES

Model	Flow rate	Gear box A 1900 rpm R=1:3,389	Gear box B 1750 rpm R=1:3,158	Gear box C 1500 rpm R=1:2,95	Pressure		Power	Power A 1900 rpm	Power B 1750 rpm	Power C 1500 rpm
LH 40	l/m	190	188	172	bar	300	HP	148	147	135
	gpm	50	49,7	45,4	psi	4350	kW	109	108	95
LH 45	l/m	240	238	218	bar	240	HP	150	149	137
	gpm	63	62,9	57,6	psi	3500	kW	110	109	101
LH 50	l/m	296	293	269	bar	200	HP	154	153	141
	gpm	78	77,4	71,1	psi	2900	kW	113	112	104
LH 55	l/m	358	355	326	bar	160	HP	148	148	136
	gpm	94	93,8	86,1	psi	2300	kW	109	109	100
LH 60	l/m	428	423	388	bar	140	HP	155	154	142
	gpm	113	112	102	psi	2050	kW	114	113	105

Crankshaft speed: A= 560 rpm B= 554rpm C= 508 rpm

6. DIMENSIONS AND WEIGHT

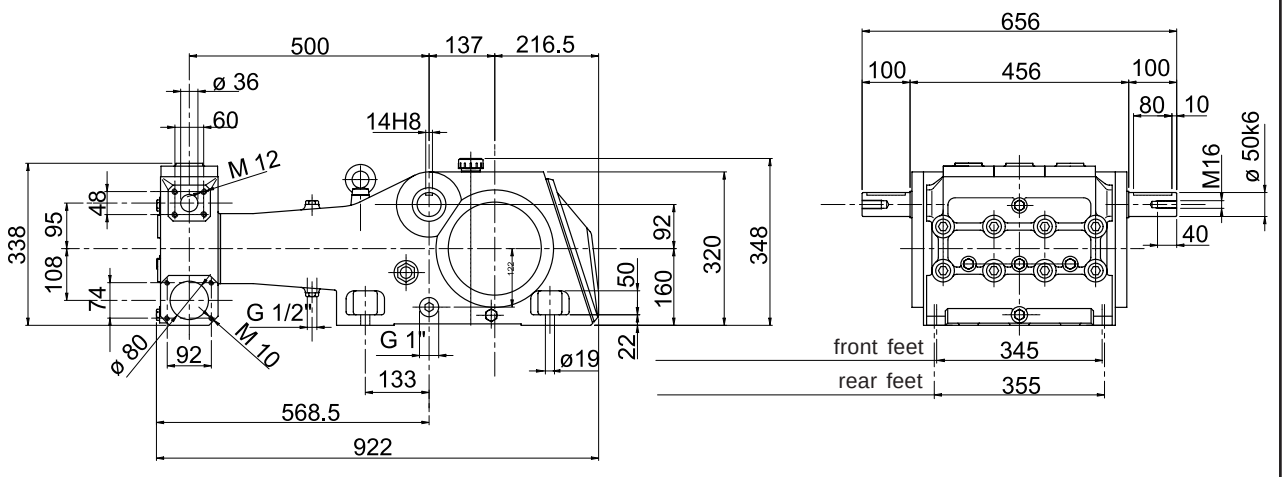


Fig.2

Weight: 365 Kg

7. GENERAL INFORMATION ABOUT THE PUMP USE

The LH pump has been designed to pump fresh and filtered water at room temperature. LHZ and LHN special stainless steel versions are also available for critical fluids.

7.1 Water temperature

Water temperature is critical for the pump life, the higher it is, the more likely it is to create cavitation, resulting in premature seals and valves failures.

Here below the temperature chart and relevant limitations:

< 40°C	Water is considered to be at room temperature.
from 40°C to 60°C	feed the plunger pump with a centrifugal pump supplying at least twice the plunger pump volume at 2 to 3 bar (30 to 45 psi). reduce pump rated rpm by 30% to 50%. make sure the crankshaft turns as indicated by the arrows located near the drive shaft projection (see Fig.5)
> 60°C	standard pump not suitable, contact our Tech. Dept. for special version.

7.2 Max flow and pressure ratings

The performance data indicated in the catalogue and in 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.

7.3 Lowest operating rpm

The lowest operating speed **of the crankshaft** for all LH's (all versions) is 350 rpm.

8. CONNECTIONS AND PLUGS

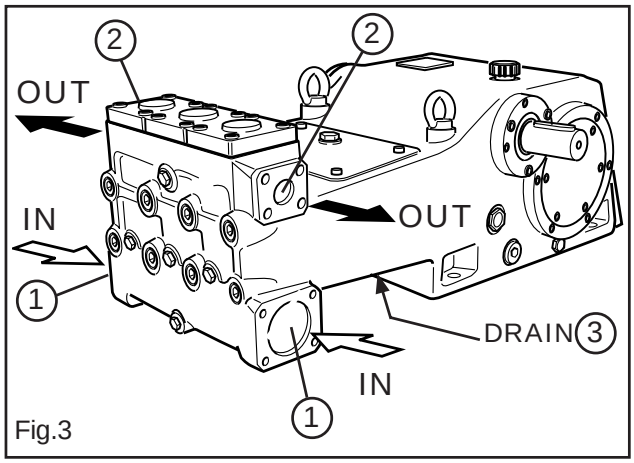


Fig.3

LH pumps are provided with (Fig.3):

1 - N°2 inlet ports IN Ø 80 mm.
Suction line connection to any of the two inlet ports is acceptable, the port not being used should be sealed with the correct plug.

2 - N°2 outlet ports Ø 36 mm.

3 - N°1 hole DRAIN provided underneath the crankcase and designed to drain out the water leakage of the pressure packings. **This hole must always be left open (see par. 10.3 Fig.7 page 9).**

9. PUMP INSTALLATION

9.1 Positioning

The pump should be installed flat on a rigid base by means of the four feet Ø 19 mm.

The base should be rigid enough to avoid any misalignment of flexing of the pump/transmission coupling axis due to the torque involved during operation.

On no account should the pump be installed in such a way its fluid end rests on the base where the pump is mounted. The fluid end should be left free and not subjected to any force (Fig.4).

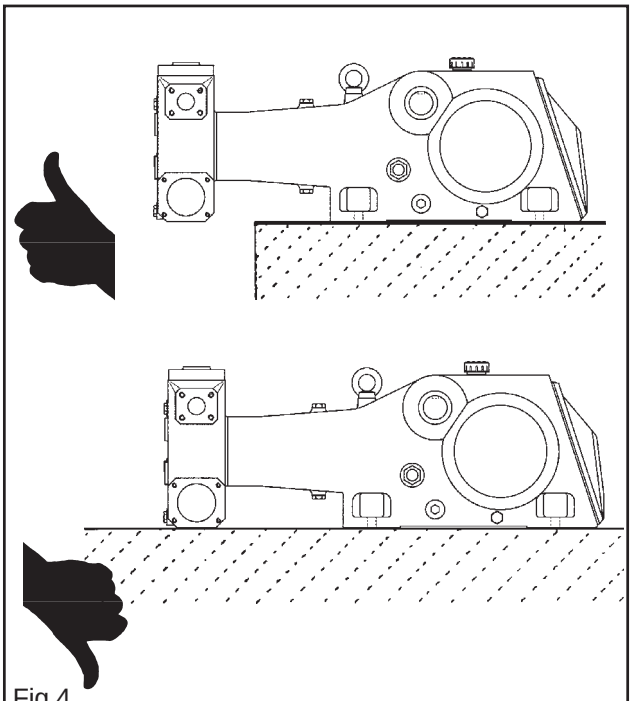


Fig.4

9.2 Direction of rotation

The fig. 5 shows the correct direction of rotation looking at the pump from the fluid end side. Two arrows stamped on the crankcase nearby the crankshaft provide the information as well.

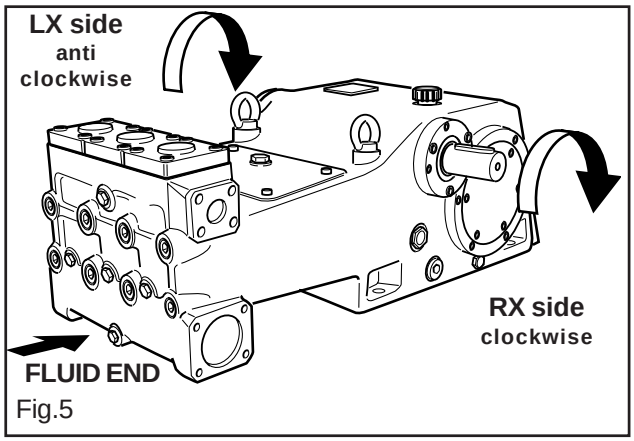


Fig.5

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 lines at least for the first length. The flexible suction hose must be rigid enough to prevent it from collapsing during the suction stroke, when a partial vacuum may occur.

9.4 Suction line

Plunger pumps are not self priming therefore a positive suction head should always be provided.

Information for the correct suction line:

1. Internal diameter should be at least 80 mm. in any point, possibly larger, depending of the drop in pressure due to the length and shape of the line.
2. 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. should be perfectly airtight.
4. should be completely free from 90° elbows, diameter reductions, counter slopes, “T” connections and should not be connected to other pipelines.
5. should be positioned in such a way to prevent the pipe emptying after the pump stops.
6. do not use high pressure flexible hoses for the suction line.
7. do not use high pressure hydraulic fittings like 90° elbows, high pressure adaptors, high pressure 3 or 4 ways nipples and so on.
8. do not install any kind of detergent injetor along the suction line.
9. do not install standing valves, check valves or other kind of one-way valves.
10. make sure that the feed tank capacity 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.
11. do not connect the by-pass line from the valve directly to the pump suction line.
12. the water flow from the valve should be directed back in the tank. Make sure that the by-pass and tank feeding flows do 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.
13. before connecting the suction line to the pump inlet port make sure the pipe is perfectly clean inside.

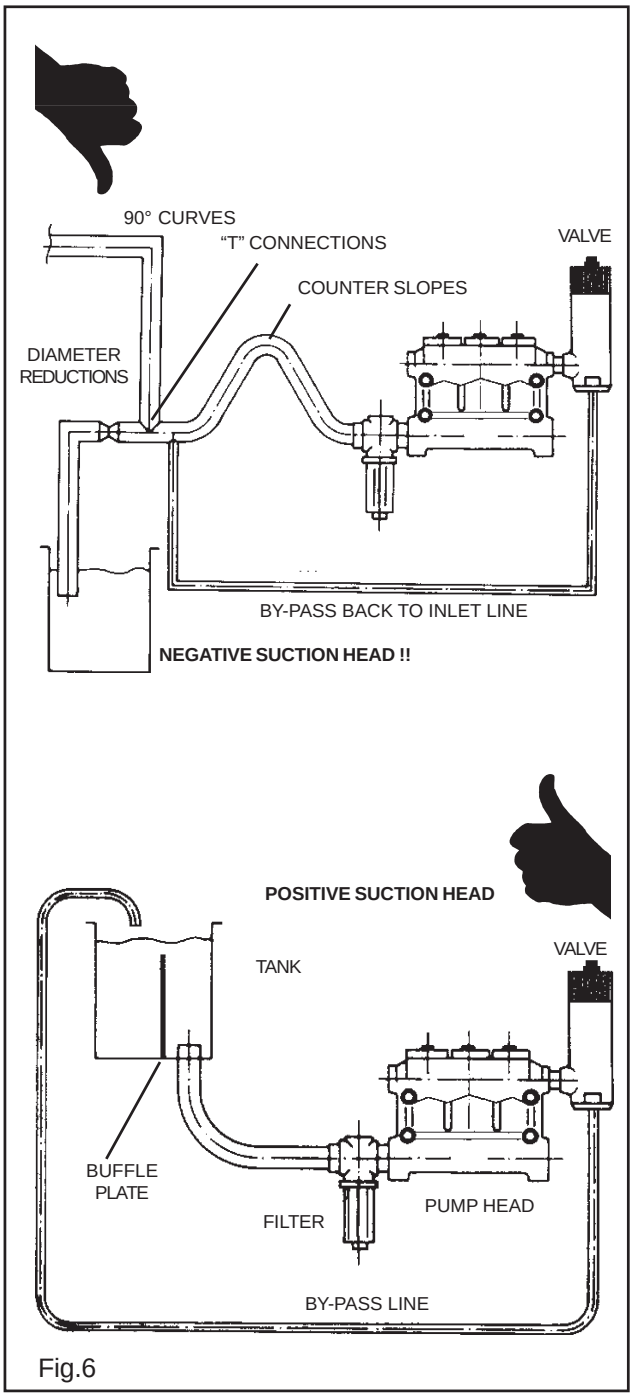


Fig.6

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 should be at least three times the rated pump volume.
2. filter port diameters should 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.**

9.6 Delivery line

For a correct delivery line comply with the following instructions:

1. the first length of delivery hose should 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 conditions.
3. a suitable relief valve should be installed in the delivery line.
4. use glycerin filled pressure gauges, being 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 in the pressure line.

10. START UP AND RUNNING PROCEDURES

10.1 Before start up

Before start up make sure that the following conditions have been complied with:

1. suction line should be connected: **the pump must never run dry.**
2. suction line must be perfectly air-tight.
3. any ON-OFF valve in between pump and water source should 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 line connections are fully tightened.
6. Joint alignment, belt tightening and PTO shaft inclination tolerances should remain within the values indicated by the trasmission Manufacturer.
7. make sure of the correct oil level.

Note: in case the pump has not run for a long period check the suction and delivery valves for scaling (see par.11.2).

10.2 Starting up

1. pump and motor/engine should start offload, set the regulating valve to zero or set the pressure line in dump mode by means of proper dumping devices.

2. when starting the pump up for the first time or after every wiring re-connection check for the proper direction of rotation.

3. check that the rotating speed does not exceed the rated value.

4. before putting the pump under pressure let it run for some time until the oil flows freely.

5. before stopping the pump release the pressure from the system 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 cetrifugal pump, make sure that the plunger pump starts only when the correct inlet pressure is provided.

10.3 Water leakage

During operation a small amount of water (a few drops a minute) is released from the pump fluid end; this leakage is designed to provide lubrication of the pressure packings. The leakage is drained out of the pump through a hole in the lower cover (Fig.7).
This hole must always be left open.

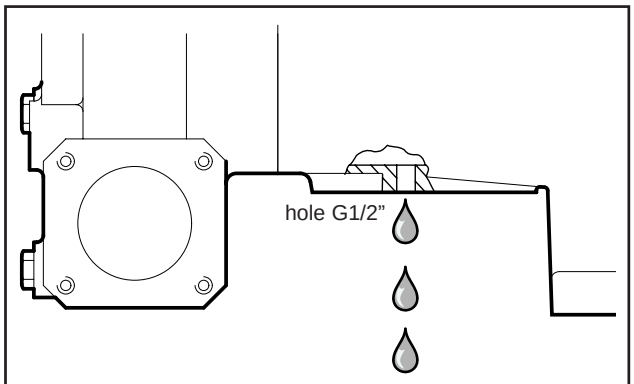


Fig.7

11. MAINTENANCE INSTRUCTIONS

11.1 Crank mechanism maintenance.

Check oil level through the oil level indicator (1, Fig.8) at least on a weekly basis.

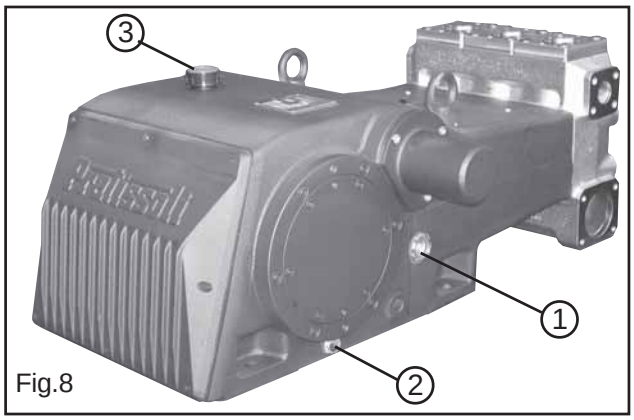


Fig.8

If necessary, top up from the oil plug 3, Fig.8.
Check the oil when cold and change the oil when still hot (pump still at working temperature).
In order to drain the oil from the pump remove the magnetic plug 2, Fig.8.
At every oil change clean the magnetic plug 2 Fig.8 and check the lower cover of Fig.7 for sediments or deposits.

OIL CHANGES	hours	Q.ty Lt.	Oil type
1° change	50	14	ISO 220
further changes	500		

Oil should be changed at least once a year.

Recommended oils:

BRAND	TYPE
AGIP	ACER 220
ARAL	MOTANOL HP 220
AVIA	AVILUB RSL 220
BP	ENERGOL HL 220
CASTROL	ALPHA ZN 220
ESSO	NUTO 220
FINA	SOLNA 220
IP	HYDRUS 220
MOBIL	DTE OIL BB
SHELL	TELLUS C 220
TEXACO	REGOL OIL 220
TOTAL	CORTIS 220

11.2 Fluid end maintenance

The fluid end does not require periodical maintenance. Service operations are limited to the valves inspection and/or replacement, when necessary.
In order to remove the valves:

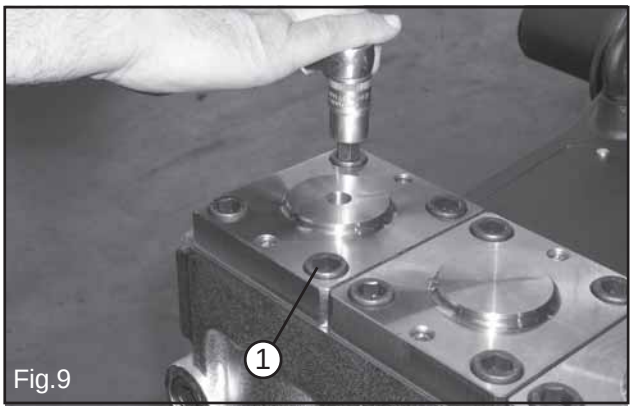


Fig.9

Loose and remove the valve cover screws 1,Fig.9.

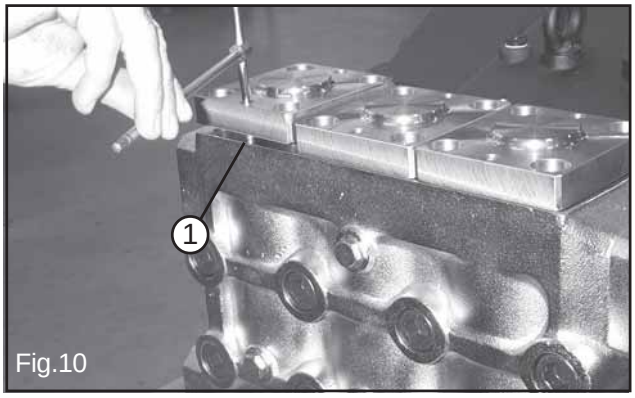
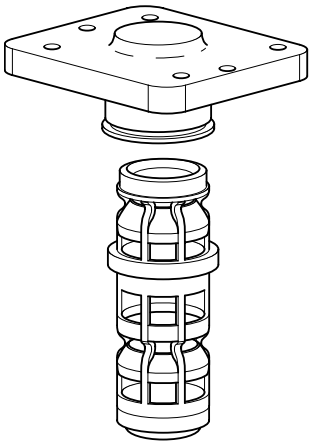


Fig.10

Tighten the two grub screws 1, Fig.10 of each valve cover till the complete valve unit moves upwards enough to allow easy extraction.



Valve components of each valve unit are screwed together in one single block and therefore they can be easily serviced, replaced and installed back in place. Separating the various components of the valve unit is carried out by means of simple tools as shown in Fig. 11, 12, 13 of the next page.

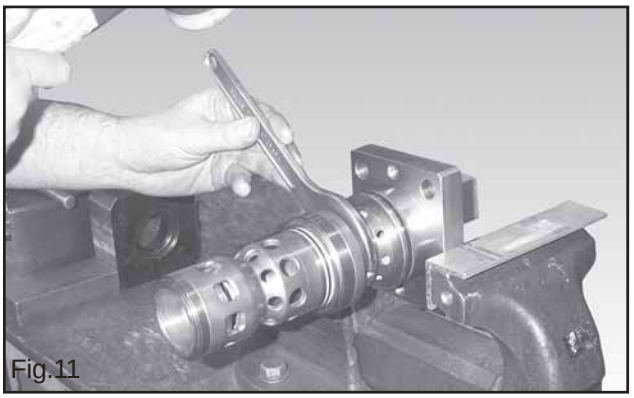


Fig.11

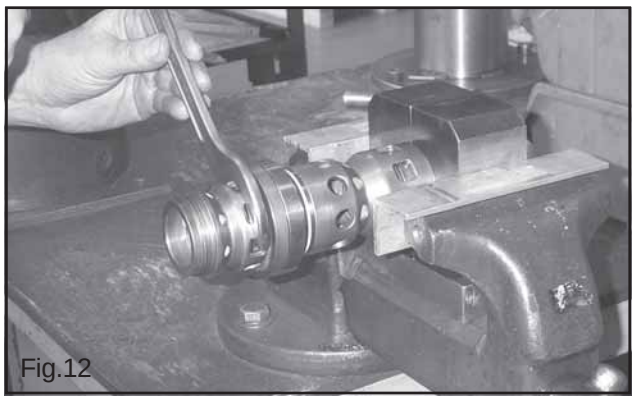


Fig.12

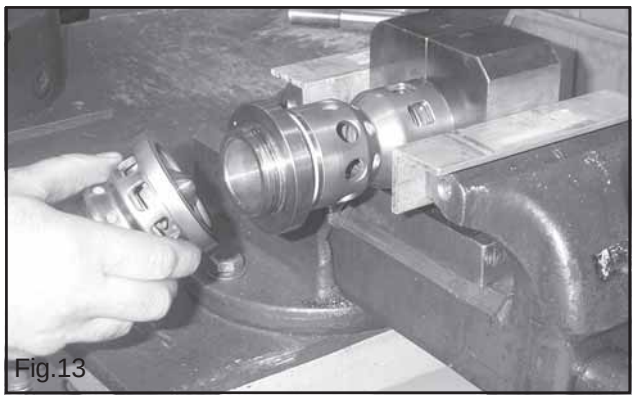


Fig.13

Check the valve components for wear and replace where necessary.
Every time valves are inspected all O'rings of the valve units and valve covers should be replaced.

Reassemble the valves units and fit them back in the fluid end.Valve cover screws should be tightened with a torque wrench set for 12 kgm.

IMPORTANT:
BEFORE REPOSITIONING THE VALVE UNITS CLEAN AND PERFECTLY DRY ALL VALVE HOUSINGS INSIDE THE FLUID END (SEE ARROWS).

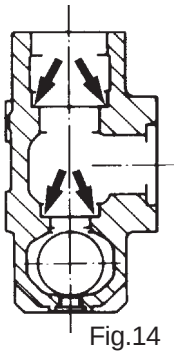


Fig.14

Should excessive scaling inside the fluid end hinder the valve extraction open one of the two lateral inlet port, remove the three plugs 1, Fig.15, insert our special tool p/n 2000.3009.0 (2, Fig.15), or a corresponding one, and push the valve unit out as shown in Fig.15.

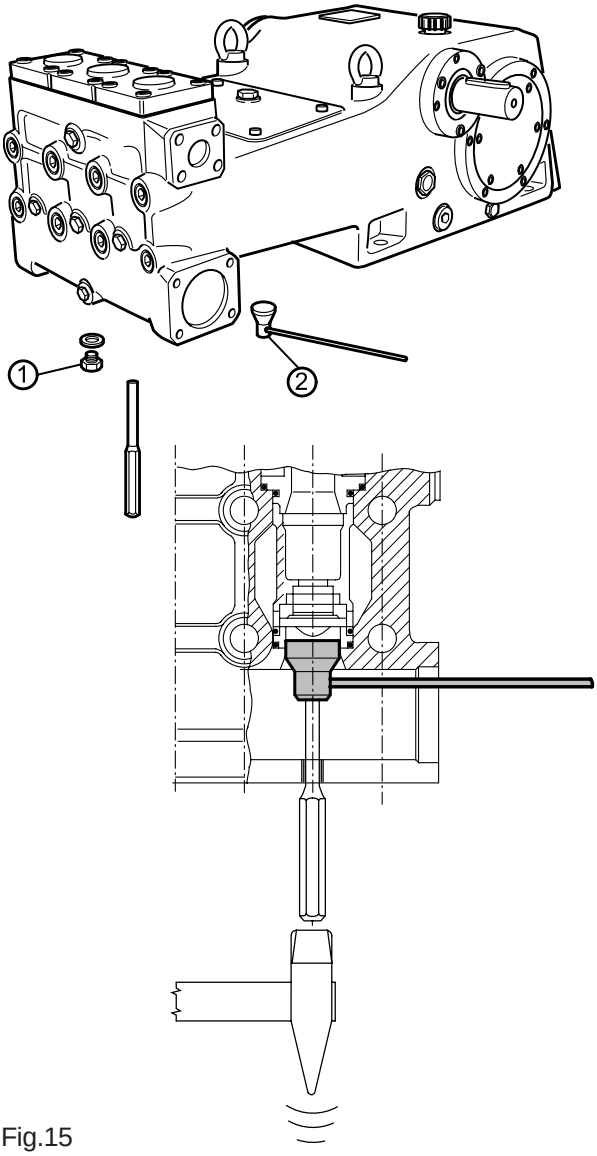


Fig.15

11.3 Pumping unit maintenance.

The only maintenance operation required for the pumping unit is the periodical check of the amount of water drained out by the pump through the hole provided in the lower cover (Fig.7, page 9). It clearly shows the pressure packing state of wear; replace them if water dripping becomes continuous and not intermittent.

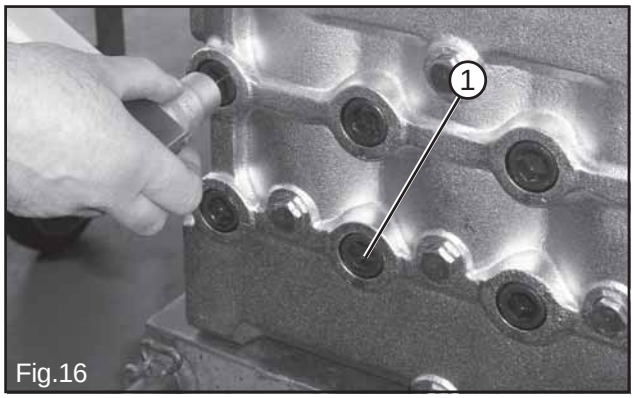


Fig.16

For inspecting the pumping unit remove the head by loosening the eight head screws (1, Fig. 16).

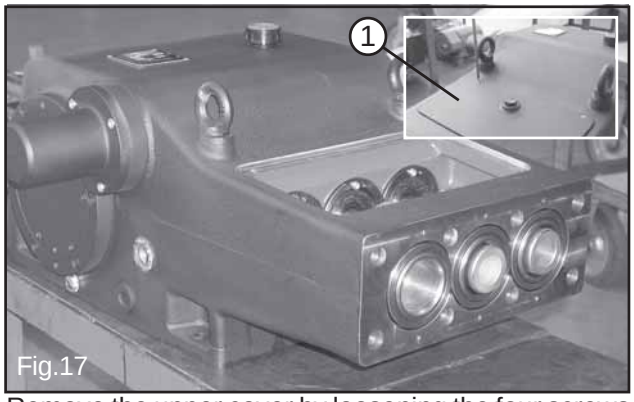


Fig.17

Remove the upper cover by loosening the four screws (1, Fig.17).

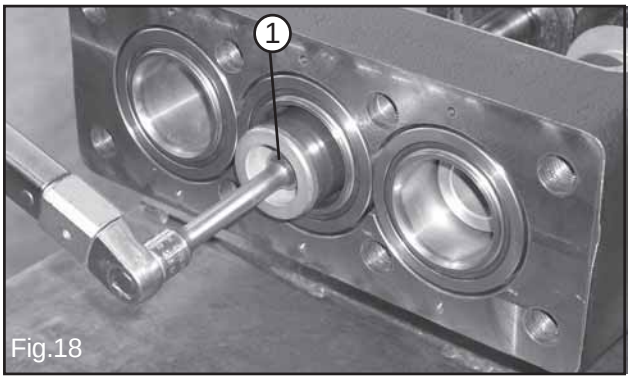


Fig.18

Loose and remove the plungers screws (1, Fig.18).

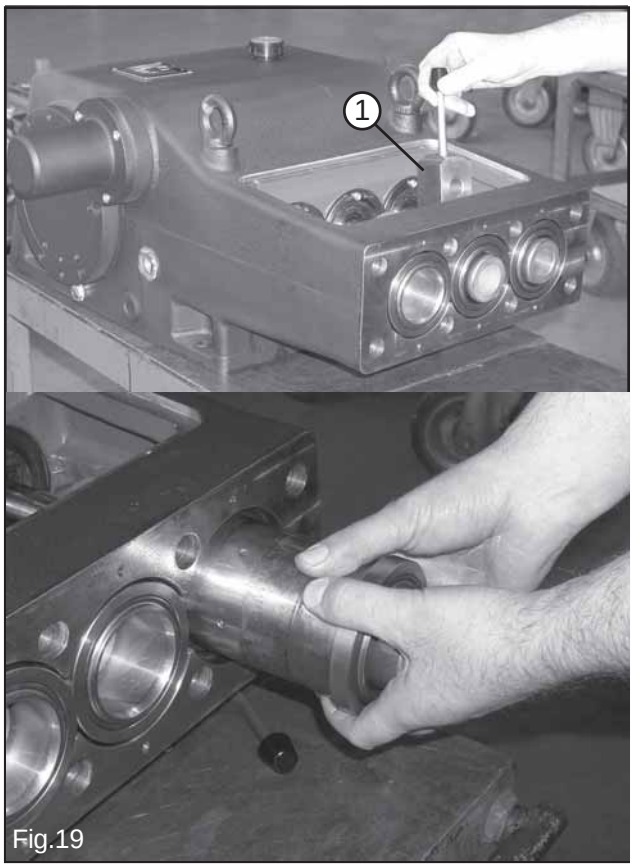


Fig.19

Push the plungers forward by rotating the crankshaft, then introduce our tool p/n 2000.3006.0 (or equivalent) (1, Fig.19) in between the piston guide and the cylinder. With the tool in place, rotate the crankshaft until the cylinder is pushed out together with the plungers. (Fig.19).

Repeat the operation for each pumping unit.

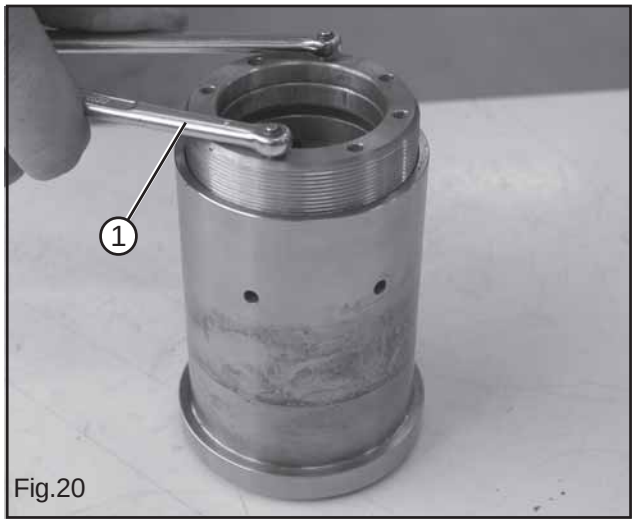


Fig.20

Disassemble the packing support from the cylinder by means of a pin key (1,Fig.20).

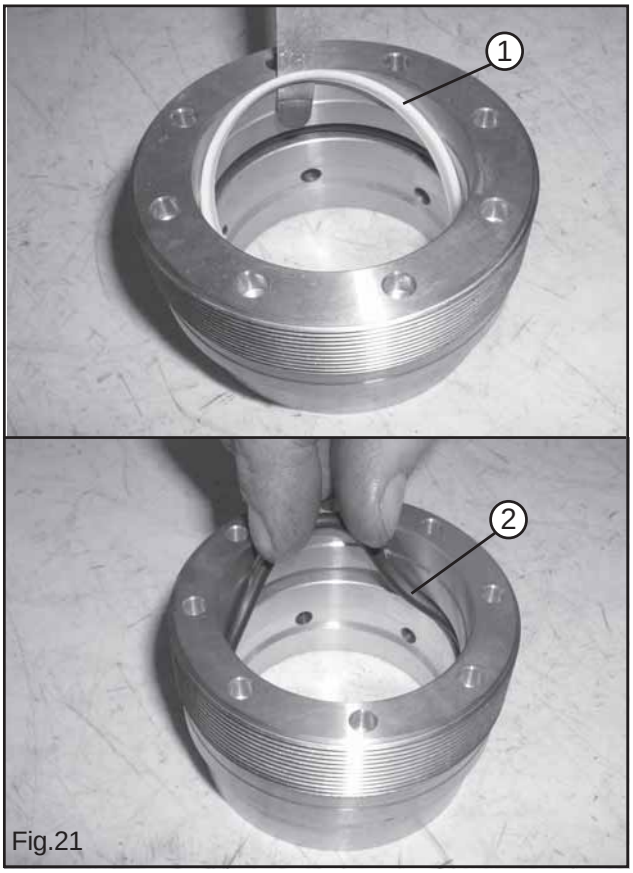


Fig.21

Remove scraper (1, Fig.21) and O'ring (2, Fig.22) from the packing support.

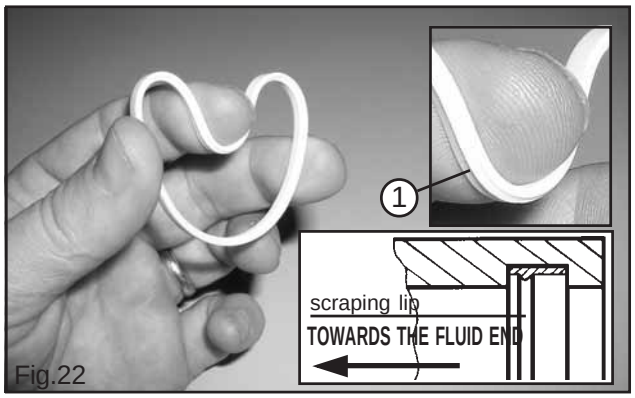


Fig.22

In order to fit the new scraper in place shape it manually as shown in Fig.22.
VERY IMPORTANT! the scraper is provided with an internal lip which performs the correct scraping effect only if oriented towards the fluid end. See window inside Fig.22.

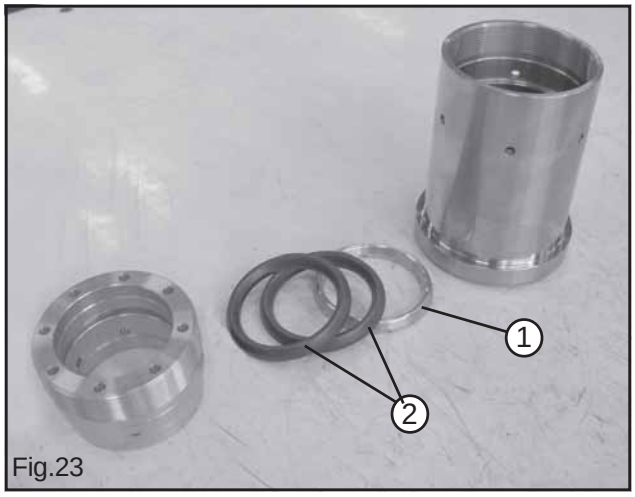


Fig.23

Before re-assembling the pumping unit carefully clean the pressure packing seat in the cylinders, fit in place the packing ring (1, Fig.23) and then the pressure packings (2, Fig.19). A little bit of grease helps sliding the packings into the packing support.
Pressure packings and O'rings should always be replaced at every disassembling of the pumping unit.

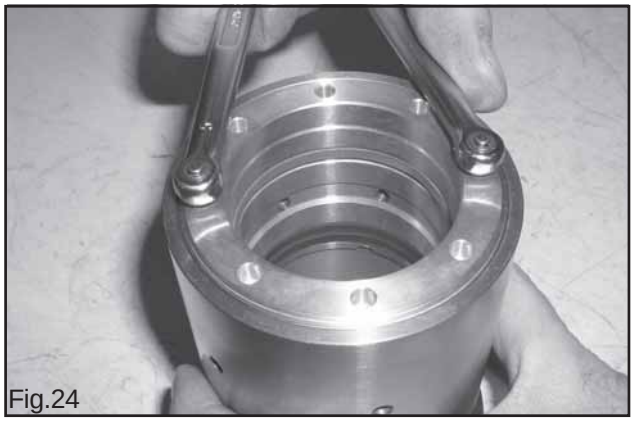


Fig.24

Set up the complete package without tightening the packing support (1, Fig.24) but making sure that the pressure packings snap in place.

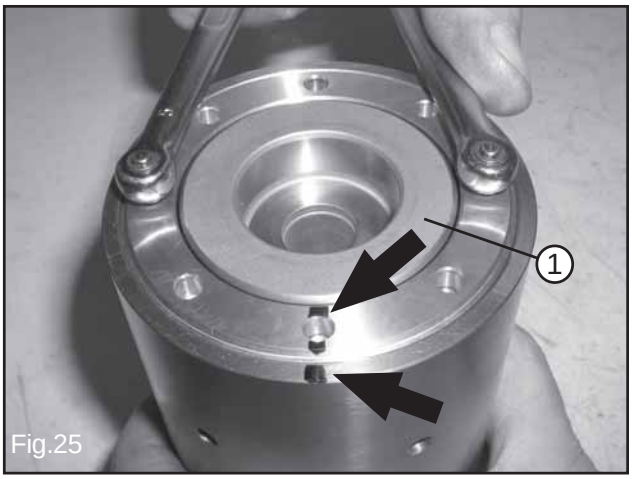


Fig.25


Fig.26

For the correct load of the pressure packings proceed as follows:

- Fit the plunger in the pumping unit (1, Fig.25).
- Mark the position of anyone of the 8 holes of the packing support referring at the cylinder (see arrows Fig.25).
- Tighten the packing support of 1/8 of a complete turn (45° degrees) or of the distance of one hole (see arrows Fig.26).

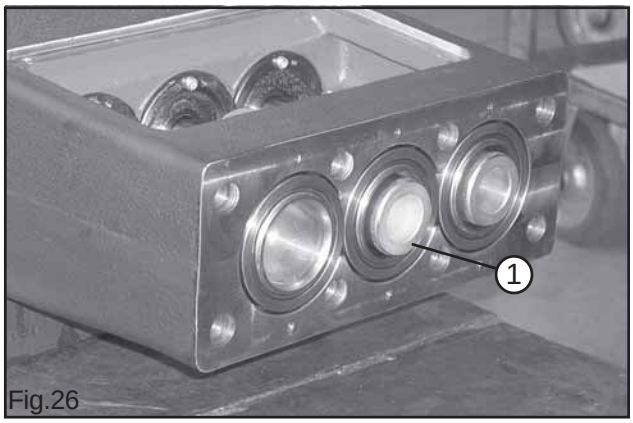


Fig.26

Fit the pumping units back in the pump cranckcase (1, Fig.26).

Tighten the plunger screws with a torque wrench set for 10 Kgm.
Mount the head back in place and tighten the eight head screws with a torque wrench set for 36 kgm.

12. SCREW CALIBRATION

Screw calibration is to be carried out by means of a torque wrench only:

DESCRIPTION	Kgm.
valve cover screws	12
head screws	36
plunger screws	10
connecting rod screws	7,5

13. MAINTENANCE TOOLS

The following tools are designed to facilitate mounting and dismounting operations of some pump components:

for disassembling:

- packing support extractor cod. 2000.3006.0

- valve extractor cod. 2000.3009.0

14. PUMP STOPPED FOR LONG TIME

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 dry **only for a few seconds** in order to drain out the water collected inside the fluid end.

15. PRECAUTIONS AGAINST FREEZING

In the 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 specifically for this purpose along the lowest point of the lines.
- run the pump **only for a few seconds** in order 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.

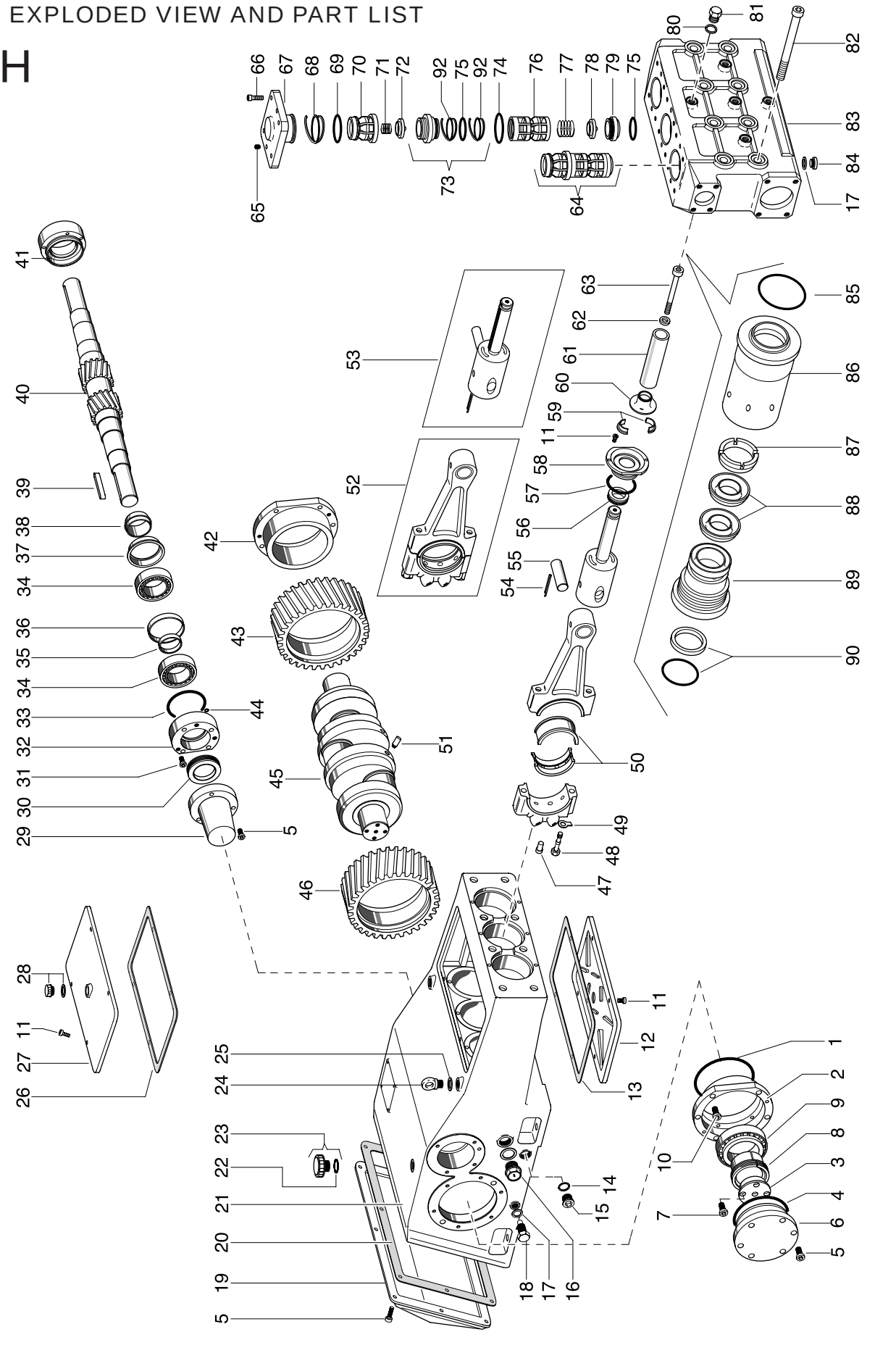
If a pump is frozen or appears frozen ON NO ACCOUNT SHOULD THE PUMP BE OPERATED until the entire system has been thawed out.

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 products which Manufacturer's investigation shows were defective at the time of shipment. All products subject to this warranty shall be returned free of any freight charges to Pratissoli Pompe division of Interpump Group S.p.a., via Felice 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 of 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 automatically voids the warranty.

17. EXPLODED VIEW AND PART LIST

LH

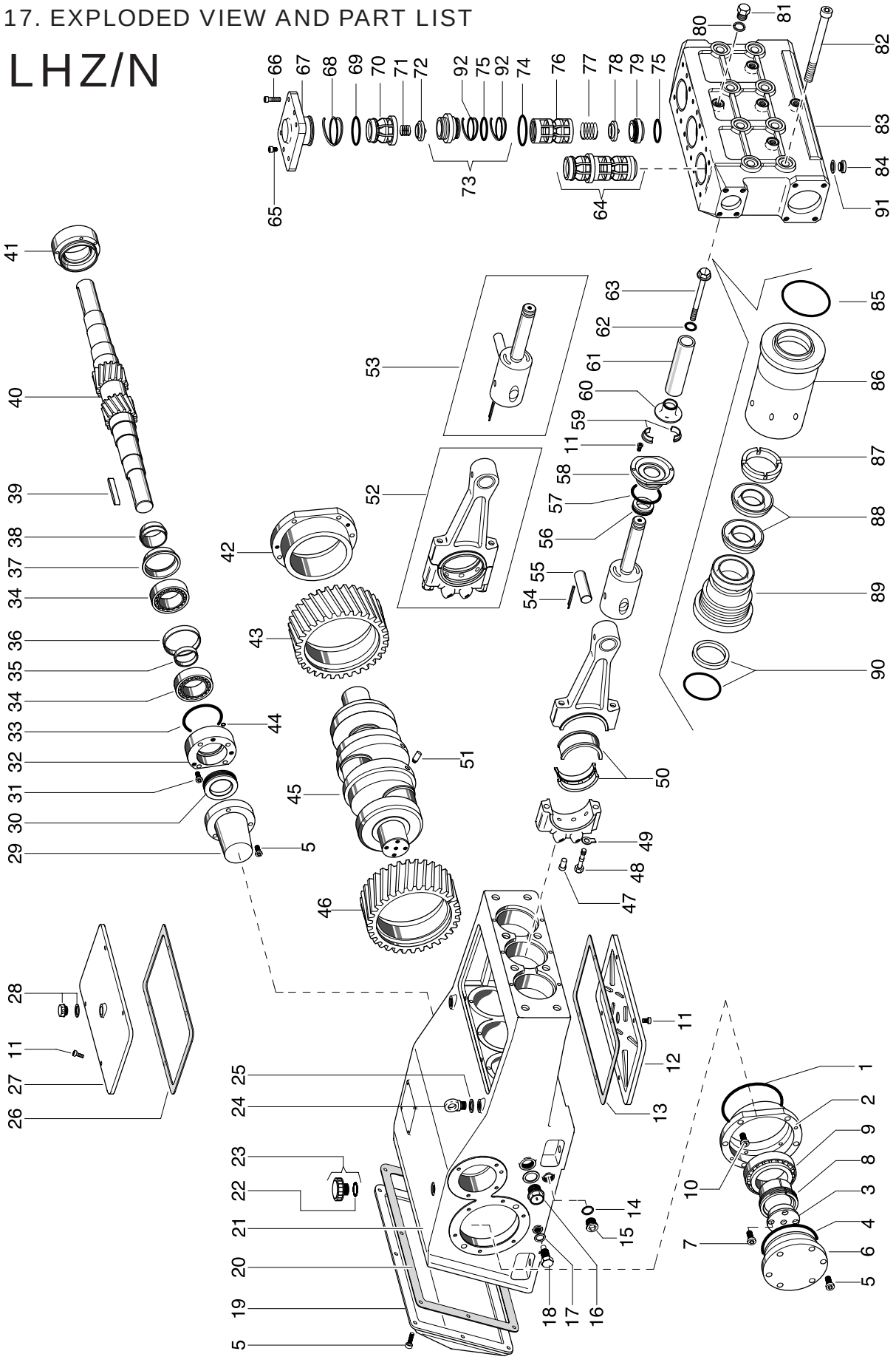


OS	CODE	KIT	DESCRIPTION	Qt.
1	8810.1013.3	C	OR Ø 183,82 x 2,62	2
2	0101.0007.0		Left bearing support	1
3	0300.0001.0		Bearing bush retainer flange	2
4	8810.1013.2	C	OR Ø 152,07 x 2,62	2
5	8711.2115.2		Screw TCEI M8 x 20	23
6	0634.0028.0		Bearing cover	2
7	8711.3110.2		Screw TCEI M12 x 25	8
8	0300.0002.0		Bearing bush	2
9	8111.1101.7		Bearing 22218 CCK	2
10	8711.2515.4		Screw TCEI M10 x 30	12
11	8711.1515.2		Screw TCEI M6 x 14	14
12	0404.0005.0		Lower cover	1
13	0806.0003.0	C	Lower cover gasket	1
14	8720.4300.8		Aluminium washer Ø 1"	2
15	8212.0300.6		Plug G 1"	2
16	8010.5301.2		Oil level indicator G 1"	2
17	8720.4300.2	BC	Aluminium washer Ø 1/2"	5
18	8010.5700.2		Magnetic plug G 1/2"	2
19	0634.0024.0		Back cover	1
20	0806.0001.0	C	Back cover gasket	1
21	0601.0016.0		Pump body	1
22	8810.1011.6	C	OR Ø 29,82 x 2,62	1
23	8010.5402.7		Oil filling plug G 1"	1
24	8720.2600.3		Eyebolt M16	2
25	0300.0003.0		Eyebolt spacer	2-4
26	0806.0002.0	C	Upper cover gasket	1
27	0404.0003.0		Upper cover	1
28	8010.5600.2		Venting plug G 1/2"	1
29	0404.0007.0		Crankshaft end cap	1
30	8810.8002.6	C	Oil seal Ø 55 x 75 x 10	2
31	8711.2115.4		Screw TCEI M8 x 30	8
32	0634.0030.0		Left bearing cover	1
33	8810.1013.0	C	OR Ø 94,92 x 2,62	2
34	8111.0101.9		Bearing NJ 2211	4
35	0310.0002.0		Internal bearing spacer	2
36	0310.0001.0		External bearing spacer	2
37	0610.0000.0		Lubricating bush	2
38	0314.0000.0		Lubricating cone	2
39	8720.9701.3		Pinion key	1
40	0520.0002.0		Pinion 1500 rpm (Z20)	1
	0520.0005.0		Pinion 1750 rpm (Z19)	1
	0520.0016.0		Pinion 1900 rpm (Z18)	1
41	0634.0031.0		Right bearing cover	1
42	0101.0008.0		Right bearing support	1
43	0520.0000.0		Gear 1500 rpm (Z59, left toothing)	1
	0520.0003.0		Gear 1750 rpm (Z60, left toothing)	1
	0520.0014.0		Gear 1900 rpm (Z61, left toothing)	1
44	8810.1000.3	C	OR Ø 8,73 x 1,78	2
45	0500.0006.0		Crankshaft	1
46	0520.0001.0		Gear 1500 rpm (Z59, right toothing)	1
	0520.0004.0		Gear 1750 rpm (Z60, right toothing)	1
	0520.0015.0		Gear 1900 rpm (Z61, right toothing)	1
47	0340.0000.0		Con rod pin	3
48	0350.0007.0		Con rod screw	6
49	8720.6700.6	C	Locking washer Ø 12	6
50	0233.0000.0		Brass bearing	3
51	0020.0000.0		Crankshaft pin	2
52	2500.0003.0		Con rod (complete)	3
53	2500.0107.0		Piston (complete)	3
54	8721.4201.5	C	Retainer pin Ø 5 x 36	3
55	0710.0005.0		Wrist pin Ø 35	3

POS	CODE	KIT	DESCRIPTION	Qt.
56	8810.8100.1	C	Oil seal Ø 35 x 47 x 8,5 Spec.	3
57	8810.1012.8	C	OR Ø 72,69 x 2,62	3
58	0634.0042.0		Piston oil seal cover	3
59	0300.0007.0		Wiper bush	3
60	0412.0001.0		Wiper	3
61	0242.0025.0		Plunger LH40	3
	0242.0026.0		Plunger LH45	3
	0242.0027.0		Plunger LH50	3
	0242.0028.0		Plunger LH55	3
	0242.0029.0		Plunger LH60	3
62	8720.4000.4	AC	Washer Ø 14 Spec.	3
63	8711.3552.0		Screw TCEI M14 x 160 inox LH40 45	3
	8711.3551.4		Screw TCEI M14 x 100 inox LH50 55 60	3
64	2080.0523.0		Valve assembly	3
65	8712.4535.6		Screw STEI-B M10 x 20	6
66	8711.3515.2		Screw TCEI M14 x 40	12
67	0632.0003.0		Valve cover	2
	0632.0004.0	BC	Valve cover G 1/4"	1
68	8811.1200.3	BC	Antiextrusion ring	3
69	8810.1125.2		OR Ø 70 x 4 Spec.	3
70	0212.0028.0		Delivery valve guide	3
71	0902.0005.0		Delivery valve spring	3
72	0822.0006.0		Delivery valve disk	3
73	2050.0011.0	BC	Delivery valve seat	3
74	8810.1116.8	BC	OR Ø 72 x 3 Spec.	3
75	8810.1116.1		OR Ø 56 x 3 Spec.	6
76	0212.0026.0		Suction valve guide	3
77	0902.0004.0		Suction valve spring	3
78	0822.0005.0		Suction valve disk	3
79	0812.0006.0	C	Suction valve seat	3
80	8720.4130.0		Copper washer Ø 1/4"	5
81	8212.0105.1		Plug G 1/4"	5
82	8711.5116.8		Screw TCEI M20 x 160	8
83	0641.0020.0		Manifold	1
84	0840.0001.0	AC	Plug G 1/2" NK	3
85	8810.1125.3		OR Ø 72 x 4 Spec.	3
86	0622.0009.0		Cylinder LH40	3
	0622.0010.0		Cylinder LH45	3
	0622.0011.0		Cylinder LH50	3
	0622.0012.0		Cylinder LH55	3
	0622.0013.0		Cylinder LH60	3
87	0312.0010.0		Packing ring LH40	3
	0312.0011.0		Packing ring LH45	3
	0312.0021.0		Packing ring LH50	3
	0312.0022.0		Packing ring LH55	3
	0312.0023.0	AC	Packing ring LH60	3
88	8810.2001.1	AC	Pressure packing LH40	6
	8810.2001.2	AC	Pressure packing LH45	6
	8810.2001.4	AC	Pressure packing LH50	6
	8810.2001.5	AC	Pressure packing LH55	6
	8810.2001.6		Pressure packing LH60	6
89	0223.0021.0		Packing support LH40	3
	0223.0022.0		Packing support LH45	3
	0223.0023.0		Packing support LH50	3
	0223.0024.0		Packing support LH55	3
	0223.0025.0	AC	Packing support LH60	3
90	8810.6101.5	AC	Scraper LH40	3
	8810.6101.7	AC	Scraper LH45	3
	8810.6101.8	AC	Scraper LH50	3
	8810.6101.9	AC	Scraper LH55	3
	8810.6102.1	BC	Scraper LH60	3
92	0105.0029.0		Antiextrusion ring	6

17. EXPLODED VIEW AND PART LIST

LHZ/N



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4	8810.1013.2	C	OR Ø 152,07 x 2,62	2
5	8711.2115.2		Screw TCEI M8 x 20	23
6	0634.0028.0		Bearing cover	2
7	8711.3110.2		Screw TCEI M12 x 25	8
8	0300.0002.0		Bearing bush	2
9	8111.1101.7		Bearing 22218 CCK	2
10	8711.2515.4		Screw TCEI M10 x 30	12
11	8711.1515.2		Screw TCEI M6 x 14	14
12	0404.0005.0		Lower cover	1
13	0806.0003.0	C	Lower cover gasket	1
14	8720.4300.8		Aluminium washer Ø 1"	2
15	8212.0300.6		Plug G 1"	2
16	8010.5301.2		Oil level indicator G 1"	2
17	8720.4300.2	BC	Aluminium washer Ø 1/2"	5
18	8010.5700.2		Magnetic plug G 1/2"	2
19	0634.0024.0		Back cover	1
20	0806.0001.0	C	Back cover gasket	1
21	0601.0016.0		Pump body	1
22	8810.1011.6	C	OR Ø 29,82 x 2,62	1
23	8010.5402.7		Oil filling plug G 1"	1
24	8720.2600.3		Eyebolt M16	2
25	0300.0003.0		Eyebolt spacer	2-4
26	0806.0002.0	C	Upper cover gasket	1
27	0404.0003.0		Upper cover	1
28	8010.5600.2		Venting plug G 1/2"	1
29	0404.0007.0		Crankshaft end cap	1
30	8810.8002.6	C	Oil seal Ø 55 x 75 x 10	2
31	8711.2115.4		Screw TCEI M8 x 30	8
32	0634.0030.0		Left bearing cover	1
33	8810.1013.0	C	OR Ø 94,92 x 2,62	2
34	8111.0101.9		Bearing NJ 2211	4
35	0310.0002.0		Internal bearing spacer	2
36	0310.0001.0		External bearing spacer	2
37	0610.0000.0		Lubricating bush	2
38	0314.0000.0		Lubricating cone	2
39	8720.9701.3		Pinion key	1
40	0520.0002.0		Pinion 1500 rpm (Z20)	1
	0520.0005.0		Pinion 1750 rpm (Z19)	1
	0520.0016.0		Pinion 1900 rpm (Z18)	1
41	0634.0031.0		Right bearing cover	1
42	0101.0008.0		Right bearing support	1
43	0520.0000.0		Gear 1500 rpm (Z59, left toothing)	1
	0520.0003.0		Gear 1750 rpm (Z60, left toothing)	1
	0520.0014.0		Gear 1900 rpm (Z61, left toothing)	1
44	8810.1000.3	C	OR Ø 8,73 x 1,78	2
45	0500.0006.0		Crankshaft	1
46	0520.0001.0		Gear 1500 rpm (Z59, right toothing)	1
	0520.0004.0		Gear 1750 rpm (Z60, right toothing)	1
	0520.0015.0		Gear 1900 rpm (Z61, right toothing)	1
47	0340.0000.0		Con rod pin	3
48	0350.0007.0		Con rod screw	6
49	8720.6700.6	C	Locking washer Ø 12	6
50	0233.0000.0		Brass bearing	3
51	0020.0000.0		Crankshaft pin	2
52	2500.0003.0		Con rod (complete)	3
53	2500.0107.0		Piston (complete)	3
54	8721.4201.5	C	Retainer pin Ø 5 x 36	3
55	0710.0005.0		Wrist pin Ø 35	3
56				
57				
58				
59				
60				

POS	CODE	KIT	DESCRIPTION	Qt.
61	0242.0112.0		Plunger LHZ/N40	3
	0242.0113.0		Plunger LHZ/N45	3
	0242.0114.0		Plunger LHZ/N50	3
	0242.0115.0		Plunger LHZ/N55	3
	0242.0115.0		Plunger LHZ/N60	3
62	8810.1105.7	AC	OR Ø 19 x 2 Spec.	3
63	0352.0013.0		Plunger screw	3
64	2080.0621.0		Valve assembly LHZ	3
	2080.0523.0		Valve assembly LHN	3
65	8711.2560.1		Screw TCEI M10 x 16 inox	6
66	0632.0007.0		Screw TCEI M14 x 40 Spec.	12
67	0632.0007.0		Valve cover	3
68	8811.1200.3	BC	Antiextrusion ring	3
69	8810.1125.2	BC	OR Ø 70 x 4 Spec.	3
70	0212.0028.0		Delivery valve guide	3
71	0902.0007.0		Delivery valve spring LHZ	3
	0902.0005.0		Delivery valve spring LHN	3
72	0822.0008.0		Delivery valve disk LHZ	3
	0822.0006.0		Delivery valve disk LHN	3
73	2050.0012.0		Delivery valve seat LHZ	3
	2050.0011.0		Delivery valve seat LHN	3
74	8810.1116.8	BC	OR Ø 72 x 3 Spec.	3
75	8810.1116.1	BC	OR Ø 56 x 3 Spec.	6
76	0212.0026.0		Suction valve guide	3
77	0902.0006.0		Suction valve spring LHZ	3
	0902.0004.0		Suction valve spring LHZ	3
78	0822.0007.0		Suction valve disk LHZ	3
	0822.0005.0		Suction valve disk LHN	3
79	0812.0008.0		Suction valve seat LHZ	3
	0812.0006.0		Suction valve seat LHN	3
80	8811.1012.6	C	Washer Ø 3/8" inox	5
81	0842.0047.0		Plug G 3/8" inox	5
82	0350.0009.0		Screw TCEI M20 x 160 Spec.	8
83	0642.0018.0		Manifold	1
84	8212.0312.8		Plug G 1/2" inox	3
85	8810.1125.3	AC	OR Ø 72 x 4 Spec.	3
86	0622.0014.0		Cylinder LHZ/N40	3
	0622.0015.0		Cylinder LHZ/N45	3
	0622.0016.0		Cylinder LHZ/N50	3
	0622.0026.0		Cylinder LHZ/N55	3
	0622.0027.0		Cylinder LHZ/N60	3
87	0312.0015.0		Packing ring LHZ/N40	3
	0312.0016.0		Packing ring LHZ/N45	3
	0312.0024.0		Packing ring LHZ/N50	3
	0312.0030.0		Packing ring LHZ/N55	3
	0312.0031.0		Packing ring LHZ/N60	3
88	8810.2001.1	AC	Pressure packing LHZ/N40	6
	8810.2001.2	AC	Pressure packing LHZ/N45	6
	8810.2001.4	AC	Pressure packing LHZ/N50	6
	8810.2001.5	AC	Pressure packing LHZ/N55	6
	8810.2001.6	AC	Pressure packing LHZ/N60	6
89	0223.0026.0		Packing support LHZ/N40	3
	0223.0027.0		Packing support LHZ/N45	3
	0223.0028.0		Packing support LHZ/N50	3
	0223.0047.0		Packing support LHZ/N55	3
	0223.0048.0		Packing support LHZ/N60	3
90	8810.6101.5	AC	Scraper LHZ/N40	3
	8810.6101.7	AC	Scraper LHZ/N45	3
	8810.6101.8	AC	Scraper LHZ/N50	3
	8810.6101.9	AC	Scraper LHZ/N55	3
	8810.6102.1	AC	Scraper LHZ/N60	3
91	8811.1012.7	BC	Washer Ø 1/2" inox	3
92	0105.0029.0	BC	Antiextrusion ring	6

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 of the fluid end.

THE PUMP KNOCKS:
- air suction.
- insufficient feeding.
- bends, elbows and 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, is not of the suitable type or provides insufficient pressure or volume.
- 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. pump inactivity for long time).
- jammed or worn-out valves.
- worn-out pressure packings.
- the pressure regulating valves do not work properly.
- clearance in the drive system.
- r.p.m. are higher than rated.

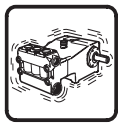
.

THE PUMP DOES NOT DELIVER THE RATED VOLUME:
- insufficient feeding (due to the cause listed above).
- r.p.m. are less than rated.
- excesive amount of water by-passed by the pressure regulating valve.
- worn out valves.
- excessive leakage from pressure packings.

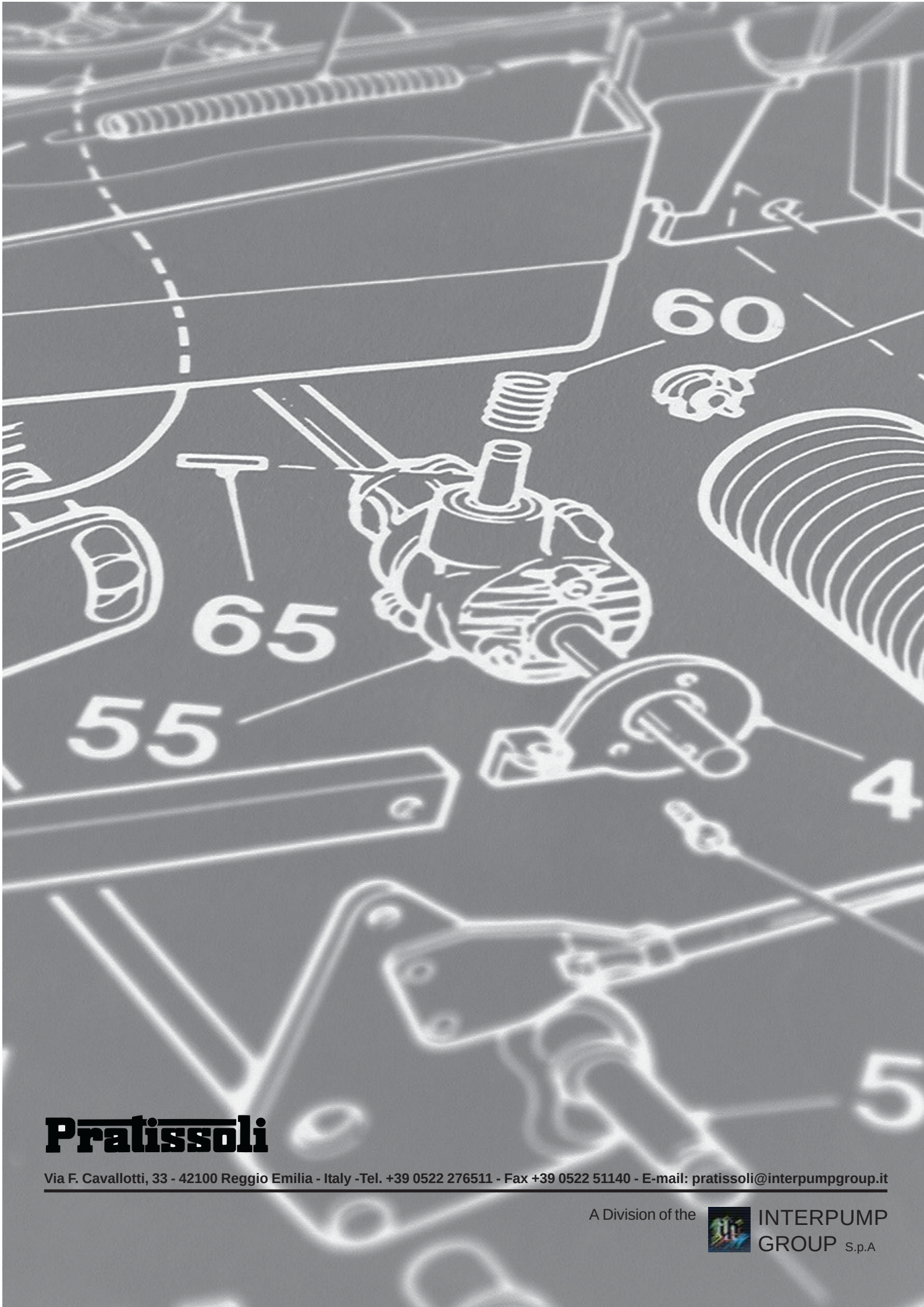
INSUFFICIENT PUMP PRESSURE:
- the nozzle is (or has become) too large.
- r.p.m. are less than rated.
- excessive leakage from pressure packings.
- excessive amount of water by-passed by the pressure regulating valve or faulty valve operation.
- worn out valves.

EXCESSIVE 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 fully used.
- water in the oil.
- excessive belt tension or incorrect alignment of the joint (where provided) .
- excessive inclination of the pump during operation.



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



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