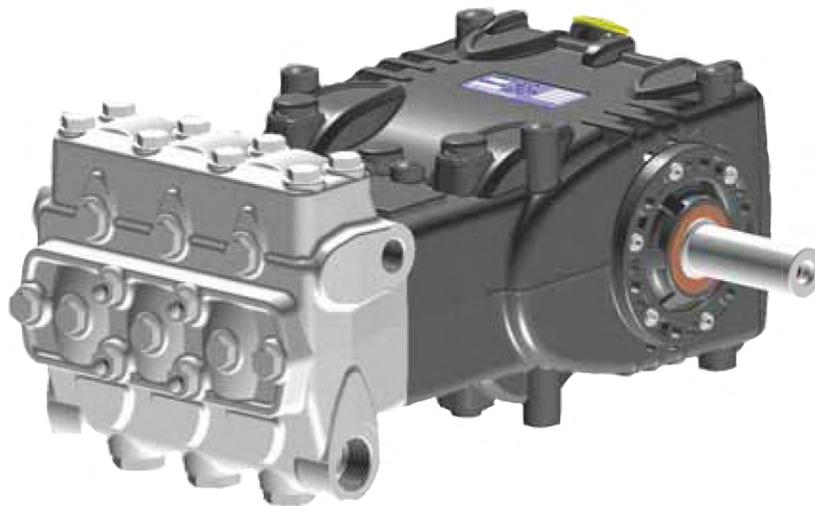


Owner's Manual

- *Installation*
- *Use*
- *Maintenance*



KT45M

INDEX

1.	INTRODUCTION	Page 3
2.	SYMBOLS DESCRIPTION	Page 3
3.	SAFETY	Page 4
	3.1 General safety instructions	Page 4
	3.2 High pressure unit safety requirements	Page 4
	3.3 Safety during operation	Page 4
	3.4 General procedures for using nozzles	Page 4
	3.5 Safety during unit maintenance	Page 5
4.	PUMP IDENTIFICATION	Page 5
5.	TECHNICAL FEATURES	Page 6
6.	DIMENSIONS AND WEIGHT	Page 6
7.	OPERATING INSTRUCTIONS	Page 7
	7.1 Bentonite temperature	Page 7
	7.2 Maximum flow and pressure rates	Page 7
	7.3 Minimum operating speed	Page 7
	7.4 Recommended lubricant types and Manufacturers	Page 7
8.	PORTS AND CONNECTIONS	Page 9
9.	PUMP INSTALLATION	Page 9
	9.1 Installation	Page 9
	9.2 Direction of rotation	Page 10
	9.3 Version change and reducer positioning	Page 10
	9.4 Hydraulic connections	Page 11
	9.5 Pump power supply	Page 11
	9.6 Suction line	Page 11
	9.7 Outlet line	Page 11
	9.8 Typical diagram	Page 12
	9.9 V-belt transmission	Page 12
	9.10 Transmission definition	Page 13
	9.11 Definition of static pull to apply on belts	Page 15
10.	START UP AND OPERATION	Page 17
	10.1 Preliminary inspections	Page 17
	10.2 Starting up	Page 17
11.	PREVENTATIVE MAINTENANCE	Page 18
12.	PUMP STORAGE	Page 18
	12.1 Long term inactivity	Page 18
	12.2 Filling the pump with anti-corrosion emulsion or anti-freeze	Page 18
13.	PRECAUTIONS AGAINST FREEZING	Page 19
14.	WARRANTY TERMS	Page 19
15.	TROUBLESHOOTING	Page 19
16.	EXPLODED VIEWS AND PARTS	Page 21
17.	MAINTENANCE LOG	Page 23

1. INTRODUCTION

This manual describes the use and maintenance instructions of the KT45M Series pump, and should be carefully read and understood before using the pump.

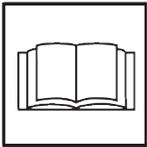
Correct use and adequate maintenance will guarantee the pumps trouble-free operation for a long time. General Pump declines any responsibility for damage caused by misuse or the non-observance of the instructions indicated in this manual.

Upon receiving the pump, check that it is complete and in perfect condition. Should anything be found out of order, please contact us before installing and starting the pump.

2. SYMBOL DESCRIPTIONS



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 protective boots

3. SAFETY

3.1 General Safety Indications

Improper use of pumps and high pressure systems, and the non-compliance with installation and maintenance instructions may cause severe injury to people and/or damage to property. Anyone assembling or using high pressure systems must possess the necessary competence to do so, should be aware of the characteristics of the components assembled/used, and must take all precautions necessary to ensure maximum safety in any operating condition. In the interest of safety, both for the Installer and the Operator, no reasonably applicable should be omitted.

3.2 High pressure unit safety requirements

1. The pressure line must always be equipped with a safety valve.
2. High pressure system components, in particular for those units working outside, must be adequately protected against rain, frost and heat.
3. The electrical control system must be adequately protected from water spray, and must comply with the specific regulations in force.
4. High pressure hoses must be properly sized for maximum operating pressure of the system and always and only used within the operating pressure range specified by the hose manufacturer. The same rules should be observed for all other auxiliary systems affected by high pressure.
5. The ends of high pressure hoses must be sheathed and secured to a solid structure to prevent dangerous whiplash in case of bursting or broken connections.
6. Appropriate safety guards must be provided for the pump transmission systems (couplings, pulleys and belts, auxiliary drives).



3.3 Safety During Operation

The working area of a high pressure system must be clearly marked. Access must be prohibited to un-authorized personnel and, wherever possible, the area should be restricted or fenced. The personnel authorized to access this area should first be trained, and informed about the risks that may arise from failures or malfunctions of the high pressure unit.

Before starting the unit, the operator must check:

1. That the high pressure system is properly powered (see paragraph 9.5).
2. That pump intake filters are perfectly clean; we advise the use of a device that indicates the filters clogging level.
3. Electrical parts are adequately protected and in perfect condition.
4. The high pressure hoses do not show apparent signs of abrasion, and that fittings are in perfect shape.
5. **Attention:** during operation the outer surfaces may reach high temperatures. Try to take precautions to avoid contact with hot parts.

Any fault or reasonable doubt that may arise before or during operation should be promptly reported and verified by competent personnel. In these cases, pressure should immediately be released and the high pressure system stopped.



3.4 General Procedures For Using Nozzles

1. The Operator must always place his/her safety and security first, as well as that of others that may be directly affected by his/her actions, or any other assessments or interests. The operator's work must be dictated by common sense and responsibility.
2. The Operator must always wear a helmet with a protective visor, waterproof clothing, and appropriate boots capable of guaranteeing grip on wet surfaces.

Note: appropriate clothing will effectively protect against water spray, but it may not offer adequate protection against the direct impact of water jets or sprays from a close distance. Some circumstances may require further protection.

3. It is generally best to organize personnel into teams of at least two people capable of giving mutual and immediate assistance in case of necessity and of taking turns during long and demanding operation.
4. Access to the work area that is within the water jets' range must be absolutely prohibited to and free from objects that, inadvertently under a pressure jet, can be damaged and or create dangerous situations.
5. The water jet must only and always be directed in the direction of the work area, including during testing or preliminary tests or checks..
6. The Operator must always pay attention to the trajectory of the debris removed by the water jet. If necessary, suitable guards must be provided by the Operator to protect anything that may be accidentally exposed.
7. The Operator should not be distracted for any reason during operation. Workers needing to access the operating area must wait for the Operator to stop work, and then immediately make their presence known.
8. For safety reasons, it is important that each member of the team is fully aware of the intentions and actions of other team members in order to avoid dangerous misunderstandings.
9. The high pressure system must not be started up and run under pressure without all team members in position and without the Operator having already directed his/her lance toward the work area.

3.5 Safety During System Maintenance

1. The pressure system maintenance must be carried out in the time intervals set by the manufacturer who is responsible for the whole group according to law.
2. Maintenance should always be carried out by trained and authorized personnel.
3. Assembly and disassembly of the pump and its various components must be performed exclusively by authorized personnel, using appropriate equipment in order to avoid damage to components and connections.
4. Always use original spare parts to ensure total reliability and safety.

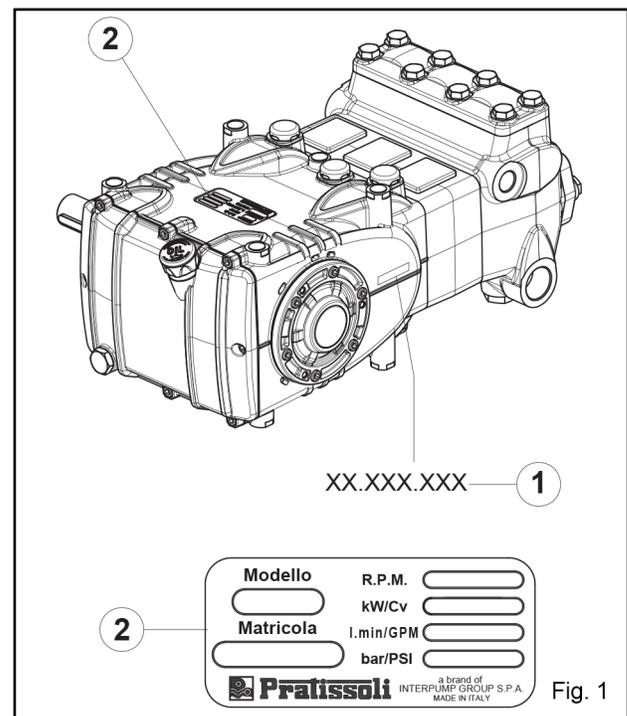
4. PUMP IDENTIFICATION

Each pump has its own Serial No. XX.XXX.XXX see (1, fig 1) and a specific label (2, fig. 1) which contains:

- Pump model and version
- Serial number
- Maximum RPM
- Power Hp - kW
- Pressure - P.S.I.
- Flow Rate - GPM



Pump model, version and serial number must always be specified when ordering spare parts.



5. TECHNICAL FEATURES

MODEL	RPM	FLOW RATE		PRESSURE		POWER	
		l/min	GPM	PSI	Bar	Hp	kW
KT45M MB	600	74	19.6	750	50	9.6	7.1

6. DIMENSIONS AND WEIGHT

For standard version pump dimensions and weight, refer to fig. 2.

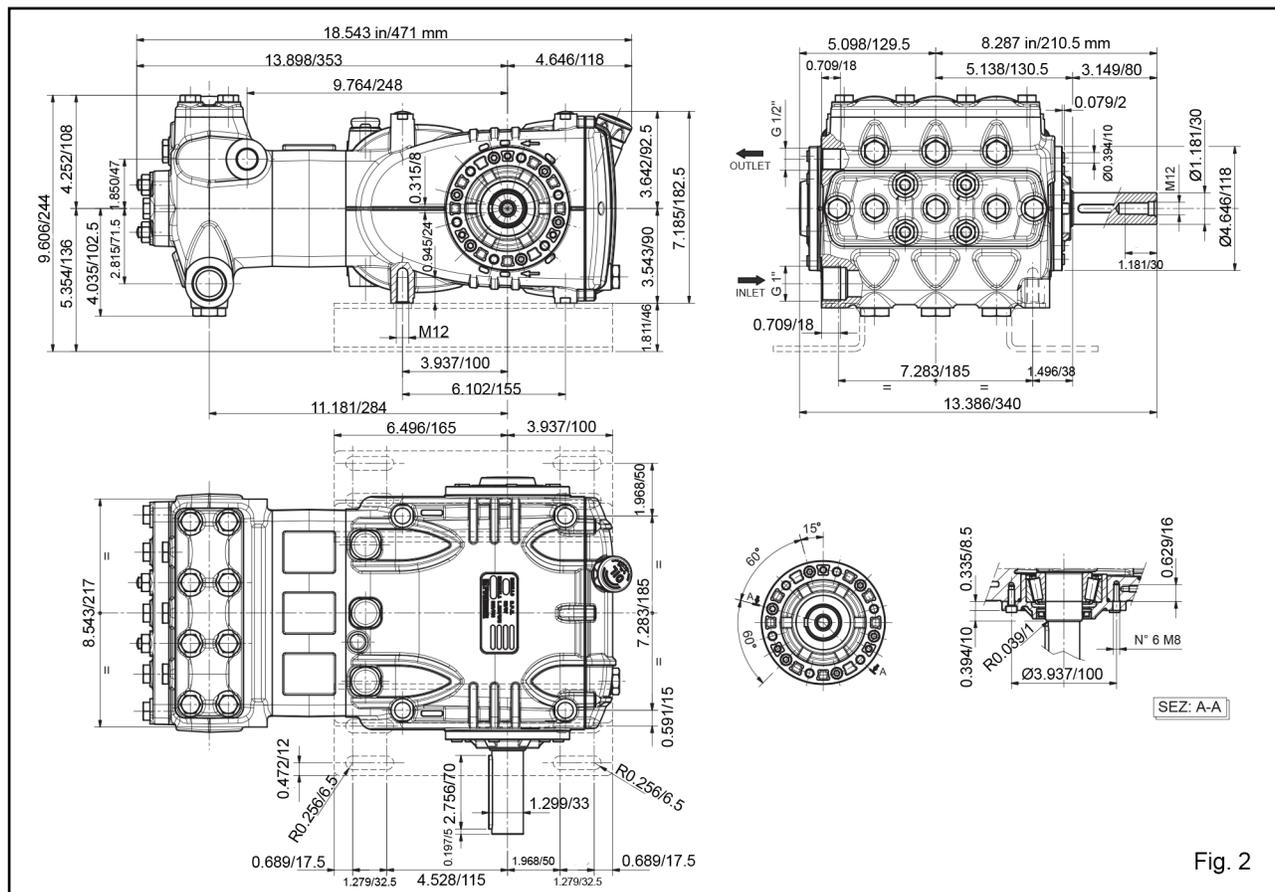


Fig. 2

Dry weight 82.67 lbs (37.5 kg).

7. INFORMATION ABOUT PUMP USE



The KT45M pump, is designed to operate in environments with atmospheres that are not potentially explosive, and with fluids with a high percentage of bentonite, whose recommended maximum value of density is equal to ~45 sec. Marsh cone and a maximum temperature of 104°F (40°C).

Other fluids may be used only upon the approval of The Customer Service Department.



7.1 Bentonite Temperature

The max bentonite temperature is 86°F (30°C). However, it is possible to use the pump at temperatures of up to 104°F (40°C) for short periods of time. In this case we advise consulting the Customer Service Department.

7.2 Max Pressure and Flow Rate

The performance values indicated in the catalog refer to the maximum performance of the pump. Regardless of the power used, pressure and maximum RPM values indicated on the plate may not be exceeded unless expressly authorized by the **Customer Service Department**.

7.3 Minimum Operating Speed

The minimum speed of the crankshaft for these types of pumps is 100 RPM. Any RPM value different from what is indicated in the performance table (see chapter 5) must be expressly authorized by the **Customer Service Department**.

7.4 Recommended Lubricant Oil Types & Manufacturers

The pump is delivered with lubricant oil compliant with room temperatures ranging between 32° and 89.6° F (0° and 30°C). Some recommended lubricant types are indicated in the table below; these lubricants are treated with additives in order to increase corrosion protection and resistance to fatigue. As an alternative, Automotive SAE 85W-90 gearing lubricants may also be used.

BRAND	TYPE
GENERAL PUMP	SERIES 220
ARAL	Aral Degol BG 220
BP	ENERGOL HLP 220
CASTROL	Hyspin VG 220, Magna 220
ELF	POLYTELIS 220
ESSO	NUTO 220
FINA	Cirkan 220
FUCHS	RENOLIN 220
MOBIL	DTE OIL BB
SHELL	TELLUS C 220
TEXACO	RANDO HD 220
TOTAL	CORTIS 220

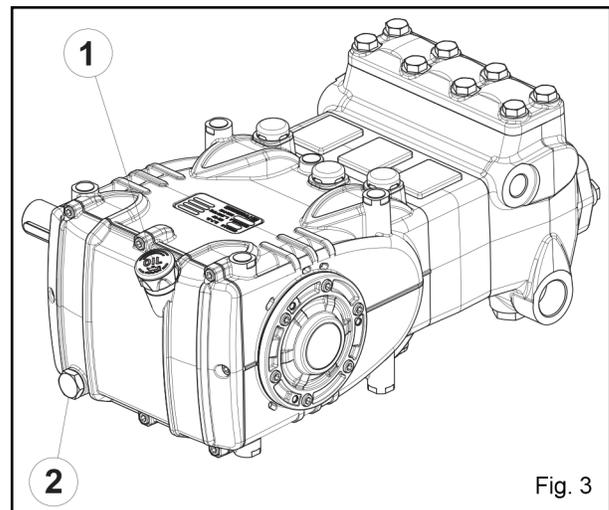


Fig. 3

Check the oil level by using the oil level dipstick (1, fig. 3). Refill if necessary to top off level. Correct oil level inspection is done with the pump at room temperature; oil is changed with the pump at working temperature, by removing the dipstick (1, fig. 3) and the oil plug (2, fig. 3). Checking and changing oil is to be carried out as indicated in fig. 14 Chapter 11. The amount required is 67.63 oz (2 liters).

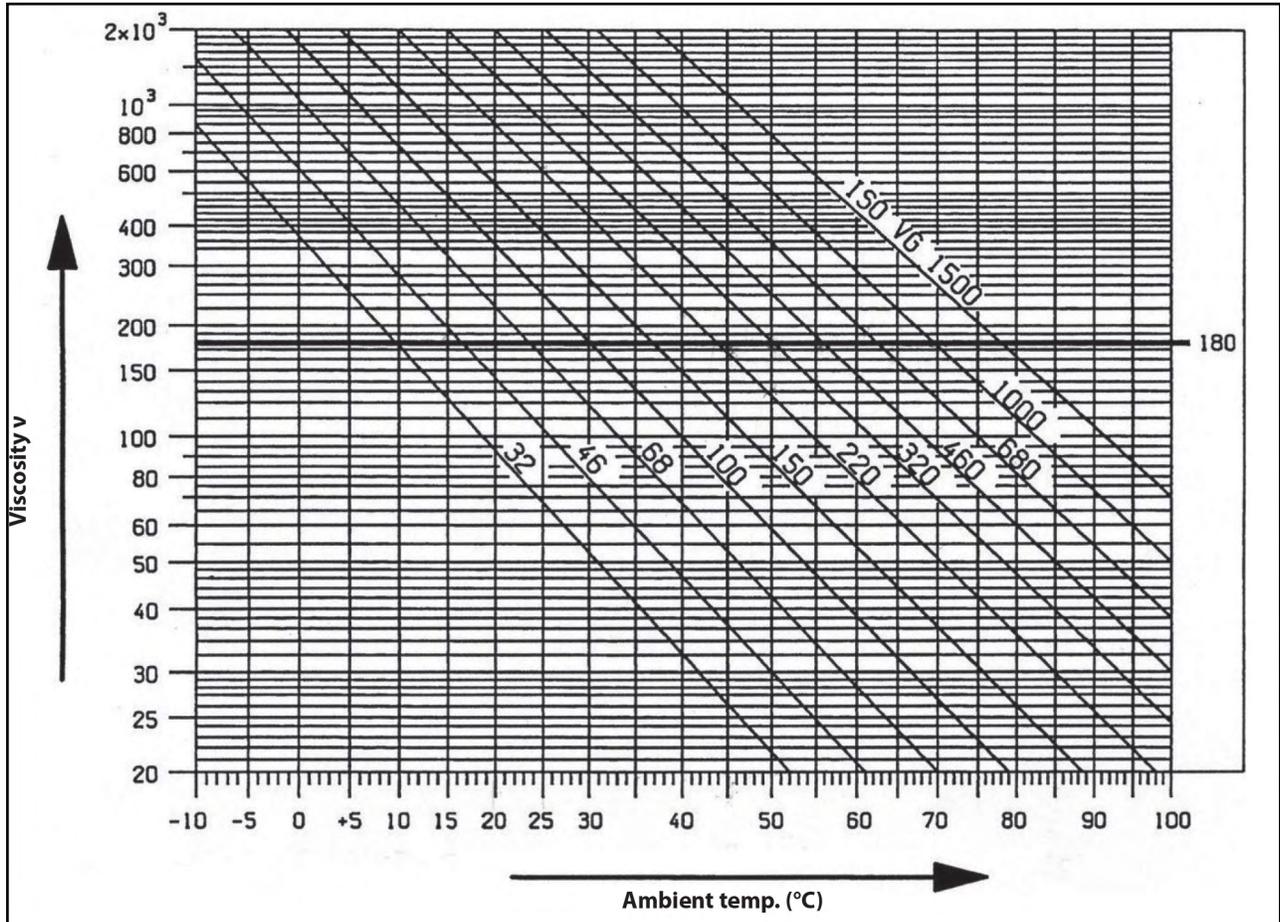


In any case, oil must be changed at least once a year since it may deteriorate by oxidation.

For room temperatures that differ from that mentioned earlier, follow the indications contained in the diagram below, keeping in mind that the oil must have a minimum viscosity of 180 cSt.

VISCOSITY/ROOM TEMPERATURE DIAGRAM

mm²/s = cSt



Exhausted oil must be collected in an appropriate container and disposed of in appropriate locations. In absolutely no case may it be dispersed into the environment.

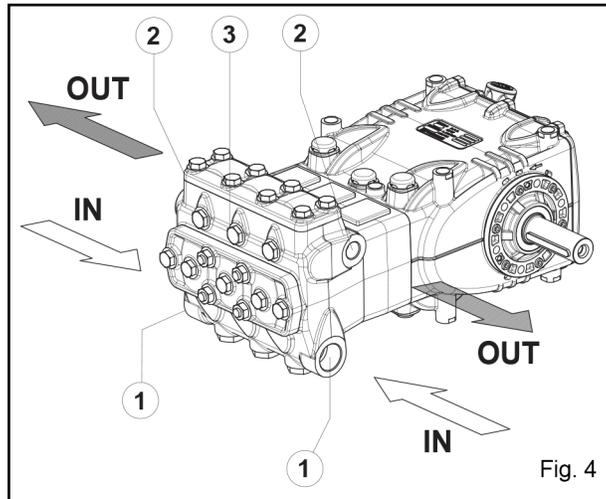
8. PORTS AND CONNECTIONS

KT45M Series pumps are equipped with (see fig. 4):

1. 2 "IN" inlet ports 1" Gas.

The line can be connected to either of the two inlet ports; the ones not being used must be hermetically sealed.

2. 2 "OUT" outlet ports 3/4" Gas.
3. 3 service ports 1/4" gas; usually used for the pressure gauge.



9. PUMP INSTALLATION

9.1 Installation

The pump must be installed in a horizontal position using the M12 threaded support feet. Tighten the screws with a torque of 17.98 ft lbs (80 Nm).

The base must be perfectly flat and rigid enough as not to allow bending or misalignment on the pump coupling and axis/transmission due to torque transmitted during operation.

The unit cannot be fixed rigidly to the floor but must be installed with vibration dampers. For special applications contact the **Customer Service Department**.



Replace the oil filling hole closing service plug (red) positioned on the rear casing cover with the plug with oil dipstick. Check the correct quantity.

The dipstick must always be reachable, even when the unit is assembled.



The pump's shaft (PTO) must not be rigidly connected to the motor unit.

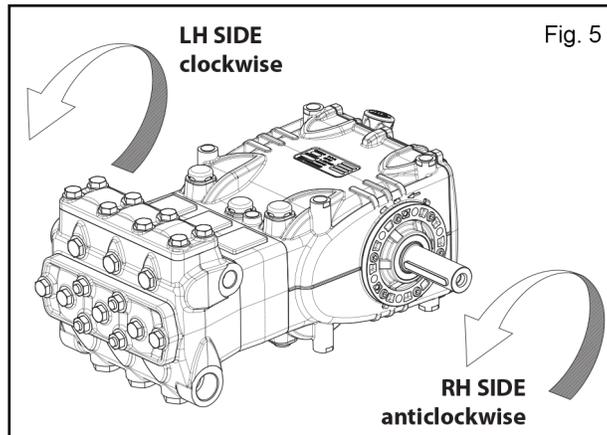
The following transmission types are suggested:

- Hydraulics by flange, contact **Customer Service Department**.
- V-belts.
- Universal joint (comply with the maximum working angles recommended by the manufacturer).
- Flexible coupling.

9.2 Direction of rotation

The rotation direction is indicated by an arrow located on the casing near the drive shaft.

From a position facing the pump head, the rotation direction will be as in fig. 5.



9.3 Version Change and Reducer Positioning

A right version pump is defined when: observing the pump from the head side, the PTO shank of the pump shaft is on the right side.

A left version pump is defined when: observing the pump from the head side, the PTO shank is on the left side. See fig. 5.



The version may be changed only by trained and authorized personnel by carefully following the instructions in the repair manual.

1. Separate the hydraulic part from the mechanical part as indicated in Chapter 2 in points 2.2.2.1 of the **Repair Manual**.
2. Turn the mechanical part 180° and reposition the rear casing cover in such a way that the oil dipstick is turned upward. Reposition the lifting bracket and relative hole closing plugs in the upper part of the casing. Finally, properly reposition the specification label in its housing on the casing.



Make sure that the lower crankcase draining holes in correspondence with the plungers are open and not closed from the plastic plugs provided for the previous version.

3. Reassemble the hydraulic part to the mechanical part as indicated in Chapter 2 in points 2.2.2.2 of the **Repair Manual**.

9.4 Hydraulic Connections

In order to isolate the system from the vibrations produced by the pump, we advise to build the first section of the duct near the pump (both for intake and delivery) with flexible hose. The consistency of the intake section must allow to avoid deformation caused by the depressurization produced by the pump.

9.5 Pump Power Supply

A positive head of at least 0.65 Ft. (0.20 m) recommended for the best volumetric efficiency, to be increased with increasing fluid density.



For the priming conditions see the chart in par. 9.8.

9.6 Suction Line

For the pump's correct operation, the suction line must have the following characteristics:

1. Minimum internal diameter for hoses of length less than 26.25 Ft. (8 m.) is 1".
The hose must be rigid enough to avoid self construction caused by pressure drop.



Along the duct, avoid localized diameter reductions that may cause pressure drops with subsequent cavitation. Absolutely avoid 90° elbows, connections with other hoses, bottlenecks, counter-slopes, upside down "U" shaped curves, "T" connections.

2. With a layout that is set in such a way to prevent cavitation.
3. It should be perfectly airtight, and built in a way that guarantees perfect sealing over time.
4. Avoid pump emptying when stopping (even partial emptying).
5. Do not use hydraulic fittings, 3 or 4 way fittings, adapters, swivel joints, etc., since they may hinder the pump's performance.
6. Do not use foot valves or other types of unidirectional valves.
7. Do not connect the by-pass line from the valve directly to the pump suction line.
8. Provide appropriate baffle plates inside the tank in order to avoid bentonite flows coming from both the by-pass and feeding lines which may create turbulence near the tank's outlet port.
9. Make sure that the suction line is perfectly clean inside before connecting it to the pump.

9.7 Outlet Line

To obtain a correct delivery line, please comply with the following installation instructions:

1. The internal diameter of the hose must be sufficient to ensure correct fluid velocity.
2. The first section of the hose connected to the pump must be flexible in order to isolate pump vibrations from the rest of the system.
3. Use high pressure hoses and fittings that guarantee wide safety margins in any working condition.
4. Install a safety valve on the delivery line.
5. Use pressure switches suitable for the pulsating loads typical of plunger pumps.
6. In the design phase, take into proper account the pressure drop along the line, since this causes a reduction in usage pressure with respect to the value measured at the pump.
7. If the pump pulsations are harmful for particular applications, install an appropriately sized pulsation dampener on the outlet line.

9.8 Typical Diagram.

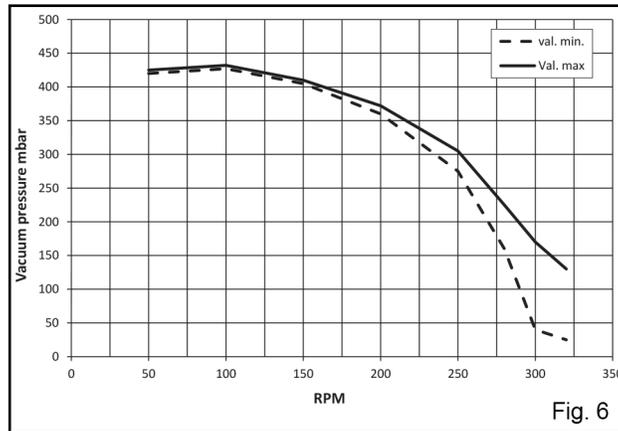


Fig. 6

9.9 V-belt Transmission

The pump can be controlled by a V-belt system. For this pump model, we recommend use of 4 XPB belts (16.5 x 13 serrated). Use an XPC profile only for long durations. Both the characteristics and transmissible power of each belt can be verified in the diagram in fig. 7, in relation to the number of rpm normally declared by the manufacture. Minimum duct pulley diameter (on pump shaft): ≥ 6.30 in (160 mm). The radial load on the shaft must not exceed 674.43 Lbs (3000 N) (value necessary for layout definition). The transmission is considered adequate if the load is applied to a maximum distance $a=1.18$ in (30 mm) from the shaft shoulder (PTO) as shown in fig. 10.



For dimensions differing from those specified about contact the **Customer Service Departments**.

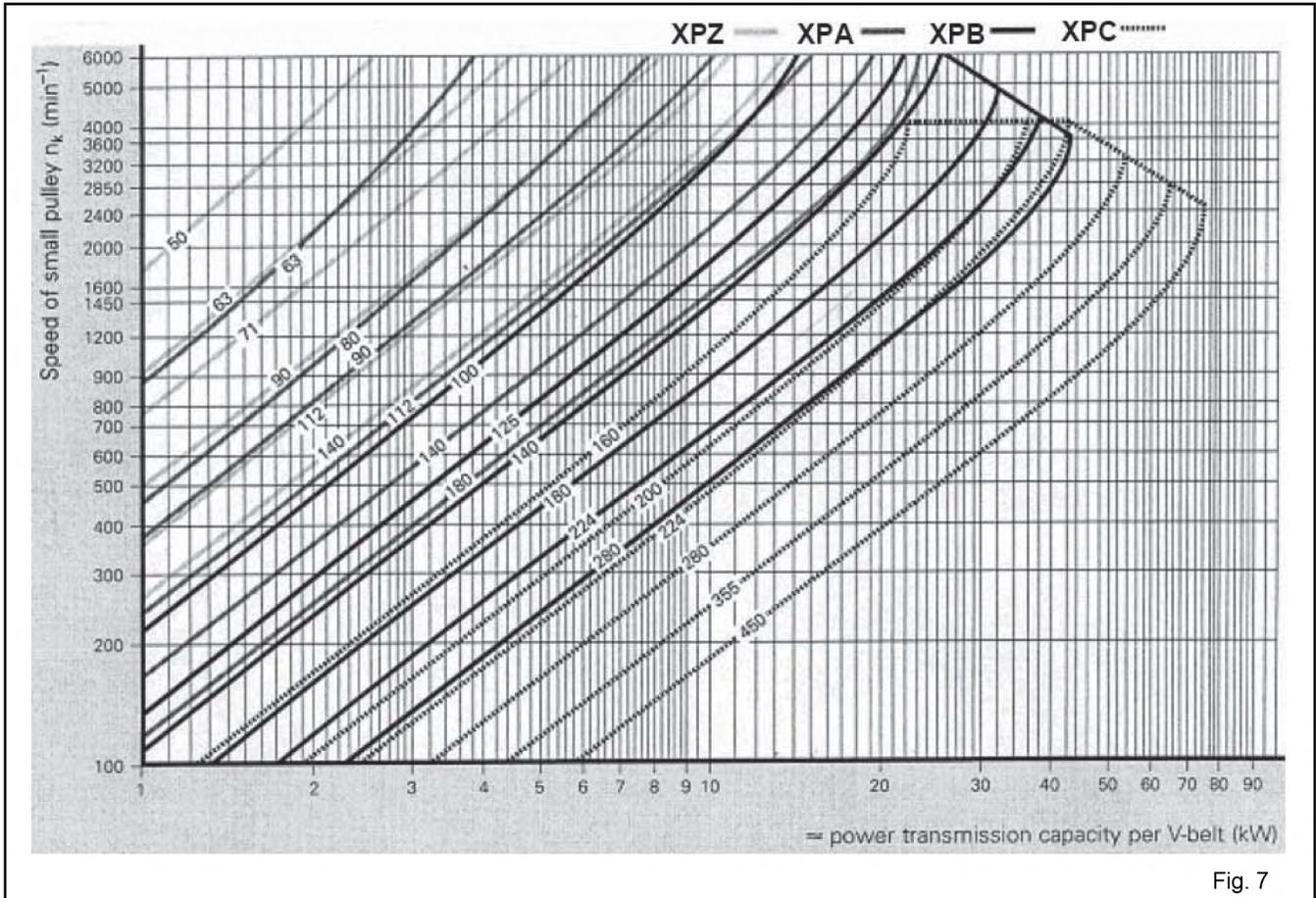


Fig. 7

9.10 Transmission Definition

To prevent irregular radial loads on the shaft and the relative bearing, follow these directions:

A) Use pulleys with V-belts with the size of the groove required/recommended by the manufacture of belt used. In the absence of directions, follow fig. 8 and the table in fig. 9.

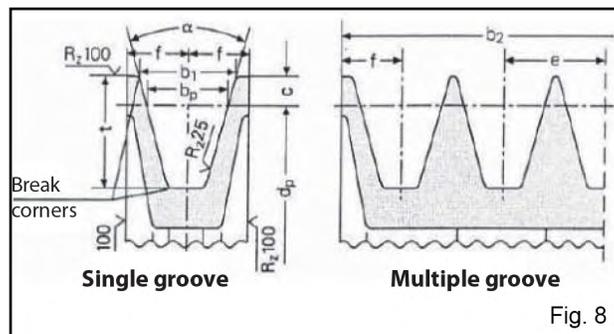


Fig. 8

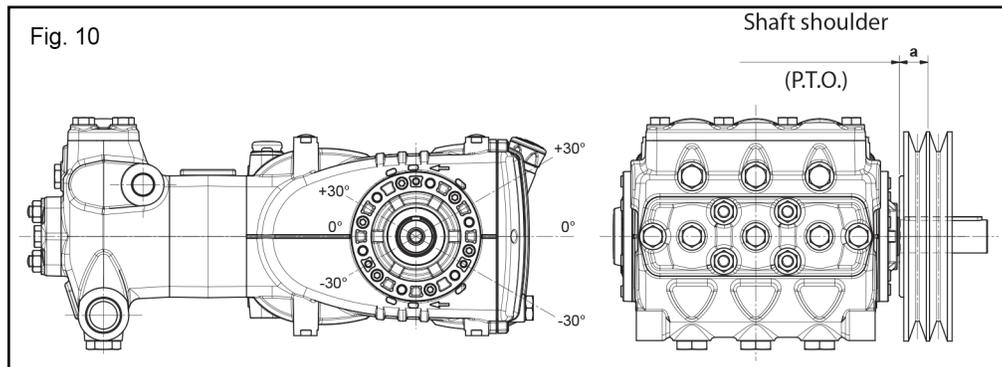
Dimensions (in mm)

Belt section as per DIN 7753 part 1 and B.S. 3790		DIN symbol symbol B.S./ISO	XPB/SPB SPB	XPC/SPC SPC	
Belt section as per DIN 2215 and B.S. 3790		DIN symbol symbol B.S./ISO	17 B	22 C	
Pitch width		b_w	14.0	19.0	
Increased grooving width $b_1 \approx$		$\alpha = 34^\circ$ $\alpha = 38^\circ$	18.9	26.3	
			19.5	27.3	
		c	8.0	12.0	
Distance between grooving		e	23 ± 0.4	31 ± 0.5	
		f	14.5 ± 0.8	20.0 ± 1.0	
Increased grooving depth		t_{min}	22.5	31.5	
α	34°	by primitive diameter narrow-section V-belts DIN 7753 part 1	d_w	from 140 to 190	from 224 to 315
	38°			> 190	> 315
α	34°	by primitive diameter classic section V-belts DIN 2215	d_w	from 112 to 190	from 180 to 315
	38°			> 190	> 315
Tolerance for $\alpha = 34^\circ - 38^\circ$			$\pm 1^\circ$	$\pm 30'$	
Pulleys for b_2 by grooving number z $b_2 = (z-1)e + 2f$			1	29	40
			2	52	71
			3	75	102
			4	98	133
			5	121	164
			6	144	195
			7	167	226
			8	190	257
			9	213	288
			10	236	319
			11	259	350
			12	282	381

Minimum pulley diameter must be respected.
Do not use laminated V-belts.

Fig. 9

B) Use high performance belts - for example **XPB** instead of **SPB** - as a lower quantity of belts for the same transmitted power may be necessary and a consequent shorter resulting distance compared to the shaft shoulder (PTO) "a" of fig. 10.



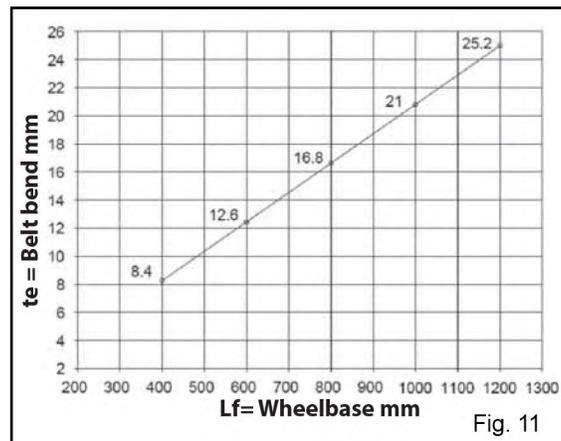
- C) Pull the belts according to manufacturer instructions. Excessive pulling can cause reduced bearing life and wear out the pulley prematurely. Pulling depends on different variables as indicated in paragraph 9.11.
- D) Belt length has a natural tolerance $\geq \pm 0.75\%$. For this reason, the 2 belts must be purchased as a pair.
- E) Follow the direction of the belt pull as shown in fig. 9 for other needs contact the **Customer Service Department**.
- F) Take care of the alignment of the driving pulley and driven pulley grooves.

9.11 Definition of static pull to apply on belts

Static pull depends on:

- A) The wheelbase between the two pulleys (belt length).
- B) The load due to static pull of the belt.
- C) The number of belts
- D) The winding angle of the smallest pulley
- E) Average speed

The diagram in fig. 11 for belts with an XPB profile in relation to the wheelbase indicates the correct tensioning T_e belt sag with a dynamometer load of 15.96 ft. lbs. (71 N).



Conclusion: with a wheelbase of 15.75 in (400 mm) and with a dynamometer, loading the belt branch with 16.86 lbs (75 N) as indicated in fig. 12 a “te” bend of approximately .33 in (8.4 mm) is obtained.

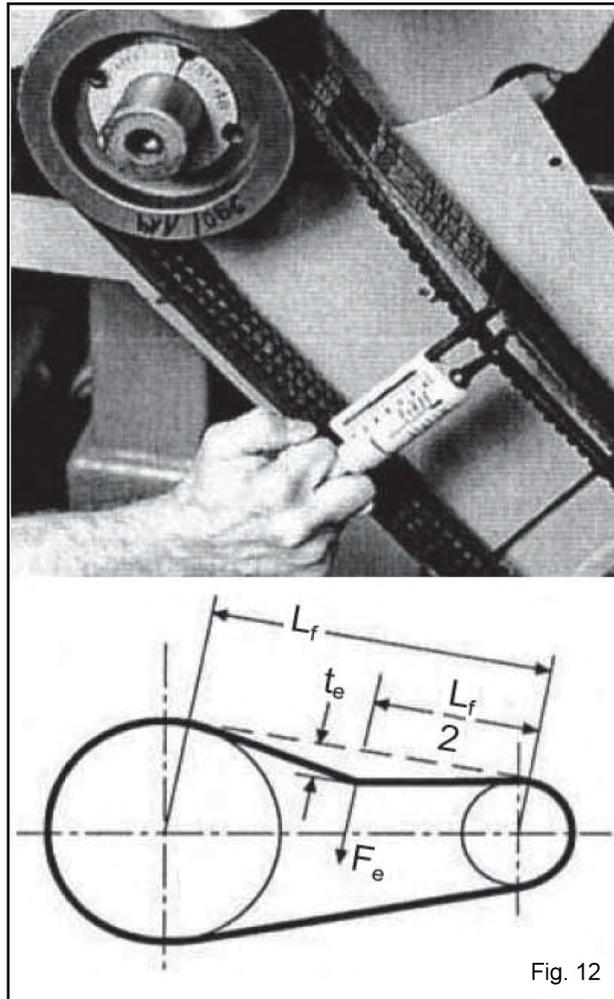


Fig. 12

L_f = Wheelbase
 t_e = Belt bend
 F_e = 75 N Dynamometer load

Note 1: Unless otherwise stated by the supplier of the belts, control of proper pull and its relative re-tensioning should be performed after no less than 30 minutes of motion necessary for the normal adjustment of the belts. Best performance and durability will be achieved with proper tensioning.

Note 2: In case of necessity or for routine maintenance, never replace a single belt but the complete set.

10. START-UP AND OPERATION

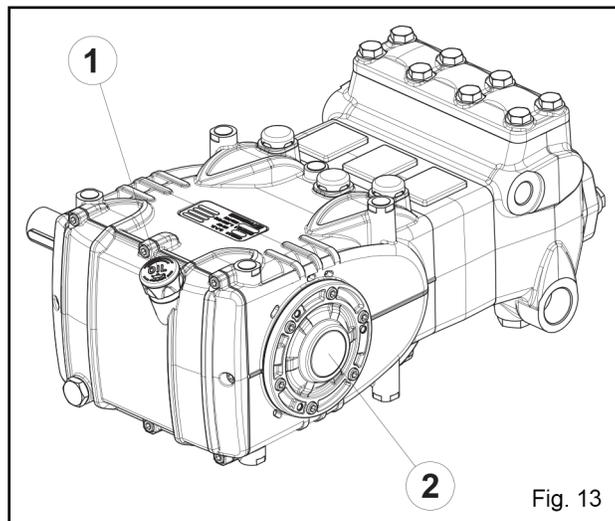
10.1 Preliminary Inspections

Before Start-up Be sure that:



The suction line is connected and up to pressure (see paragraph 9.4 - 9.5 - 9.6) and the graphic in par. 9.8.

1. The suction line must be perfectly airtight.
2. All the On-Off valves between the pump and the feeding source are completely open. The delivery line must discharge freely in order to allow the air in the pump to be ex-pulsed easily, thus facilitating pump priming.
3. All suction/delivery connections and fittings must be correctly tightened.
4. Coupling tolerances on the pump/transmission axis (half-joint misalignment, Cardan joint tilt belt tightening, etc.) must remain within the limits indicated by the transmission Manufacturer.
5. The pump's oil level must be verified using the correct dipsticks (1, fig. 13) and with the lever indicator (2, fig.13)



In case of prolonged storage or long-term inactivity, check proper functioning of the inlet and outlet valves.

10.2 Start-up

1. When starting the pump for the first time, check for the correct direction of rotation.
2. The pump must be started off-load.
3. Verify correct feeding pressure.
4. During operation, check that the rotating speed does not exceed the rated value.
5. Before putting the pump under pressure let it run for at least 3 minutes.
6. Before stopping the pump, release the pressure by acting on the adjustment valve or on any discharging device and reduce to a minimum RPM (activation with combustion motors).

11. PREVENTIVE MAINTENANCE

To guarantee pump reliability and efficiency, comply with the maintenance intervals as indicated in the table below.

PREVENTIVE MAINTENANCE	
EVERY 500 HOURS	EVERY 1500 HOURS
Check oil level	Change oil
	Check / Replace: Balls Valve housing
	Check / Replace: H.P seal Wiper ring



If the pump is temporarily not going to be used, in order to prevent stiffening or corrosion caused by the fluids being pumped, it is strongly recommended to flush all the components inside the head
To increase the component life of hydraulic parts, wash the parts with clean water at the end of the working day.

12. PUMP STORAGE



12.1 Long Term Inactivity

After long term inactivity of pump, before operation check oil level, inspect valves as specified in chapter 10, then follow described start-up procedures.

12.2 Filling the Pump With An Anti-Corrosion Emulsion or Anit-freeze solution

- A) Make sure the connecting hose is clean.
- B) Fix the inlet hose to the diaphragm pump, open the pump inlet connection and attach the hose between it and the diaphragm pump.
- C) Fill the container with solution / emulsion.
- D) Insert the free ends of the inlet hose and the high pressure exhaust hose inside the container.
- E) Switch on the diaphragm pump
- F) Pump the emulsion until it exits from the high pressure outlet hose.
- G) Continue pumping for at least another minute. The emulsion can be strengthened if necessary by adding Shell Donax for example to the solution.
- H) Stop the pump, remove the hose from the suction connection and close it with a plug.
- I) Remove the hose from the high pressure outlet port. Clean, grease and plug both hose connections.

13. PRECAUTIONS AGAINST FREEZING



In areas and periods of the year where there is risk of freezing, follow the instructions indicated in Chapter 12 (see paragraph 12.2).



In the presence of ice, do not start the pump for any reason until the circuit has been fully defrosted, otherwise there can be serious damage to the pump.

14. WARRANTY TERMS

The guarantee period and conditions are contained in the purchase agreement.

The warranty is void if:

- a) The pump has been used for purposes that differ from that agreed.
- b) The pump has been fit with an electric or diesel engine with performance greater than that indicated in the table.
- c) The required safety devices were un-adjusted or disconnected.
- d) The pump was used with accessories or spare parts not supplied by General Pump.
- e) Damage was caused by:
 - 1) improper use
 - 2) the non-observance of maintenance instructions
 - 3) use not compliant with operating instructions
 - 4) insufficient flow rate
 - 5) faulty installation
 - 6) incorrect positioning or sizing of the hoses
 - 7) non-authorized design changes
 - 8) cavitation

15. TROUBLESHOOTING



The pump does not produce any noise at start-up:

- The pump is not primed and is running dry, RPM is too high, see par. 9.8.
- There is no bentonite in the inlet line
- The valves are blocked
- The delivery line is closed and does not allow the air in the pump to be discharged



The pump pulses irregularly (knocking):

- Air suction
- Insufficient feeding
- Bends, elbows, fittings along the suction line obstruct the fluid's passage
- The pump is not primed due to insufficient head or the delivery line is closed during priming
- The pump is not primed due to valve seizing
- Worn valves
- Worn pressure packings
- Incorrect operation of the pressure adjustment valve
- Transmission problems



The pump does not deliver the rated flow / is noisy:

- Insufficient feeding (see the causes listed above)
- RPM are less than the rated flow
- Excessive amount of water by-passed by the pressure adjustment valve
- Worn valves
- Leakage from the pressure packings
- Cavitation due to:
 - 1) Wrong sizing of the suction hose/undersized diameters
 - 2) Insufficient flow rate
 - 3) High water temperature



Insufficient pump pressure:

- The nozzle (or has become) too large
- Insufficient RPM
- Leakage from the pressure packings
- Incorrect operation of the pressure adjustment valve
- Worn valves



Overheated pump:

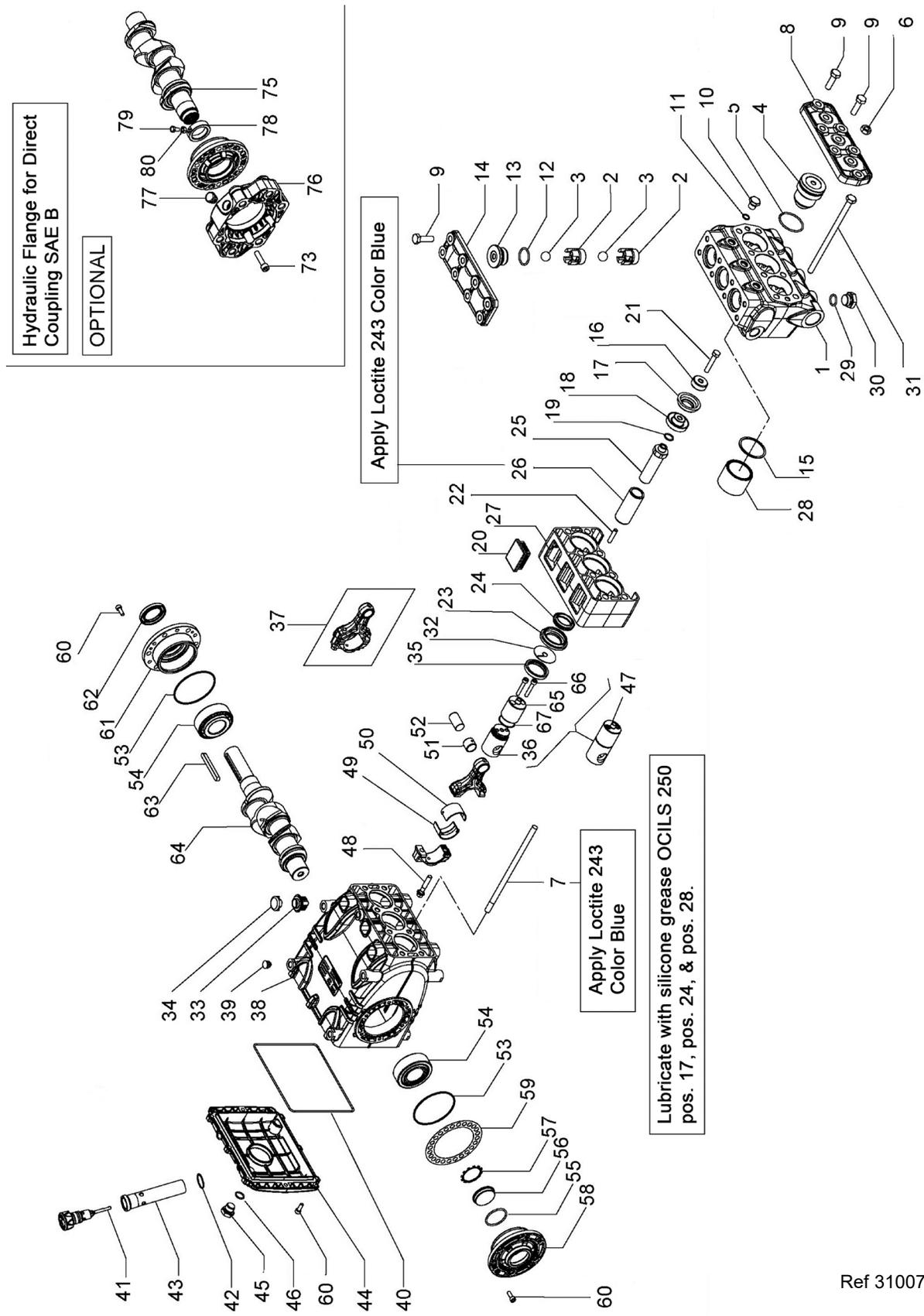
- The pump is overloaded (pressure or RPM exceed the rated values)
- Oil level is too low, or the oil is not of a suitable type, indicated in Chapter 7 (see paragraph 7.6)
- Excess belt tension or Incorrect alignment of the joint or pulleys
- Excessive tilt of the pump during operation



Pump vibrations or knocking:

- Air suction
- Incorrect operation of the pressure adjustment valve
- Valve malfunction
- Irregular drive transmission motion

16. EXPLODED VIEW AND PARTS LIST



PARTS LIST

Item	Part No.	Description	QTY.
1	F70127215 F70127315	PUMP HEAD Ø 45 PUMP HEAD Ø 45 - NPT	1
2	F36214056	VALVE SEAT	6
3	F97488800	BALL 11/16"	6
4	F70226062	VALVE PLUG	3
5	F90388500	OR Ø 45.69X2.62	3
6	F92237500	NUT M10X8	4
7	F95829500	CAPTIVE SCREW M10X200	4
8	F70225415	VALVE COVER	1
9	F99369800	SCREW M10X35	13
10	F98204700	PLUG G 1/4"X13	3
11	701013	OR Ø 10.82X1.78	3
12	F90386300	OR Ø 28.25X2.62	3
13	F70226162	VALVE PLUG	3
14	F70225515	VALVE COVER	1
15	F93199200	SEAL Ø 48.5X54.9X1.5	3
16	F70225966	PLUNGER SEAL MOUNT	3
17	F93198800	PLUNGER SEAL Ø 45	3
18	F70225870	PLUNGER SUPPORT SEAL	3
19	F90367800	OR Ø 15.00X2.00	3
20	F98243600	PLUG 47X37X12.5	3
21	F99312720	SCREW M8X45	3
22	F95822000	STUD M7X32	3
23	F70225770	SCRAPER SUPPORT	3
24	F90276800	SCRAPER RING Ø 30X45X8.5	3
25	F70225666	PLUNGER SPACER	3
26	76040056	PLUNGER Ø 90X70	3
27	F70222722	HEAD SPACER	1
28	F70060502	CYLINDER Ø 45	3
29	701115	OR Ø 17.13X2.62	3
30	F98218700	PLUG G 1/2"X10	3
31	F99386200	SCREW M10X190	4
32	F96709900	WIPER 10.0X45.0X10.0	3
33	F70222551	PLUG HOUSING	3
34	F71225951	PLUG	3
35	9016770	RING Ø 36.0X47.0X6.0/7.5	3
36	F70050015	PLUNGER GUIDE	3
37	F70030501	CON-ROD - COMPLETE	3
38	F70010022	CRANKCASE	1

Item	Part No.	Description	QTY.
39	F95200500	PLUG Ø 15	5
40	F90394200	OR Ø 190.17X2.62	1
41	F98211500	DIPSTICK Ø 21.5X70	1
42	F90360400	OR Ø 25.12X1.78	1
43	F72210695	DIPSTICK SLEEVE	1
44	F70160622	CRANKCASE COVER	1
45	F98210050	PLUG G 3/8"X13	1
46	90383300	OR Ø 13.95X2.62	1
47	F70606801	PLUNGER GUIDE, COMPLETE	3
48	F99312300	CON-ROD CLAMPING SCREW	6
49	F90922000 F90922100 F90922200	BEARING , LOWER BEARING, +0.25, LOWER BEARING, +0.50, LOWER	3
50	F90922300 F90922400 F90922500	BEARING, UPPER BEARING, +0.25, UPPER BEARING, +0.50, UPPER	3
51	F90910000	CON-ROD BUSHING	3
52	F97742000	PLUNGER PIN Ø 18X36	3
53	F90391500	OR Ø 80.60X2.62	2
54	F91847700	ROLLER BEARING	2
55	90387700	OR Ø 39.34X2.62	1
56	70211801	OIL LEVEL INDICATOR	1
57	90075600	STOP RING	1
58	F70150122	SIDE BEARING COVER	1
59	F70220081 F70220381	SHIME 0.1 MM SHIME 0.25 MM	-
60	F99185400	SCREW M6X16	12
61	F70150022	PTO SIDE BEARING COVER	1
62	F90166800	RING Ø 35.0X52.0X7.0	1
63	91490000	KEY 8X7X70	1
64	F70020635	CRANKSHAFT	1
73	F99308400	SCREW, M8X30	6
75	F70020935	CRANKSHAFT, HYDRAULIC SAE B	1
76	F10085322	FLANGE, SAE B	1
77	F90206500	PLUG, Ø 17	1
78	F70226771	RING, Ø 30	1
79	F70227034	SCREW, M6X12	1
80	F92202500	NUT, M6X5	1

REPAIR KITS

KIT NUMBER	F2318 Plunger Pack	F2319 Valve Kit	F2320 Plunger Rebuilt kit	F2321 Complete Seals	F2156 Conn. Rod	F2157 (+0.25) Conn. Rod	F2158 (+0.50) Conn. Rod
Positions Included	5, 17, 19	2, 3, 5, 12, 29,	5, 15, 17, 19, 24, 28	5, 11, 15, 17, 24, 29, 35, 40, 42, 46, 53, 55, 57, 62	49, 50	49, 50	49, 50

TORQUE SPECS*

Pos.	Ft/lb	N-M
7	3.37	15
9	9.00	40
10	9.00	40
21	4.50	20
22	2.25	10
25	4.50	20
30	9.00	40
31	9.00	40
45	9.00	40
48	6.75	30
60	2.25	10
66	2.25	10
73	4.95	22
79	2.25	10

* Decrease torque by 20% if threads are lubricated

17. Maintenance Log

HOURS & DATE

OIL CHANGE							
GREASE							
PACKING REPLACEMENT							
PLUNGER REPLACEMENT							
VALVE REPLACEMENT							



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