GENERAL PUMP

HS

Owner's Manual

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

HS18 - HS20

General Pump
is a member of
the Interpump Group

Ref 310072 Rev. B
02-23

INDEX

1. INTRODUCTION

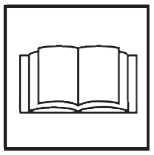
This manual describes the use and maintenance instructions of the HS pump, and should be carefully read and understood before using the pump.

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 unauthorized personnel and, wherever possible, the area should 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 pavement.

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

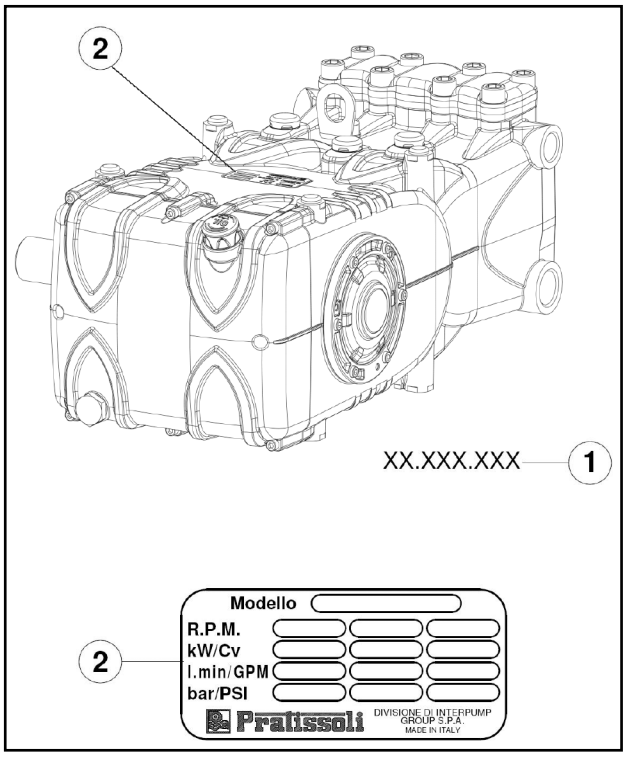
1. The pressure system maintenance must be carried out in the time intervals set by the manufacturer who is responsible for the whole group according to law.
2. Maintenance should always be carried out by trained and authorized personnel.
3. Assembly and disassembly of the pump and its various components 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
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
HS 18	1200	45	11.9	8700	600	70	70
HS 20	1200	56	14.8	7250	500	73	53.7

6. DIMENSIONS AND WEIGHT

For dimensions and weight of Standard Version pump, please refer to fig. 2

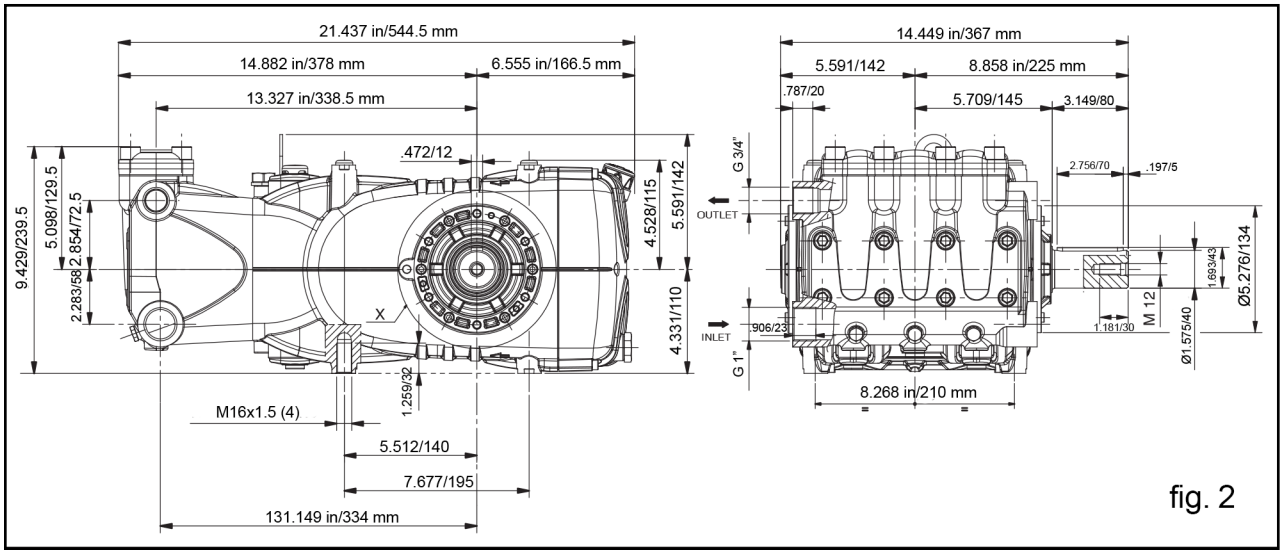


fig. 2

Dry weight 138.89 lbs (63 kg).

7.INFORMATION ABOUT PUMP USE

The HS pump, is designed to operate in environments with atmospheres that are not potentially explosive, and with filtered water (see par. 9.7)

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

7.1 Water Temperature

The max water temperature is 104^0 F (40^0 C).However, it is possible to use the pump at temperatures of up to 140^0F (60^0C) 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 9) 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 32^0 and 89.6^0 F (0^0 and 30^0C). 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

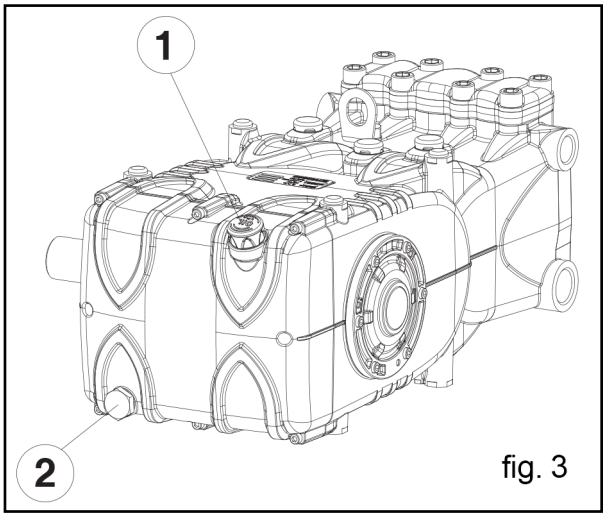


fig. 3

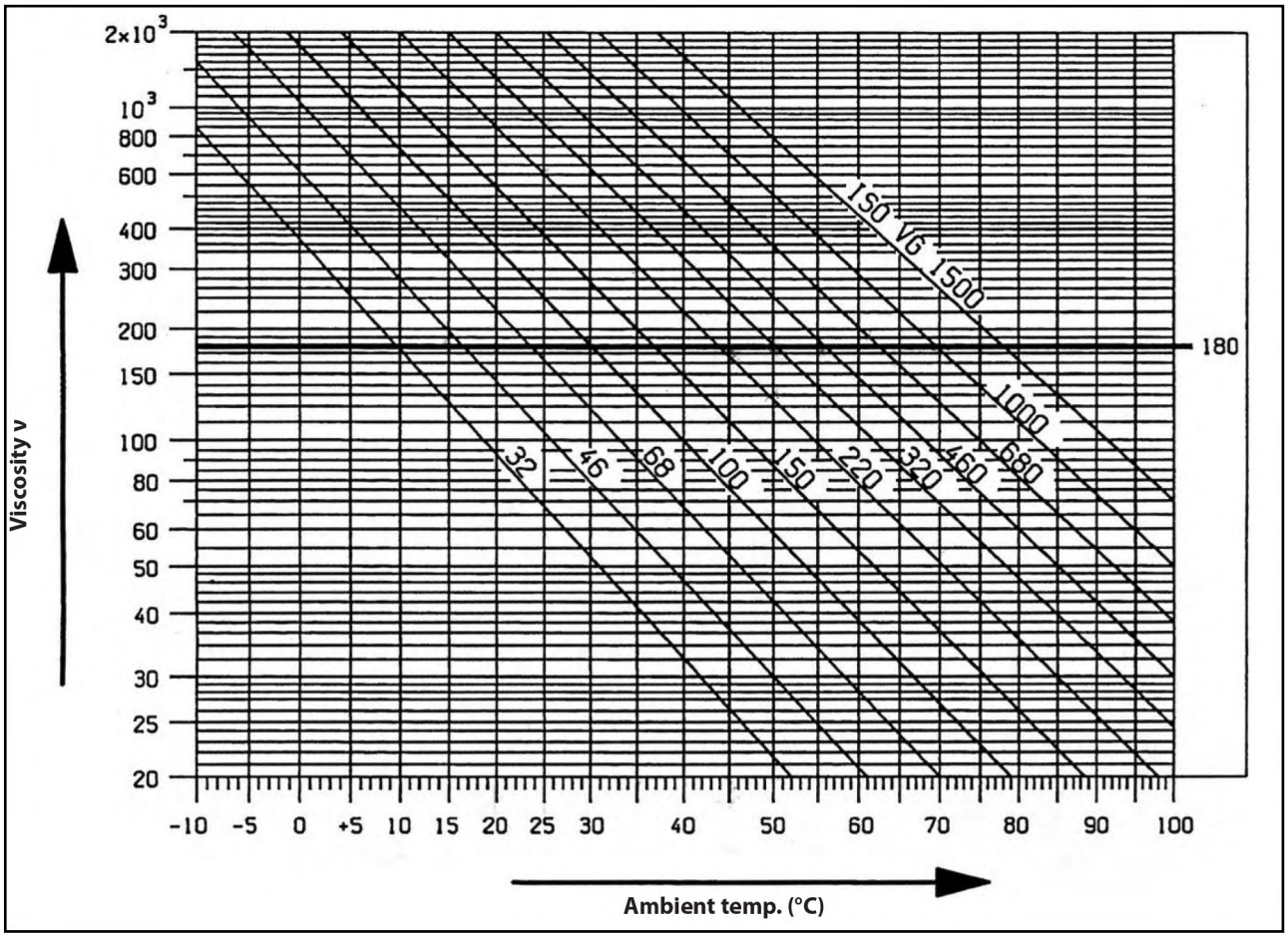
Check the oil level by using the oil level dipstick (1, fig. 3). Refill if necessary to top off level. Correct oil level inspection is done with the pump at room temperature; oil is changed with the pump at working temperature, by removing the rear plug (2, fig. 3).
Checking and changing oil is to be carried out as indicated in Chapter 11. The amount required is 128.49 oz (3.8 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

mm^2/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

HS 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.

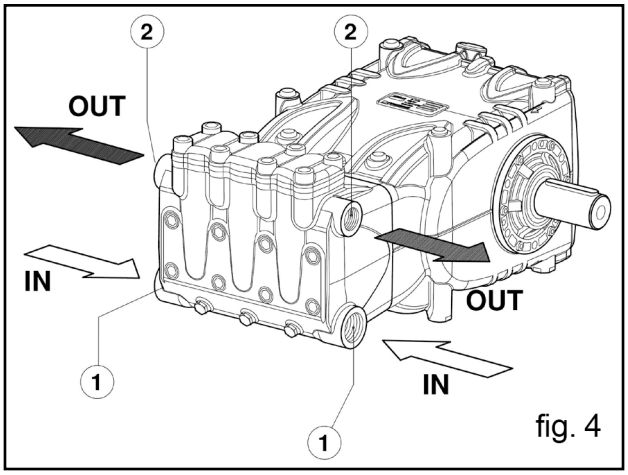


fig. 4

9. PUMP INSTALLATION

9.1 Installation
The pump must be installed in a horizontal position using the M16 x 1.5 threaded support feet.
Tighten the screws with a torque of 154.89 ft lbs (210 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 installed with vibration dampers. For special applications contact the **Customer Service Department.**

A lifting bracket is mounted on the pump for easy installation, as per the figure below.

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.

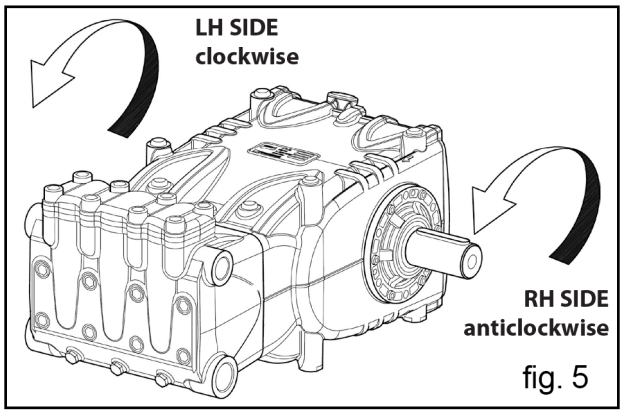


fig. 5

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 2.2.1 of the Repair Manual.

2. Turn the mechanical part 180º 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 2.2.5 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

To obtain the best volumetric efficiency, feed the pumps with a positive head (NPSHr). The recommend value, measured on the head suction flange, is given in the following table.

	HS 18	HS 20
$NPSH_r$ (ft)	6.56	11.45

The values given apply to the rated speed of rotation; otherwise contact Customer Service Department.

For any supply conditions other than those specified above, contact the Customer Service Department.

9.6 Suction Line

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

1. Minimum internal diameter as indicated in the diagram in paragraph 9.9, and in any case equal or greater than the pump head's value.

Along the duct, avoid localized diameter reductions that may cause pressure drops with subsequent cavitation. Absolutely avoid 90^0 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 install Venturi tubes or injectors for detergent intake.
7. Avoid the use of base valves or any other type of one-way valves.
8. Do not connect the by-pass line from the valve directly to the pump suction line.
9. Provide appropriate baffle plates inside the tank in order to avoid water flows coming from both the by-pass and feeding lines which may create turbulence near the tank's outlet port.
10. Make sure that the suction line is perfectly clean inside before connecting it to the pump.

9.7 Filtering

On the suction line 1 filter must be installed as indicated in fig. 7 and fig. 7/a.

With the manual adjustment valve:

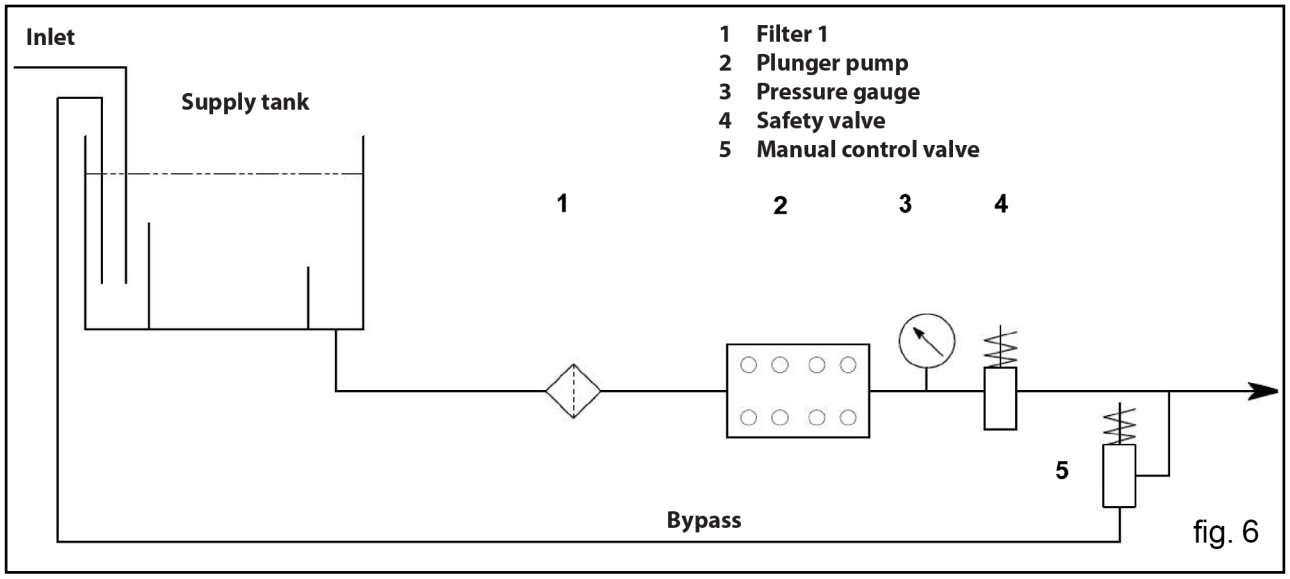


fig. 6

With the pneumatic adjustment valve:

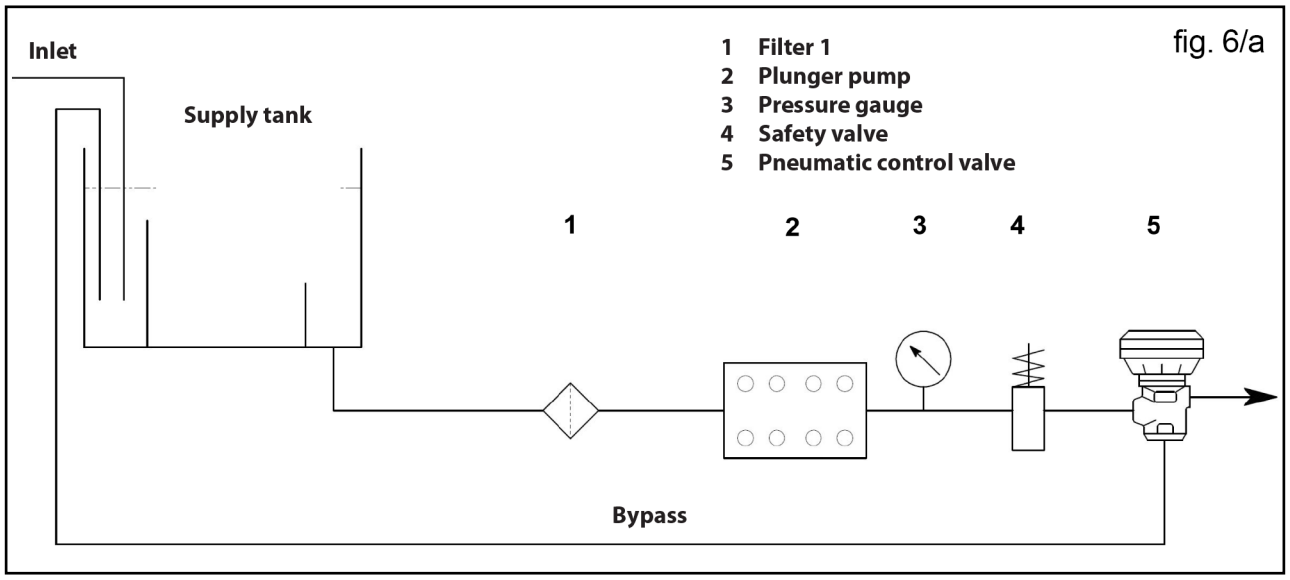


fig. 6/a

The filter must be installed as close as possible to the pump, should allow easy inspection and have the following characteristics:

1. Minimum capacity 3 times greater than the pump's rated flow value.
2. Filter port diameters must not be smaller than the pump inlet ports.
3. Filtration degree ranging between 200 and 360 µm.

In order to guarantee correct pump operation, it is important to plan periodical cleaning of the filter depending on actual pump usage, water quality and actual clogging conditions.

9.8 Outlet Line

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

1. The internal diameter of the hose must allow to guarantee correct fluid speed; see digram in paragraph 9.9
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.

9.9 Internal Diameter of the Hose Line

To determine the internal diameter of the hose, please refer to the following diagram.

Suction Hose

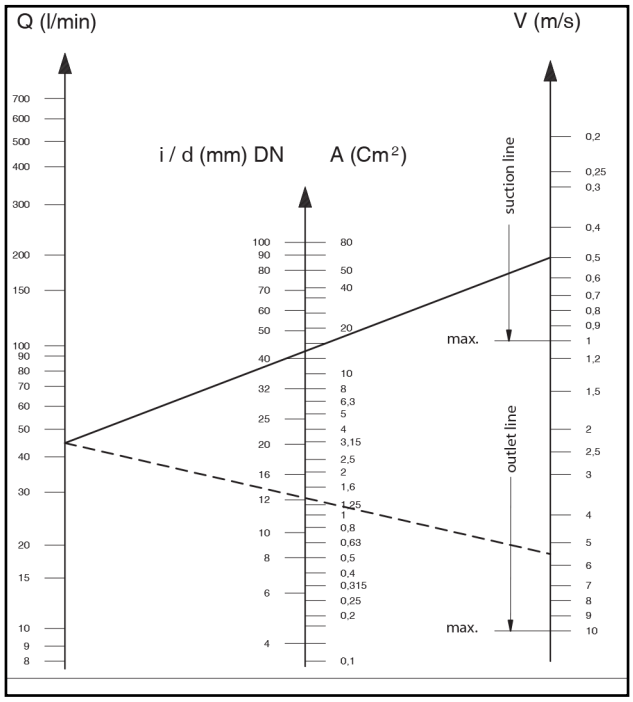
With a flow rate of ~11.89 GPM (45 l/mn) and water speed of 0.5 m/sec. the diagram line that connects the two scales intersects the central scale, indicating the diameters, at a value of ~ 1.69 inch (43 mm).

Delivery Hose

With a flow rate of ~11.89 GPM (45 l/mn) and water speed of 5.5 m/sec. The diagram line that connects the two scales intersects the central scale, indicating the diameters at a value of ~ 0.47 inch (12 mm).

Optimal speed to be obtained with the booster pump:

- Suction: ≤ 0.5 m/sec.
- Delivery: ≤ 5.5



9.10 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): ≥ 9.84 in (250 mm). The radial load on the shaft must not exceed 1686 Lbs (7500 N) (value necessary for layout definition). The transmission is considered adequate if the load is applied to a maximum distance a=1.57 in (40 mm) from the shaft shoulder (PTO) as shown in fig. 10.

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

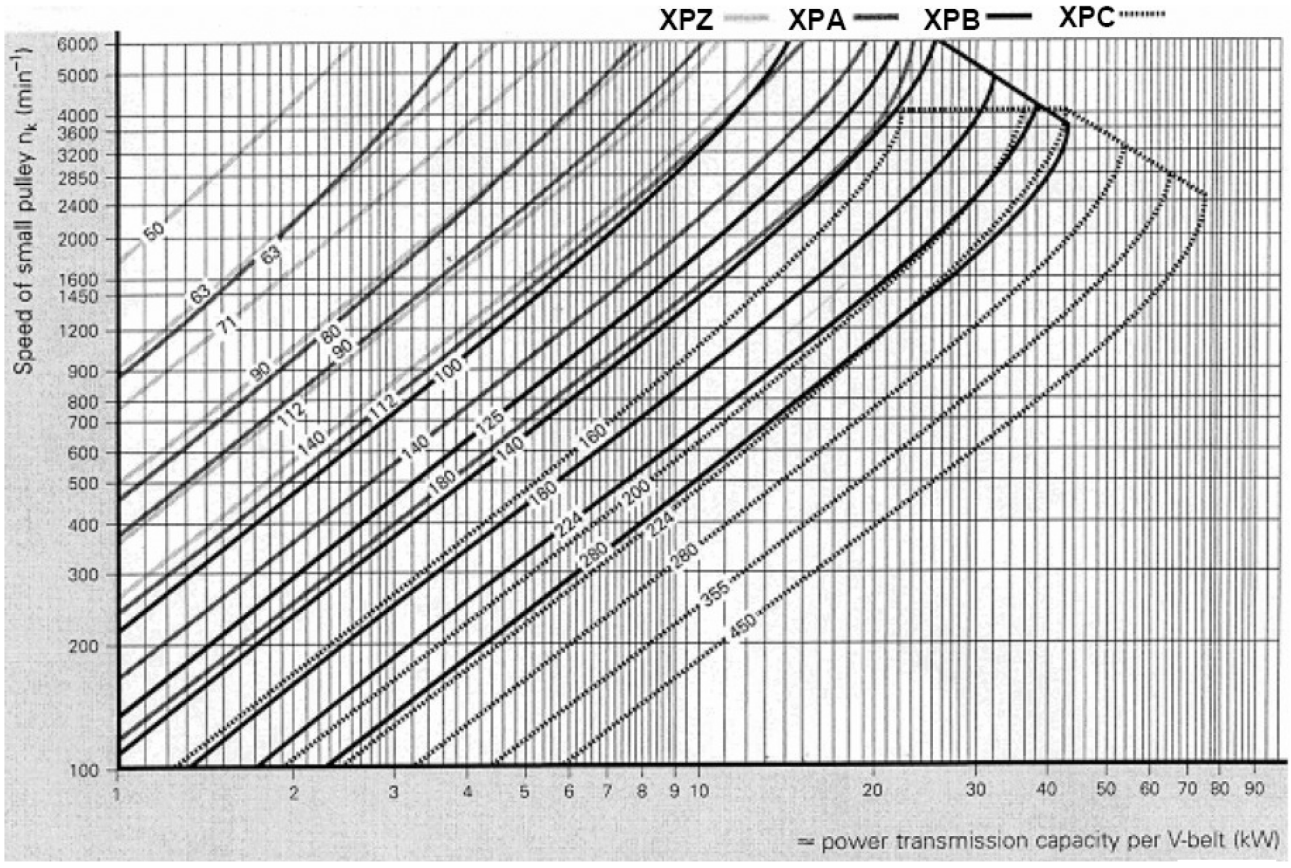


fig. 7

9.11 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.

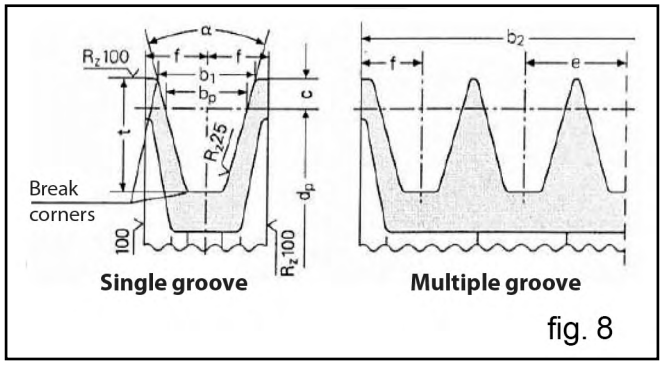


fig. 8

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 $b_1 \approx$	α = 34°			18.9	26.3
	α = 38°			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 α = 34°-38°				± 1°	± 30′
Pulleys for b2 by grooving number z b2 = (z-1) e + 2 f			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.

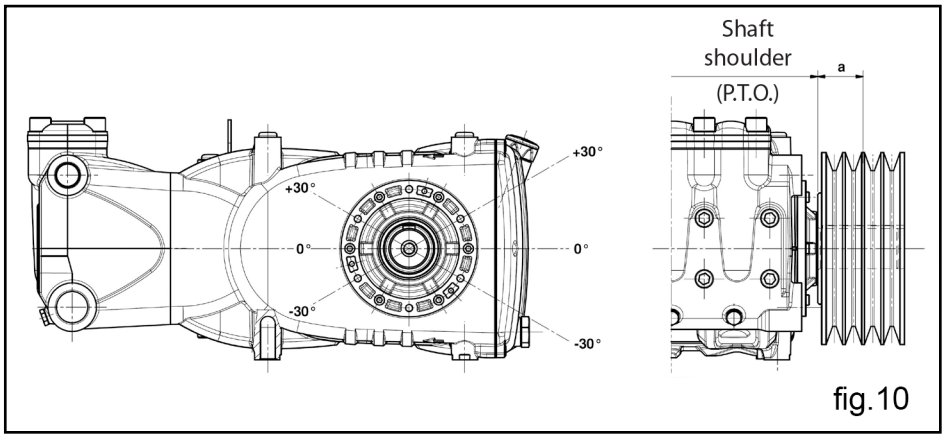


fig.10

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 9.12.

D) Belt length has a natural tolerance ≥ ±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.

9.12 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

Values of the static pull to be applied can be obtained from the diagram in fig. 11 for belts with a XPB profile in relation to the wheelbase.

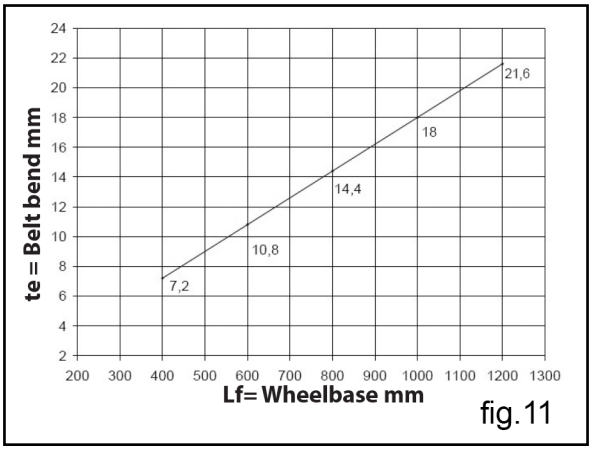


fig.11

Conclusion: with a wheelbase of 23.62 in (600 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 .43 in (10.8 mm) is obtained.

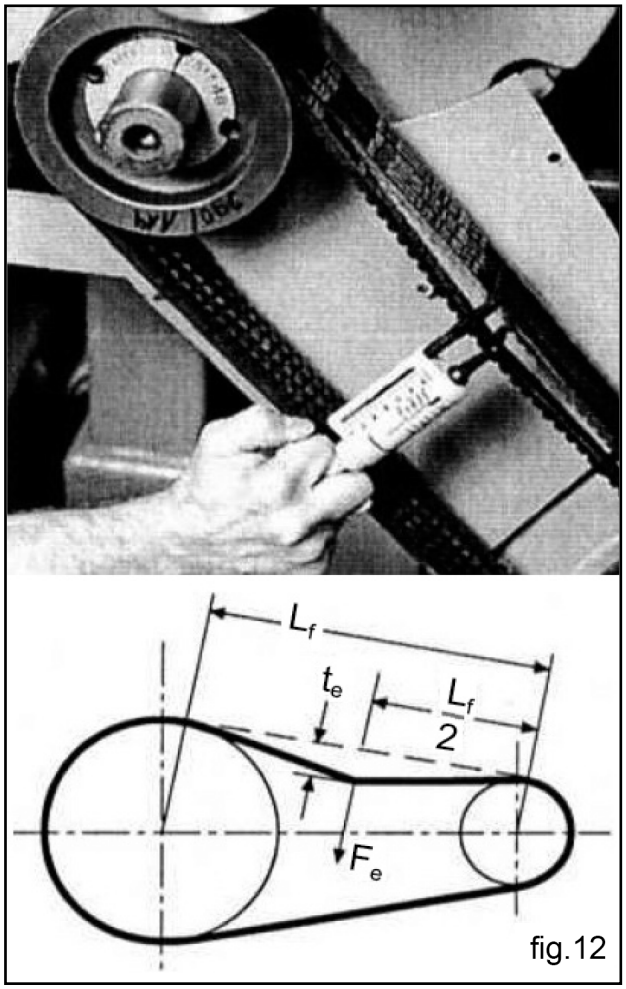


fig.12

Lf = Wheelbase
te = Belt bend
Fe = 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.

9.13 Transmission of power from the second PTO

Upon request, HS series pumps can be supplied with and auxiliary PTO on the opposite side to the driver (Transmission of power from the second PTO).

Transmission can be carried out:
- By means of the V-belts.
- By means of the joint.

By means of the V-belt, with drawable Max Torque is:
47.94 lbs (65 Nm) which corresponds to:
7 HP at 750 RPMs
7.4 HP at 800 RPMs
8.3 HP at 900 RPMs
9.3 HP at 1000 RPMs
11.1 HP at 1200 RPMs

By means of the joint, with drawable Max Torque is:
95.88 lbs (130 Nm) which corresponds to:
14 HP at 750 RPMs
14.8 HP at 800 RPMs
16.6 HP at 900 RPMs
18.6 HP at 1000 RPMs
22.2 HP at 1200 RPMs

By means of the V-belt, the transmission is considered suitable if: belt pull is applied at a max distance of 0.87 in (22 mm) from the crankshaft shoulder fig. 13. Minimum diameter of pulley to be used = Ø 3.94 (100 mm).

With transmission by means of the joint, pay close attention to align so that no transverse forces are generated on the pump shaft.

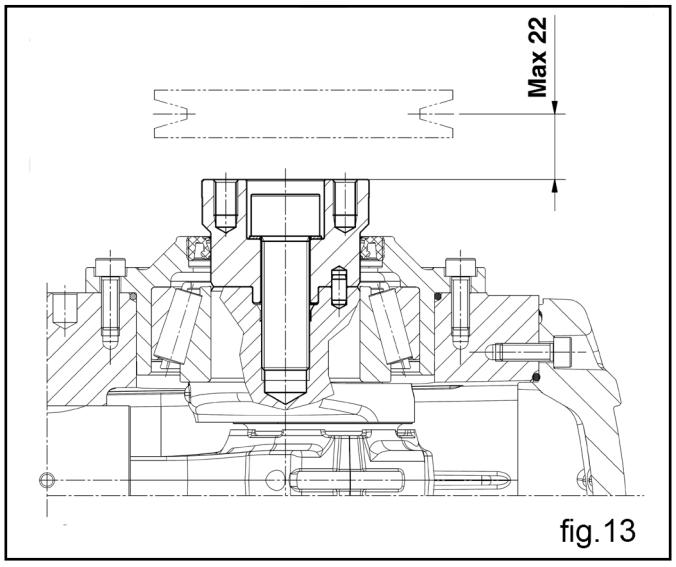


fig.13

For applications differing from those specified above, contact **Customer Service Departments.**

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) the pump must never run dry.

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. 14) and with the lever indicator (2, fig.14)

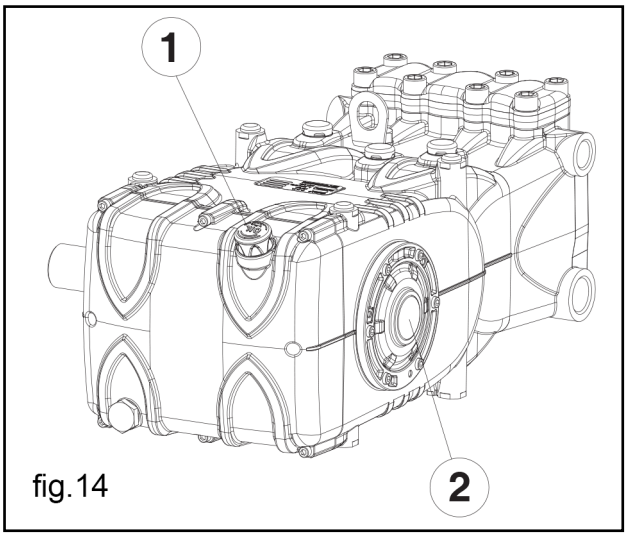


fig.14

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: Valves Valve seats Valve springs Valve guides
	Check / Replace: H.P packings L.P. packings

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
Method for filling pump with anti-corrosion emulsion or anti-freeze solution using an external diaphragm pump based on the layout shown in paragraph 9.7, between position 1 and position 2 of fig. 6 and fig. 6/a.

A) In place of the service tank, use a suitable container containing the solution to be pumped.
B) Close the filter draining, if open.
C) Be sure that the connecting hose is clean, spread with grease and connect it to the high pressure outlet port.
D) Fit a suction hose to the diaphragm pump. Open the pump suction connection and fit hose between it and the diaphragm pump.
E) Fill the container with the solution/emulsion.
F) Put the free extremities of the suction line and the high pressure outlet hose inside the container.
G) Start up the diaphragm pump.
H) Pump the emulsion until it comes out of the high pressure hose.
I) Continue pumping for at least another minute; if needed, the emulsion can be reinforced by adding, for example, Shell Donax
J) Stop the pump, remove the hose from the suction connection and close it with a plug.
K) Remove the hose from the high pressure outlet port. Clean, grease and plug both connections and the hoses.

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 unadjusted 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
- There is no water 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 inlet filter is dirty or too small
- The booster pump, where provided, supplies insufficient pressure or flow rate
- 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

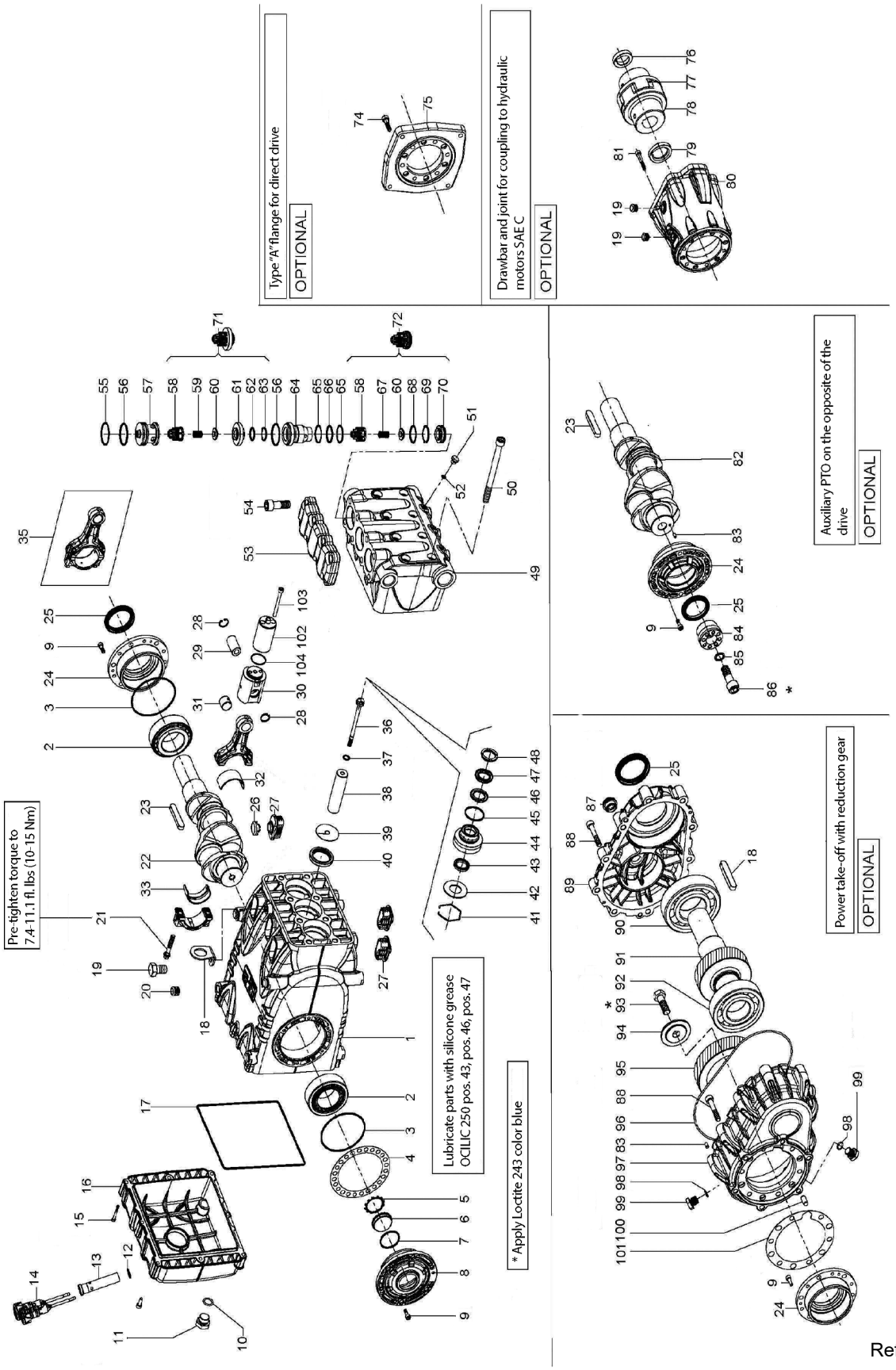
Overheated pump:

- 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	71010022	PUMP CRANKCASE	1
2	91859000	ROLLER BEARING	2
3	90391800	OR Ø 94.92X2.62	2
4	F71220081 F71220381	SHIM 0.1 MM SHIM 0.25 MM	- -
5	F90075600	RING Ø 45	1
6	F70211801	OIL LEVEL INDICATOR	1
7	90387700	OR Ø 39.34X2.62	1
8	F71150122	OIL LEVEL INDICATOR, BEARING COVER SIDE	1
9	F90186700	SCREW M6X18	12
10	701115	OR Ø17.13X2.62	1
11	F98218700	PLUG G1/2"X10	1
12	F90360400	OR Ø 25.12X1.78	1
13	F72210695	DIPSTICK TUBE	1
14	F98212000	DIPSTICK	1
15	F99196800	SCREW M6X50	8
16	F72160022	CRANKCASE COVER	1
17	F90400000	OR Ø 215.00X3.00	1
18	F71223074	LIFTING EYEBOLT	1
19	99426600	SCREW M12X25	1
20	98206000	PLUG Ø 15	4
21	F99313800	CONNECTING ROD SCREW	3
22	F71020035	CRANKSHAFT	1
23	F91500000	CRANKSHAFT KEY 12.0X8.0X70	1
24	F71150022	SIDE BEARING COVER	1
25	90170000	OIL SEAL Ø 50.0X65.0X8.0	1
26	F71225951	PLUG HOUSING CAP	3
27	F71225851	PLUG HOUSING	6
28	F90060600	RING Ø 20	6
29	F97743000	PIN Ø 20X38	3
30	F71050715	PLUNGER GUIDE	3
31	F90911000	CONNECTING ROD BUSHING	3
32	F90924300 F90924400 F90924500	CONROD HEAD SEMI-BUSHING, UPPER CONROD HEAD SEMI-BUSHING, UPPER +0.25 CONROD HEAD SEMI-BUSHING, UPPER +0.50	3
33	F90924000 F90924100 F90924200	CONROD HEAD SEMI-BUSHING, LOWER CONROD HEAD SEMI-BUSHING, LOWER +0.25 CONROD HEAD SEMI-BUSHING, LOWER +0.50	3
35	F71030701	CONNECTING ROD	3
36	F71219566	PLUNGER BOLT	3
37	F90367100	OR Ø 11.0X2.00	3
38	F71040009 F71041509	PLUNGER Ø 18X95 PLUNGER Ø 20X95	3
39	96714000	WIPER Ø 10.0X50.0X1.0	3
40	90167800	RING Ø 38.0X52.0X7.0/8.5	3
41	90079700	STOP RING Ø 52	3
42	F71217070 F71224770	PACKING RING Ø 18 PACKING RING Ø 20	3
43	F90264800 F90268800	PACKING Ø 18.0X26.0X5.5 PACKING Ø 20.0X28.0X5.5	3
44	F71214070 F71224870	PACKING SUPPORT Ø 18 PACKING SUPPORT Ø 20	3
45	F90387500	OR Ø 37.77X2.62	3
46	F90268700 F90270400	RESTOP RING Ø 18.00X32.00X6.2/3.0 RESTOP RING Ø 20.00X35.00X5.5/2.0	3
47	F90268600 F90270500	PACKING Ø 18.0X32.0X7.0/4.5 H.P. PACKING Ø 20.0X35.0X7.5/4.5 H.P.	3
48	F71100051 F70100051	FRONT RING Ø 18 FRONT RING Ø 20	3
49	F71120536 F72120836 F71124036 F72120936	PLUNGER MANIFOLD Ø 18 PLUNGER MANIFOLD Ø 20 PLUNGER MANIFOLD Ø 18 - NPT PLUNGER MANIFOLD Ø 20 - NPT	1

Item	Part No.	Description	QTY.
50	F99448000	SCREW M12X150	8
51	F98197200	PLUG G 1/8"X8	3
52	F90357600	OR Ø 6.75X1.78	3
53	F71210036	VALVE COVER	1
54	F99485000	SCREW M14X16	8
55	F90522000	BACK-UP RING Ø 40.9X45.0X1.5	3
56	F90387800	OR Ø 39.34X2.62	6
57	F71211070	VALVE PLUG Ø 45	3
58	F36209751	SUCTION/DELIVERY VALVE GUIDE	6
59	F94740100	SPRING Ø 12.0X17.0	3
60	F36205066 F36203966	SUCTION/DELIVERY VALVE PLATE - HS18 SUCTION/DELIVERY VALVE PLATE	3
61	F36204366	VALVE SEAT DELIVERY	3
62	F90385100	OR Ø 21.89X2.62	3
63	F90514500	BACK-UP RING Ø 22.9X27.0X1.5	3
64	F71211566	VALVE SPACER	3
65	F90517900	BACK-UP RING Ø 31.4X35.5X1.5	6
66	F90386600	OR Ø 29.82X2.62	3
67	F94739700	SPRING Ø 11.4X20.0	3
68	F90385600 F90386600	OR Ø 23.47X2.62 - HS18 OR Ø 29.82X2.62 - HS20	3
69	F90515500 F90517700	BACK-UP RING Ø 23.9X28.0X2.0 - HS18 BACK-UP RING Ø 30.0X34.5X1.5 - HS20	3
70	F36204966 F36204266	VALVE SEAT SUCTION - HS18 VALVE SEAT SUCTION - HS20	3
71	F36713901	VALVE ASSEMBLY DELIVERY	3
72	F36713801 F36714401	VALVE ASSEMBLY SUCTION - HS20 VALVE ASSEMBLY SUCTION - HS18	3
74	F99309800	SCREW M8X35	6
75	F10067720	FLANGE	1
76	F10074570	SPACER Ø 31.75 LENGTH 10.5	1
77	F10074947	ELASTIC ELEMENT	1
78	F10742801	ELASTIC JOINT Ø 40.00X31.75	1
79	F10074670	SPACER Ø 40.00 LENGTH 10.0	1
80	F10075020	HYDRAULIC MOTOR FLANGE	1
81	F99314600	SCREW M8X50	6
82	F71020735	CRANKSHAFT, PTO	1
83	F97615200	PIN	1
84	F71226554	AUXILIARY, PTO	1
85	F96737800	WASHER Ø 17X24.0X1.0	1
86	F99514200	SCREW, M16X45	1
87	F97594000	OIL SIGHT GLASS	1
88	F99314600	SCREW M8X50	16
89	F72210920	COVER GEARBOX	1
90	F91859300	BEARING	1
91	F10070835 F10070935 F10071035	PINION Z27 R1250 PINION Z25 R1500 PINION Z22 R1830	1
92	F91857700	BEARING	1
93	F99430700	SCREW M12X40	1
94	F72211055	GEAR MOUNTING WASHER	1
95	F10071135 F10071235 F10071335	GEAR RING Z34 R1250 GEAR RING Z37 R1500 GEAR RING Z40 R1830	1
96	F90394800	O-RING, Ø 209.22X2.62	1
97	F72210820	COVER GEARBOX	1
98	F90358500	O-RING, Ø 10.82X1.78	2
99	F98204250	PLUG G1/4"X13	2
100	F97618500	PIN Ø 8.0X18.0	1
101	F72210784	SHIM	1
102	F71050866	PLUNGER STEM GUIDE	3
103	F99199400	SCREW M6X65	6
104	F90352800	OR Ø 30.00X1.5	3
	200082	BOLT, M16-1.5 x 40	4
	200083	LOCK WASHER, M16	4

REPAIR KITS

KIT NUMBER	**F2024 HS18 (D.18)** Plunger Pack.	**F2071 HS20 (D.20)** Plunger Pack.	**F2031 Inlet** Valve	**F2022 Inlet** Valve	**F2023 Outlet** Valve	**F2025 (HS18)** Complete Seals	**F2072 (HS20)** Complete Seals	**F2135** Conn. Rod	**F2154** Conn. Rod	**F2155** Conn. Rod
Positions Included	43, 45, 46, 47	43, 45, 46, 47	72	72	62, 63, 71	3, 5, 7, 10, 17, 25, 37, 40, 43, 45, 46, 47, 48, 52, 55, 56, 62, 63, 65, 66, 68, 69	3, 5, 7, 10, 17, 25, 37, 40, 43, 45, 46, 47, 48, 52, 55, 56, 62, 63, 65, 66, 68, 69	32, 33	32, 33	32, 33

TORQUE SPECS*

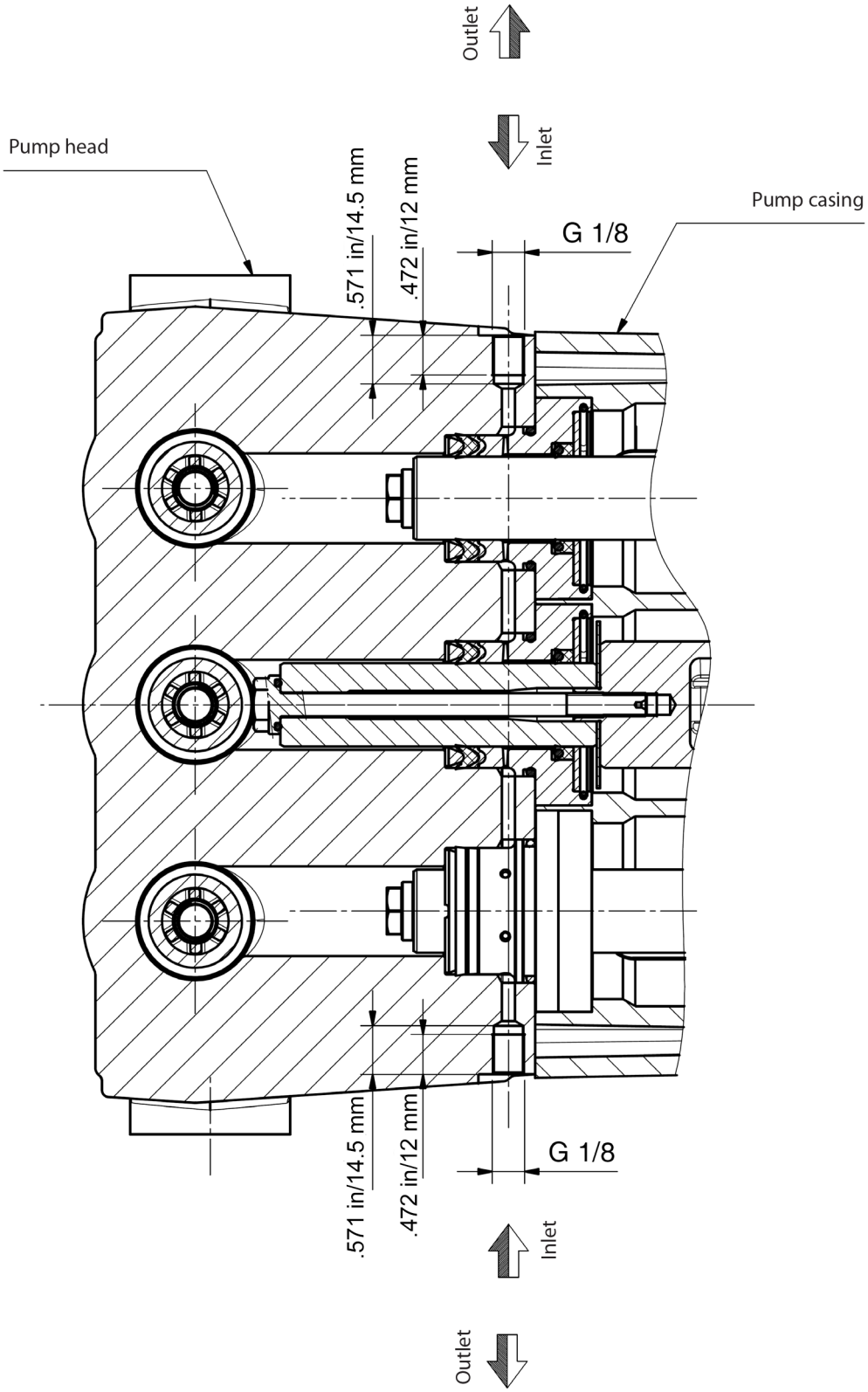
ITEM	Ft-lbs	Nm
9	7.4	10
11	29.5	40
15	29.5	40
21	22.2	30
36	14.8	20
50	59.0	80
51	9.6	13
54	73.8	180
74	29.5	40
81	29.5	40
87	7.4	10
88	29.5	40
93	51.6	70
103	14.8	20

*Decrease torque by 20% if threads are lubricated.

***Use Loctite 243.

17. Flushing circuit diagram

Adhere to the following valves for proper system operation:
minimum circuit flow rate 1.057 gal/min (4 l/min), maximum fluid pressure 87.02 PSI (6 bar).



18. Maintenance Log

	HOURS & DATE						
OIL CHANGE							
GREASE							
PACKING REPLACEMENT							
PLUNGER REPLACEMENT							
VALVE REPLACEMENT							

GP Companies, Inc.
1174 Northland Drive
Mendota Heights, MN 55120
Phone:651.686.2199 Fax: 800.535.1745
www.generalpump.com email: sales@gpcompanies.com