

# Owner's Manual

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



General Pump is a  
member of the  
Interpump Group



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## 1. INTRODUCTION

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

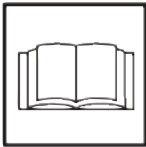
Correct use and adequate maintenance will guarantee the pumps trouble-free operation for a long time. General Pump declines any responsibility for damage caused by misuse or the non-observance of the instructions indicated in this manual.

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/or failure to observe the installation and maintenance instructions may cause serious 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 precaution 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 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 verify that:

1. The high pressure system is properly fed by a minimum pressure of 75-100 PSI (5-7 Bar), metered in the head flange.
2. The pump intake filters are perfectly clean; we recommend 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 evident signs of abrasion, and that fittings are in perfect shape.
5. During use pump may get hot. 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 Lances/Nozzles

1. The Operator must always place his own and other worker's safety before any other interest; his and should always be governed by good 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.

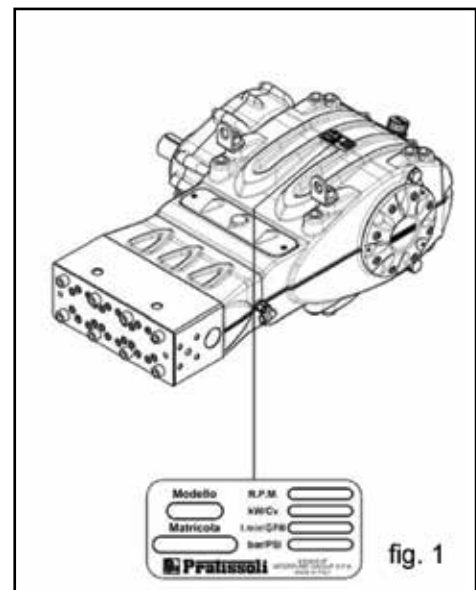
## 4. PUMP IDENTIFICATION

Each pump has a specific label which contains:

Pump model and version  
Serial Number  
Maximum RPM  
Power - Hp-kW  
Pressure - PSI  
Flow Rate - GPM



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

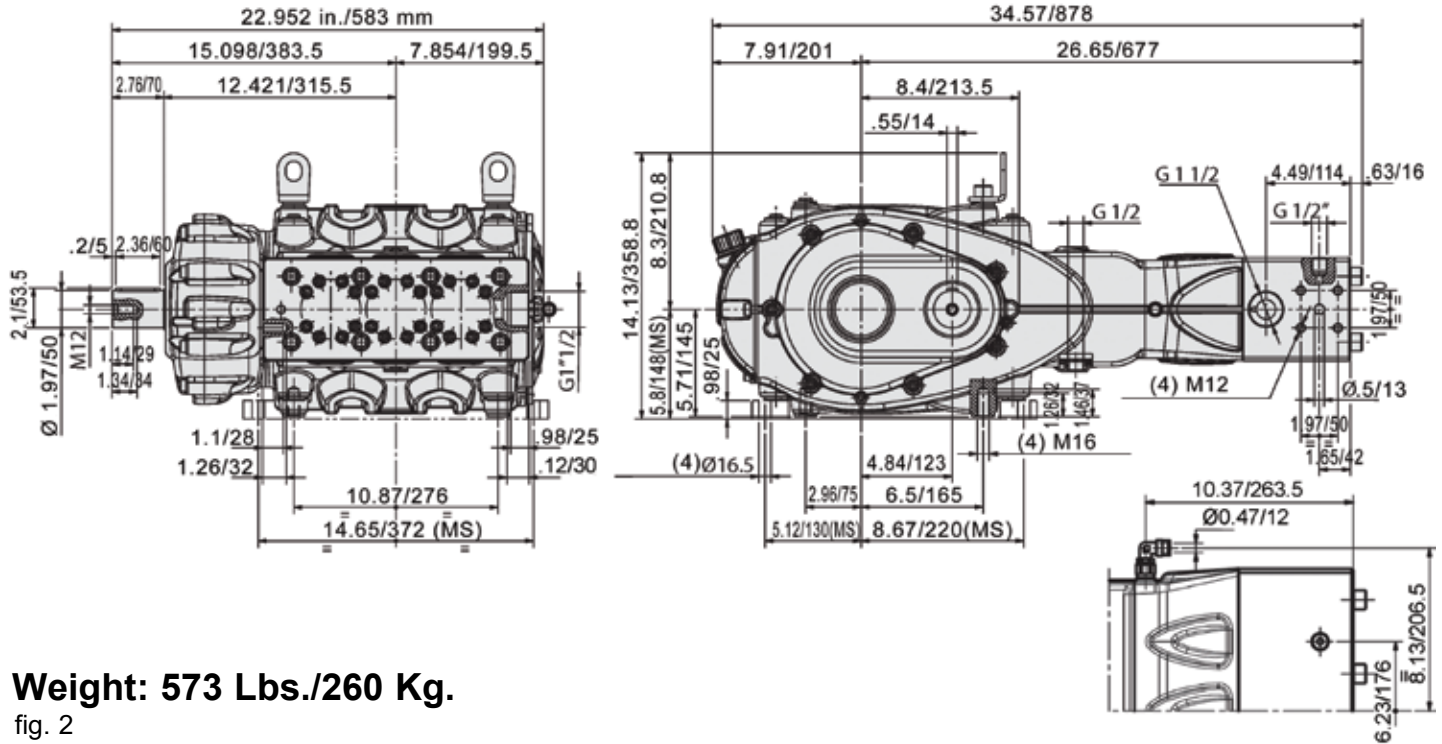


**5. TECHNICAL FEATURES**

MODEL	RPM	FLOW RATE		PRESSURE		POWER	
		GPM	l/min	PSI	Bar	Hp	kW
SMH14	800	6.9	26	21750	1500	101	74
	1500	6.9	26	21750	1500	101	74
	1800	6.9	26	21750	1500	101	74
	2200	6.9	26	21750	1500	101	74
SMH16	800	9.0	34	17400	1200	106	78
	1500	9.0	34	17400	1200	106	78
	1800	9.0	34	17400	1200	106	78
	2200	9.0	34	17400	1200	106	78
SMH18	800	11.4	43	13050	900	101	74
	1500	11.4	43	13050	900	101	74
	1800	11.4	43	13050	900	101	74
	2200	11.4	43	13050	900	101	74
SMH20	800	14.0	53	10875	750	103	76
	1500	14.0	53	10875	750	103	76
	1800	14.0	53	10875	750	103	76
	2200	14.0	53	10875	750	103	76
SMH22	800	16.9	64	8700	600	100	73.5
	1500	16.9	64	8700	600	100	73.5
	1800	16.9	64	8700	600	100	73.5
	2200	17.2	65	8700	600	101	74
SMH24	800	20.1	76	7250	500	99	73
	1500	20.1	76	7250	500	99	73
	1800	20.1	76	7250	500	99	73
	2200	20.3	77	7250	500	100	73.5

**6. DIMENSIONS AND WEIGHT**

For dimensions and weight, please refer to fig. 2.



**Weight: 573 Lbs./260 Kg.**  
fig. 2

**7. OPERATING INSTRUCTIONS**



The SMH pump was designed to operate with filtered water (see paragraph 9.7) and at maximum temperature of 104° F (40° C).

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



**7.1 Water Temperature**

The max water temperature is 85° F (30° C).

**7.2 Max Flow Rate and Pressure Values**

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 Lowest RPM**

The minimum speed allowed for these types of pumps is 300 rpm; any rpm other than mentioned and shown in the performance table (see chapter 5) must be expressly and formally authorized by the **Customer Service Department**.

**7.4 Vibration**

The detection of vibration shall be carried out only with the pump set up on the plant and at the performance declared by the customer. Values must be in accordance with regulations.

**7.5 Recommended Lubricant Oil Types & Manufacturers**

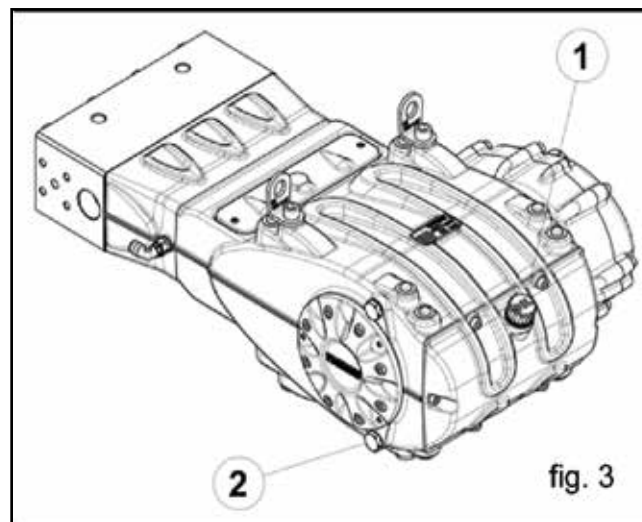
The pump is delivered with lubricant oil compliant with room temperatures ranging between 32° and 89.6° F (0° and 30° C). Some recommended lubricant types are indicated in the table below; these lubricants are treated with additives in order to increase corrosion protection and resistance to fatigue.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

<b>BRAND</b>	<b>TYPE</b>
<b>GENERAL PUMP</b>	<b>SERIES 220</b>
ARAL	Aral Degol BG220
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

Check the oil level with the oil level lights located on the sides (1, fig. 3). If necessary, top off via the oil plug (3, fig. 3).

To correctly check the oil level the pump must be at ambient temperature. To change the oil the pump must be at operating temperature, and is done by removing the plug (2, fig. 3).

Checking and changing the oil must be done as shown in Chapter 11. The quantity necessary is 287 oz. (8.5 liters) for pumps with a reduction unit and 253 oz. (7.5 liters) for pumps with no reduction unit.



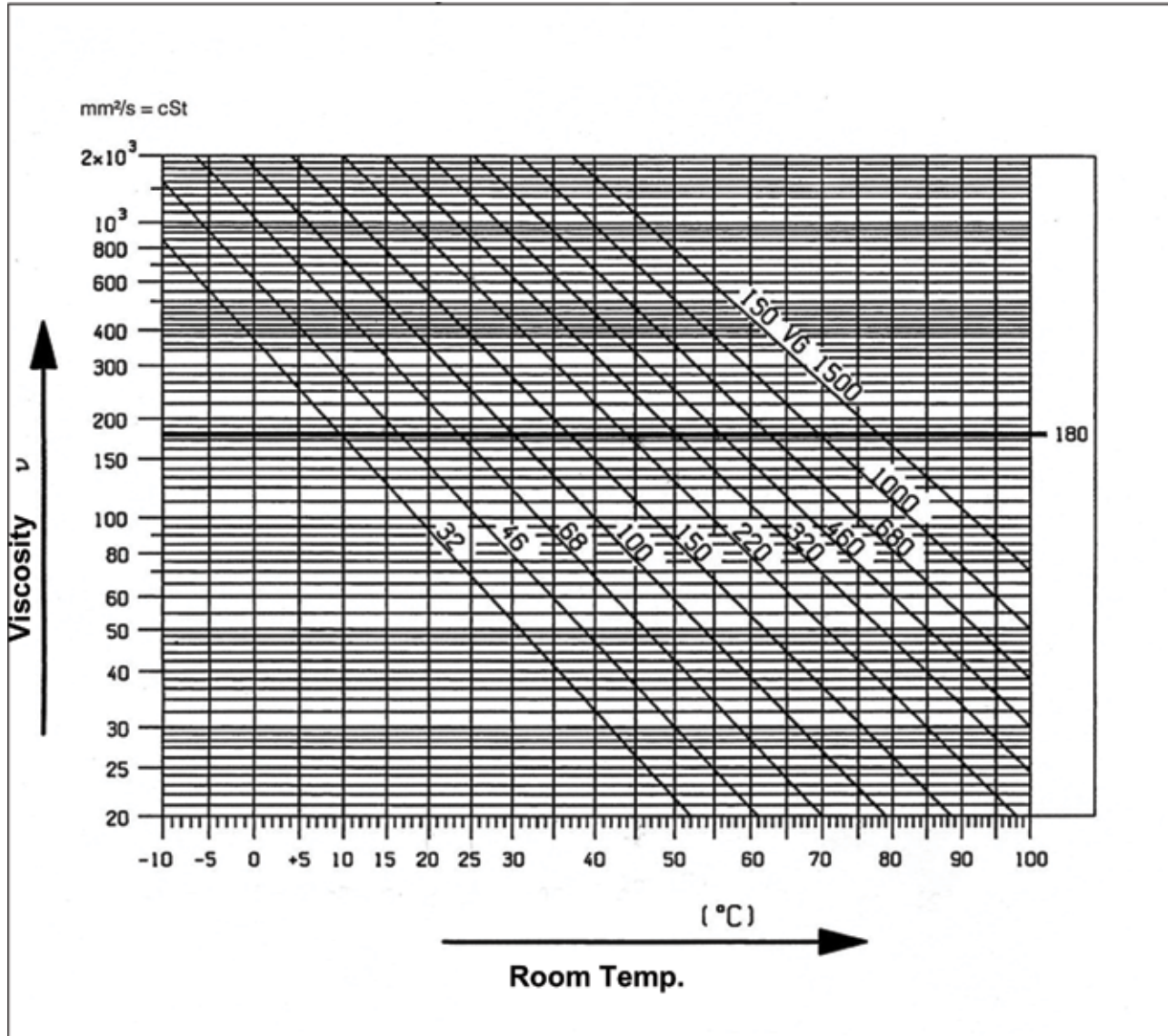




In any case, oil must be changed at least once a year since it may deteriorate by oxidation.

For room temperatures other than between 32° - 86° F (0° - 30° C), 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**

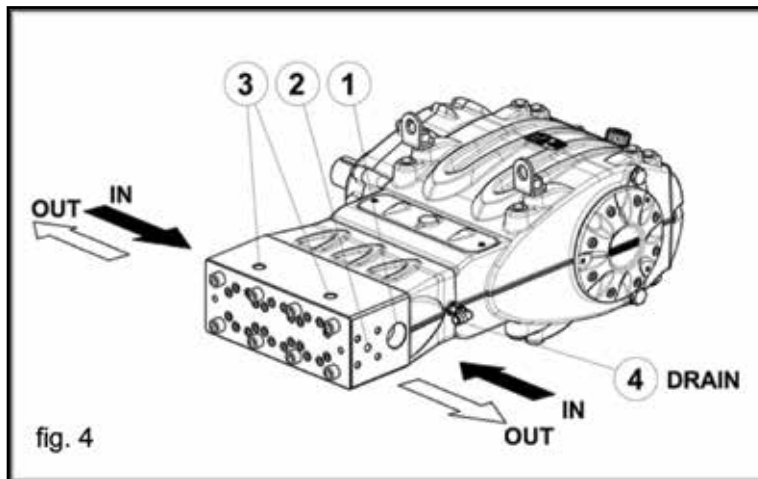


Exhausted oil must be collected in an appropriate container and disposed of in appropriate locations. Do not under any circumstances discard it into the environment.

## 8. PORTS AND CONNECTIONS

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

1. 2 inlet ports "IN", 1-1/2" Gas  
The line can be connected to either of the two inlet ports; the ones not being used must be hermetically sealed.
2. 2 outlet ports "OUT", Ø 13mm
3. 2 service ports, 1/2" Gas. These can be used for the pressure gauge
4. 1 drain port "DRAIN" supplied with a 90° adjustable quick coupling for polyamory hose with Ø 12mm. These allow drainage recovery of the seal pack cooling circuit and must be connected to the discharge, making sure that there is no back pressure.

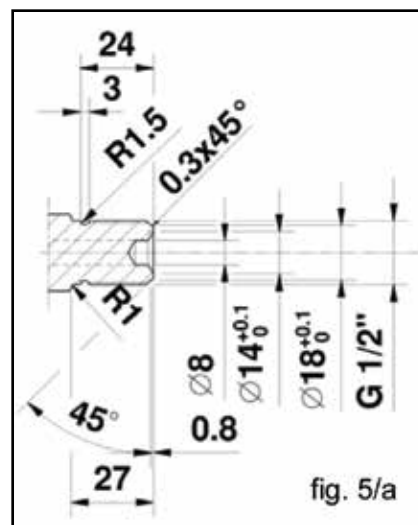
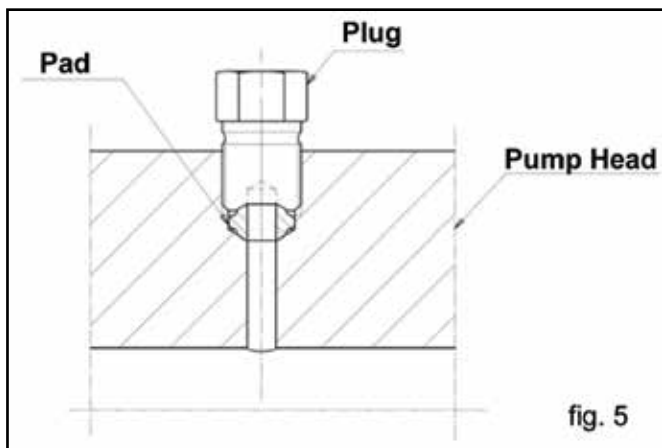


### 8.1 Linings/Nose Cones

SMH pumps are provided with 4 steel tapered linings, for use in the corresponding outlet ports of the pump (see fig. 5) or in the optional connection flanges, to ensure the connection seal. While the seat of the pump's outlet port is already machined to accept the tapered lining, if it is necessary to make the connection for the outlet connection or the closing plug, these must be specifically machined as shown in fig. 5a.



**At every disassembly, the tapered linings must be replaced.**



## 9. PUMP INSTALLATION

### 9.1 Installation

The pump must be installed in a horizontal position using the M 16x1.5 threaded support feet. Tighten the screws with a torque of 148 ft. lbs. (200 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.

Two lifting eyebolts are mounted on the pump for easy installation, as per the figure below.



The brackets are sized solely for pump lifting and therefore are absolutely not permitted for use of additional loads.



**Replace the oil filling hole closing service plug positioned on the rear casing cover with the plug with oil dipstick.** Check the correct quantity of oil. The dipstick must always be reachable, even when the unit is assembled.



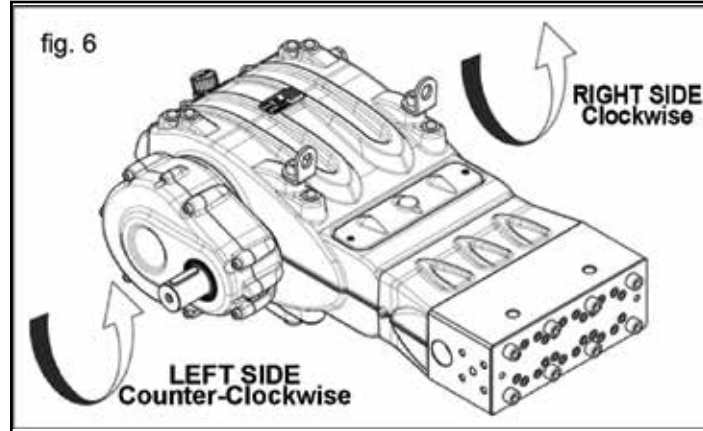
**The pump shaft (PTO) should not be rigidly connected to the propulsor unit**

The following typed of transmissions are recommended:

- Flexible joint
- Cardan-shaft (comply with manufacturer's Max. recommended working angles)
- Belts. For proper application consult with our **Customer Service Department**

### 9.2 Direction of rotation

The PTO rotation is indicated by an arrow located on the reduction gear cover. From a position facing the pump head, the rotation direction will be as in fig. 6.



### 9.3 Version change and reduction gear positioning

The pump version is defined as right when: observing the pump facing the head side, the crankshaft is on the right side.

The pump version is defined as left when: observing the pump facing the head side, the crankshaft is on the left side.



**The version can only be modified by trained and authorized personnel and carefully following the instructions below:**

1. Separate the hydraulic part from the mechanical part as indicated in Chapter 2, section 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. Invert the two inspection covers, ensuring that the open one is positioned lower. Finally, properly reposition the specification label in its housing on the casing.



**Make sure that the lower inspection cover draining holes are open**

3. Join the hydraulic part to the mechanical part as indicated in Chapter 2, section 2.2.2 of the repair manual.

It is also possible to place the reduction gear in 5 different positions as per fig. 7.

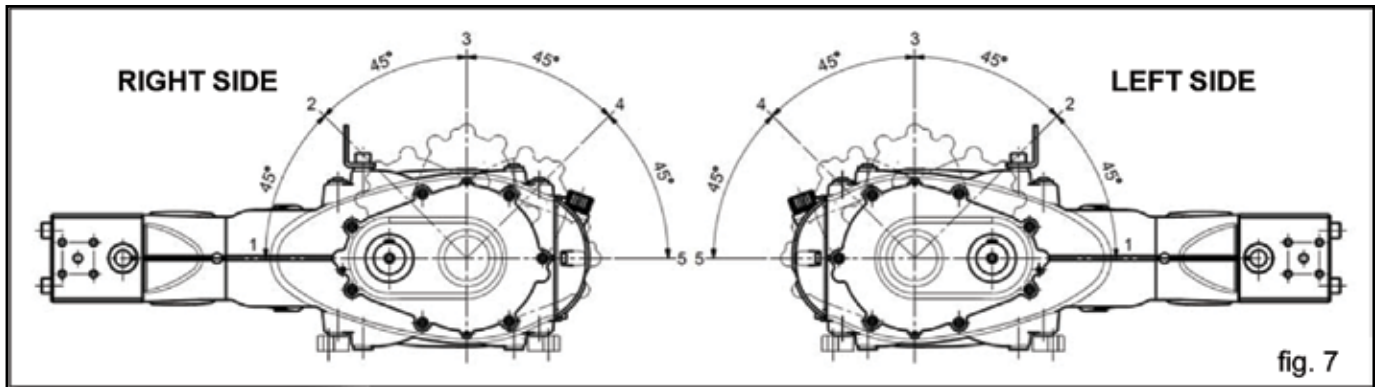


fig. 7



The reducer's position may be changed only by specialized and authorized personnel by carefully following the instructions in the repair manual.

### 9.4 Hydraulic Connections

To isolate the plant from the vibrations produced by the pump, we recommend building the first section of hose adjacent to the pump (for both intake and outlet) with flexible hose. The solidity of the intake section must be enough to prevent deformation caused by the depression produced by the pump.

### 9.5 Pump Supply

SMH pumps require a positive water head (NPSH<sub>r</sub>) of between 75-100 PSI (5-7 Bar) at the pump head entrance. The booster supply pump must have a flow rate at least double that of the rated flow rate of the plunger pump, and a minimum pressure of 75 PSI (5 bar). These supply conditions must be respected for any and all working regimes. The booster pump must be run independent of the plunger pump.



The booster pump must always be started before the plunger pump. We recommend installing a pressure regulator on the supply line downstream of the filters, to protect the pump.

### 9.6 Suction Line

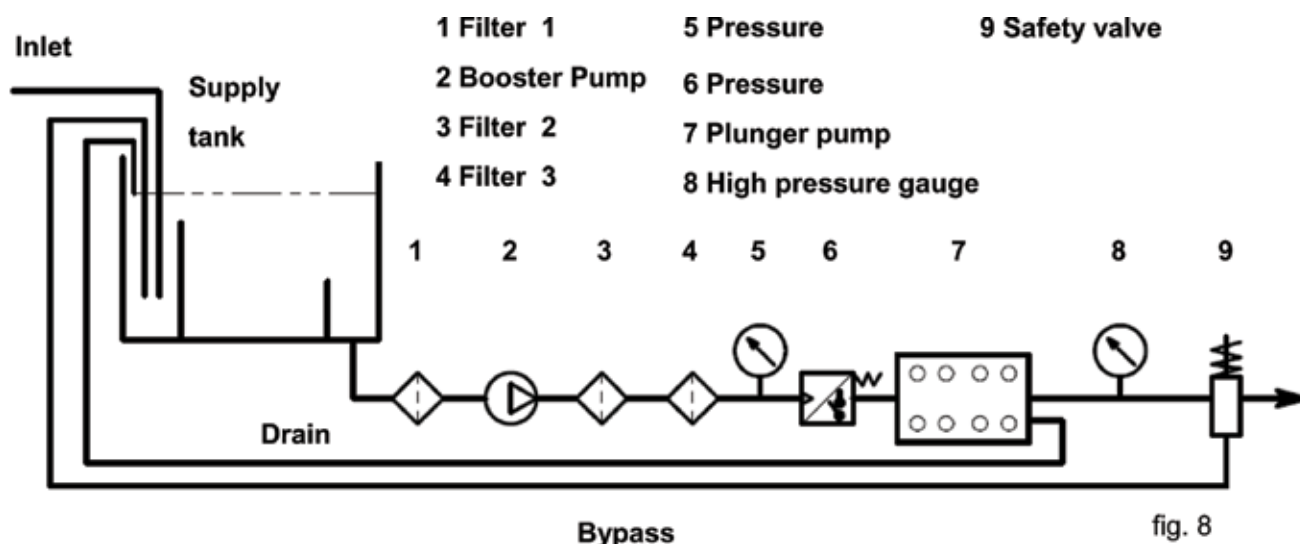
For the pump's correct operation, the suction line must have the following characteristics:



1. Minimum internal diameter as indicated in the diagram in paragraph 9.8 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° 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, 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 standing valves, check 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 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.
11. The pressure gauge for checking booster pressure must be installed near the plunger pump's outlet port, and always downstream from the filters.

## 9.7 Filtration

The level of filtration permitted for this series of pumps must be maximum 20 µm (micron). Normally this is obtained by a battery of at least three filters, positioned as shown in fig. 8.



The filters must be installed as close as possible to the pump. They must be easily accessible for inspection and must have the following specifications:

- Filter number 1: 250 µm
- Filter number 3: 100 µm
- Filter number 4: 20 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.**

**To guarantee the supply pressure required (see 9.5) install a pressure regulator.**

## 9.8 Outlet Line

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

1. The internal diameter of the pump must allow to guarantee correct fluid speed; see diagram 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 outlet line.
5. Use pressure gauges suitable to withstand 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.

#### Inlet Hose

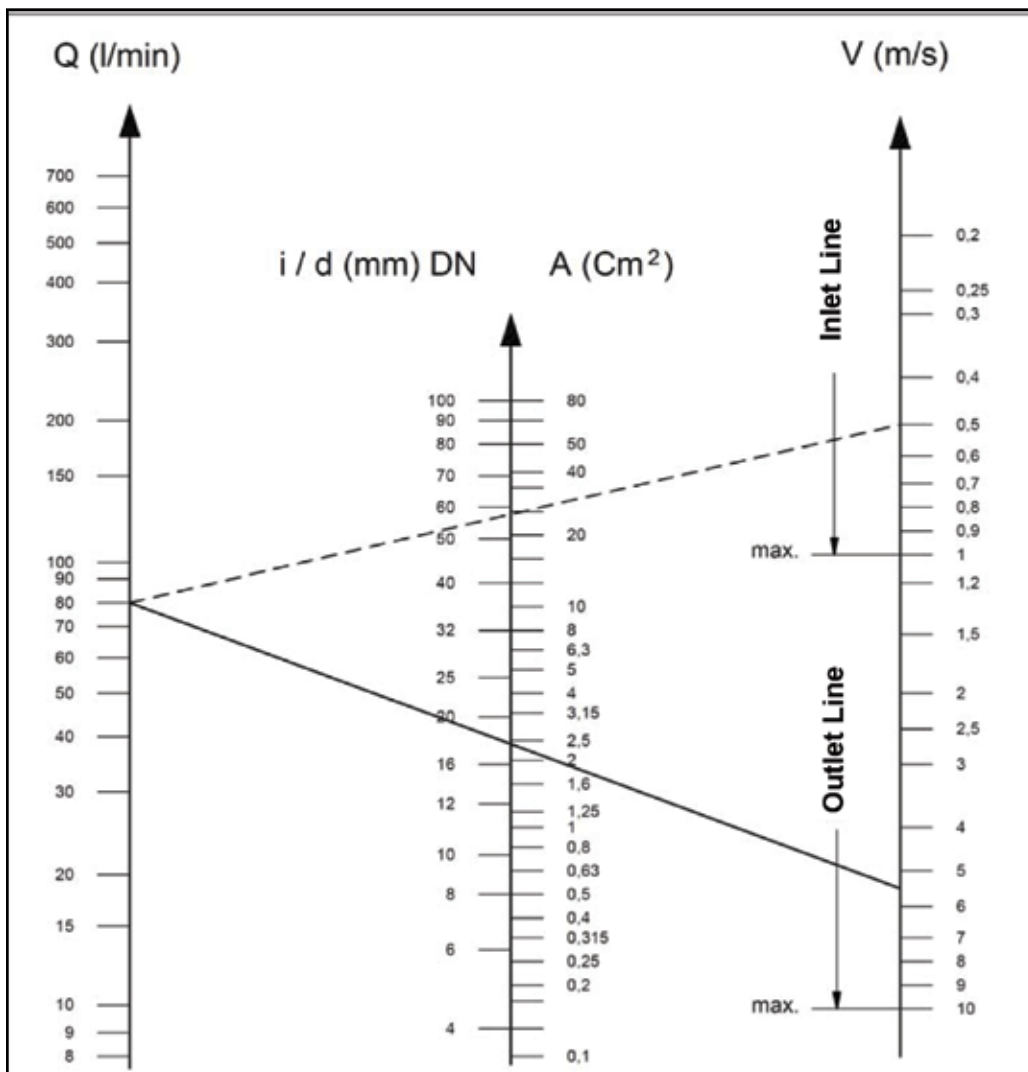
With a flow rate of ~21 GPM (80 l/mn) and water speed of 0.5 m/sec. The diagram line that connects the two scales intersects the central scale, indicating the diameters, at a value of ~ 2.3 inch (58 mm).

#### Outlet Hose

With a flow rate of ~21 GPM (80 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 ~ .71 inch (18 mm).

#### Optimal speed to be obtained with the booster pump:

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



The diagram does not take into account the hose and valve resistance, the pressure drop due to the pipe length, the viscosity and the temperature of the pumped fluid. If necessary, contact our **Customer Service Department**.

**9.10 V-belt Transmission**

As indicated in point 9.1, the pump can be controlled by a v-belt system only in exceptional cases. For proper layout sizing, consult our **Customer Service Department**.

**9.11 Transmission of power from the second crankshaft**

SM series pumps can, upon request, be supplied with an auxiliary power outlet on the opposite side of the activation.

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 111 ft. lbs (150 Nm) corresponding to 17 HP (12.5 Kw) at 800 RPM.

By means of the joint, with drawable max torque is 162 ft. lbs. (220 Nm) corresponding to 25 HP (18.4 Kw) at 800 RPM.



**With transmission by means of the joint, pay particular attention to perfect alignment so that no transverse forces are generated on the pump shaft.**

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



## 10. START-UP AND OPERATION

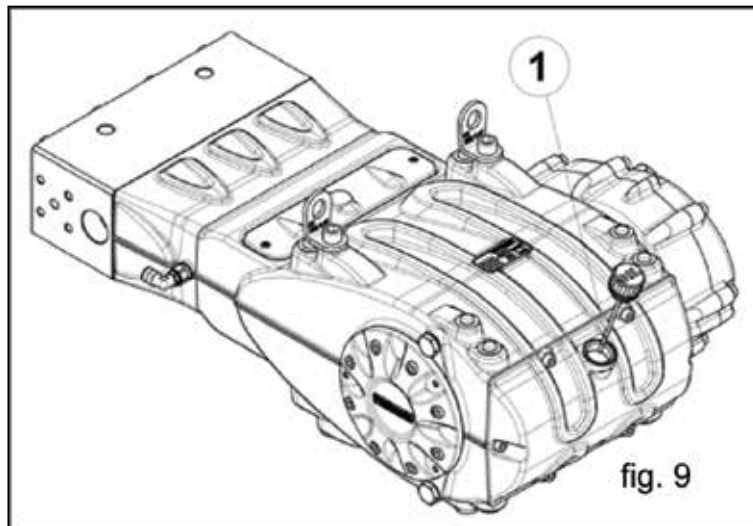
### 10.1 Preliminary Inspections

Before Start-up Be sure that:



**The inlet line is connected and up to pressure (see Chapter 9) the pump must NEVER run dry.**

1. The inlet line must be perfectly airtight.
2. All the On-Off valves between the pump and the feeding source are completely open. The outlet line must discharge freely in order to allow the air in the pump to be expelled easily, thus facilitating pump priming.
3. All fittings and connections must be correctly tightened.
4. Coupling tolerances on the pump/transmission axis (half-joint misalignment, Cardan inclination, 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 (position 1, fig 9).



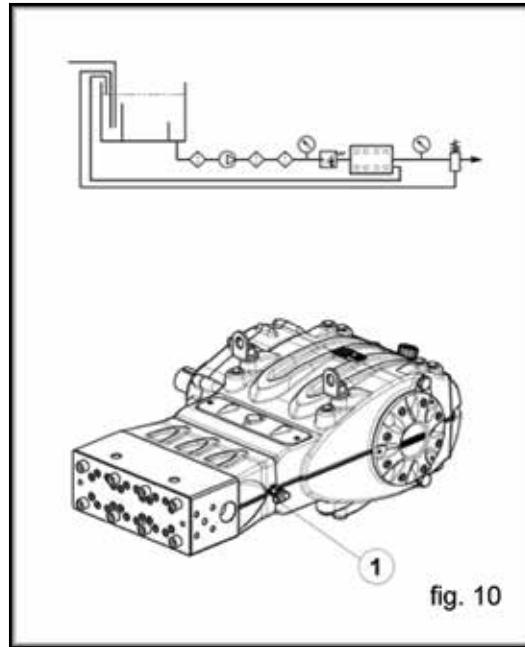
**In case the pump has not run for a long period of time, recover the correct operation of the suction valves by opening the three valve-lifting devices (see fig. 9). Be sure to reclose the valves before the pump start-up.**

### 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.

### 10.3 Seal Pack Cooling Circuit

During operation, some water from the cooling circuit seal packings will be discharged from port 1 (fig. 10). The drainage from this circuit must be redirected to the inlet line upstream of the booster pump (fig. 10) or to the collection tank.



## 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 1000 HOURS
Check oil level	Change oil
	Check / Replace:* <ul style="list-style-type: none"> <li>• Valves</li> <li>• Valve seats</li> <li>• Valve springs</li> <li>• Valve guides</li> </ul>
	Check / Replace: <ul style="list-style-type: none"> <li>• H.P packings</li> <li>• L.P. packings</li> </ul>

\* For replacement follow instructions contained in the repair manual.

## 12. PUMP STORAGE

### 12.1 Inactivity for Lengthly Periods



If the pump is started for the first time after a long period of inactivity, before putting it into operation check the oil level, inspect the valves as indicated in Chapter 10, and then follow the prescribed startup procedures.

### 12.2 Filling the Pump With An Anti-Corrosion Emulsion or Antifreeze By Using An External Diaphragm Pump As In The Layout Shown in Paragraph 9.6.

- a) Close the filter draining, if open.
- b) Be sure that the connecting hose is clean, spread with grease and connect it to the high pressure outlet port.
- c) Fit a suction hose to the membrane pump. Open the pump suction connection and fit hose between it and the membrane pump.
- d) Fill the container with the solution/emulsion.
- e) Put the free extremities of the suction line and the high pressure outlet hose inside the container.
- f) Start up the diaphragm pump.
- g) Pump the emulsion until it comes out of the high pressure hose.
- h) Continue pumping for at least another minute; if needed, the emulsion can be reinforced by adding, for example, Shell Donax
- i) Stop the pump, remove the hose from the suction connection and close it with a plug.
- j) Remove the hose from the high pressure outlet port. Clean, grease and plug both connections and the hoses.

### 12.3 Hoses

- a) Before greasing and protecting the hoses according to the previously described procedure, dry the connections using compressed air.
- b) Cover with polyethylene.
- c) Do not wrap them too tightly; be sure there is no bending.

## 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, in no case must the pump be started until the entire circuit has been completely thawed out; not complying with this indication may cause serious damage to the pump.**

## 14. WARRANTY TERMS

The pump is guaranteed for a period of 5 years from the delivery date, with the exception of parts subject to wear. In any case, please refer to the contract terms for other warranty conditions. 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
- 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 7.4)
- Incorrect alignment of the joint or pulleys
- Excessive inclination 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

**AUXILIARY PTO VERSION**

**DIRECT DRIVE VERSION**

**SMH**

**Pockets to fill with grease**

\*\*\* Lubricate with silicone grease Type OKS 1110, following the operations listed below:

- The external diameter must only be slightly moistened
- On the internal diameter, grease must be applied paying great attention to filling all the pockets between the sealing lips as shown in the figure.

**OPTIONAL**

\* Lubricate the threaded shank with Molybdenum Disulphide grease code 12001500

\*\* Lubricate with silicone grease Type OKS 1110. The external and internal diameters must be only slightly moistened.

**OPERATION 1:** Tightening M16x320 screws (pos. 1) in two steps observing the sequence indicated in figure: (A-B, C-D, E, F, G-H)

1<sup>st</sup> Phase = 147 ft. lbs. (200 Nm) 2<sup>nd</sup> Phase = 208 ft. lbs. (280 Nm)

**OPERATION 2:** Tightening M10x140 screws (pos. 26) in four steps observing the sequence indicated in figure: (1-2, 3-4, 5-6, 7-8)

1<sup>st</sup> Phase = 29 ft. lbs. (40 Nm) 2<sup>nd</sup> Phase = 47 ft. lbs. (65 Nm)

3<sup>rd</sup> Phase = 61 ft. lbs. (83 Nm) 4<sup>th</sup> Phase = 61 ft. lbs. (83 Nm)

**Tightening seal support screws pos.22**

Tightening of M8x100 screws according to the sequence indicated

1<sup>st</sup> Phase = 29 ft. lbs. (40 Nm) 2<sup>nd</sup> Phase = 29 ft. lbs. (40 Nm)

3<sup>rd</sup> Phase = 29 ft. lbs. (40 Nm) 4<sup>th</sup> Phase = 29 ft. lbs. (40 Nm)

check respecting the sequence

Item	Part No.	Description	QTY.
1	F99524200	SCREW, M16X320, UNI 5931	8
2	F73120656	MANIFOLD	1
3	F36208060	VALVE GUIDE	3
4	F94747500	SPRING, Ø 18X35, SS	3
5	F36208356	VALVE, Ø 14, 16, 18	3
6	F93198700	GASKET, Ø 36x31x3.8	3-6
7	F36210956	VALVE HOUSING, Ø 14, 16, 18	3
	F36208156	VALVE HOUSING, 20, 22, 24	3
8	F90309300	O-RING, Ø 60X2X2.62	3
9	F93197400	GASKET, Ø 26X31X3.8 SMH 14-16-18	3
	F93198700	GASKET, Ø 36X31X3.8 SMH 20-22-24	3
10	F36211056	FLAT VALVE, Ø 14, 16, 18	3
	F36207856	FLAT VALVE, Ø 20, 22, 24	3
11	F94752500	SPRING, Ø23.2X30.8, SM14-16-18	3
	F94746000	SPRING, Ø32X40, SM20-22-24	3
12	F73217320	SPACER FOR LINER	1
13	F73060456	LINER, SM14-16-18	3
	F73060556	LINER, SM20-22-24	3
14	F73224356	INTERMEDIATE SUPPORT, Ø14-16-18	3
	F73224482	INTERMEDIATE SUPPORT, Ø20-22-24	3
15	F73041201	PLUNGER, COMPLETE, Ø14	3
	F73041301	PLUNGER, COMPLETE, Ø16	3
	F73041401	PLUNGER, COMPLETE, Ø18	3
	F73041501	PLUNGER, COMPLETE, Ø20	3
	F73041601	PLUNGER, COMPLETE, Ø22	3
	F73041701	PLUNGER, COMPLETE, Ø24	3
16	F90260650	ALT. SEAL RING, Ø14X26X11, HP	3
	F90263500	ALT. SEAL RING, Ø16X26X11, HP	3
	F90265200	ALT. SEAL RING, Ø18X25X10.6, HP	3
	F90271200	ALT. SEAL RING, Ø 20X36X17.9, HP	3
	F90273300	ALT. SEAL RING, Ø 22X36X17.9, HP	3
	F90274400	ALT. SEAL RING, Ø 24X36X17.9, HP	3
17	F73219268	ANTI-EXTRUSION RING, Ø 14	3
	F73219368	ANTI-EXTRUSION RING, Ø 16	3
	F73219468	ANTI-EXTRUSION RING, Ø 18	3
	F78212568	ANTI-EXTRUSION RING, Ø 20	3
	F78212668	ANTI-EXTRUSION RING, Ø 22	3
	F78212768	ANTI-EXTRUSION RING, Ø 24	3
18	F73219560	SEAL BUSHING, Ø 14	3
	F73219660	SEAL BUSHING, Ø 16	3
	F73219760	SEAL BUSHING, Ø 18	3
	F78213160	SEAL BUSHING, Ø 20	3
	F78213260	SEAL BUSHING, Ø 22	3
	F78213360	SEAL BUSHING, Ø 24	3
19	F90260400	ALT. SEAL RING, Ø14X26X11, LP	3
	F90262950	ALT. SEAL RING, Ø16X26X11, LP	3
	F90265150	ALT. SEAL RING, Ø18X25X10.6, LP	3
	F90268900	ALT. SEAL RING, Ø 20X36X17.9, LP	3
	F90271400	ALT. SEAL RING, Ø 22X36X17.9, LP	3
	F90273900	ALT. SEAL RING, Ø 24X36X17.9, LP	3
20	F73218656	SEAL RING, Ø 14	3
	F27218756	SEAL RING, Ø 16	3
	F73218856	SEAL RING, Ø 18	3
	F73218956	SEAL RING, Ø 20	3
	F73219056	SEAL RING, Ø 22	3
	F73219156	SEAL RING, Ø 24	3
21	F90073100	RING, SEEGER, Ø 40, UNI 7437	3
22	F99326100	SCREW M8X100 UNI 5931	30
23	F90391300	O-RING, Ø 67.95X2.62	6
24	F73218056	GASKET SUPPORT, Ø 14	3
	F73218156	GASKET SUPPORT, Ø 16	3
	F73218256	GASKET SUPPORT, Ø 18	3
	F73218356	GASKET SUPPORT, Ø 20	3
	F73218456	GASKET SUPPORT, Ø 22	3
	F73218556	GASKET SUPPORT, Ø 24	3
25	F90386600	O-RING, Ø 29.82X2.62, SM14-16-18	3
	F90387800	O-RING, Ø 39.34X2.62, SM20-22-24	3
26	F99382800	SCREW, M10X140, UNI 5931	24
27	F90381800	O-RING, Ø 7.59X2.62	1
28	F96738000	WASHER, Ø 17.5X23X1.5	1
29	F78214566	CHOKE FITTING, Ø 3-3/8"-3/8" M-M	1
30	F96416400	ROTATING FITTING, 90 DEGREE	1
31	F73101456	HEAD RING, Ø 14	3
	F73101556	HEAD RING, Ø 16-18	3
	F78100570	HEAD RING, Ø 20	3
	F78100670	HEAD RING, Ø 22-24	3
32	F79211689	CENTERING BUSH	4
33	F93174000	PLUG, G 1/2"	2
34	F96738000	WASHER, Ø 17.5x23x1.5	3
35	F73150022	INSPECTION COVER, CLOSED	1
36	F73050336	PLUNGER GUIDE ROD	3
37	F90414800	O-RING, Ø 202.8X3.53	2
38	F73150422	INSPECTION COVER, OPEN	1
39	F90168500	RADIAL RING, Ø 40X72X7/8.5	3
40	F99188400	SCREW, M6X20	12

Item	Part No.	Description	QTY.
41	F73010013	PUMP CASTING	1
42	F73050443	PLUNGER GUIDE	3
	F73050543	PLUNGER GUIDE	3
43	F73210674	LIFTING BRACKET	1
44	F99513000	SCREW, M16X30	2
45	F73030101	CONNECTING ROD COMPLETE	3
46	F99378800	CONROD SCREW	6
47	F90928300	BABBITT BUSHING, LOWER	3
	F90928400	BABBITT BUSHING, +0.25	3
	F90928500	BABBITT BUSHING, +0.50	3
	F90928000	BABBITT BUSHING, UPPER	3
48	F90928100	BABBITT BUSHING, +0.25	3
	F90928200	BABBITT BUSHING, +0.50	3
49	F90915800	CONROD FOOD BUSHING	3
50	F90069000	RING, SEEGER, Ø 32	6
51	F97744000	SPINDLE	3
52	F99183700	SCREW, M6X14	2
53	F98206000	PLUG, Ø 15	6
54	F98233500	DIPSTICK G 1"	1
55	F90361600	O-RING, 34.65X1.78	1
56	F73210295	OIL FILLING TUBE	1
57	F91854000	ROLLER BEARING	1
58	F10076735	PINION, HELICAL Z24 R. 1.875	1
	F10076835	PINION, HELICAL Z21 R. 2.238	1
	F10076935	PINION, HELICAL Z18 R. 2.722	1
	F10082255	PINION, HELICAL Z19 R. 3.211	1
59	F97623000	CYLINDER PIN, Ø 10X24	2
60	F90101000	RING GEAR STOP	1
61	F91859900	ROLLER BEARING	1
62	F73210455	BEARING SUPPORT RING	1
63	F90081000	RING, SEEGER	1
64	F90172400	RING, RADIAL, Ø 55X75X8	1
65	F91500500	TAB 14X9X60	1
66	F73210589	GEAR SUPPORT RING	1
67	F99366700	SCREW, M10X25	2
68	F91511000	TAB, 22X14X80	1
69	F74213255	GEAR STOP RING	1
70	F73020035	CRANKSHAFT	1
71	F10077035	RING GEAR Z45 R. 1.875, HELICAL	1
	F10077135	RING GEAR Z47 R. 2.238, HELICAL	1
	F10077235	RING GEAR Z49 R. 2.722, HELICAL	1
	F10082355	RING GEAR Z61 R. 3.211, HELICAL	1
72	F99371000	SCREW, M10X40	15
73	F73210113	REDUCTION GEAR COVER	1
74	F90415000	O-RING, Ø 253.60X3.53	2
75	F73210013	REDUCTION GEARBOX	1
76	F91881000	BEARING	2
77	F73210384	GASKET	2
78	F73160022	REAR COVER	1
79	F99368600	SCREW, M10X30	14
80	F73150222	BEARING COVER	1
81	F98218700	PLUG, G1/2"X10	2
82	F96751400	WASHER, Ø 21.5X27X1.5	2
83	F96338000	BOLT, G1/2"	1
84	F98217300	PLASTIC PLUG, G1/2"	1
85	F73224184	REAR COVER SEAL	1
86	F99194300	SCREW, M6X40	2
112	F73200064	PUMP FOOT	2

**WITH HYDRAULIC MOTOR**

100	F10077355	PINION Z24 R. 1.875, HELICAL FEMALE	1
	F10077455	PINION Z21 R. 2.238, HELICAL FEMALE	1
	F10079455	PINION Z18 R. 2.722, HELICAL FEMALE	1
101	F70227034	SCREW M6X12	1
102	F73224271	RING, Ø 54	1
103	F92202500	NUT, M6X5	1
104	F90206500	PLUG, Ø 17	1
105	F73215513	REDUCTION GEAR COVER	1

**DIRECT DRIVE**

79	F99368600	SCREW M10X30	8
106	F73150322	BEARING COVER	1
107	F90391450	O-RING, Ø 75.87X2.62	1
110	F90195000	RING, Ø 90X111X12	1
111	F73215654	DIRECT DRIVE RING	1

**AUXILIARY PTO**

79	F99368600	SCREW, M10X30	8
106	F73150322	BEARING COVER	1
107	F90391450	O-RING, Ø 75.87X2.62	1
108	F73215754	AUXILIARY POWER TAKE-OFF	1
109	F99367100	SCREW, M10X25	6
110	F90195000	RING, Ø 90X110X12	1

## REPAIR KITS AND TORQUE SPECS

KIT NUMBER	<b>F2190 (SM14)</b> Plunger Packing Kit	<b>F2191 (SM16)</b> Plunger Packing Kit	<b>F2192 (SM18)</b> Plunger Packing Kit	<b>F2198 (SM20)</b> Plunger Packing Kit	<b>F2199 (SM22)</b> Plunger Packing Kit	<b>F2200 (SM240)</b> Plunger Packing Kit
Positions Included	8, 16, 17, 18, 19, 23, 25, 27	8, 16, 17, 18, 19, 23, 25, 27	8, 16, 17, 18, 19, 23, 25, 27	8, 16, 17, 18, 19, 23, 25, 27	8, 16, 17, 18, 19, 23, 25, 27	8, 16, 17, 18, 19, 23, 25, 27

KIT NUMBER	<b>F2193 (SM14, SM16, SM18)</b> Valve Seals Kit	<b>F2085 (SM20, SM22, SM24)</b> Valve Seals Kit
Positions Included	6, 9	6, 9

KIT NUMBER	<b>F2195 (SM14)</b> Complete Seals Kit	<b>F2196 (SM16)</b> Complete Seals Kit	<b>F2197 (SM18)</b> Complete Seals Kit	<b>F2201 (SM20)</b> Complete Seals Kit	<b>F2202 (SM22)</b> Complete Seals Kit	<b>F2203 (SM24)</b> Complete Seals Kit
Positions Included	6, 8, 9, 16, 17, 18, 19, 23, 25, 27, 37, 39, 55, 64, 74, 77, 85	6, 8, 9, 16, 17, 18, 19, 23, 25, 27, 37, 39, 55, 64, 74, 77, 85	6, 8, 9, 16, 17, 18, 19, 23, 25, 27, 37, 39, 55, 64, 74, 77, 85	6, 8, 9, 16, 17, 18, 19, 23, 25, 27, 37, 39, 55, 64, 74, 77, 85	6, 8, 9, 16, 17, 18, 19, 23, 25, 27, 37, 39, 55, 64, 74, 77, 85	6, 8, 9, 16, 17, 18, 19, 23, 25, 27, 37, 39, 55, 64, 74, 77, 85

KIT NUMBER	<b>F2150 (All SM models)</b> Connecting Rod Bushing Kit Standard	<b>F2151 (All SM models)</b> Connecting Rod Bushing Kit, +0.25	<b>F2153 (All SM models)</b> Connecting Rod Bushing Kit, +0.50
Positions Included	47, 48	47, 48	47, 48

KIT NUMBER	<b>F2194 (SM14, SM16, SM20)</b> Inlet & Outlet Valves Kit	<b>F2111 (SM20, SM22, SM24)</b> Inlet & Outlet Valves Kit
Positions Included	3, 4, 5, 6, 7, 9, 10, 11	3, 4, 5, 6, 7, 9, 10, 11

KIT NUMBER	<b>F2152 (All SM models)</b> Mounting Feet Set
Positions Included	44, 112

## TORQUE SPECS

Position	Ft.-Lbs.	Nm.
1	206.5	280
15	29.5	40
22	29.5	40
26	61.2	83
29	33.2	45
40	7.4	10
44	147.5	200
46	47.9	65

Position	Ft.-Lbs.	Nm.
52	7.4	10
67	59	80
72	33.2	45
79	33.2	45
81	29.5	40
86	7.4	10
101	7.4	10
109	80.4	109

## MAINTENANCE LOG

### HOURS & DATE

<b>OIL CHANGE</b>							
<b>GREASE</b>							
<b>PACKING REPLACEMENT</b>							
<b>PLUNGER REPLACEMENT</b>							
<b>VALVE REPLACEMENT</b>							



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