

Owner's Manual

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



General Pump is a
member of the
Interpump Group



INDEX

1.	INTRODUCTION	Page 3
2.	DESCRIPTION OF SYMBOLS	Page 3
3.	SAFETY	Page 4
	3.1 General safety warnings	Page 4
	3.2 Essential safety in high pressure systems	Page 4
	3.3 Safety during use	Page 4
	3.4 General procedures for using lances	Page 4
	3.5 Safety during system maintenance	Page 5
4.	PUMP IDENTIFICATION	Page 5
5.	TECHNICAL CHARACTERISTICS	Page 6
6.	DIMENSIONS AND WEIGHT	Page 7
7.	OPERATING INSTRUCTIONS	Page 7
	7.1 Water temperature	Page 7
	7.2 Maximum flow and pressure rates	Page 7
	7.3 Minimum RPM	Page 7
	7.4 Recommended lubricant types and manufacturers	Page 8
8.	PORTS AND CONNECTIONS	Page 10
	8.1 Conic sealing pads	Page 10
9.	PUMP INSTALLATION	Page 11
	9.1 Installation	Page 11
	9.2 Direction of rotation	Page 12
	9.3 Version Change	Page 12
	9.4 Hydraulic connections	Page 13
	9.5 Pump power supply	Page 13
	9.6 Inlet line	Page 13
	9.7 Filtration	Page 14
	9.8 Outlet line	Page 14
	9.9 Internal diameter of hose	Page 15
	9.10 V-belt transmission	Page 16
	9.11 Transmission definition	Page 17
	9.12 Definition of static pull to apply on belts	Page 18
	9.13 Transmission of power from the second PTO	Page 18
10.	START UP AND OPERATION	Page 20
	10.1 Preliminary inspections	Page 20
	10.2 Starting up	Page 20
	10.3 Cooling circuit seal packing	Page 21
11.	PREVENTATIVE MAINTENANCE	Page 21
12.	PUMP STORAGE	Page 22
	12.1 Inactivity for lengthy periods	Page 22
	12.2 Filling the pump with anti-corrosion emulsion or anti-freeze	Page 22
	12.2 Hoses	Page 22
13.	PRECAUTIONS AGAINST FREEZING	Page 22
14.	WARRANTY CONDITIONS	Page 22
15.	TROUBLESHOOTING	Page 23
16.	EXPLODED VIEWS AND PARTS	Page 24
17.	MAINTENANCE LOG	Page 26

1. INTRODUCTION

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

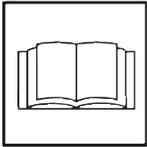
Correct use and adequate maintenance will guarantee the pumps trouble-free operation for a long time. General Pump declines any responsibility for damage caused by misuse or the non-observance of the instructions indicated in this manual.

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 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 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.
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

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.

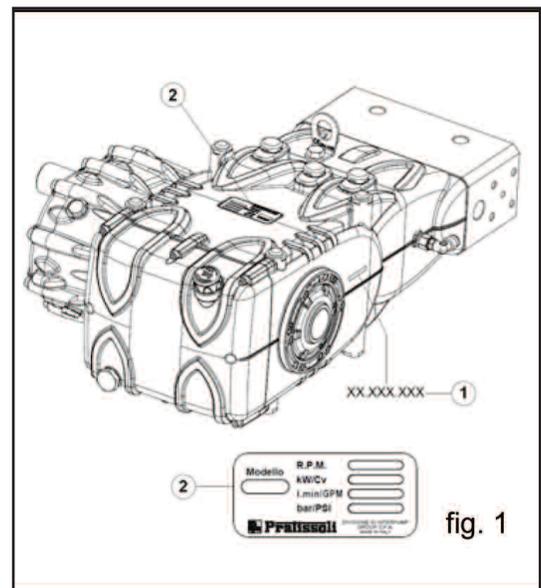
4. PUMP IDENTIFICATION

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	LPM	PSI	BAR	HP	kW
VKH12	Version without reduction gear	1200	5.3	20	21,750	1500	75	55
	Version with reduction gear	1500						
		1800						
		2200						
VKH14	Version without reduction gear	1200	7.4	28	15,950	1100	75	55
	Version without reduction gear	1500						
		1800						
		2200						

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

Any RPM value different from what is indicated in the performance table (see chapter 5) must be explicitly authorized by the **Customer Service Department**.

7.4 Recommended Lubricant Oil Types & Manufacturers

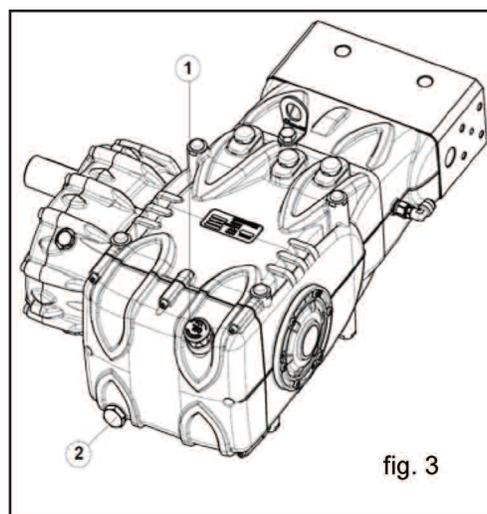
The pump is delivered with lubricant oil compliant with room temperatures ranging between 32° and 89.6° F (0° and 30°C). Some recommended lubricant types are indicated in the table below; these lubricants are treated with additives in order to increase corrosion protection and resistance to fatigue.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

BRAND	TYPE
GENERAL PUMP	SERIES 220
ARAL	Aral Degol 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 162.3 oz. (4.8 liters) for versions with a reduction gear in positions 1 and 4 (fig. 6). Said quantity will be slightly lower for positions 2 and 3. Quantity of oil for version without a reduction gear is 148.8 oz. (4.4 liters).

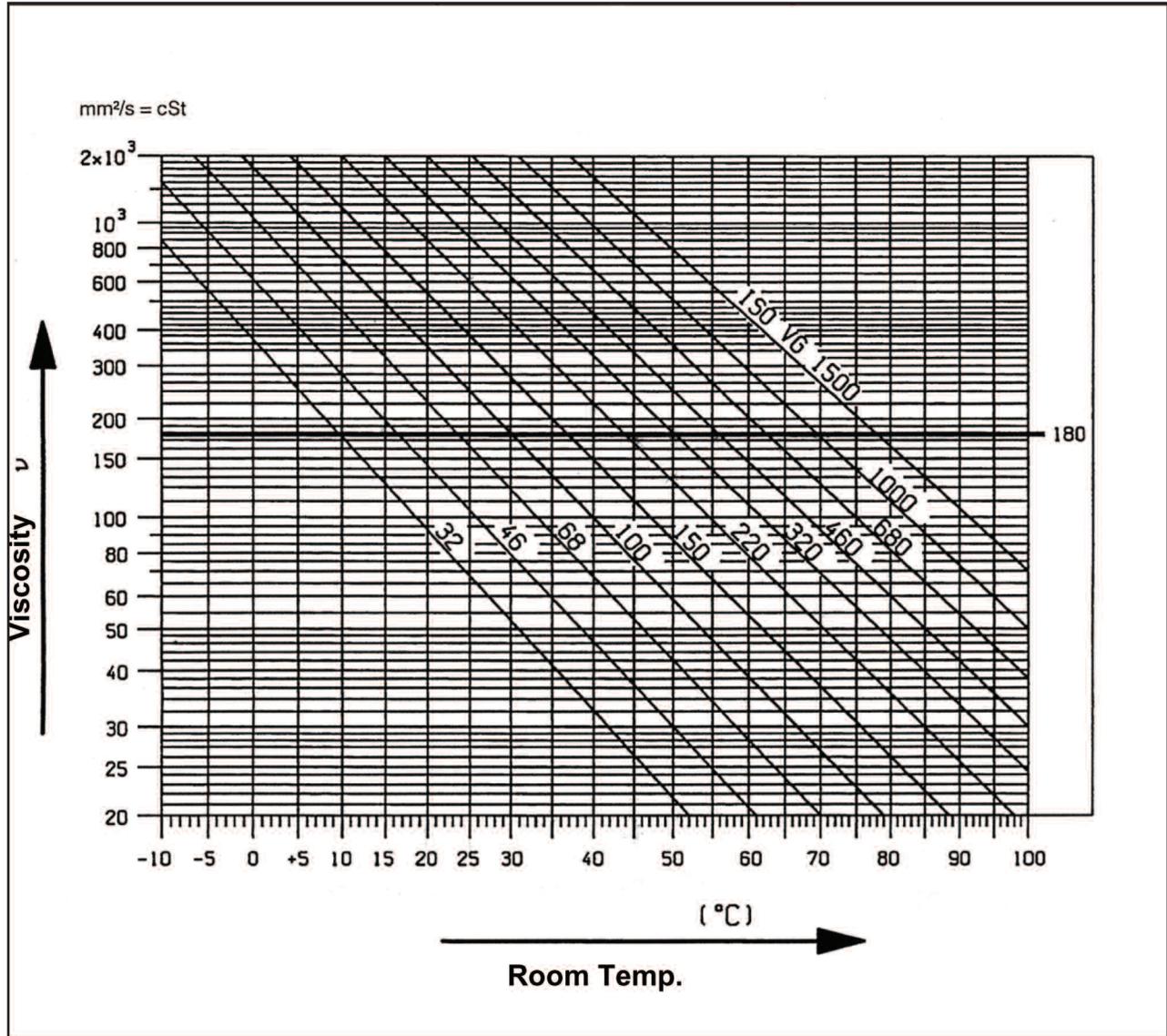




In any case, oil must be changed at least once a year since it may deteriorate by oxidation.

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

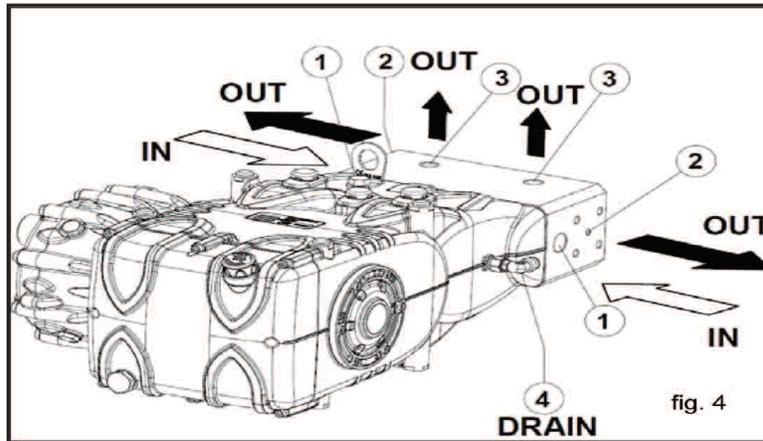


Exhausted oil must be collected in an appropriate container and disposed of in appropriate locations. Do not under any circumstances discard it into the environment.

8. PORTS AND CONNECTIONS

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

1. 2 inlet ports "IN", 3/4" BSP-F.
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 1/2" BSP-Flange.
3. 2 service ports, 1/2". These can be used for the pressure gauge and the safety valve.
4. 1 drain port "DRAIN" supplied with a 90° adjustable quick coupling for polyamide hoses with Ø of 10 mm. These serve to recover drainage of the seal pack cooling circuit and must be connected to the discharge making sure there is no back pressure.

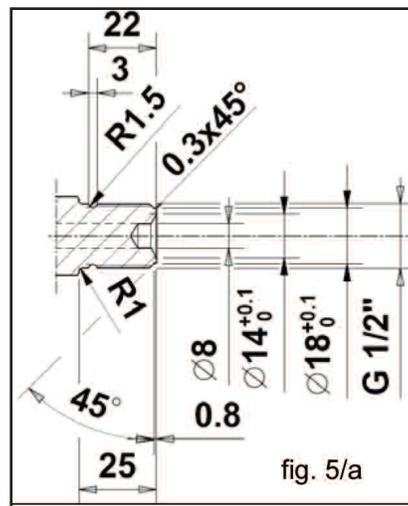
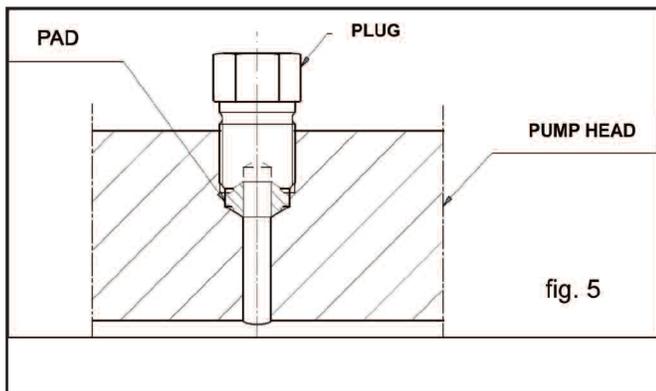


8.1 Conical Sealing Pads

VKH pumps are equipped 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 in order to hold the conic pad, the connections for the outlet fitting or the closing plug must be properly machined as indicated in fig. 5a.



At every disassembly, the conic pads must be replaced.



9. PUMP INSTALLATION

9.1 Installation

The pump must be fixed horizontally using the M16x1.5 threaded support feet. Tighten the screws with a torque of 155 Ft.Lb. (210 Nm). The base must be perfectly flat and rigid enough as not to allow bending or misalignment on the pump coupling axis/transmission due to torque transmitted during operation.

The unit cannot be fixed rigidly to the floor must must be protected with vibration dampeners. 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 plug (red) positioned on the rear casing cover. Check the correct quantity with the oil dipstick.

The oil 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.

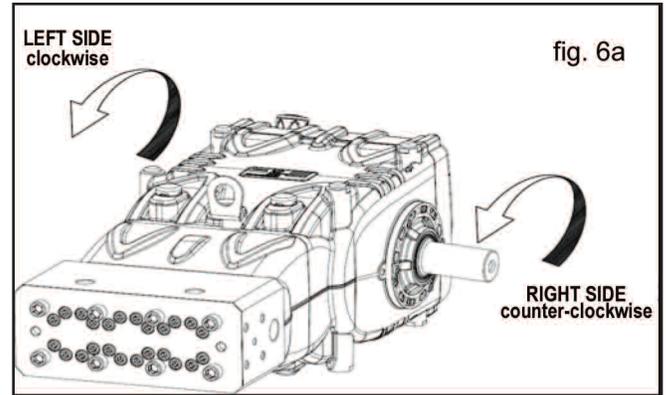
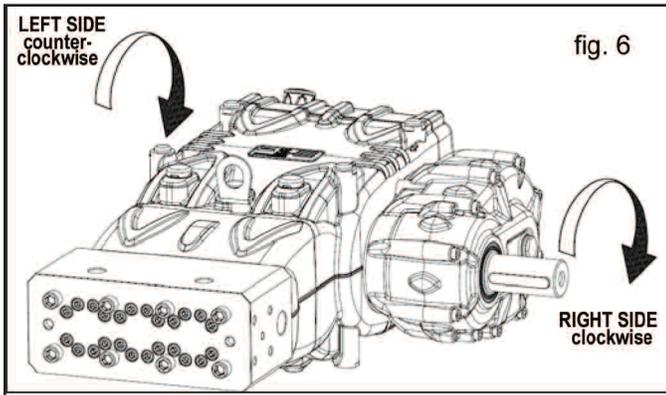
The following transmission types are suggested:

- Flexible joint
- Universal Joint (please respect the maximum working angles indicated by the manufacturer)
- V-belts, only allowed on versions without a reduction gear

9.2 Direction of rotation

The PTO rotation is indicated by an arrow located on the casings. From a position facing the pump head, the rotation direction will be:

- As per fig. 6 for versions with a reduction gear
- As per fig. 6a for versions without a reduction gear



9.3 Version Change

The pump version is defined as right when observing the pump facing the head, the pump shaft must have a PTO shaft on the right.

The pump version is defined as left when observing the pump facing the head, the pump shaft must have a PTO shaft on the left.

NOTE: the versions shown in fig. 6 and 6a are right.



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

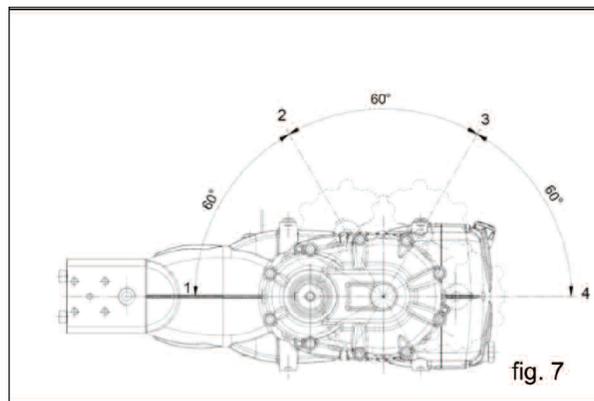
1. Separate the hydraulic part from the mechanical part as indicated in the repair manual.
2. Turn the mechanical part 180° and reposition the rear casing cover in such a way that the oil dipstick is turned upward. Reposition the lifting bracket and relative drain plugs in the upper part of the casing.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



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

3. Separate the hydraulic part from the mechanical part as indicated in the repair manual.

It is also possible to place the reduction gear in 4 different positions as per fig. 7



The reduction gear position can only be modified by trained and authorized personnel carefully following directions contained in the repair manual.

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9.4 Hydraulic Connections

To isolate the system 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 rigidity of the intake section must be enough to prevent deformation caused by the depression produced by the pump.

9.5 Pump Power Supply

VKH pumps require a positive suction head (NPSH_r) 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 switch 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 9.9 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° 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 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.
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.

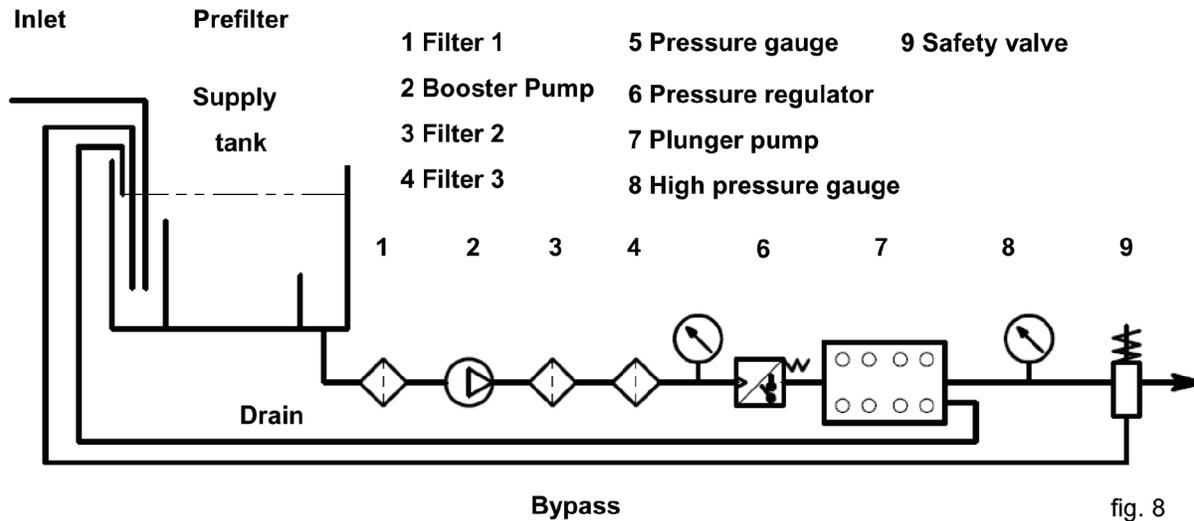


fig. 8

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:

1. Minimum flow rates at least 3 times the nominal flow rate of the pump.
2. Inlet/outlet port diameters no smaller than the inlet port diameter of the pump.
3. Filtration degree:
 - Filter number 1: 250 µm
 - Filter number 2: 100 µm
 - Filter number 3: 20 µm



For smooth 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 delivery line, please comply with the following installation instructions:

1. The internal diameter of the pump 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.

Inlet Hose

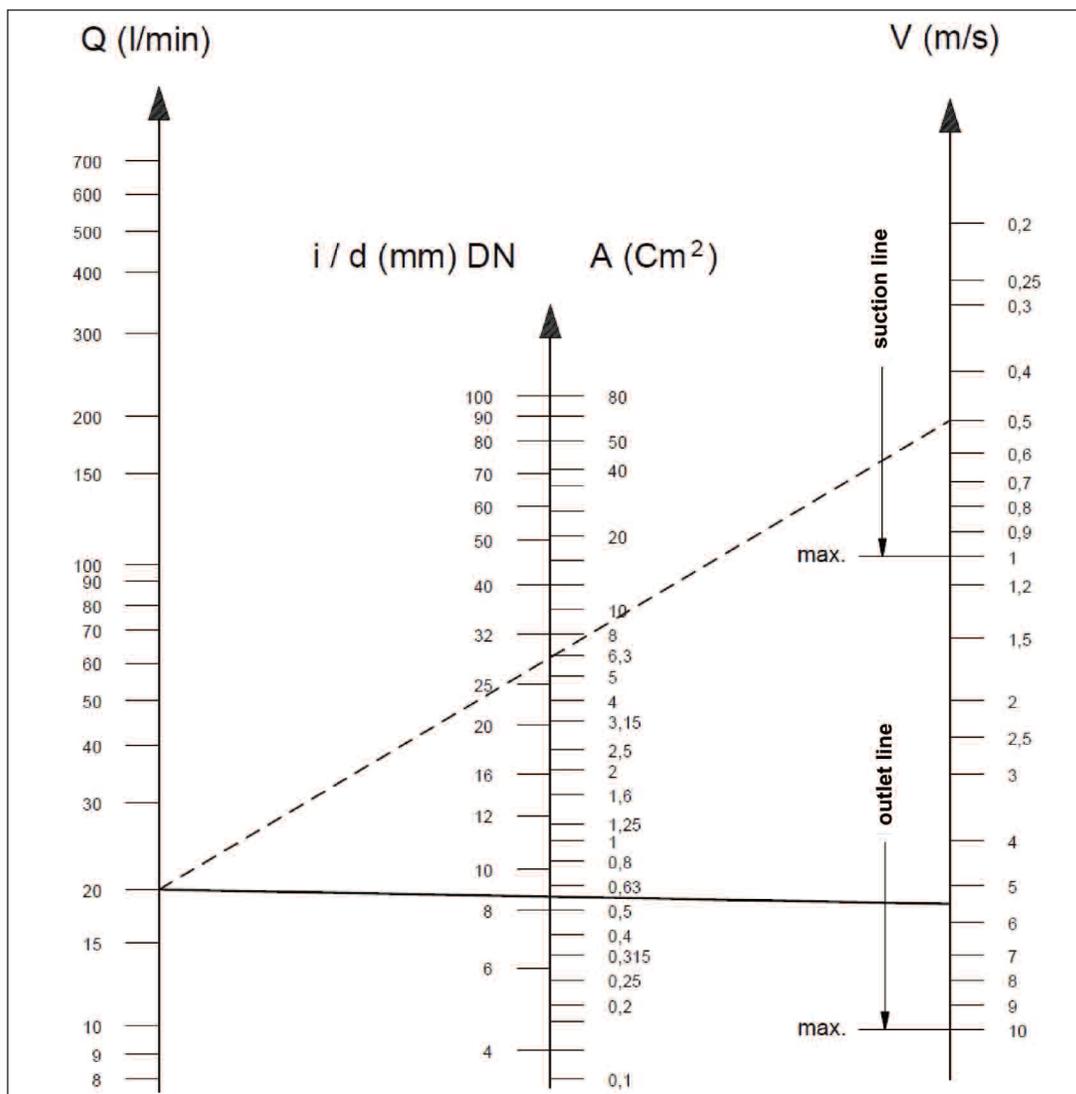
With a flow rate of ~5.3 GPM (20 l/mn) and water speed of 0.5 m/sec. The diagram line that connects the two scales intersects the central scale, indicating the diameters, at a value of ~ 1.1 inch (28 mm).

Outlet Hose

With a flow rate of ~5.3 GPM (20 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 ~ .3 inch (8.5 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 Transmissions



V-belt transmission is only allowed on versions without a reduction gear.

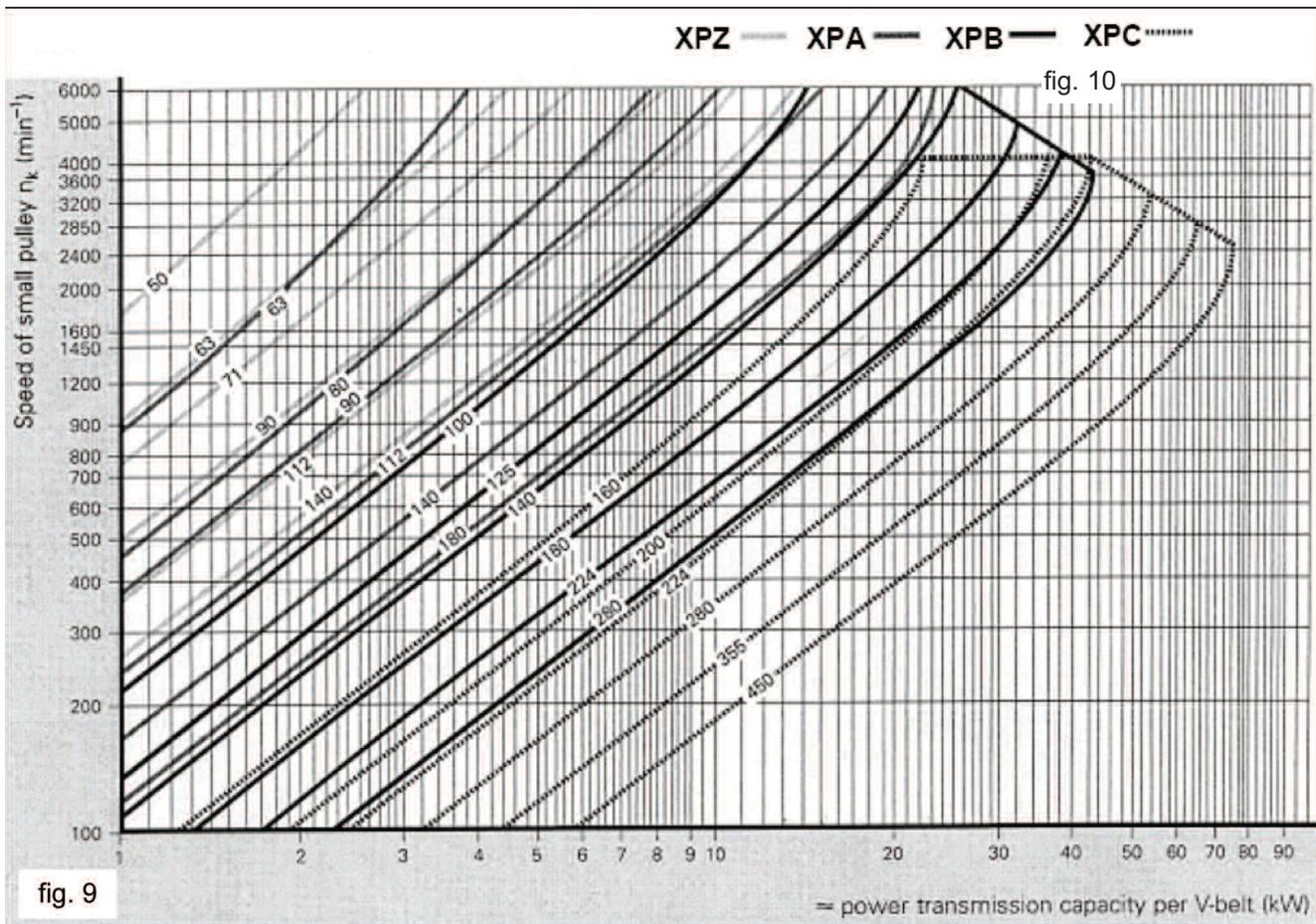
For this pump model, we recommend use of 4 XPB belts (16.5 x 13 serrated). Use an XPC profile only for long durations. Both the characteristics and transmissible power of each belt can be verified in the diagram in fig. 9, in relation to the number of RPM normally declared by the manufacturer.

Minimum duct pulley diameter (on pump shaft): ≥ 250 mm.

The radial load on the shaft must not exceed 7,500 N (value necessary for Layout definition). The transmission is considered adequate if the load is applied to a maximum distance $a=40$ mm from the shaft shoulder (PTO) as shown in fig. 12.



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



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 manufacturer of belt used. In the absence or directions, follow fig. 10 and the table in fig. 11.

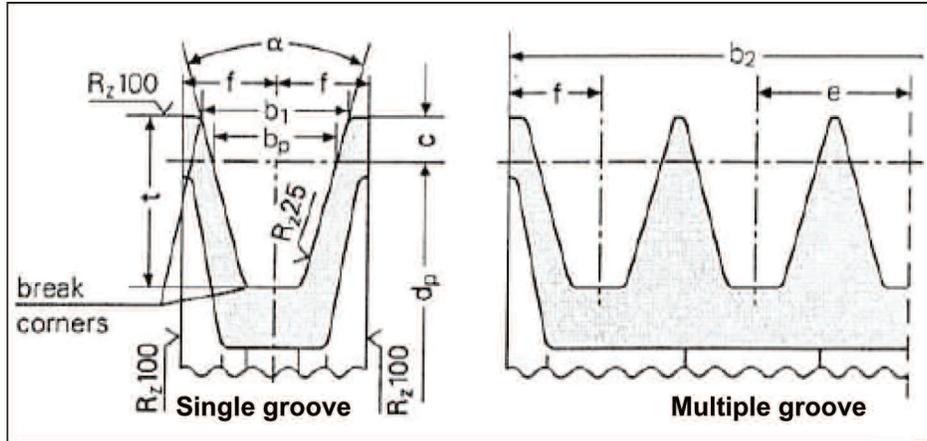


fig. 10

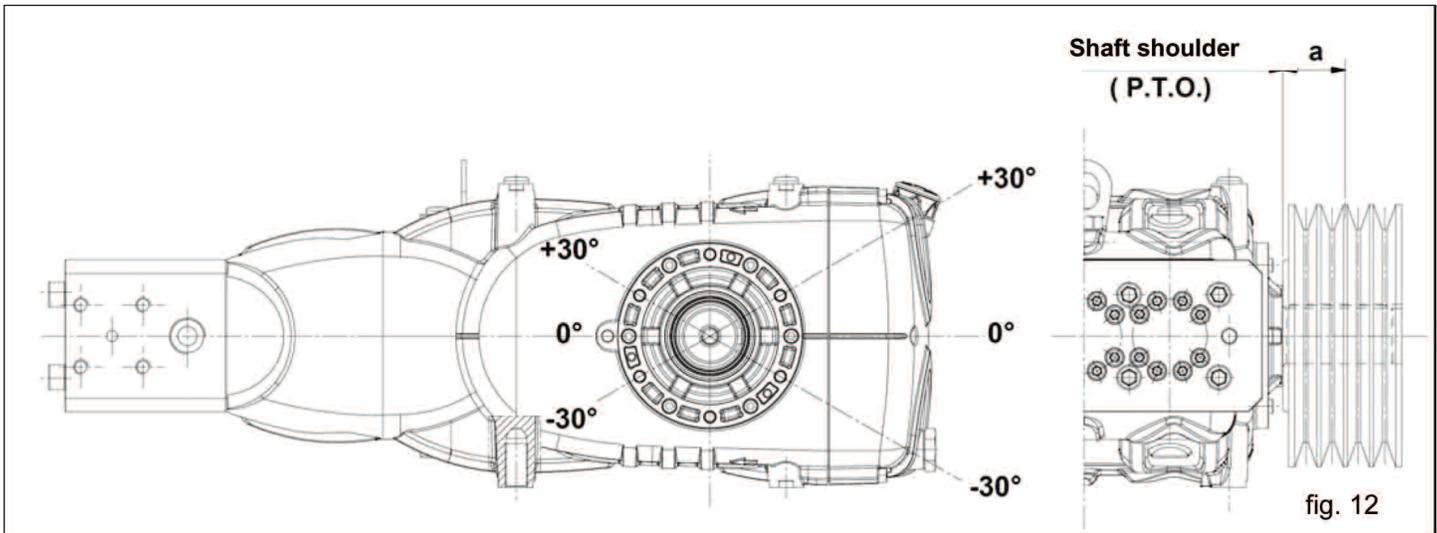
Dimensions in mm

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 $b_1 \approx$		$\alpha = 34^\circ$	18.9	26.3	
		$\alpha = 38^\circ$	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

fig. 11

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

- b) Use high performance belts - for example **XPB** instead of **SPB** - as a lower quality of belts for the same transmitted power may be necessary and a consequent shorter resulting distance compared to the shaft shoulder (PTO), "a" in fig. 12.



- 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 point 9.12.
- d) Belt length has a natural tolerance $\geq 0.75\%$. For this reason, the three belts must be purchased as a pair.
- e) Follow the direction of the belt pull as shown in fig. 12; for other needs, contact our **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:

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

Values of the static pull to be applied can be obtained from the diagram in fig. 13

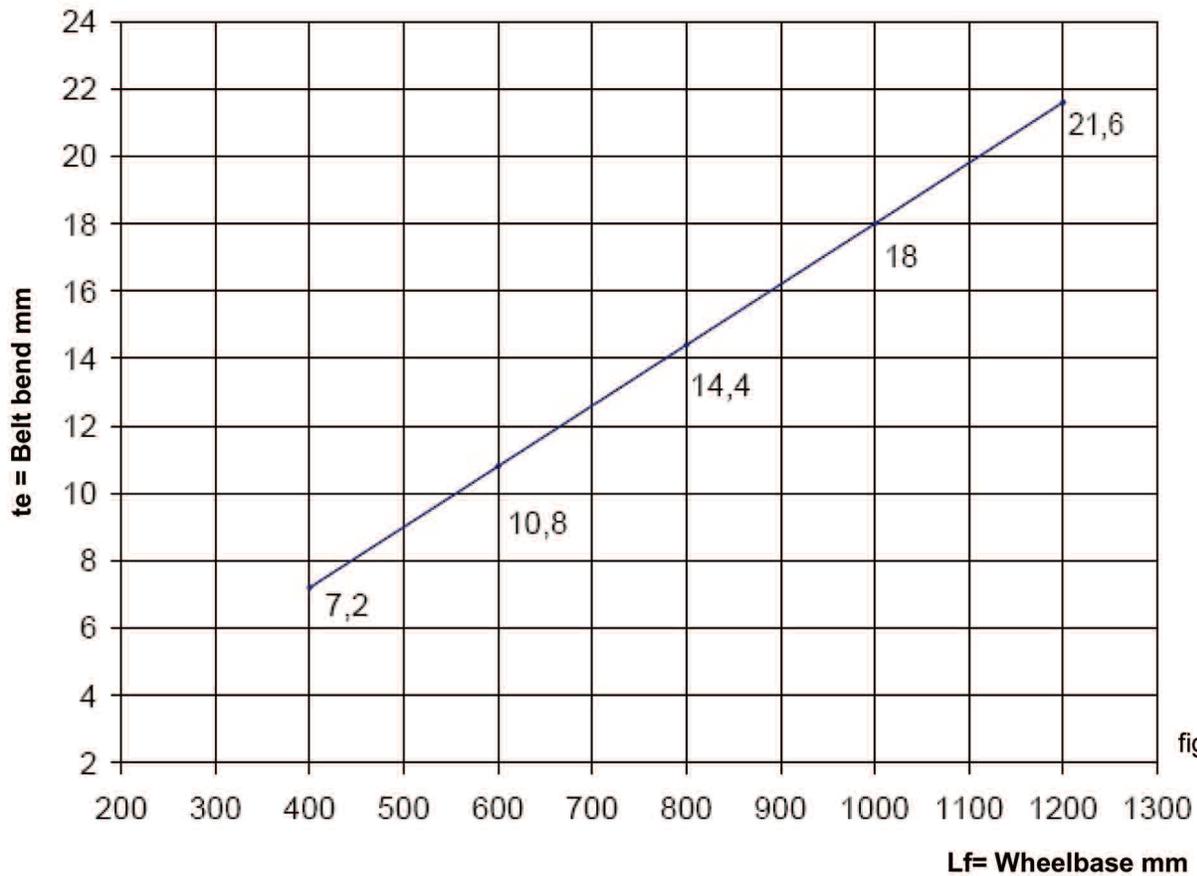


fig. 13

Conclusion: with a dynamometer, loading the belt branch with 75 N as indicated in fig. 14, a “te” bend of approximately 10.8 mm is obtained.

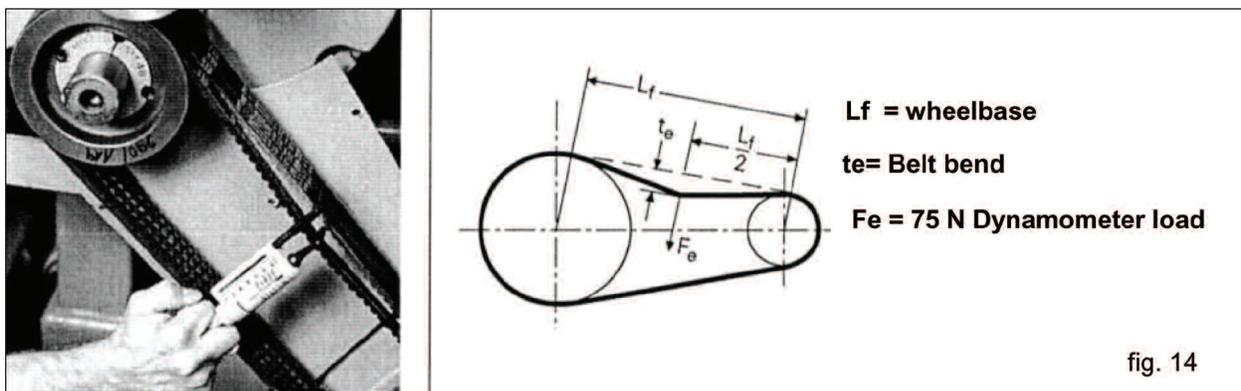


fig. 14

Note₁: 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.

Note₂: In case of necessity or for routine maintenance, never replace a single belt, but the complete set.

10. START-UP AND OPERATION

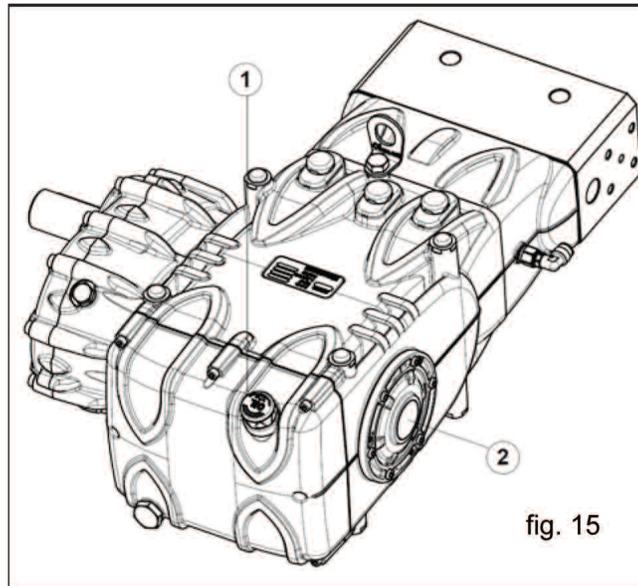
10.1 Preliminary Inspections

Before Start-up Be sure that:



The 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 15).



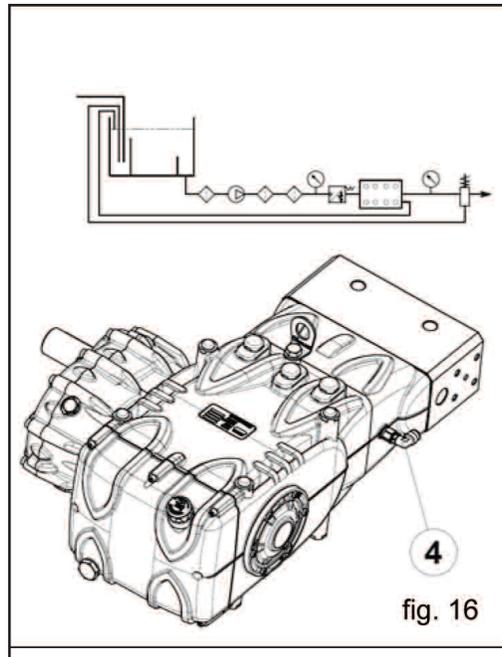
In case the pump has not run for a long period of time, recover the correct operation of the suction valves by opening the three valve-lifting devices (see fig. 9). Be sure to reclose the valves before the pump start-up.

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 Packing Cooling Circuit

During operation, some water from the cooling circuit seal packings will be discharged from orifice 4 (fig. 16). The drainage from this circuit must be redirected to the inlet line upstream of the booster pump (fig. 16) or to the collection tank.



11. PREVENTIVE MAINTENANCE

For 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"> • Valves • Valve seats • Valve springs • Valve guides
	Check / Replace: <ul style="list-style-type: none"> • H.P packings • L.P. packings

* 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 Anit-freeze By Using An External Diaphragm Pump As In The Layout Shown in Paragraph 9.7 in fig. 8.

- 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 diphragm 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 polyethelene.
- 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:**

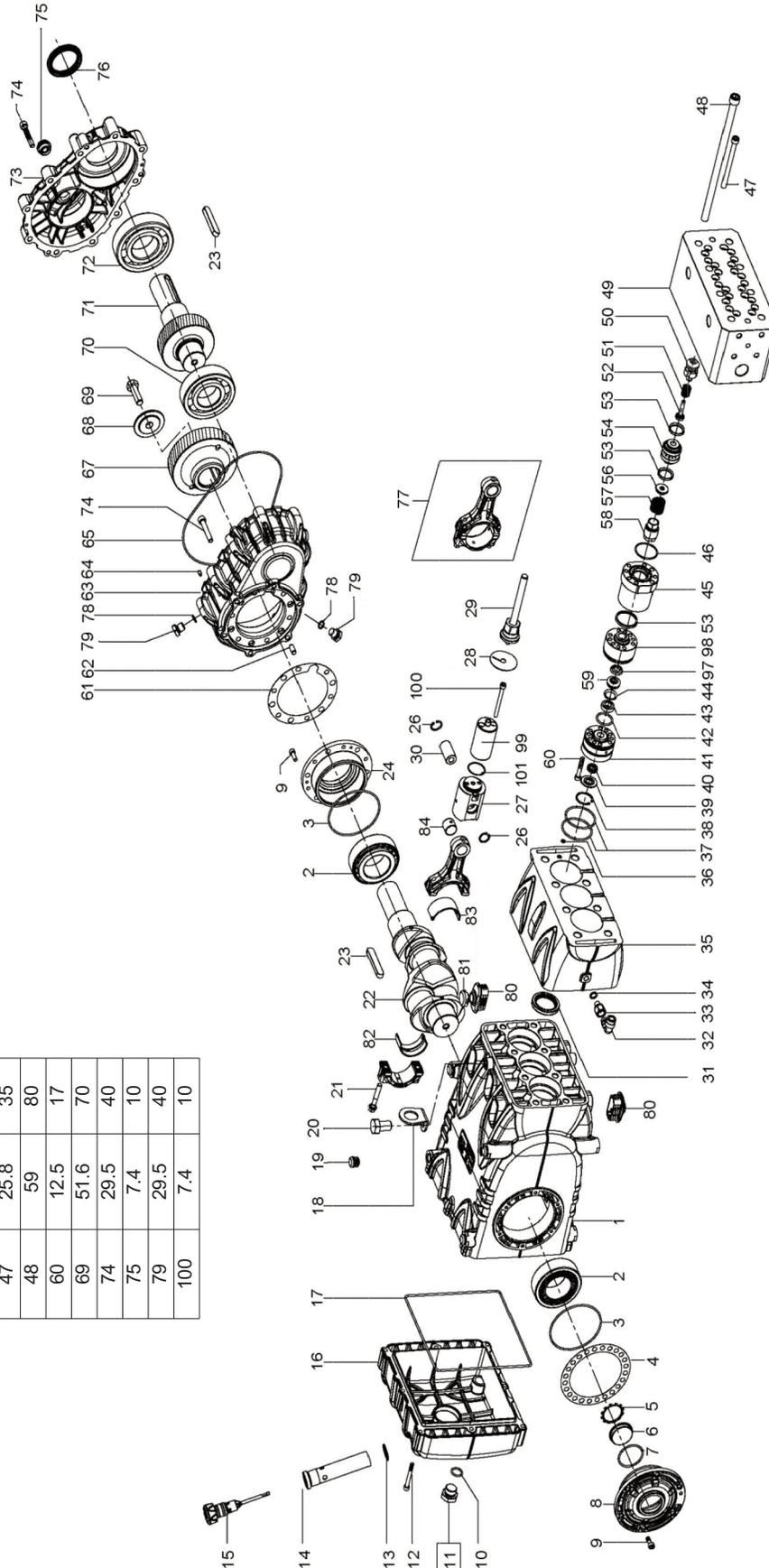
- The pump is overloaded (pressure or RPM exceed the rated values)
- Oil level is too low, or the oil is not of a suitable type, indicated in Chapter 7 (see paragraph 7.4)
- Incorrect alignment of the joint or pulleys
- Excessive inclination of the pump during operation

**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

VKH



TORQUE SPECS		
Position	Ft.-Lbs.	Nm
9	7.4	10
11	29.5	40
12	7.4	10
20	29.5	40
21	22.1	30
29	14.8	20
33	7.4	10
47	25.8	35
48	59	80
60	12.5	17
69	51.6	70
74	29.5	40
75	7.4	10
79	29.5	40
100	7.4	10

Item	Part #	Description	QTY.
1	F71010022	Pump Casing	1
2	F91859000	Tapered Roller Bearing, 50x90x32	2
3	F90391800	O-ring, Ø 91.92x2.62	2
4	F71220081	Shim Washer, 0.1 mm	1
	F71220381	Shim Washer, 0.25 mm	1
5	F90075600	Ring, ZJ45	1
6	F70211801	Oil Level Indicator	1
7	F90387700	O-ring, Ø39.34x2.62	1
8	F71150122	Indicator Side Bearing Cover	1
9	F99186700	Screw, M16x18	12
10	F90384100	O-ring, Ø 17.13x2.62	1
11	F98218700	Plug, Nickel	1
12	F99196800	Screw, M6x50	8
13	F90360400	O-ring, Ø 25.12x1.78	1
14	F72210695	Oil Dipstick Tube	11
15	F98212000	Plug With Rod, Ø 21. x91	1
16	F72160022	Cover, Rear	1
17	F90400000	O-ring, Ø215x3	1
18	F71223074	Lifting Bracket	1
19	F98206000	Plug, Ø 15	1
20	F99426600	Screw, M12x25	1
21	F99313800	Screw, Connecting Rod, M8x1x48	6
22	F71020035	Bend Shaft	1
23	F91500000	Tab, 12x8x70	2
24	F71150022	PTO Side Bearing Cover	1
26	F90060600	Stop Ring, Ø 20	6
27	F71050715	Plunger Guide	3
28	F96714000	Washer, Ø 10x50x1	3
29	F71040702	Plunger Assembly, Ø 12	3
	F71040802	Plunger Assembly, Ø 14	3
30	F97743000	Pin, Ø20x38	3
31	F90167800	Ring, Rad, Ø 38x52,7/8.5	3
32	F96416000	90 degree fitting, Ø 10, Revolving	1
33	F71223566	Throttle Fitting	1
34	F96710000	Washer, Ø 10x14x1.5, Aluminum	1
35	F71165020	Spacer for Liner	1
36	F90366300	O-ring, Plunger Assembly, Ø4 x 2	1
37	F90389100	O-ring, Ø 52.07 x 2.62	6
38	F90067200	Ring	3
39	F71216766	Seal Ring, Ø 12	3
	F71216866	Seal Ring, Ø 14	3
40	F90258800	Alt. Seal Ring, Ø 12x10x6 L.P.	3
	F90260400	Alt. Seal Ring, Ø 14x22x6, L.P.	3
41	F71228656	Fitting Support, Ø 12	3
	F71228756	Fitting Support, Ø 14	3
42	F90386100	O-ring, 26.65x2.62	3
43	F71211370	Fitting Bushing, Ø 12	3
	F71211470	Fitting Bushing Ø 14	3
44	F71224368	Anti-extruding Ring, Ø 12	3
	F71224668	Anti-extrusion Ring, Ø 14	3
45	F71060756	Lining	3
46	F90370200	O-ring, Ø 38 x 2	3
47	F99326100	Screw, M8x100	24
48	F99455000	Screw, M12x260	8
49	F71127056	Manifold, Ø 12 and 14	1

Item	Part #	Description	QTY.
50	F36205570	Valve Guide	3
51	F94742300	Spring, Ø 13.9x23	3
52	F36205666	Valve	3
53	F93186500	Fitting, Ø 24x29x3.8	9
54	F36205266	Valve Seat, Ø 12	3
	F36210266	Valve Seat, Ø 14	3
56	F36205366	Flat Valve	3
57	F94751800	Spring, Ø 21.6x37	3
58	F71228482	Plunger Bushing, Ø 12	3
	F71228582	Plunger Bushing, Ø 14	3
59	F90259000	Alt Seal Ring, Ø 12x24x11, H.P.	3
	F90260600	Alt. Seal Ring, Ø 14x24x11, H.P.	3
60	F99200000	Screw, M6x40	30
61	F72210784	Reduction Gear Box Fitting	1
62	F97618500	Cylindrical Pin, Ø 8x18	1
63	F72210820	Reduction Gear Box	1
64	F97615200	Cylindrical Pin, Ø 5x10	2
65	F90394800	O-ring, 209.22 x 2.62	1
67	F10071335	Ring Gear, Z40-2200, Helical	1
	F10071235	Ring Gear, Z37-1800, Helical	1
	F10071135	Ring Gear, Z34-1500, Helical	1
68	F72211055	Ring Gear Fastening Washer	1
69	F99430700	Screw, M12x40	1
70	F91857700	Ball Bearing, 45x100x25	1
71	F10071035	Pinion, Z22-2200, Helical	1
	F10070935	Pinion, Z25-1800, Helical	1
	F10070835	Pinion, Z27-1500, Helical	1
72	F91859300	Ball Bearing, 50x100x27	1
73	F72210920	Reduction Gear Box Cover	1
74	F99314600	Screw, M8x50	16
75	F97394000	Oil Level Indicator	1
76	F90170000	Rad. Ring, Ø 50x65x8	1
77	F71030701	Connecting Rod Assembly	3
78	F90358500	O-ring, Ø 10.82 x 1.78	2
79	F98204250	Plug, Nickel	2
80	F71225851	Casing Plug	6
81	F71225951	Casing Plug Cap	3
82	F90924300	Connecting Rod Head Semi-Bushing - Lower	3
	F90924400	Connecting Rod Head Semi-Bushing - +0.25 Lower	3
	F90924500	Connecting Rod Head Semi-Bushing - =0.50, Lower	3
83	F90924000	Connecting Rod Head Semi-Bushing - Upper	3
	F90924100	Connecting Rod Head Semi-Bushing - +0.25 - Upper	3
	F90924200	Connecting Rod Head Semi-Bushing - +0.50 - Upper	3
84	F90911000	Connecting Rod Foot Bushing	3
	F71101160	Head Ring, Ø12	3
97	F71101260	Head Ring, Ø14	3
	F71228856	Intermediate Support	3
99	F71050866	Plunger Guide Pin	3
100	F99199400	Screw, M6x65	6
101	F90352800	O-ring, Ø 30x1.5	3

REPAIR KITS

KIT NUMBER	F2037 (VKH12) Plunger Packing Kit	F2035 (VKH14) Plunger Packing Kit	F2038 Valve Kit	F2128 (VKH12) Complete Seals Kit	F2129 (VKH14) Complete Seals Kit	F2110 (VKH12) Valve Kit	KF2130 (VK14) Valve Kit	F2135 Conn. Rod Kit	F2154 Conn. Rod Kit	F2155 Conn. Rod Kit
Positions Included	36, 37, 40, 42, 43,44, 46, 59	36, 37, 40, 42, 43,44, 46, 59	53	3, 7, 10, 13, 17, 31, 36, 37, 40, 42, 43, 44, 46, 53, 55, 59,61, 65, 76, 78	3, 7, 10, 13, 17, 31, 36, 37, 40, 42, 43, 44, 46, 53, 55, 59, 61, 65, 76, 78	50, 51, 52, 53, 54, 56, 57	50, 51, 52, 53, 54, 56, 57	82, 83	82, 83	82, 83

KIT NUMBER	F2343 (VKH12) Interchangability Kit VK - VKH	F2344 (VKH14) Interchangability Kit VK - VKH
Positions Included	37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 53, 58, 59, 60, 97, 98	37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 53, 58, 59, 60, 97, 98

17. MAINTENANCE LOG

HOURS & DATE

OIL CHANGE							
GREASE							
PACKING REPLACEMENT							
PLUNGER REPLACEMENT							
VALVE REPLACEMENT							



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