INSTRUCTIONS MANUAL

Version 001-18
ORIGINAL INSTRUCTIONS

MOTORPUMP

LEUCO S.p.A.

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This manual and associated information can be downloaded from the website: www.hawkspumps.com

This manual is an integral part of the product and should always be made available to any persons using it

CONTENTS

1 GENERAL INFORMATION

1.1 Structure of the Manual

This manual is an integral part of the official documents provided with the pump. It is written by the Manufacturer and provides the operating instructions and criteria to be followed for the installation, use and maintenance of the pump.

Before choosing and/or using any LEUCO product, it is important that the customer controls all aspects related to its specific application with due care and studies the information provided in the technical sales literature published by LEUCO. As LEUCO products may be used in different operating conditions and/or applications, the customer is responsible for carrying out any tests and analysis that will help him choose the best product for his needs. He is also responsible for complying with all operating specifications and safety requisites.

LEUCO's products and publications are subject to change at any time without notice.

The customer must ensure the installation is carried out in full compliance with the instructions provided in this manual, as well as with current national legislation and standards.

The Manufacturer is not liable for any damages caused by incorrect use, negligence, superficial interpretation or total lack of application of the safety related information provided in this manual.

1.1.1 Aim and contents

These operating instructions provide all the information concerning the installation, use, maintenance, storage and all stages of the life cycle of the high-pressure positive displacement piston pumps to be observed by any persons involved in its assembly/end user in order to prevent possible risks.

Operators and qualified technicians must read the instructions in this publication with due care before starting any operation on the equipment.

Contact LEUCO S.p.A for the necessary explanations if you have any doubts regarding the correct meaning of the instructions.

1.1.2 Intended recipients / Definitions

These instructions are intended for skilled personnel who have been given appropriate training for carrying out installation and routine maintenance.

Customer
The person, public agency or private company who bought the pump and intends to use for its intended purposes. This may also be the person responsible for its assembly provided he has the necessary requisites.

User/Operator
An authorised person with the requisites, skills and information needed to use the pump, machine or system where the pump is fitted, and to carry out routine maintenance.

Ordinary/general maintenance
The actions required to maintain the machine in good working order, to guarantee a longer working life and to safeguard safety requisites at all times. The Manufacturer has provided a description of the maintenance schedule and methods in this manual. Maintenance may be carried out by qualified personnel, including the operator, as described above.

Supplementary maintenance
The actions required to restore the working order and efficiency of the machine. Such actions are required in case of sudden anomaly and may only be carried out by a specialised technician.

Installer/Assembler
An authorised technician with the specific requisites and skills needed to carry out the actions needed to install the pump and/or similar machines and to carry out routine maintenance in complete safety, independently and without incurring risks.

Training
The period when the operators are given the necessary instructions to carry out any actions in a correct and risk free manner.

Person at risk

Any person finding themselves totally or partly in a danger zone.

1.1.3 Storage

This instructions manual should be kept in the direct vicinity of the machine, in a specific container, protected from contact with liquids and any other substance that could render it illegible.

1.1.4 Symbols used in the manual

SYMBOL	MEANING	COMMENT
	**DANGER**	Indicates a potentially serious risk for the user/assembler.
	**CRUSHING HAZARD FOR UPPER AND LOWER LIMBS**	Indicates the danger of crushing the upper limbs when positioning or handling the pump.
	**MOVING MECHANICAL PARTS HAZARD**	Indicates a hazard due to the presence of moving parts (such as drive shafts or reduction units).

SYMBOL	MEANING	COMMENT
 	**WARNING** **SAFETY INFORMATION**	A warning or note regarding key features or useful information. Pay maximum attention to the text boxes indicated by these symbols.
	**REFERENCE**	Refer to the instructions manual before attempting any action.
	**ADJUSTMENTS/MAINTENANCE**	Specific mechanical adjustment and/or electrical calibration (when applicable) may be necessary in cases of special operating modes and/or anomalies.

1.2 Manufacturer

HAWK INTERNATIONAL LEUCO S.p.A. A company of the Group KÄRCHER	**LEUCO S.p.A.** **Via Colletta, 20 - 42124 Reggio Emilia (RE) - ITALY**

1.3 Service Centres

Contact LEUCO S.p.A. or specialised personnel authorised by the Manufacturer for further information relating to operation or maintenance.
Make a note of the information you will find on the pump's specifications plate and the type of fault found whenever requesting technical assistance.

1.4 EC Mark and Certification - Declaration of Incorporation

The Hawk motorpumps described in this manual are manufactured in compliance with Directive 2006/42/CE and European Community Directives that are pertinent and applicable at the time they are sold. As they are "partly completed machinery"

according to Article 2, letter g) of the above Directive, a Declaration of Incorporation is issued in place of a certification. As its contents make clear, the final Installer is responsible for issuing the declaration of conformity and relative CE mark (which may be the same person as the Customer).
These assembly instructions were drafted in accordance with Annex VI of the above Directive.

This instructions manual complies with Annex I section 1.7.4 of the above Directive as well as UNI 10893 standard and ISO/IEC 37 guidelines.

	The list of Directives and the standards applied can be found in the Declaration of Incorporation in the attachments (Attachment I) of this Manual.

1.5 Guarantee

LEUCO S.p.A. guarantees HAWK products from defects in their construction and materials for a period of (1) year from the time they left the factory.
This guarantee is limited to the repair and replacement of parts or products that LEUCO S.p.A. deems were defective at the time of delivery. All the products covered by this limited guarantee must be returned freight paid for inspection, repair or replacement by the manufacturer.
This limited warranty is the only form of valid guarantee and replaces any other form of explicit or implicit warranty, including any guarantee of fitness for sale or any particular purpose. The manufacturer refuses any such liability with this statement.
Faulty products will only be repaired or replaced according to these terms. LEUCO S.p.A. is not liable for any further loss, damage or expense, including accidental or indirect damages caused directly or indirectly from the sale or use of these products.
Any unauthorised use of spare parts that were not manufactured by LEUCO S.p.A. automatically invalidates this guarantee, which is subject to compliance with the instructions for installation and operation provided. There are no additional guarantees other than the guarantee described above.

All motorpumps supplied by LEUCO are carefully controlled during their production and undergo cycles of testing before shipment. For optimum pump performance, to prevent incidents and avoid invalidating the guarantee, it is essential to comply with the procedures described in this manual regarding the correct assembly and initial start-up of the pump.

	LEUCO S.p.A. is not liable for any errors made when drafting this manual.
	The Manufacturer is not liable in case of any unauthorised modification to the product or to any part of it and any such action will invalidate the guarantee.

2 GENERAL DESCRIPTION

Hawk high-pressure piston pumps are positive displacement pumps. HAWK pumps are designed and built for pumping clean, fresh water or water with a low percentage of commonly used detergents, up to a temperature of 65°C.

Hawk Motorpumps/electropumps are high pressure equipment of exquisite workmanship. Our experienced workers are renowned worldwide for their passion and proficiency.
The brand Hawk is a leader in the high-pressure pumps manufacturing industry as well as in the related accessories sector. Hawk Motorpumps stand out in the market because they can operate up to 100bar and a water temperature of 65°C (149°F). for this reason they are very versatile and are normally installed inside vehicles washing system.

Hawk motorpumps are units comprising a power supply part (or electric motor) and a pump operating unit described below.

The main parameters that determine your choice of Hawk pump are volume, pressure, rotation speed and power consumption.

- The volume is given in litres per minute and is directly proportional to the rotation speed.
- The speed of rotation is given as revolutions per minute.
- The pressure is given in bars and is the maximum pressure that the pump can reach.
- The power consumption is shown in kW and is the absorption required to achieve the maximum flow rate and pressure indicated.

Subsection 2.1.1 shows the performance characteristics of the models referred to in this documentation.

	**Hawk pumps were not designed for pumping potentially hazardous liquids (explosive, toxic and flammable liquids). Contact the Manufacturer in case of doubt.**

	**Before choosing and/or using any LEUCO product, it is important that the customer controls all aspects related to the specific application with due care and studies the information provided in the technical and sales literature published by LEUCO S.p.A.** **LEUCO's products and this document are subject to change at any time without notice.**

2.1 Main parts

A - HIGH-PRESSURE PISTON PUMP
comprising: manifold housing with delivery and suction valves 1; oil level plug on the pump body 2; oil level indicator 3; plungers and connecting rod inside the pump body for motion transmission to the crankshaft.

B - HOLLOW SHAFT ELECTRIC MOTOR
comprising: frame with stator and winding 4; fan cover cap 5; terminal board (with terminal strip, seals, fairlead, header, cover) 6; pre-installed feet to be assembled 7.

More details on the parts can be found in the exploded views attached to this manual (ATTACHMENT II).

The pumping action is created by a series of plungers, connected to the drive shaft by connecting rods. During motion, the plungers slide on their axis inside the manifold housing where the suction and delivery lines are fitted with valves that allow the liquid to flow in a single direction.

2.1.1 Technical characteristics

MOTORPUMP PART NUMBER 1.099-378.0	
PUMP	*NHD1112R*
ELECTRIC MOTOR	*Single-phase, 4 poles, 1450rpm, 230V, 50Hz, IEC 100, 2.2Kw, 3hp, hollow shaft*
MAXIMUM PRESSURE	*100 bar*
FLOW AT 50Hz	*11 l/min*
FLOW AT 60Hz	*/**
WEIGHT	*28 Kg*
**This is the only series of products that, having a single-phase motor, operate only at 50Hz.*	

MOTORPUMP PART NUMBER 1.099-379.0	
PUMP	*NHD1015R*
ELECTRIC MOTOR	*Single-phase, 4 poles, 1450rpm, 230V, 50Hz, IEC 100, 3Kw, 4hp, hollow shaft*
MAXIMUM PRESSURE	*150 bar*
FLOW AT 50 Hz	*10 l/min*
FLOW AT 60Hz and 1740rpm	*/**
WEIGHT	*29 Kg*

MOTORPUMP PART NUMBER 1.099-380.0	
PUMP	*NHD1115R*
ELECTRIC MOTOR	*Three-phase, 4 poles, 1450rpm, 230/400V, 50Hz, IEC 100, 3Kw, 4hp, hollow shaft*
MAXIMUM PRESSURE	*140 bar*
FLOW AT 50 Hz	*11 l/min*
FLOW AT 60Hz and 1740rpm	*13 l/min*
WEIGHT	*28 Kg*

MOTORPUMP PART NUMBER 1.099-381.0	
PUMP	*NHD1415R*
ELECTRIC MOTOR	*Three-phase, 4 poles, 1450rpm, 230/400V, 50Hz, IEC 100, 4Kw, 5.5hp, hollow shaft*
MAXIMUM PRESSURE	*150 bar*
FLOW AT 50 Hz	*14 l/min*
FLOW AT 60Hz and 1740rpm	*17 l/min*
WEIGHT	*28 Kg*

MOTORPUMP PART NUMBER 1.099-382.0	
PUMP	*NMT1220*
ELECTRIC MOTOR	*Three-phase, 4 poles, 1450rpm, 230/400V, 50Hz, IEC 112, 5.5Kw, 7.5hp, hollow shaft*
MAXIMUM PRESSURE	*200 bar*
FLOW AT 50 Hz	*12.5 l/min*
FLOW AT 60Hz and 1740rpm	*15 l/min*
WEIGHT	*42 Kg*

MOTORPUMP PART NUMBER 1.099-383.0	
PUMP	*NMT1520*
ELECTRIC MOTOR	*Three-phase, 4 poles, 1450rpm, 230/400V, 50Hz, IEC 112, 5.5Kw, 7.5hp, hollow shaft*
MAXIMUM PRESSURE	*190 bar*
FLOW AT 50 Hz	*15 l/min*
FLOW AT 60Hz and 1740rpm	*18 l/min*
WEIGHT	*42 Kg*

MOTORPUMP PART NUMBER 1.099-387.0	
PUMP	*NMT1520*
ELECTRIC MOTOR	*Three-phase, 4 poles, 1450rpm, 230/400V, 50Hz, IEC 112, 5.5Kw, 7.5hp, hollow shaft*
MAXIMUM PRESSURE	*190 bar*
FLOW AT 50 Hz	*15 l/min*
FLOW AT 60Hz and 1740rpm	*18 l/min*
WEIGHT	*42 Kg*

MOTORPUMP PART NUMBER 1.905-612.0	
PUMP	*NMT1520**
ELECTRIC MOTOR	*Three-phase, 4 poles, 1450rpm, 230/400V, 50Hz, IEC 112, 5.5Kw, 7.5hp, hollow shaft*
MAXIMUM PRESSURE	*190 bar*
FLOW AT 50 Hz	*15 l/min*
FLOW AT 60Hz and 1740rpm	*18 l/min*
WEIGHT	*42 Kg*

MOTORPUMP PART NUMBER 1.099-385.0	
PUMP	*NMT1820CW*
ELECTRIC MOTOR	*Three-phase, 4 poles, 1450rpm, 230/400V, 50Hz, IEC 122, 5.5Kw, 7.5hp, hollow shaft*
MAXIMUM PRESSURE	*150 bar*
FLOW AT 50 Hz	*18 l/min.*
FLOW AT 60Hz and 1740rpm	*21 l/min.*
WEIGHT	*42 Kg*

MOTORPUMP PART NUMBER 1.099-384.0	
PUMP	*NMT2120*
ELECTRIC MOTOR	*Three-phase, 4 poles, 1450rpm, 230/400V, 50Hz, IEC 132, 7.5Kw, 10hp, hollow shaft*
MAXIMUM PRESSURE	*190 bar*
FLOW AT 50 Hz	*21.0 l/min*
FLOW AT 60Hz and 1740rpm	*25 l/min*
WEIGHT	*58 Kg*

MOTORPUMP PART NUMBER 1.099-394.0	
PUMP	*XLT3517IR*
ELECTRIC MOTOR	*Three-phase, 4 poles, 1450rpm, 230/400V, 50Hz, IEC 132, 11Kw, 15hp, hollow shaft*
MAXIMUM PRESSURE	*150 bar*
FLOW AT 50 Hz	*35 l/min*
FLOW AT 60Hz and 1740rpm	*42 l/min*
WEIGHT	*73 Kg*

2.2 Local conditions

The local operating conditions are specified on the product's specifications plate (see the fac-simile in section 3.8).
Some of the operating conditions are listed below.

Parameter	Tolerated values
Room temperature	from -10°C to +50°C
Storage temperature	from 0°C to +50°C
Humidity	from 20% to 80%

The Hawk motorpumps described in this manual were NOT designed or built for operating in potentially explosive environments.

2.3 Vibration

Hawk motorpumps will not produce hazardous vibrations in conditions of normal use and provided the installation and assembly instructions in this document were carried out properly. There will be no contact with the operator during operation, as the pump is part of the machine/system where it is fitted.

2.4 Noise

The equipment was designed and built to reduce the generation of noise at source as far as its application and method of use allows this.
The noise measured is below the minimum level envisaged in current legal standards.

2.5 High temperatures

Mechanical parts are lubricated to prevent them overheating as a result of prolonged friction. The lubricating oil is indicated below in this manual and takes into account the specifications of the pumps that make up the assembly. There is no probable risk provided normal maintenance procedures are followed.
Operators should use appropriate personal protective equipment provided, including work wear and gloves.

2.6 Stability

Instructions are supplied with LEUCO pumps to ensure a stable and safe assembly on the machine/system that incorporates them. The assembler/operator must follow these instructions carefully.

The motorpumps were designed and built so that they do not present any hazard in terms of stability in conditions of normal use.

	More information is provided in section 5 “Installation”.

2.7 Pressurised liquids

The motorpumps described in this manual are built using materials that are capable of tolerating the envisaged operating pressures. They are complete with all the necessary parts (plugs, valves, plungers, etc..) for the correct operation and circulation of the liquids (water and lubricating oil). The lubricating transmission products contained in the pump body are used to safeguard correct pump operation by keeping the mechanical parts lubricated.

3 SAFETY

3.1 General safety instructions

Hawk motorpumps were designed to be safe to operate for the intended purposes, provided they are run (incorporated), used and maintained according to the instructions in these operating and maintenance instructions.

Before attempting to install or use the motorpumps, the machine operators and any other personnel involved must read and understand the instructions provided in the manual and the project data for installation.

	**Do not tamper with equipment. The manufacturer is not liable in case of incorrect pump operation or for any damage resulting from use of the product if tampering is suspected.**
	**Before using the equipment, make sure that any safety hazard has been eliminated.**

Operators must follow the safety instructions below:

	Do not attempt to remove or alter any part of the pump, unless instructed in this manual and in the manner described.
	Only qualified technical personnel authorised by the Manufacturer may undertake internal inspections, modifications or repairs.
	Do not allow unauthorised personnel to tamper with the equipment.
	Do not wear rings, wrist watches, jewellery, loose clothing or items like neck ties, scarves, torn clothing, unbuttoned jackets or shirts with open zips, as these could get caught in moving parts.
	Wear appropriate personal protective equipment as specified in the manual for the work to be carried out.
	Make sure all the steps described in the section on maintenance are carried out regularly.
	The equipment must be taken out of service ***immediately*** in case of malfunction or damage that could affect its operation and safety.
	Notify the personnel in charge of maintenance in case of any operating anomaly.
	Make sure that all protective guards and other devices are in place and that all safety devices are present and working properly (pump crankcase and the safety devices on the machine/system where the pump is fitted).
	Check that the direction of rotation of the motor is the same as that of the pump when it is started up for the first time or after any maintenance.
	Never open the compartments of the electrical equipment when the device is connected to the power supply.
	Disconnect the power supply before carrying out any cleaning or ordinary maintenance operations.

	**Check if there are any other safety instructions that must be followed in the Operating and Maintenance Manual for the machine where the pump is fitted.**

3.2 Residual risks

The pumps were designed and built in order to eliminate any risks associated with their operation.
The residual risks are described below:

a) Crushing: 

Handling and positioning the pump/motorpump may bring the risk of crushing the upper limbs or hands or feet. Pay particular attention when undertaking these actions. It is compulsory to wear the personal protective equipment provided (work gloves and boots) and to comply with all the procedures designed to safeguard the correct completion of the operating cycle.

b) Heat-related hazards: 

The motorpump can reach high temperatures during operation depending on the temperature of the pumped liquid. As a result, the person in charge of the installation must bear this in mind and provide appropriate safety devices and warning signs for personnel.

c) Electrocution: 

On the motor that makes up the motorpump there are signs indicating the risk of electrocution if the protective covers are opened. The manufacturer specifies that these covers must only be removed by qualified staff and only after disconnecting the specific equipment from the power supply. Please refer to the specific Use and Maintenance Manual of the main piece of equipment.

3.3 Personal protective equipment

Failure to use the personal protective equipment specified in this section will expose the machine operators to danger.
Employers are required to provide personal protective equipment to the operators using the machine referred to in this manual.

The operators using the equipment must wear the following personal protective equipment, in line with the work being carried out:

- **Personal protective equipment against the risk of cuts, bruises and high temperatures (max 85 °C)**
- **Work boots**
- **Safety goggles or glasses (if necessary)**

The Employer may decide to use additional safety equipment after assessing any risks and considering any changes made to the production processes.

3.4 Working safely

To reduce the consequences of the hazards described in the section above, operators must comply with the following instructions:

- **Wear** the personal protective equipment referred to in section 3.3;
- **Monitor areas where any hazard is present**, do not start a test cycle if there are any persons located within the hazardous area or in the immediate vicinity who are not involved in the job to be undertaken. Release the controls immediately should any unauthorised persons enter the hazardous area when work is underway.

3.4.1 Safety when using the pump

The area and environment that the high pressure system operates in must be clearly signposted and prohibited to unauthorised personnel. The area should also be restricted and defined. The staff responsible for carrying out the work must first undergo workplace conduct training as well as training on the risks arising from high pressure system damages or defects. Prior to starting up the system, the operator or operators are required to check:

- **that the system has the correct power supply;**
- **that the electrical parts are correctly and adequately protected and work efficiently;**
- **that the high pressure hoses and hose fittings do not exhibit signs of abrasion or excessive wear.**

Any defect, damage or reasonable doubt that might arise before or during the operation must be reported and verified by qualified staff. Should this happen, the system must be stopped immediately and the pressure brought down to zero.

3.4.2 Safety when using high pressure circuits

Here below are some basic indications regarding the high pressure circuit where the pump can be installed.

High pressure circuits should always be fitted with a safety or pressure relief valve.

Components of the high pressure circuits, particularly those that mainly operate outdoors, must be imperviousness to weather conditions such as rain, frost or heat. All electrical parts should have adequate protection against direct or indirect sprays of water and be suitable for use in wet environments.
High pressure hoses must be sized in accordance with the maximum operating pressure of the circuit and always within the field of operation specified by the hose manufacturer. These precautions should also be respected for all the components found within high pressure circuits. The ends of the high pressure hoses should be sheathed or, in any event, secured to a structure in order to prevent dangerous whiplash in the event of a blast or a rupture in the connections.
Lastly, appropriately sized crankcases must be provided in order to protect the rotating component parts for the motion transmission (flexible couplings and universal joints, belts, pulleys, etc.).

Check if there are any other safety instructions that must be followed in the Operating and Maintenance Manual for the machine where the pump is fitted.

3.4.3 Rules of conduct regarding the use of high pressure lance

Here below are some basic indications regarding the use of the pump with high pressure lance equipment.

Those who operate high pressure nozzles must always put their own safety - as well as the safety of third parties likely to be affected by their actions - before any other assessment or action in respect of the situation. Their work must always be guided by common sense and an awareness of responsibility and precautions.
The operator must always acquire appropriate personal protective equipment (helmet with protective visor, waterproof overalls and rubber boots) that guarantee good grip and stability on the ground in wet conditions.
Adequate clothing is effective against splashes of water, but cannot withstand the direct impact of water jets or splashes at close range. In these circumstances, additional protection is recommended.
It is also desirable to have the operators work in teams of at least two people in order that they may provide mutual assistance in case of need or danger, and have them organize an appropriate rotation that will provide cover in the event of long and tiring shifts.
The area affected by the water jet must be prohibited and free from objects which, if hit by the jet, might be damaged or projected elsewhere.
The jet should always be aimed in the direction of the workspace, including during preliminary or trial operations.
Attention must always be paid to the trajectory of debris removed from the jet. If necessary, anything that might be exposed to the jet should be given adequate protection.
The operator should not be distracted for any reason while carrying out his or her work. Those wishing to enter the workspace must wait for the operator to suspend work on his or her own initiative and make their presence immediately known.
Team members must always be aware of each other's intentions in order to avoid potentially dangerous situations.
The system must never be started-up and pressurized before each team member is at their own station and the operator has aimed the jet into the workspace.

Check if there are any other safety instructions that must be followed in the Operating and Maintenance Manual for the machine where the pump is fitted.

3.5 Safety during lifting and handling

	**Before starting work, clear the work area so that the lifting and movement of materials can be undertaken in safety.**
	**Only authorised qualified personnel who have received specific training may undertake unloading, loading, handling and lifting operations.**
	**People who are not involved in the operations must keep at a safe distance during lifting and handling.**
	**All equipment used for lifting and transport, including accessories (such as hooks, ropes and chains), must be a suitable capacity and checked regularly according to legal standards.**

3.5.1 Packing, unpacking and transport

The packing used for Hawk motorpumps was designed specifically to prevent damage caused by impact or vibration during transport or handling.

Each motorpump is packed so that it is protected from stress and impact, and will not be damaged during transport.
Based on the amount of goods to be shipped and the final place of destination, the packed pumps can be placed on a pallet to facilitate lifting and handling.

When unpacking, check the parts are intact and they are the correct amount. If any parts are damaged or missing, contact your dealer or the Manufacturer for instructions.
Dispose of packing materials correctly according to legal obligations.

Different means of transport may be used to ship Hawk motorpumps (road, rail, sea or air) depending on their final destination.
Secure the packs to the vehicle properly during transport to prevent movement.

Failure to comply with these instructions may lead to situations of extreme danger.

As evidenced by the dimensional specifications, the product described in this document requires special handling with suitable lifting devices, for example belts and hoists:

1

- *Check that the lifting devices and relevant accessories are of a suitable capacity.*
- *Position the belts on the motorpump so that the centre of gravity is centre of the pump.*
- *Ensure that the ends of the belts inserted in the block allow the safety hook to close correctly. Otherwise, use smaller belts*

2

- *With one hand, use the controls on the pushbutton panel. lifting the motorpump a little at first to ensure that it is stable.*
- *Aid the movement of the motorpump with the other hand. Use slow movements and ensure that no persons not involved in the operation are in the area.*

3

- *Move towards the bench or the are where the motorpump is to be positioned, ensuring that it is clear, stable and flat.*
- *Slowly rest the motorpump on the bench.*

4

- *Once the motorpump is securely on the support surface free the belts and more the lifting device away.*
- *The lifting and movement*

3.6 Safety during Maintenance

Follow the instructions below whenever carrying out any maintenance or repair work:

Depressurise the water system and disconnect the pump from any power source before starting any maintenance or repair work.

- Before starting work, hang a "**MACHINE UNDERGOING MAINTENANCE**" sign in a prominent position on the machine/system where the pump is fitted
- Do not use solvents or flammable chemicals or materials for cleaning that could generate static electricity
- Pay attention not to spill any oil or lubricant
- When you have finished the job, replace any safety guards and covers that were removed or opened and secure them properly.

	**Only qualified technical personnel are authorised to carry our maintenance/repair work.**

3.7 Products used

All the products used during normal operation, including oils, lubricants and cleaning products, must be used as instructed in the safety notices provided by the manufacturer.

	Use the oil already in the pump for the first 50 hours and then replace with **SAE 10/40W oil, as shown on the label.**

Dispose of used oil correctly according to legal obligations.

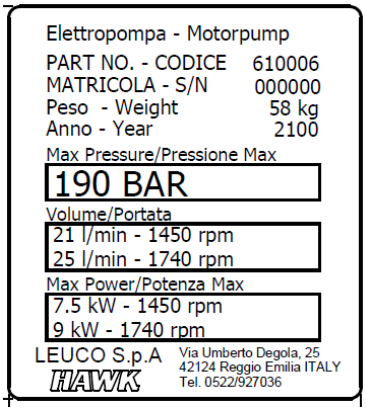
3.8 Product Labels

The hazard, warning and compulsory signs illustrated in this manual are placed in the vicinity of the equipment.
Providing an exact description of the pump, model, serial number and technical data makes it easier for the technical personnel to deliver a fast and efficient service (if needed).

The identification data is on the label attached to the equipment, as shown below.

	**Do not remove (or change the position) of any type of id plate and/or labels containing information and/or warning notices on the equipment.**

FAC – SIMILE
Machine Id Plate



Other signs on the equipment

The yellow label* is attached to the plug on the top of the pump body.

**the label on the plug is the same colour as the plug and so may vary depending on the model of pump.*

3.9 First Aid

A brief description follows of some of the standard First Aid procedures that may be useful in case of injury when using the pump or the machine/plant where it is fitted.

They may be useful if a machine operator has to handle an emergency when using the equipment during the various stages of its working life (transport, installation, operation, maintenance, adjustments, etc.) to help himself or to assist others in the direct vicinity of the equipment.

3.9.1 What the First Aider does

a) Calls for help (emergency services);
b) Assesses the condition of the injured person and sustains their vital functions, if necessary;
c) Stops the flow of blood;
d) Protects wounds and burns;
e) Protects the injured person from further injury;
f) Does not take any unnecessary or potentially harmful initiative like moving the injured person or giving him a drink, attempting to treat sprains and/or broken bones, etc..

3.9.2 The Emergency Call

To be sure of a successful outcome, it is important to make sure the emergency services can reach the place of the event without delay.
So it is very important that the first aider who calls the emergency services, gives the following information:

- The address where the accident (or medical emergency) has taken place;
- How many people are injured (or ill);
- What may have caused the emergency;
- The status of the injured person's vital functions, whether he is conscious or not, and whether he is breathing normally or not.

After confirming the above information, it is advisable:

- To give your own name and a telephone number where you can be reached;
- To wait outside for the emergency services to arrive (near the main entrance, for example).

Calling the emergency services is of major importance. Do everything you are instructed to do by the emergency team to ensure a successful outcome.

3.9.3 Injuries

What to do in case of sprains, dislocations or broken bones:
Use a splint or a bandage to immobilise the area where the injury occurred, in the position that causes less pain for the injured person and without attempting any unnecessary and potentially harmful manoeuvres. Apply a cold pack (an ice pack or similar);
In case of an open fracture, apply pressure away from the fracture to stop the bleeding and then cover the injury with a sterile dressing.

Bruises, crushing:
If the upper or lower extremities of a limb have been bruised and/or crushed (fingers, hands, feet, etc.), put the affected limb immediately under (cold) running water and then apply an ice pack. Check for open wounds and/or cuts and disinfect the affected area if necessary.

3.9.4 Bleeding

It may be necessary to apply direct pressure to the bleeding area using a sterile dressing, lift the limb and apply pressure upstream to the origin of the bleeding with a tourniquet

Surface wounds:
Expose the wound and clean it with water, disinfect it with saline solution and medicate it, covering it with a sterile dressing. Cover this with a bandage without tightening the bandage excessively to permit normal circulation

Deep wounds:
Wearing gloves and a facemask to protect yourself from the risk of infection is a priority. Compress the area until the bleeding stops or the ambulance arrives by applying direct pressure or using other pressure points. Call the emergency services (each country has its own number for the emergency services) and inform them that the person has arterial bleeding.
Do not attempt to treat the wound before the bleeding has been controlled.

	**Do NOT use cotton wool, alcohol or antibiotic powder to disinfect a wound.**
	**Always remember to wear latex gloves to prevent contact with body fluids.**

4 INTENDED USE

4.1 Intended use

Hawk motorpumps must not be used for any other purposes than those described in these instructions. Complying with the terms of use, repair and maintenance specified by the Manufacturer in strict accordance are an essential element with regard to the intended use.

The Hawk motorpumps described in these instructions were designed and built to be incorporated in cleaning machines/equipment (high pressure cleaner). They must be used in a manner that corresponds to their technical specifications (section 2.1.1), without unauthorised modifications and not be used for improper purposes.

	**The pump may ONLY be used and fitted by trained and qualified personnel who are familiar with the information in this manual.**
	**Do not operate the motorpump until the machine where it is fitted has been declared as compliant with current legal standards (e.g. 2006/42/EC directive).**

4.2 Improper Uses

The equipment must not be used:

- By any other recipients than those referred to in 1.1.2

- For any other uses than those described in section 2 and section 4.1
- In any other operating conditions than those described in section 2.2
- For pumping liquids that are flammable, toxic, corrosive or with an unsuitable density or temperatures higher than those specified in the technical data listed in this document or on the product's specifications label
- For pumping drinking water
- For food uses
- For pharmaceuticals
- In potentially explosive atmospheres (see the specific Hawk product range)

	**The Manufacturer reserves the right to review the terms of the guarantee if the equipment is used for any other purpose than those mentioned above.**

5 INSTALLATION AND ASSEMBLY

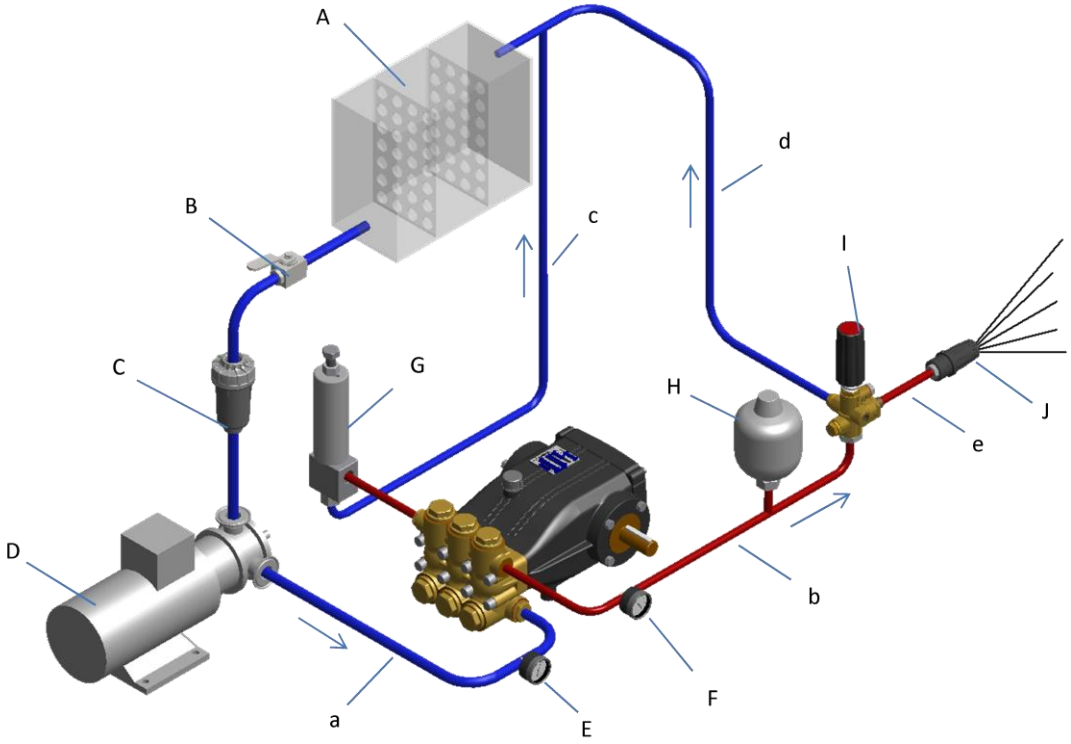
Read this chapter with due care before starting to install the machine.

	**Failure to install the pumping system correctly can result in injury or damage to property: it is important to follow all the points below.**

The electric pump-motor assembly is constructed by directly coupling the pump crankshaft and the hollow shaft of the motor.

Read the following points carefully:

	The pump should be installed horizontally with respect to its base to facilitate optimum lubrication, on an anti-vibration base.
	Check the direction of rotation of the motor and the crankshaft (indicated near the crankshaft): they must be the same.
	The pump's suction pipe must be proportional to the volume and its diameter must not be smaller than the suction mouth. It is important there are as few bottlenecks on this line as possible (elbows, T couplings, reductions, etc...). Each junction on the suction line must be sealed properly with Teflon tape or a similar product to avoid leaks or air intake (cavitation). Cavitation is the formation of bubbles of steam in the liquid: their implosion generates abnormal stress, which is very damaging for all pump parts. To safeguard optimum pump life, avoid the circulation of liquid containing sand or other solid particles as this affects the efficiency of valves, the plungers and seals. This can be prevented by fitting an oversized filter on the suction pipe with respect to the pump volume. The filter should be cleaned regularly.
	The delivery pipe must be able to support the operating pressure of the pump. Excessively narrow passages can result in lance pressure loss.
	**To prevent injury and damage to the pump, it is essential to fit a pressure control valve and a safety valve to prevent the pressure accidentally exceeding its operating level. Contact our technical staff before fitting these valves.** To keep the system pressure under control, a pressure gauge should be fitted on the delivery line with an appropriate bottom scale.
	With regard to electrical components, 1.5mm cables (panels for motors up to 4Kw) and 2.5mm cables (panels for motors up to 7.5Kw) are recommended. Further assessments should be discussed with the Manufacturer as necessary.



A) Tank or mains water supply
B) Shut-off valve
C) Suction filter
D) Auxiliary pump
E) Suction pressure gauge
F) Delivery pressure gauge
G) Safety valve
H) Pressure damper
I) By-pass and control valve
J) Nozzle

a) Supply pipe line
b) Delivery pipe line
c) Safety valve release pipe line
d) By-pass pipe line
e) Valve outlet pipe line

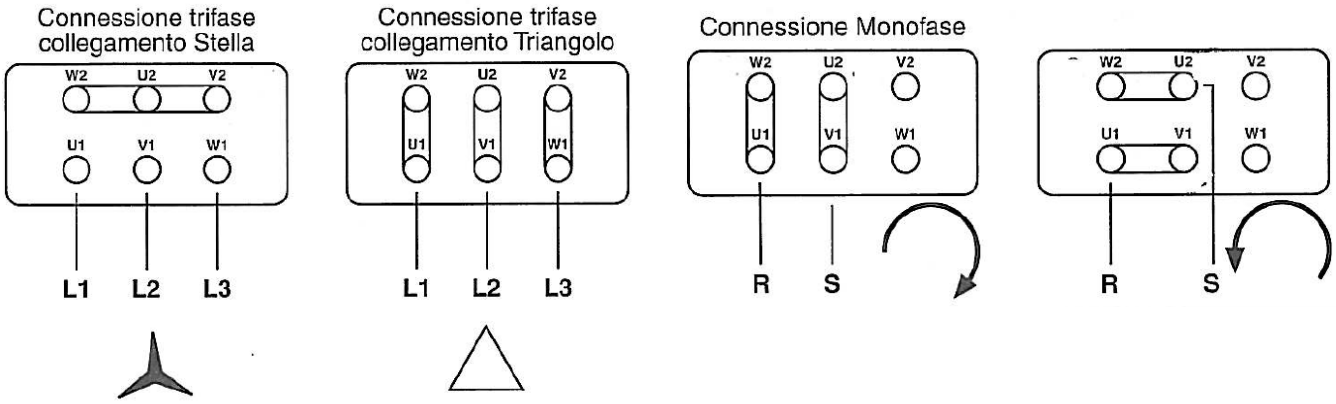
5.1 Responsibilities of the Customer/User

The customer/User are responsible for:

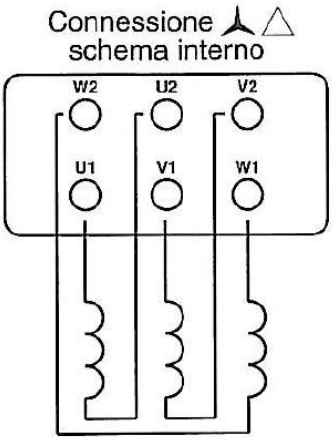
	Checking the condition of the motorpump when it is delivered. Contact LEUCO S.p.A. in case of damage conditions that do not match the purchase order
	Checking that the electrical connections are suitably protected from overloading with respect to the rated current indicated on the specifications plate. The protection equipment must guarantee electrical quality and performance standards that ensure they are durable over time and provide reliable service.
	The assembler/end user must fit a maximum pressure valve near the pump delivery line outlet.
	The assembler/end user must fit a system that guarantees the hydraulic system will stop immediately in case of a sudden increase in the pump temperature and/or excessive current absorption.

With regard to the electrical connections, adhere to the following points:

- The motor must be connected according to the diagrams shown below



- for motors designed for Y/△ start-up following the diagram shown below



- ensure that you connect the earthing wire.

Once the electrical connections have been made close the terminal strip, ensuring that the seals are correctly arranged. Tighten all of the screws as well as the cable gland.

For further information on connections refer to the Operating and Maintenance Manual for the main machine incorporating the motorpump. These connections must be made by qualified staff.

5.2 Pre-commissioning instructions

A series of checks and controls must be completed before starting up the motorpump for the first time in order to prevent errors or accidents during commissioning:

- Check the machine was not damaged during assembly, installation and transport (check its stability, screws and/or bolts are tight, mechanical parts/gears are coupled correctly);
- If you notice any leaks from pressurised pipes, stop the pump immediately and find and solve what is causing the leak
- **Before starting up the pump,** make sure the oil is up to level. We recommend the first oil change within the first 50 hours of operation. Subsequent oil changes should take place every 500 hours, or more often in case of heavy use. The type of oil to use for our pumps is SAE 10/40W, as indicated on the specifications plate.
- **Replace the oil cap** used for shipment with the cap with the dipstick and bleed supplied.

Always comply with the safety instructions in **section 3**.

Failure to comply with these operating conditions invalidates the guarantee.

If the equipment does not appear capable of running safely and correctly, TAKE IT OUT OF SERVICE until it has been repaired or any damaged parts have been replaced.

After the installer has completed all of the necessary connections, he will complete a series of tests to check all of the devices fitted are operating properly:

- After starting up the pump, aid priming by keeping the delivery line open (lance). Do not let the pump run dry: this can result in rapid seal wear and invalidates the warranty.
- After use, run the pump with clean water for several minutes. Do not use the pump at very low temperatures. To prevent freezing, run the pump dry for about 20 seconds to drain the pipes.
- Do not exceed ±5% of the voltage and ±1% of the frequency shown on the specifications plate of the motor.
- When Y/△ start-up is used the start-up time with the Y-connected winding must allow the motor to reach the rpm in a stable manner and then immediately to the △connection.
- Check that the motor has not absorbed humidity by measuring the insulation resistance (R phase - ground better than 10MΩ). Take particular care to do this following long periods of downtime. Check the condensation outlet.

5.3 Long periods of inactivity

In case of long periods of inactivity, follow the instructions below:

- Run the pump with clean water for several minutes.
- Run the pump dry for about 10 seconds with the delivery line open (lance) to drain the pump and the delivery circuit and prevent the formation of scale
- Clean the pump with water and solvents authorised by current legal standards
- Dry the pump using compressed air
- Grease any unpainted parts
- Do not let the system come into contact with corrosive substances.
- Keep the motorpump in a dry place at a humidity level lower than 90% and protect it from impacts, vibration, stresses and jumps in temperature

The properties of mineral oils are impaired if they are not used or remain inactive for more than six months, and so must be replaced.

	**When resuming operation of the machine after a long period of inactivity, repeat the checks carried out prior to the initial start up (section 5.2). Also check the screws and the level of the oil.**

5.4 Operation

To safeguard proper pump operation, the pump should preferably be fed (maximum pressure 8 bar), otherwise it should be located under the water head or at the same level as the tank.
Hawk motorpumps are delivered with their first oil fill and are fitted with a sealed cap to prevent oil spilling during transport. Before starting to use the pump for the first time, remember to replace the sealed cap with the cap with the dipstick and bleed.

	**Poor supply can cause serious damage to the pump, such as priming problems, vibration, noise and short seal life.**
	**The motorpump should not be used at higher pressures or speeds of rotation than those shown on the product's specifications plate.**

NOZZLE TABLE: *the table below is an example of how to choose the nozzle correctly based on the pump's specifications (maximum pressure and flow rate factor). The table gives an example (pump with Pmax=100 bar and Flow Rate =15 l/min).*

Select the pressure in the first line and go down the table to the flow rate factor that is closest to that of the pump, rounded down, to get the best type of nozzle to achieve the values followed. To be sure the pressure ratings will remain constant over time, choose a nozzle matching the flow rate factor immediately below the next one (in the example, the value is circled in green).

FATTORE PORTATA	FLOW RATE FACTOR
PORTATA (L/MIN) ALLA PRESSION (BAR)	FLOW RATE (L/MIN) TO PRESSURE (BAR)

FATTORE PORTATA	PORTATA (L/MIN) ALLA PRESSIONE (BAR)											PORTATA (L/MIN) ALLA PRESSIONE (BAR)												
	BAR	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	220	240	250	280	300	320	350
O2		3,3	3,6	3,8	4,1	4,4	4,6	4,8	5,0	5,2	5,4	5,6	5,8	6,0	6,2	6,3	6,5	6,8	7,1	7,3	7,7	8,0	8,2	8,6
O3		4,8	5,3	5,7	6,1	6,5	6,8	7,1	7,4	7,8	8,0	8,3	8,6	8,9	9,1	9,4	9,6	10,1	10,5	10,8	11,4	11,8	12,2	12,7
O4		6,4	7,0	7,6	8,1	8,6	9,1	9,5	10,0	10,4	10,8	11,1	11,5	11,9	12,2	12,5	12,9	13,5	14,1	14,4	15,2	15,8	16,3	17,0
O45		7,3	8,0	8,6	9,2	9,8	10,3	10,8	11,3	11,7	12,2	12,6	13,0	13,4	13,8	14,2	14,6	15,3	16,0	16,3	17,2	17,8	18,4	19,3
O5		8,1	8,8	9,5	10,2	10,8	11,4	12,0	12,5	13,0	13,5	14,0	14,4	14,9	15,3	15,7	16,1	16,9	17,7	18,0	19,1	19,7	20,4	21,3
O55		8,8	9,7	10,5	11,2	11,9	12,5	13,1	13,7	14,3	14,8	15,3	15,8	16,3	16,8	17,2	17,7	18,5	19,4	19,8	20,9	21,7	22,4	23,4
O6		9,7	10,6	11,5	12,3	13,0	13,7	14,4	15,0	15,6	16,2	16,8	17,3	17,9	18,4	18,9	19,4	20,3	21,2	21,7	22,9	23,7	24,5	25,6
O65		10,5	11,5	12,4	13,2	14,0	14,8	15,5	16,2	16,9	17,5	18,1	18,7	19,3	19,9	20,4	20,9	22,0	22,9	23,4	24,8	25,6	26,5	27,7
O7		11,3	12,4	13,4	14,3	15,2	16,0	16,8	17,5	18,2	18,9	19,6	20,2	20,9	21,5	22,1	22,6	23,7	24,8	25,3	26,8	27,7	28,6	29,9
O75		12,1	13,2	14,3	15,3	16,2	17,1	17,9	18,7	19,5	20,2	20,9	21,6	22,3	22,9	23,6	24,2	25,4	26,5	27,0	28,6	29,6	30,6	32,0
O8		12,9	14,1	15,2	16,3	17,3	18,2	19,1	19,9	20,8	21,5	22,3	23,0	23,7	24,4	25,1	25,7	27,0	28,2	28,8	30,5	31,5	32,6	34,0
O85		13,7	15,0	16,2	17,4	18,4	19,4	20,3	21,3	22,1	23,0	23,8	24,5	25,3	26,0	26,7	27,4	28,8	30,1	30,7	32,5	33,6	34,7	36,3
O9		14,8	16,3	17,6	18,8	19,9	21,0	22,0	23,0	23,9	24,8	25,7	26,6	27,4	28,2	28,9	29,7	31,1	32,5	33,2	35,1	36,4	37,6	39,3
O95		15,6	17,0	18,4	19,7	20,9	22,0	23,1	24,1	25,1	26,0	26,9	27,8	28,7	29,5	30,3	31,1	32,6	34,1	34,8	36,8	38,1	39,4	41,2
10		16,3	17,8	19,2	20,6	21,8	23,0	24,1	25,2	26,2	27,2	28,2	29,1	30,0	30,9	31,7	32,5	34,1	35,6	36,4	38,5	39,8	41,1	43,0
11		17,7	19,4	20,9	22,4	23,7	25,0	26,2	27,4	28,5	29,6	30,6	31,6	32,6	33,5	34,5	35,4	37,1	38,7	39,5	41,8	43,3	44,7	46,8
115		18,4	20,1	21,8	23,3	24,7	26,0	27,3	28,5	29,6	30,8	31,8	32,9	33,9	34,9	35,8	36,8	38,6	40,3	41,1	43,5	45,0	46,5	48,6
12		19,1	20,9	22,6	24,1	25,6	27,0	28,3	29,6	30,8	31,9	33,1	34,2	35,2	36,2	37,2	38,2	40,0	41,8	42,7	45,2	46,8	48,3	50,5
125		19,8	21,7	23,4	25,0	26,6	28,0	29,4	30,7	31,9	33,1	34,3	35,4	36,5	37,6	38,6	39,6	41,5	43,4	44,3	46,9	48,5	50,1	52,4
13		21,2	23,2	25,1	26,8	28,5	30,0	31,5	32,9	34,2	35,5	36,7	37,9	39,1	40,2	41,4	42,4	44,5	46,5	47,4	50,2	52,0	53,7	56,1
14		22,6	24,8	26,8	28,6	30,4	32,0	33,6	35,1	36,5	37,9	39,2	40,5	41,7	42,9	44,1	45,3	47,5	49,6	50,6	53,5	55,4	57,2	59,9
15		24,0	26,3	28,4	30,4	32,3	34,0	35,7	37,2	38,8	40,2	41,6	43,0	44,3	45,6	46,9	48,1	50,4	52,7	53,8	56,9	58,9	60,8	63,6
16		25,5	27,9	30,1	32,2	34,2	36,0	37,8	39,4	41,0	42,6	44,1	45,5	46,9	48,3	49,6	50,9	53,4	55,8	56,9	60,2	62,4	64,4	67,3
18		29,0	31,8	34,3	36,7	38,9	41,0	43,0	44,9	46,7	48,5	50,2	51,9	53,5	55,0	56,5	58,0	60,8	63,5	64,8	68,6	71,0	73,3	76,7
20		32,5	35,6	38,5	41,1	43,6	46,0	48,2	50,4	52,4	54,4	56,3	58,2	60,0	61,7	63,4	65,1	68,2	71,3	72,7	77,0	79,7	82,3	86,1
25		31,2	36,0	40,3	44,2	47,7	51,0	54,1	57,0	59,8	62,4	65,0	67,4	69,8	72,1	74,3	76,5	80,6	84,5	86,4	91,9	95,4	98,7	103,5

Nozzles chart / Tabella ugelli **10 - 150**

SIZE	Flow rate (l/min) at Pressure (bar) / Portata (l/min) alla Pressione (bar)																	
FAN. POINT.	Flow rate (GPM) at Pressure (PSI) / Portata (GPM) alla Pressione (PSI)																	
	bar	10	15	20	25	30	40	50	60	70	80	90	100	110	120	130	140	150
	PSI	145	218	290	363	435	580	725	870	1015	1160	1305	1450	1595	1740	1885	2030	2175
O2		1,5	1,8	2,1	3,6	2,5	2,9	3,3	3,6	3,8	4,1	4,4	4,6	4,8	5,0	5,2	5,4	5,6
		0,4	0,5	0,5	0,9	0,7	0,8	0,9	0,9	1,0	1,1	1,2	1,2	1,3	1,3	1,4	1,4	1,5
O23*		1,6	1,9	2,2	2,5	2,7	3,2	3,5	3,9	4,2	4,5	4,7	5,0	5,2	5,5	5,7	5,9	6,1
		0,4	0,5	0,6	0,7	0,7	0,8	0,9	1,0	1,1	1,2	1,3	1,3	1,4	1,4	1,5	1,6	1,6
O25*		1,8	2,2	2,5	2,8	3,1	3,5	4,0	4,3	4,7	5,0	5,3	5,6	5,9	6,1	6,4	6,6	6,9
		0,5	0,6	0,7	0,7	0,8	0,9	1,0	1,1	1,2	1,3	1,4	1,5	1,6	1,6	1,7	1,8	1,8
O27*		1,9	2,4	2,7	3,1	3,3	3,9	4,3	4,7	5,1	5,5	5,8	6,1	6,4	6,7	7,0	7,2	7,5
		0,5	0,6	0,7	0,8	0,9	1,0	1,1	1,2	1,3	1,4	1,5	1,6	1,7	1,8	1,8	1,9	2,0
O3		2,2	2,6	3,0	3,4	3,7	4,3	4,8	5,3	5,7	6,1	6,5	6,8	7,1	7,4	7,8	8,0	8,3
		0,6	0,7	0,8	0,9	1,0	1,1	1,3	1,4	1,5	1,6	1,7	1,8	1,9	2,0	2,0	2,1	2,2
O32*		2,2	2,7	3,2	3,6	3,9	4,5	5,0	5,5	5,9	6,4	6,7	7,1	7,4	7,8	8,1	8,4	8,7
		0,6	0,7	0,8	0,9	1,0	1,2	1,3	1,5	1,6	1,7	1,8	1,9	2,0	2,1	2,1	2,2	2,3
O35*		2,5	3,0	3,5	3,9	4,3	4,9	5,5	6,0	6,5	7,0	7,4	7,8	8,2	8,5	8,9	9,2	9,6
		0,7	0,8	0,9	1,0	1,1	1,3	1,5	1,6	1,7	1,8	2,0	2,1	2,2	2,3	2,3	2,4	2,5
O37*		2,7	3,3	3,8	4,2	4,6	5,3	5,9	6,5	7,0	7,5	8,0	8,4	8,8	9,2	9,6	9,9	10,3
		0,7	0,9	1,0	1,1	1,2	1,4	1,6	1,7	1,9	2,0	2,1	2,2	2,3	2,4	2,5	2,6	2,7
O4		2,9	3,5	4,1	4,6	5,0	5,8	6,4	7,0	7,6	8,1	8,6	9,1	9,5	10,0	10,4	10,8	11,1
		0,8	0,9	1,1	1,2	1,3	1,5	1,7	1,9	2,0	2,2	2,3	2,4	2,5	2,6	2,7	2,8	2,9
O43*		3,1	3,8	4,3	4,9	5,3	6,1	6,9	7,5	8,1	8,7	9,2	9,7	10,2	10,6	11,1	11,5	11,9
		0,8	1,0	1,1	1,3	1,4	1,6	1,8	2,0	2,1	2,3	2,4	2,6	2,7	2,8	2,9	3,0	3,1
O45		3,3	4,0	4,6	5,2	5,6	6,5	7,3	8,0	8,6	9,2	9,8	10,3	10,8	11,3	11,7	12,2	12,6
		0,9	1,1	1,2	1,4	1,5	1,7	1,9	2,1	2,3	2,4	2,6	2,7	2,9	3,0	3,1	3,2	3,3
O5		3,6	4,4	5,1	5,7	6,2	7,2	8,1	8,8	9,5	10,2	10,8	11,4	12,0	12,5	13,0	13,5	14,0
		1,0	1,2	1,3	1,5	1,6	1,9	2,1	2,3	2,5	2,7	2,9	3,0	3,2	3,3	3,4	3,6	3,7
O53*		3,8	4,6	5,4	6,0	6,6	7,6	8,5	9,3	10,0	10,7	11,4	12,0	12,6	13,1	13,7	14,2	14,7
		1,0	1,2	1,4	1,6	1,7	2,0	2,2	2,5	2,7	2,8	3,0	3,2	3,3	3,5	3,6	3,8	3,9
O55		4,0	4,8	5,6	6,3	6,8	7,9	8,8	9,7	10,5	11,2	11,9	12,5	13,1	13,7	14,3	14,8	15,3
		1,0	1,3	1,5	1,7	1,8	2,1	2,3	2,6	2,8	3,0	3,1	3,3	3,5	3,6	3,8	3,9	4,0
O6		4,3	5,3	6,1	6,9	7,5	8,7	9,7	10,6	11,5	12,3	13,0	13,7	14,4	15,0	15,6	16,2	16,8
		1,1	1,4	1,6	1,8	2,0	2,3	2,6	2,8	3,0	3,2	3,4	3,6	3,8	4,0	4,1	4,3	4,4
O65		4,7	5,7	6,6	7,4	8,1	9,4	10,5	11,5	12,4	13,2	14,0	14,8	15,5	16,2	16,9	17,5	18,1
		1,2	1,5	1,7	2,0	2,1	2,5	2,8	3,0	3,3	3,5	3,7	3,9	4,1	4,3	4,5	4,6	4,8
O7		5,1	6,2	7,2	8,0	8,8	10,1	11,3	12,4	13,4	14,3	15,2	16,0	16,8	17,5	18,2	18,9	19,6
		1,3	1,6	1,9	2,1	2,3	2,7	3,0	3,3	3,5	3,8	4,0	4,2	4,4	4,6	4,8	5,0	5,2
O75		5,4	6,6	7,6	8,6	9,4	10,8	12,1	13,2	14,3	15,3	16,2	17,1	17,9	18,7	19,5	20,2	20,9
		1,4	1,7	2,0	2,3	2,5	2,9	3,2	3,5	3,8	4,0	4,3	4,5	4,7	4,9	5,2	5,3	5,5
O8		5,8	7,0	8,1	9,1	10,0	11,5	12,9	14,1	15,2	16,3	17,3	18,2	19,1	19,9	20,8	21,5	22,3
		1,5	1,9	2,2	2,4	2,6	3,0	3,4	3,7	4,0	4,3	4,6	4,8	5,0	5,3	5,5	5,7	5,9
O85		6,1	7,5	8,7	9,7	10,6	12,3	13,7	15,0	16,2	17,4	18,4	19,4	20,3	21,3	22,1	23,0	23,8
		1,6	2,0	2,3	2,6	2,8	3,2	3,6	4,0	4,3	4,6	4,9	5,1	5,4	5,6	5,8	6,1	6,3
O9		6,6	8,1	9,4	10,5	11,5	13,3	14,8	16,3	17,6	18,8	19,9	21,0	22,0	23,0	23,9	24,8	25,7
		1,8	2,1	2,5	2,8	3,0	3,5	3,9	4,3	4,6	5,0	5,3	5,5	5,8	6,1	6,3	6,6	6,8
O95		7,0	8,5	9,8	11,0	12,0	13,9	15,6	17,0	18,4	19,7	20,9	22,0	23,1	24,1	25,1	26,0	26,9
		1,8	2,3	2,6	2,9	3,2	3,7	4,1	4,5	4,9	5,2	5,5	5,8	6,1	6,4	6,6	6,9	7,1
10		7,3	8,9	10,3	11,5	12,6	14,5	16,3	17,8	19,2	20,6	21,8	23,0	24,1	25,2	26,2	27,2	28,2
		1,9	2,4	2,7	3,0	3,3	3,8	4,3	4,7	5,1	5,4	5,8	6,1	6,4	6,7	6,9	7,2	7,4
11		7,9	9,7	11,2	12,5	13,7	15,8	17,7	19,4	20,9	22,4	23,7	25,0	26,2	27,4	28,5	29,6	30,6
		2,1	2,6	3,0	3,3	3,6	4,2	4,7	5,1	5,5	5,9	6,3	6,6	6,9	7,2	7,5	7,8	8,1
115		8,2	10,1	11,6	13,0	14,2	16,4	18,4	20,1	21,8	23,3	24,7	26,0	27,3	28,5	29,6	30,8	31,8
		2,2	2,7	3,1	3,4	3,8	4,3	4,9	5,3	5,7	6,1	6,5	6,9	7,2	7,5	7,8	8,1	8,4
12		8,5	10,5	12,1	13,5	14,8	17,1	19,1	20,9	22,6	24,1	25,6	27,0	28,3	29,6	30,8	31,9	33,1
		2,3	2,8	3,2	3,6	3,9	4,5	5,0	5,5	6,0	6,4	6,8	7,1	7,5	7,8	8,1	8,4	8,7
125		8,9	10,8	12,5	14,0	15,3	17,7	19,8	21,7	23,4	25,0	26,6	28,0	29,4	30,7	31,9	33,1	34,3
		2,3	2,9	3,3	3,7	4,1	4,7	5,2	5,7	6,2	6,6	7,0	7,4	7,8	8,1	8,4	8,8	9,1
13		9,5	11,6	13,4	15,0	16,4	19,0	21,2	23,2	25,1	26,8	28,5	30,0	31,5	32,9	34,2	35,5	36,7
		2,5	3,1	3,5	4,0	4,3	5,0	5,6	6,1	6,6	7,1	7,5	7,9	8,3	8,7	9,0	9,4	9,7
14		10,1	12,4	14,3	16,0	17,5	20,2	22,6	24,8	26,8	28,6	30,4	32,0	33,6	35,1	36,5	37,9	39,2
		2,7	3,3	3,8	4,2	4,6	5,3	6,0	6,5	7,1	7,6	8,0	8,5	8,9	9,3	9,6	10,0	10,4
15		10,8	13,2	15,2	17,0	18,6	21,5	24,0	26,3	28,4	30,4	32,3	34,0	35,7	37,2	38,8	40,2	41,6
		2,8	3,5	4,0	4,5	4,9	5,7	6,4	7,0	7,5	8,0	8,5	9,0	9,4	9,8	10,2	10,6	11,0
16		11,4	13,9	16,1	18,0	19,7	22,8	25,5	27,9	30,1	32,2	34,2	36,0	37,8	39,4	41,0	42,6	44,1
		3,0	3,7	4,3	4,8	5,2	6,0	6,7	7,4	8,0	8,5	9,0	9,5	10,0	10,4	10,8	11,3	11,6
18		13,0	15,9	18,3	20,5	22,5	25,9	29,0	31,8	34,3	36,7	38,9	41,0	43,0	44,9	46,7	48,5	50,2
		3,4	4,2	4,8	5,4	5,9	6,9	7,7	8,4	9,1	9,7	10,3	10,8	11,4	11,9	12,4	12,8	13,3
20		14,5	17,8	20,6	23,0	25,2	29,1	32,5	35,6	38,5	41,1	43,6	46,0	48,2	50,4	52,4	54,4	56,3
		3,8	4,7	5,4	6,1	6,7	7,7	8,6	9,4	10,2	10,9	11,5	12,2	12,7	13,3	13,9	14,4	14,9
25		18,0	22,1	25,5	28,5	31,2	36,0	40,3	44,2	47,7	51,0	54,1	57,0	59,8	62,4	65,0	67,4	69,8
		4,8	5,8	6,7	7,5	8,2	9,5	10,6	11,7	12,6	13,5	14,3	15,1	15,8	16,5	17,2	17,8	18,4
30		21,5	26,3	30,4	34,0	37,2	43,0	48,1	52,7	56,9	60,8	64,5	68,0	71,3	74,5	77,5	80,5	83,3
		5,7	7,0	8,0	9,0	9,8	11,4	12,7	13,9	15,0	16,1	17,0	18,0	18,8	19,7	20,5	21,3	22,0
35		25,3	31,0	35,8	40,0	43,8	50,6	56,6	62,0	66,9	71,6	75,9	80,0	83,9	87,6	91,2	94,7	98,0
		6,7	8,2	9,5	10,6	11,6	13,4	14,9	16,4	17,7	18,9	20,1	21,1	22,2	23,2	24,1	25,0	25,9
40		28,8	35,2	40,7	45,5	49,8	57,6	64,3	70,5	76,1	81,4	86,3	91,0	95,4	99,7	103,8	107,7	111,5
		7,6	9,3	10,8	12,0	13,2	15,2	17,0	18,6	20,1	21,5	22,8	24,0	25,2	26,3	27,4	28,4	29,4
50		36,0	44,2	51,0	57,0	62,4	72,1	80,6	88,3	95,4	102,0	108,1	114,0	119,6	124,9	130,0	134,9	139,6
		9,5	11,7	13,5	15,1	16,5	19,0	21,3	23,3	25,2	26,9	28,6	30,1	31,6	33,0	34,3	35,6	36,9
60		43,3	53,1	61,3	68,5	75,0	86,6	96,9	106,1	114,6	122,5	130,0	137,0	143,7	150,1	156,2	162,1	167,8
		11,4	14,0	16,2	18,1	19,8	22,9	25,6	28,0	30,3	32,4	34,3	36,2	38,0	39,7	41,3	42,8	44,3
70		50,6	62,0	71,6	80,0	87,6	101,2	113,1	123,9	133,9	143,1	151,8	160,0	167,8	175,3	182,4	189,3	196,0
		13,4	16,4	18,9	21,1	23,2	26,7	29,9	32,7	35,4	37,8	40,1	42,3	44,3	46,3	48,2	50,0	51,8
80		57,6	70,5	81,4	91,0	99,7	115,1	128,7	141,0	152,3	162,8	172,7	182,0	190,9	199,4	207,5	215,3	222,9
		15,2	18,6	21,5	24,0	26,3	30,4	34,0	37,2	40,2	43,0	45,6	48,1	50,4	52,7	54,8	56,9	58,9
90		64,8	79,4	91,7	102,5	112,3	129,7	145,0	158,8	171,5	183,4	194,5	205,0	215,0	224,6	233,7	242,6	251,1
		17,1	21,0	24,2	27,1	29,7	34,3	38,3	42,0	45,3	48,4	51,4	54,2	56,8	59,3	61,8	64,1	66,3

Nozzles chart / Tabella ugelli **160 - 320**

SIZE	Flow rate (l/min) at Pressure (bar) / Portata (l/min) alla Pressione (bar)																
FAT. PORT.	Flow rate (GPM) at Pressure (PSI) / Portata (GPM) alla Pressione (PSI)																
	bar	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320
	PSI	2320	2465	2610	2755	2900	3045	3190	3335	3480	3625	3770	3915	4060	4205	4350	4495	4640
O2		5,8	6,0	6,2	6,3	6,5	6,7	6,8	7,0	7,1	7,3	7,4	7,6	7,7	7,8	8,0	8,1	8,2
		1,5	1,6	1,6	1,7	1,7	1,8	1,8	1,8	1,9	1,9	2,0	2,0	2,0	2,1	2,1	2,1	2,2
O23*		6,3	6,5	6,7	6,9	7,1	7,2	7,4	7,6	7,7	7,9	8,1	8,2	8,4	8,5	8,7	8,8	8,9
		1,7	1,7	1,8	1,8	1,9	1,9	2,0	2,0	2,0	2,1	2,1	2,2	2,2	2,2	2,3	2,3	2,4
O25*		7,1	7,3	7,5	7,7	7,9	8,1	8,3	8,5	8,7	8,9	9,0	9,2	9,4	9,5	9,7	9,9	10,0
		1,9	1,9	2,0	2,0	2,1	2,1	2,2	2,2	2,3	2,3	2,4	2,4	2,5	2,5	2,6	2,6	2,6
O27*		7,7	8,0	8,2	8,4	8,6	8,8	9,0	9,3	9,5	9,6	9,8	10,0	10,2	10,4	10,6	10,7	10,9
		2,0	2,1	2,2	2,2	2,3	2,3	2,4	2,4	2,5	2,5	2,6	2,6	2,7	2,7	2,8	2,8	2,9
O3		8,6	8,9	9,1	9,4	9,6	9,9	10,1	10,3	10,5	10,8	11,0	11,2	11,4	11,6	11,8	12,0	12,2
		2,3	2,3	2,4	2,5	2,5	2,6	2,7	2,7	2,8	2,8	2,9	3,0	3,0	3,1	3,1	3,2	3,2
O32*		9,0	9,3	9,5	9,8	10,0	10,3	10,5	10,8	11,0	11,2	11,4	11,7	11,9	12,1	12,3	12,5	12,7
		2,4	2,4	2,5	2,6	2,7	2,7	2,8	2,8	2,9	3,0	3,0	3,1	3,1	3,2	3,2	3,3	3,4
O35*		9,9	10,2	10,5	10,8	11,0	11,3	11,6	11,8	12,1	12,3	12,6	12,8	13,1	13,3	13,5	13,7	14,0
		2,6	2,7	2,8	2,8	2,9	3,0	3,1	3,1	3,2	3,3	3,3	3,4	3,4	3,5	3,6	3,6	3,7
O37*		10,6	11,0	11,3	11,6	11,9	12,2	12,5	12,7	13,0	13,3	13,5	13,8	14,1	14,3	14,5	14,8	15,0
		2,8	2,9	3,0	3,1	3,1	3,2	3,3	3,4	3,4	3,5	3,6	3,6	3,7	3,8	3,8	3,9	4,0
O4		11,5	11,9	12,2	12,5	12,9	13,2	13,5	13,8	14,1	14,4	14,7	15,0	15,2	15,5	15,8	16,0	16,3
		3,0	3,1	3,2	3,3	3,4	3,5	3,6	3,6	3,7	3,8	3,9	4,0	4,0	4,1	4,2	4,2	4,3
O43*		12,3	12,6	13,0	13,4	13,7	14,1	14,4	14,7	15,0	15,3	15,6	15,9	16,2	16,5	16,8	17,1	17,4
		3,2	3,3	3,4	3,5	3,6	3,7	3,8	3,9	4,0	4,1	4,1	4,2	4,3	4,4	4,4	4,5	4,6
O45		13,0	13,4	13,8	14,2	14,6	14,9	15,3	15,6	16,0	16,3	16,6	16,9	17,2	17,5	17,8	18,1	18,4
		3,4	3,5	3,7	3,8	3,8	3,9	4,0	4,1	4,2	4,3	4,4	4,5	4,6	4,6	4,7	4,8	4,9
O5		14,4	14,9	15,3	15,7	16,1	16,5	16,9	17,3	17,7	18,0	18,4	18,7	19,1	19,4	19,7	20,1	20,4
		3,8	3,9	4,0	4,2	4,3	4,4	4,5	4,6	4,7	4,8	4,9	4,9	5,0	5,1	5,2	5,3	5,4
O53*		15,2	15,6	16,1	16,5	17,0	17,4	17,8	18,2	18,6	19,0	19,3	19,7	20,1	20,4	20,8	21,1	21,5
		4,0	4,1	4,3	4,4	4,5	4,6	4,7	4,8	4,9	5,0	5,1	5,2	5,3	5,4	5,5	5,6	5,7
O55		15,8	16,3	16,8	17,2	17,7	18,1	18,5	19,0	19,4	19,8	20,2	20,5	20,9	21,3	21,7	22,0	22,4
		4,2	4,3	4,4	4,6	4,7	4,8	4,9	5,0	5,1	5,2	5,3	5,4	5,5	5,6	5,7	5,8	5,9
O6		17,3	17,9	18,4	18,9	19,4	19,9	20,3	20,8	21,2	21,7	22,1	22,5	22,9	23,3	23,7	24,1	24,5
		4,6	4,7	4,9	5,0	5,1	5,2	5,4	5,5	5,6	5,7	5,8	5,9	6,1	6,2	6,3	6,4	6,5
O65		18,7	19,3	19,9	20,4	20,9	21,4	22,0	22,4	22,9	23,4	23,9	24,3	24,8	25,2	25,6	26,1	26,5
		4,9	5,1	5,2	5,4	5,5	5,7	5,8	5,9	6,1	6,2	6,3	6,4	6,5	6,7	6,8	6,9	7,0
O7		20,2	20,9	21,5	22,1	22,6	23,2	23,7	24,3	24,8	25,3	25,8	26,3	26,8	27,2	27,7	28,2	28,6
		5,3	5,5	5,7	5,8	6,0	6,1	6,3	6,4	6,5	6,7	6,8	6,9	7,1	7,2	7,3	7,4	7,6
O75		21,6	22,3	22,9	23,6	24,2	24,8	25,4	25,9	26,5	27,0	27,6	28,1	28,6	29,1	29,6	30,1	30,6
		5,7	5,9	6,1	6,2	6,4	6,5	6,7	6,9	7,0	7,1	7,3	7,4	7,6	7,7	7,8	8,0	8,1
O8		23,0	23,7	24,4	25,1	25,7	26,4	27,0	27,6	28,2	28,8	29,3	29,9	30,5	31,0	31,5	32,0	32,6
		6,1	6,3	6,5	6,6	6,8	7,0	7,1	7,3	7,4	7,6	7,8	7,9	8,0	8,2	8,3	8,5	8,6
O85		24,5	25,3	26,0	26,7	27,4	28,1	28,8	29,4	30,1	30,7	31,3	31,9	32,5	33,0	33,6	34,2	34,7
		6,5	6,7	6,9	7,1	7,2	7,4	7,6	7,8	7,9	8,1	8,3	8,4	8,6	8,7	8,9	9,0	9,2
O9		26,6	27,4	28,2	28,9	29,7	30,4	31,1	31,8	32,5	33,2	33,9	34,5	35,1	35,8	36,4	37,0	37,6
		7,0	7,2	7,4	7,6	7,8	8,0	8,2	8,4	8,6	8,8	8,9	9,1	9,3	9,4	9,6	9,8	9,9
O95		27,8	28,7	29,5	30,3	31,1	31,9	32,6	33,4	34,1	34,8	35,5	36,1	36,8	37,5	38,1	38,7	39,4
		7,4	7,6	7,8	8,0	8,2	8,4	8,6	8,8	9,0	9,2	9,4	9,6	9,7	9,9	10,1	10,2	10,4
10		29,1	30,0	30,9	31,7	32,5	33,3	34,1	34,9	35,6	36,4	37,1	37,8	38,5	39,2	39,8	40,5	41,1
		7,7	7,9	8,2	8,4	8,6	8,8	9,0	9,2	9,4	9,6	9,8	10,0	10,2	10,3	10,5	10,7	10,9
11		31,6	32,6	33,5	34,5	35,4	36,2	37,1	37,9	38,7	39,5	40,3	41,1	41,8	42,6	43,3	44,0	44,7
		8,4	8,6	8,9	9,1	9,3	9,6	9,8	10,0	10,2	10,4	10,7	10,9	11,1	11,2	11,4	11,6	11,8
115		32,9	33,9	34,9	35,8	36,8	37,7	38,6	39,4	40,3	41,1	41,9	42,7	43,5	44,3	45,0	45,8	46,5
		8,7	9,0	9,2	9,5	9,7	10,0	10,2	10,4	10,6	10,9	11,1	11,3	11,5	11,7	11,9	12,1	12,3
12		34,2	35,2	36,2	37,2	38,2	39,1	40,0	40,9	41,8	42,7	43,5	44,4	45,2	46,0	46,8	47,5	48,3
		9,0	9,3	9,6	9,8	10,1	10,3	10,6	10,8	11,1	11,3	11,5	11,7	11,9	12,1	12,4	12,6	12,8
125		35,4	36,5	37,6	38,6	39,6	40,6	41,5	42,5	43,4	44,3	45,1	46,0	46,9	47,7	48,5	49,3	50,1
		9,4	9,6	9,9	10,2	10,5	10,7	11,0	11,2	11,5	11,7	11,9	12,2	12,4	12,6	12,8	13,0	13,2
13		37,9	39,1	40,2	41,4	42,4	43,5	44,5	45,5	46,5	47,4	48,4	49,3	50,2	51,1	52,0	52,8	53,7
		10,0	10,3	10,6	10,9	11,2	11,5	11,8	12,0	12,3	12,5	12,8	13,0	13,3	13,5	13,7	14,0	14,2
14		40,5	41,7	42,9	44,1	45,3	46,4	47,5	48,5	49,6	50,6	51,6	52,6	53,5	54,5	55,4	56,3	57,2
		10,7	11,0	11,3	11,7	12,0	12,3	12,5	12,8	13,1	13,4	13,6	13,9	14,1	14,4	14,6	14,9	15,1
15		43,0	44,3	45,6	46,9	48,1	49,3	50,4	51,6	52,7	53,8	54,8	55,9	56,9	57,9	58,9	59,9	60,8
		11,4	11,7	12,1	12,4	12,7	13,0	13,3	13,6	13,9	14,2	14,5	14,8	15,0	15,3	15,6	15,8	16,1
16		45,5	46,9	48,3	49,6	50,9	52,2	53,4	54,6	55,8	56,9	58,0	59,2	60,2	61,3	62,4	63,4	64,4
		12,0	12,4	12,8	13,1	13,5	13,8	14,1	14,4	14,7	15,0	15,3	15,6	15,9	16,2	16,5	16,7	17,0
18		51,9	53,5	55,0	56,5	58,0	59,4	60,8	62,2	63,5	64,8	66,1	67,4	68,6	69,8	71,0	72,2	73,3
		13,7	14,1	14,5	14,9	15,3	15,7	16,1	16,4	16,8	17,1	17,5	17,8	18,1	18,4	18,8	19,1	19,4
20		58,2	60,0	61,7	63,4	65,1	66,7	68,2	69,8	71,3	72,7	74,2	75,6	77,0	78,3	79,7	81,0	82,3
		15,4	15,8	16,3	16,8	17,2	17,6	18,0	18,4	18,8	19,2	19,6	20,0	20,3	20,7	21,1	21,4	21,7
25		72,1	74,3	76,5	78,6	80,6	82,6	84,5	86,4	88,3	90,1	91,9	93,7	95,4	97,1	98,7	100,4	102,0
		19,0	19,6	20,2	20,8	21,3	21,8	22,3	22,8	23,3	23,8	24,3	24,7	25,2	25,6	26,1	26,5	26,9
30		86,0	88,7	91,2	93,7	96,2	98,5	100,9	103,1	105,3	107,5	109,6	111,7	113,8	115,8	117,8	119,7	121,6
		22,7	23,4	24,1	24,8	25,4	26,0	26,6	27,2	27,8	28,4	29,0	29,5	30,1	30,6	31,1	31,6	32,1
35		101,2	104,3	107,3	110,3	113,1	115,9	118,7	121,3	123,9	126,5	129,0	131,5	133,9	136,2	138,6	140,9	143,1
		26,7	27,6	28,4	29,1	29,9	30,6	31,3	32,1	32,7	33,4	34,1	34,7	35,4	36,0	36,6	37,2	37,8
40		115,1	118,6	122,1	125,4	128,7	131,9	135,0	138,0	141,0	143,9	146,7	149,5	152,3	155,0	157,6	160,2	162,8
		30,4	31,3	32,3	33,1	34,0	34,8	35,7	36,5	37,2	38,0	38,8	39,5	40,2	40,9	41,6	42,3	43,0
50		144,2	148,6	152,9	157,1	161,2	165,2	169,1	172,9	176,6	180,2	183,8	187,3	190,8	194,1	197,5	200,7	203,9
		38,1	39,3	40,4	41,5	42,6	43,6	44,7	45,7	46,7	47,6	48,6	49,5	50,4	51,3	52,2	53,0	53,9
60		173,3	178,6	183,8	188,8	193,7	198,5	203,2	207,8	212,2	216,6	220,9	225,1	229,2	233,3	237,3	241,2	245,1
		45,8	47,2	48,6	49,9	51,2	52,5	53,7	54,9	56,1	57,2	58,4	59,5	60,6	61,6	62,7	63,7	64,7
70		202,4	208,6	214,7	220,5	226,3	231,9	237,3	242,7	247,9	253,0	258,0	262,9	267,7	272,5	277,1	281,7	286,2
		53,5	55,1	56,7	58,3	59,8	61,3	62,7	64,1	65,5	66,8	68,2	69,5	70,7	72,0	73,2	74,4	75,6
80		230,2	237,3	244,2	250,9	257,4	263,7	269,9	276,0	282,0	287,8	293,5	299,1	304,5	309,9	315,2	320,4	325,6
		60,8	62,7	64,5	66,3	68,0	69,7	71,3	72,9	74,5	76,0	77,5	79,0	80,5	81,9	83,3	84,7	86,0
90		259,3	267,3	275,0	282,6	289,9	297,1	304,1	310,9	317,6	324,1	330,6	336,8	343,0	349,1	355,1	360,9	366,7
		68,5	70,6	72,7	74,7	76,6	78,5	80,3	82,1	83,9	85,6	87,3	89,0	90,6	92,2	93,8	95,4	96,9

6 MAINTENANCE

Use the special tools provided in the product's tool-kit for pump maintenance, as this will facilitate the maintenance of certain parts. If the special tool-kit is not available, standard tools can be used (screwdrivers, pin punches etc) but take care not to damage the pump's parts.

Follow the instructions below during maintenance or repairs:

- Before starting work, hang a "**MACHINE UNDERGOING MAINTENANCE**" sign in a prominent position
- Before intervening, shut off the supply from the power network, wait until the moving parts have come to a stop and check that the these cannot be restarted by other moving parts dragging the shaft. Wait for the surface temperature to drop below 50°C to prevent burns
- Do not use flammable products or materials
- When handling lubricants, wear gloves that are resistant to mineral oils, overalls (trousers must never be tucked into safety shoes) and goggles
- Do not spill any oil or lubricant

	**Maintenance work may only be carried out by authorised, qualified personnel and must be noted in the special log.**
	**Always comply with the safety instructions in section 3.**

The pump's efficiency can be safeguarded by following the preventive maintenance schedule below:

CONTROL	DAILY	WEEKLY	50 H	500 H	1000 H*	1500 H*
CLEAN FILTERS	X					
OIL LEVEL/CONDITION	X					
OIL/WATER LEAKS	X					
HYDRAULIC SYSTEM		X				
1ST OIL CHANGE			X			
CHANGE OIL				X		
REPLACE SEALS					X	
REPLACE CHECK VALVES						X

* Each maintenance schedule depends on the type of job that the pump is used for.
The operating cycle, the temperature and the quality of the pumped liquid, the type and quality of the supply and the condition of the accessories used are all fundamental factors that influence the life of pump parts.

If the pump's performance deteriorates, check whether our "**Troubleshooting**" guide describes the source of the problem. If the pump is running without any problems, check it after 1000 hours of operation and then every 500 hours of operation.

After completing any maintenance work, remember to adjust the control / unloader / safety valve and check the condition of the hydraulic system and relative couplings.

The data provided is the result of the cycles verified on our testing benches, therefore any other element that differs to the parameters used may have an impact on the life of the parts.

6.1 General maintenance

Generally speaking, the following checks must be carried out:

<u>Check the pump is secured properly:</u>

- ✓ Check the screws securing the pump are tight

- ✓ If necessary, tighten the screws using the torque indicated in the installation diagram

Check pipes and couplings:

- ✓ Check for any leaks from the couplings
  Leaks can usually be remedied by tightening the couplings properly
  Leaks from the couplings on the suction pipes are remedied by repairing the seal
- ✓ Check the condition of the hoses.
  Replace the hoses if they look old, damaged, bulging or worn etc.

Check the filter (not supplied by LEUCO):

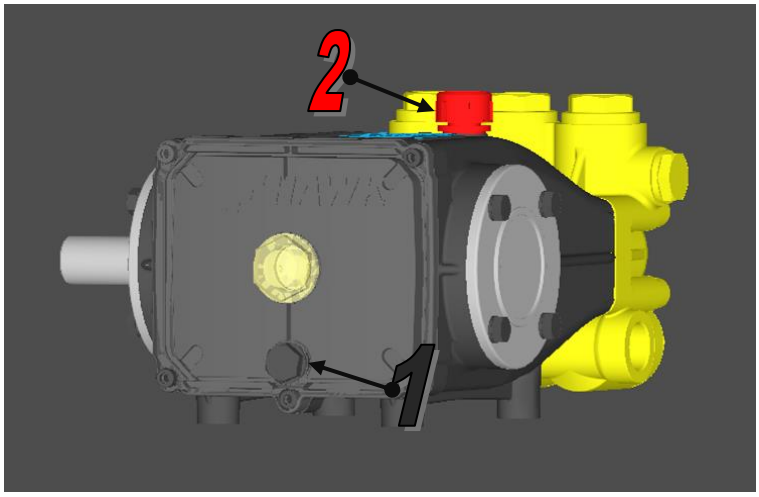
- ✓ Check the condition of the filter cartridge.
  Refer to the filter manufacturer's instructions if the filter cartridge is clogged or damaged in order to restore the original performance of the filter cartridge.

Checking the level of oil:

- ✓ Check the level when the pump is cold and on a level surface.
- ✓ Check the amount of oil using the level indicator (located on the rear of the pump body, see section 2.1, letter G).
- ✓ Top up the oil if necessary, as instructed in section 3.7 through the oil plug (located on the top of the pump body, see section 2.1, letter C).

Change the oil:

- ✓ Put the machine where the pump is fitted on a perfectly level surface with the pump slightly warm. Do not spill any oil. Dispose of oil according to current legal requirements.
- ✓ Have a suitably large container ready for the old oil.
- ✓ Unscrew the drain plug (1) and let all the oil drain out completely.
- ✓ Replace the drain plug.
- ✓ Unscrew the oil plug (letter C, section 2.1 or no. 2 in the illustration below).
- ✓ Pour new oil into the filling hole up to the correct level (as described in the section on "Checking the level of oil").
- ✓ Replace the filling cap.



With regard to the motor:

- Inspect the motor regularly;
- Remove any deposits of dust, oil or dirt from the parts of the fan cover to maintain good ventilation and motor cooling;
- Provide for correct motor cooling to be restored;
- Check the condition of ring seals and V-rings;
- Check the condition of electrical and mechanical connections and of fastening and foundation bolts;

- Check the condition of bearings, giving particular attention to any unusual noises or vibration.

For other maintenance, comply with any other instructions and/or procedures in use at the company or described in the operating manual of the final machine (high pressure cleaner).

You must find the cause of any abnormality and remedy it before the machine can be put back into operation. Contact the Manufacturer before undertaking any other maintenance (not described in this manual or its attachments).

7 TROUBLESHOOTING

7.1 Trouble Shooting

Only authorised and qualified personnel may attempt troubleshooting.

This section suggests some solutions to common problems or malfunctions that may occur.
Some of the suggested solutions may be carried out by experienced personnel; others should only be attempted by Authorised Service Centres as they require the use of specific tools as well as detailed knowledge of repairs.

Contact the Manufacturer for instructions if any faults are found on the machine or its parts and you are unable to solve the problem.

PROBLEMS	POSSIBLE CAUSES	SOLUTION
The pump runs but does not produce noise or pressure	The pump is not primed and is running dry	Check if there is water in the suction line Check if the delivery line (gun) is open Check the valves are NOT blocked
The pump runs but is too noisy and/or does not reach the expected pressure	Oversized or worn nozzle Insufficient water supply	Replace the nozzle Clean the filter. Replace the filter with an appropriately sized filter. Eliminate any possible intake of air. Check the size of the suction pipe and replace with a larger diameter pipe, if necessary.
	Pressure control valve is not calibrated or working properly.	Calibrate the valve.
	Worn piston seals	Check the status of the seat of the seal. Replace the seals
	Low speed of rotation	Check the motor and the drive
The pump comes up to pressure but pulsates and vibrates strongly	Foreign matter in the valves	Clean the valves
	Worn valves	Replace the valves
	High inlet water temperature	Reduce the water temperature
	Worn piston seals	Replace the seals
The pump is very noisy	Worn bearings	Replace the bearings
	High inlet water temperature	Reduce the water temperature
	Pump-motor coupling problems	Check the status of the keys, flexible coupling or pulley
Short piston seal life	Cavitation or air in the system	Check the state and size of the suction pipe and replace with a larger diameter pipe, if necessary.
	Damaged ceramic piston	Replace the piston
	Excessive pressure and / or temperature of the pumped water	Check the pressure and the temperature of the inlet water

Water in the oil	Worn plunger – oil shaft seal ring. If the oil is milky (emulsified), but the level does not increase in the crankcase, there is condensation	Replace the ring seal Change the oil more frequently
Water leaking between the crankcase and the manifold housing	Worn seal pack	Replace seal pack
	Worn piston	Replace piston
	Worn piston bolt seal	Replace seal
Oil leaking between the crankcase and the manifold housing	Worn piston - shaft oil seal	Replace the seal
Short bearing life	Pump-motor coupling problems	Check the status of the keys, flexible coupling or pulley
	The oil has not been changed regularly	Change the oil as instructed in the maintenance manual for the pump
	Excessive pressure of the pumped water	Check the pressure
Motor very noisy	Worn motor bearings	Change the bearings

8 DISMANTLING AND DISPOSAL

Contact the Manufacturer for information and instructions before dismantling the pump in order to move it or for its disposal.

Only qualified personnel are allowed to dispose of the pump in accordance with current legislation on safety at work.
Any parts removed must be separated for recycling according to the type of materials they are made of. Do not dump hazardous waste, including seals and lubricants, into the environment.
Any non-ferrous parts must be disposed of by an authorised company. Any parts made of iron can be recycled or sold.
The manufacturer must be notified if the machine is decommissioned or sold.

The packing materials can be recycled. Do not throw the packing materials away with normal household waste, but send them for recycling.

The pump contains important raw materials that can be recycled and so they should be sent for recycling to make sure they will be used again.
Do not throw oil away down the drain.

In Italy, electrical/ electronic parts must be delivered to an authority that deals with disposal in accordance with RAEE specifications.

Dispose of the pump/motorpump properly at an authorised waste disposal centre.

9 SPARE PARTS

Always use original spare parts (Attachment II).

10 ATTACHMENTS

1. Declaration of Incorporation
   www.hawkpumps.com → Download → Techical manuals
2. Technical specifications
   www.hawkpumps.com → Spare Parts → Select a series or a model
3. Coupling systems
   www.hawkpumps.com → Accessories