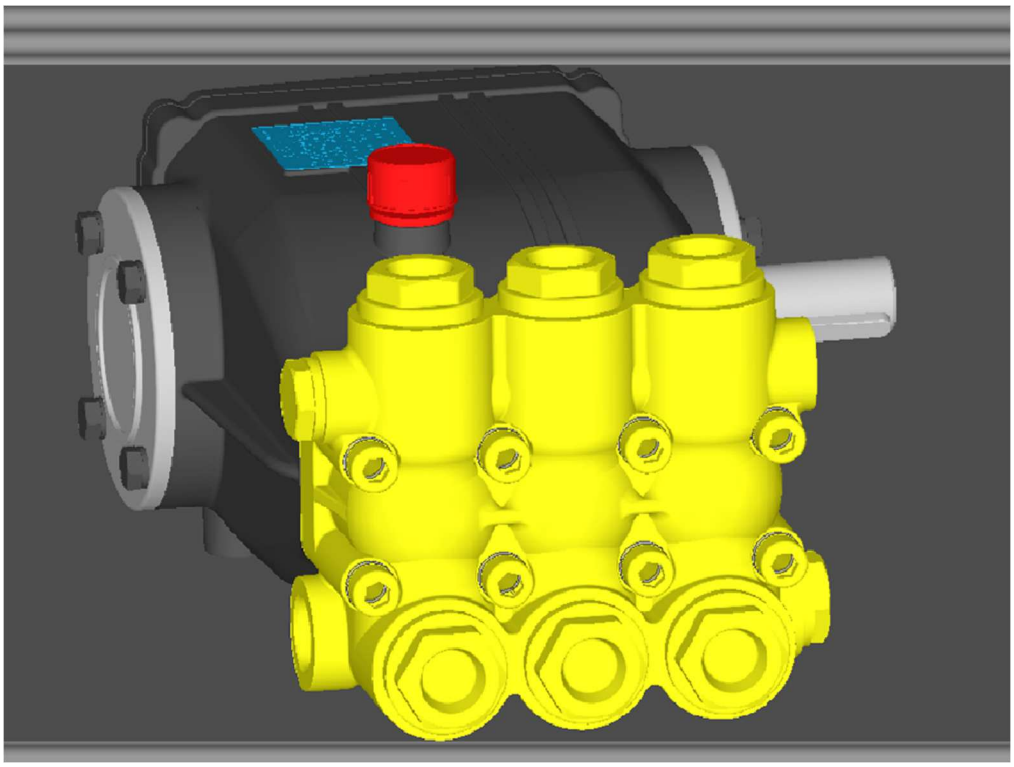
INSTRUCTION MANUAL FOR OPERATION AND MAINTENANCE

Version 001-21
Revision 3
ORIGINAL INSTRUCTIONS



“HIGH PRESSURE PISTON PUMPS”

SERIES NMT-EBCW, NHDP-EBCH, NMT-EBCH, XLTI-EBCH, MXT-EBCH, NHDP-ESA, NMT-ESA, XLT-ESA, MXT-ESA

LEUCO S.p.A.

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This manual is an integral part of the product and must always be available to the users.

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1 OVERVIEW

1.1 How the manual is structured

This manual is an integral part of the official documentation accompanying the pumps. The Manufacturer has drafted it with the purpose of providing the user with the operating instructions and principles to follow for the installation, use and maintenance of the pumps specified in the header.

Before selecting and/or using a LEUCO product, the buyer should carefully analyse all the aspects concerning its application and examine in depth the information provided in LEUCO technical and commercial brochures. As LEUCO products can be used in many different operating conditions and/or applications, the buyer is solely responsible for the final selection of the most suitable product for their needs, based on their own analysis and testing, and for compliance with all the functional and safety-related specifications.

The products and this document may be subjected to modifications by LEUCO at any time and without prior notice.

The buyer shall have the installation design implemented in compliance with the instructions given in this manual, the national and local regulations and laws in place.

The Manufacturer declines any and all responsibility for damage, of any nature whatsoever, caused by unintended use, negligence, hasty interpretations or total failure to implement the safety principles laid down in this manual.

1.1.1 Scope and information contained in this manual

These instructions for operation provide information concerning installation, operation, maintenance and storage and all the steps in the life cycle of the high pressure piston pumps, series *NMT-EBCW, NHDP-EBCH, NMT-EBCH, XLTI-EBCH, MXT-EBCH, NHDP-ESA, NMT-ESA, XLTI-ESA, MXT-ESA*

Before starting any operation on the equipment, both the operators and qualified technicians shall read the instructions given in this publication with care.

When doubts arise on the correct interpretation of these instructions, please contact LEUCO S.p.A. for the required clarifications.

1.1.2 Manual addressees

These instructions are addressed to expert and properly trained operators who are in charge of installation and routine maintenance.

Buyer
Any person, entity or company who has purchased the pump and intends to use it for its intended use. This may be the assembler if he has the necessary qualifications.

User/Operator
Any authorised person who has the qualifications, skills and information required to operate the pump, machine or system in which the pump is installed and to perform routine maintenance.

Routine/scheduled maintenance
A set of interventions required to keep the machine in good operating conditions in order to guarantee a longer service life and to keep constant its safety requirements. Maintenance intervals and procedures are described in this manual by the Manufacturer. Maintenance interventions must be performed by skilled personnel, including the operator, as described above.

Unscheduled maintenance
A set of interventions to preserve the machine functionality and efficiency. These interventions are required in the event of unexpected malfunctions and shall be performed by skilled technicians only.

Fitter/Assembler
Any authorised technician having the qualifications and specific skills required to perform tasks concerning installation of the pump and/or similar machinery and to carry out routine maintenance in safe conditions, independently and without risks.

Training
This is the transfer to the operators of the knowledge required to carry out operations correctly and without risks.

Exposed person
Any person wholly or partially in a danger zone.

1.1.3 Manual storage

This instruction manual shall be stored in the proximity of the machine, in a dedicated container, away from fluids and anything else that may render it illegible.

1.1.4 Symbols used in the manual

SYMBOL	MEANING	COMMENT
	**DANGER SIGNS**	To indicate a serious risk for the user/assembler.
	**CRUSHING OF UPPER AND LOWER LIMBS**	To indicate the hazard of crushing the upper limbs when the pump is either put in place or handled.
	**MECHANICAL PARTS IN MOTION**	To indicate the hazard resulting from the presence of mechanical parts in motion during the pump work cycle (e.g. transmission shafts, gear motors, etc.).

SYMBOL	MEANING	COMMENT
 	**WARNING SIGNS** **SAFETY INFORMATION**	To indicate a warning or remark concerning key functions or helpful information. Pay great attention to the blocks of text highlighted by these symbols.
	**CONSULTATION**	Before an operation is performed, the Instruction Manual shall be consulted.
	**ADJUSTMENT/MAINTENANCE**	A specific mechanical adjustment may be required in special operating conditions and/or malfunctions.

1.2 Manufacturer

HAWK INTERNATIONAL LEUCO S.p.A. KÄRCHER	LEUCO S.p.A. Via Pietro Colletta 20, 42124 Reggio Emilia (RE), ITALY

1.3 Service Centres

Should help be needed concerning equipment operation or maintenance, please contact LEUCO S.p.A. or specialised personnel authorised by the Manufacturer.
Whenever requesting technical service, please specify the information provided on the pump ID plate together with the identified type of fault.

1.4 Warranty

Hawk products are warranted by LEUCO S.p.A. to be free of defects in materials and workmanship for a period of one (1) year starting from the date of their release from the factory.
This warranty is limited to the repair and replacement of parts and products which, at the sole discretion of LEUCO S.p.A., are deemed defective as of the time of delivery. All products under this limited warranty shall be returned, freight prepaid, for inspection, repair or replacement by the manufacturer.
The limited warranty hereto is valid in place of any other warranty, whether express or implicit, including all warranties of merchantability or suitability for special purposes. These warranties are hereby rejected and excluded by the manufacturer.
Repairs or replacements of defective products shall be carried out in exclusive and sole compliance with the procedures described herein, and LEUCO S.p.A. shall not be liable for any further loss, damage or charge, including accidental and indirect damage, that may be caused directly or indirectly by the sales or use of these products.
Unauthorised use of spare parts that are not originally manufactured by LEUCO S.p.A. shall automatically void the warranty, which is governed by the instructions for installation and operation specified herein. No other warranty exists extending beyond the description above.

	All pumps supplied by LEUCO have been carefully checked during production and subjected to testing cycles before shipment. To achieve the best performance levels, avoid unpleasant inconveniences, and keep the warranty conditions valid, the procedures described in this manual concerning correct installation and priming of the pump must strictly be adhered to. LEUCO S.p.A. declines any and all responsibility for errors in the drafting of this manual.
	**Changes to the product, or parts thereof, that have not been agreed with the Manufacturer shall relieve them from any and all responsibility and shall also cause the warranty to become null and void.**

2 PUMP DESCRIPTION

Hawk high pressure piston pumps are volumetric pumps.
As may be inferred from the header in this document, 4 pump series are described below, which are slightly different from one another.

PUMPS NMT-EBCW
This series consists of a brass head called *ECOBRASS,* plated with a chrome layer.
The piston seals are made of rubber fabric, while the other seals are made of NBR.
The admitted work fluids are summarized in the table below

PUMPS NHDP-EBCH, NMT-EBCH, XLTI-EBCH, MXT-EBCH
This pump consists of a brass head called ECOBRASS
the piston seals are made of TEFLON (PTFE), while the O-Rings are made of FKM (Viton).
The admitted work fluids are summarized in the table below.

PUMP NHDP-ESA, NMT-ESA, XLTI-ESA, MXT-ESA
This pump consists of an AISI 316 stainless steel head.
The piston seals are made of TEFLON (PTFE), while the O-Rings are made of EPDM.
The admitted work fluids are summarized in the table below.

TABLE SHOWING THE ADMITTED WORKFLOWS

PUMP	**ADMITTED FLUIDS**
NMT-EBCW	WATER
	DEMINERALISED/DESALTED WATER
	WATER WITH ALKALINE OR ACID DETERGENTS IN 0 TO 2% CONCENTRATION

NHDP-ESA **NMT-ESA** **XLTI-ESA** **MXT-ESA**	WATER
	WATER WITH ALKALINE OR ACID DETERGENTS IN 0 TO 2% CONCENTRATION
	NITRIC ACID IN WATER SOLUTION WITH A MAX. CONCENTRATION OF 10%
	ACETIC ACID IN WATER SOLUTION WITH A MAX. CONCENTRATION OF 10%
	FORMIC ACID IN WATER SOLUTION WITH A MAX. CONCENTRATION OF 10%
	PHOSPHORIC ACID IN WATER SOLUTION WITH A MAX. CONCENTRATION OF 10%
	CITRIC ACID IN WATER SOLUTION WITH A MAX. CONCENTRATION OF 0.5%
	SULFURIC ACID IN WATER SOLUTION WITH A MAX. CONCENTRATION OF 0.5%
	HYDROCHLORIC ACID IN WATER SOLUTION WITH A MAX. CONCENTRATION OF 0.5%
	CAUSTIC SODA IN WATER SOLUTION WITH A MAX. CONCENTRATION OF 10% (NO HYPOCHLORITE)
NHDP-EBCH **NMT-EBCH** **XLTI-EBCH** **MXT-EBCH**	WATER
	DEMINERALISED/DESALTED WATER
	WATER WITH ALKALINE OR ACID DETERGENTS IN 0 TO 2% CONCENTRATION
	HYDROCARBONS SUCH AS GASOLINE OR HEAVY OIL
	AROMATIC SOLVENTS SUCH AS BENZENE* AND TOLUENE
	KETONS SUCH AS ACETON* OR METHYL ETHYL KETONE*
	ESTERS SUCH AS BUTYL ACETATE* OR METYL ACETATE*
	GLYCOLS SUCH AS BUTYL GLYCOLE
	SOLVENT MISTURES SUCH AS 85% BUTYL ACETATE AND 15% N-BUTYLIC ALCOHOL*

*for the use of these solutions contact our sales office

Hawk pumps must not be used with other materials/fluids and other motor coupling devices from those specified hereto.
If you have doubts, contact the Manufacturer.

The main parameters for the selection of a Hawk pump are the flow rate, the pressure, the rotation speed and the absorbed power.
The flow rate, expressed in litres per minute, is directly proportional to the rotation speed.
The rotation speed is expressed in revolutions per minute.
The pressure is expressed in bar and it is the max. pressure admissible from the pump.
The absorbed power is expressed in kW and it identifies the absorption required to achieve the max. flow rate and pressure performances specified.
If the pump is coupled with an electric motor, the power of the selected motor must be greater than that specified in the catalogue.
If the pump is coupled with a combustion motor, the power of the selected motor shall be at least 30% greater than that specified in the catalogue.
The absorbed power of the pump, expressed in kW, is calculated with the following formula:

Power = Flow rate (l/min) x Pressure (bar) / 520.

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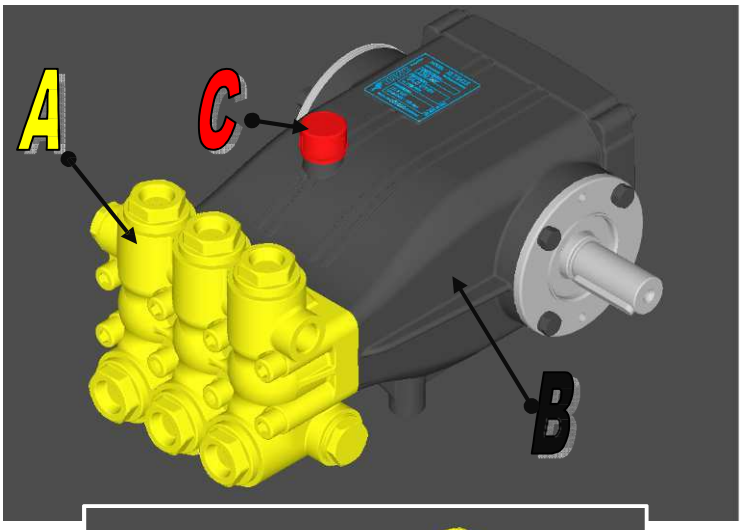
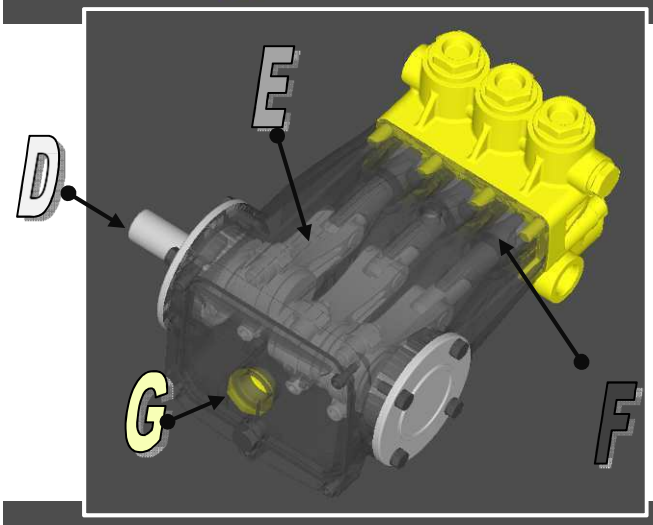
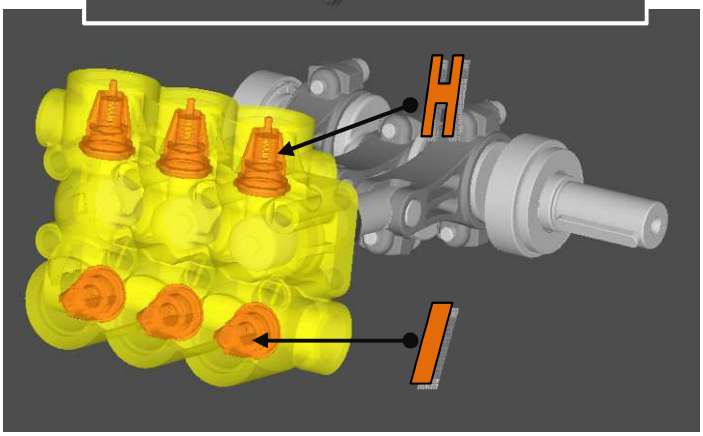
2.1 Main components







A. HEAD
B. PUMP BODY
C. OIL LEVEL PLUG
D. ECCENTRIC SHAFT
E. CONNECTING ROD
F. PISTON (related components)
G. OIL LEVEL INDICATOR
H. DELIVERY VALVE
I. INLET VALVE

Additional details on the components are given in the exploded view drawings attached to this manual.

The pumping action is implemented by a number of pistons which are linked to the motion transmission shaft by means of connecting rods. During motion the pistons slide axially inside the head where the intake and delivery lines are provided with valves that allow for fluid transit in one way only.

2.1.1 Technical characteristics

The main dimensions and specifications are as follows:

SERIES NMT-EBCW

Length	*273.5 mm*
Depth	*232 mm*
Height	*145 mm*
Weight	*10.5 Kg*
Capacity	*0.7 l*

Caratteristiche Tecniche — **NMT EBCW** CAR WASH — *Technical Characteristics*

Pump Pompa	Pressure Pressione		Volume Portata				RPM giri/min		Power Potenza			
			l/min		GPM				HP		kW	
	bar	PSI	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
NMT1520EBCW	200	3000	15.0	18.0	4.0	4.7	1450	1740	7.7	9.2	5.7	6.8
NMT2120EBCW	200	3000	21.0	25.0	5.5	6.6	1450	1740	10.7	12.8	7.9	9.4

SERIES NHDP-EBCH

Length	*266.5 mm*
Depth	*213 mm*
Height	*135 mm*
Weight	*8.2 Kg*
Capacity	*0.4 l*

NHDP EBCH – 200 BAR

Caratteristiche Tecniche — **Albero maschio – Solid shaft** — **Technical Characteristics**

Pump Pompa	**Pressure Pressione**		**Volume Portata**				**RPM giri/min**		**Power Potenza**			
			l/min		**GPM**				**HP**		**kW**	
	bar	**PSI**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**	**50 Hz**	**60 Hz**
NHDP8520EBCH	**200**	**2900**	**8.5**	**10.1**	**2.2**	**2.7**	**1450**	**1740**	**4.3**	**5.1**	**3.2**	**3.9**
NHDP1120EBCH	**200**	**2900**	**11**	**13.2**	**2.9**	**3.5**	**1450**	**1740**	**5.7**	**6.8**	**4.3**	**5.1**

SERIES NMT-EBCH

Length	*274 mm*
Depth	*232 mm*
Height	*145 mm*
Weight	*10.5 Kg*
Capacity	*0.7 l*

Caratteristiche Tecniche — NMT EBCH CHEMICALS — *Technical Characteristics*

Pump Pompa	Pressure Pressione		Volume Portata				RPM giri/min		Power Potenza			
			l/min		GPM				HP		kW	
	bar	PSI	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
NMT1520EBCH	200	3000	15.0	18.0	4.0	4.7	1450	1740	7.7	9.2	5.7	6.8
NMT2120EBCH	200	3000	21.0	25.0	5.5	6.6	1450	1740	10.7	12.8	7.9	9.4

SERIES XLT-EBCH

Length	*341.5 mm*
Depth	*266 mm*
Height	*168 mm*
Weight	*20.5 Kg*
Capacity	*1.2 l*

Caratteristiche Tecniche — XLT EBCH Albero Ø24 Shaft — *Technical Characteristics*

Pump Pompa	Pressure Pressione		Volume Portata				RPM giri/min		Power Potenza			
			l/min		GPM				HP		kW	
	bar	PSI	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
XLT2515EBCH	150	2175	25	30	6.6	7.9	1450	1740	9.8	11.8	7.2	8.7
XLT3015EBCH	150	2175	30	36	7.9	9.5	1450	1740	11.8	14.1	8.7	10.4
XLT3515EBCH	150	2175	35	42	9.2	11	1450	1740	13.7	16.5	10.1	12.1
XLT4015EBCH	150	2175	40	48	10.6	12.7	1450	1740	15.7	18.8	11.5	13.8
XLT5015EBCH	150	2175	50	60	13.2	15.8	1450	1740	19.6	23.5	14.4	17.3

SERIES MXT-EBCH

Length	*430.5 mm*
Depth	*346.5 mm*
Height	*217 mm*
Weight	*29.5 Kg*
Capacity	*2.1 l*

Caratteristiche Tecniche — MXT EBCH 2021 — *Technical Characteristics*

Pump Pompa	Pressure Pressione		Volume Portata				RPM giri/min		Power Potenza			
			l/min		GPM				HP		kW	
	bar	PSI	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
MXT1015EBCH	150	2175	100	120	25,9	31,1	1450	1740	37,7	45,2	27,7	33,2
MXT8515EBCH	150	2175	85	102	22,2	26,6	1450	1740	32,3	38,8	23,8	28,6
MXT7015EBCH	150	2175	70	84	18,5	22,2	1450	1740	26,9	32,3	19,8	23,8

SERIE NHDP-ESA

Lunghezza	*263 mm*
Profondità	*213 mm*
Altezza	*135 mm*
Peso	*8.2 Kg*
Capacità	*0.4 l*

Caratteristiche Tecniche — NHD PLUS - 200 BAR — *Technical Characteristics*

Albero maschio - Solid shaft

Pump Pompa	Pressure Pressione		Volume Portata				RPM giri/min		Power Potenza			
			l/min		GPM				HP		kW	
	bar	PSI	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
NHDP8520ESA	200	2900	8.5	10.1	2.2	2.7	1450	1740	4.3	5.1	3.2	3.9
NHDP1120ESA	200	2900	11	13.2	2.9	3.5	1450	1740	5.7	6.8	4.3	5.1

SERIES NMT-ESA

Length	*280 mm*
Depth	*232 mm*
Height	*145 mm*
Weight	*11.5 Kg*
Capacity	*0.7 l*

NMT ESA – 200 BAR

Caratteristiche Tecniche **Albero maschio – Solid shaft** **Technical Characteristics**

Pump Pompa	Pressure Pressione		Volume Portata				RPM giri/min		Power Potenza			
			l/min		GPM				HP		kW	
	bar	PSI	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
NMT2120ESAR	200	2900	21.0	25.0	5.5	6.6	1450	1740	10.7	12.8	7.9	9.4
NMT1520ESAR	200	2900	15.0	18.0	4.0	4.7	1450	1740	7.7	9.2	5.7	6.8

SERIES XLT-ESA

Length	*338.5 mm*
Depth	*266 mm*
Height	*168 mm*
Weight	*18.5 Kg*
Capacity	*1.2 l*

Caratteristiche Tecniche

XLT ESAR

Stainless Steel AISI 316L

Technical Characteristics

Pump Pompa	Pressure Pressione		Volume Portata				RPM giri/min		Power Potenza			
			l/min		GPM				HP		kW	
	bar	PSI	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
XLT2515ESA	150	2175	25	30	6.6	7.9	1450	1740	9.8	11.8	7.2	8.7
XLT3015ESA	150	2175	30	36	7.9	9.5	1450	1740	11.8	14.1	8.7	10.4
XLT3515ESA	150	2175	35	42	9.2	11	1450	1740	13.7	16.5	10.1	12.1
XLT4015ESA	150	2175	40	48	10.6	12.7	1450	1740	15.7	18.8	11.5	13.8
XLT5015ESA	150	2175	50	60	13.2	15.8	1450	1740	19.6	23.5	14.4	17.3

SERIES MXT-ESA

Length	*424.5 mm*
Depth	*346.5 mm*
Height	*217 mm*
Weight	*39 Kg*
Capacity	*2,1 l*

Caratteristiche Tecniche **MXT ESA 2024** *Technical Characteristics*

Pump Pompa	Pressure Pressione		Volume Portata				RPM giri/min		Power Potenza			
			l/min		GPM				HP		kW	
	bar	PSI	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
MXT7015ESA	150	2175	70	84	18,5	22,2	1450	1740	26,9	32,3	19,8	23,8
MXT8515ESA	150	2175	85	102	22,2	26,6	1450	1740	32,3	38,8	23,8	28,6
MXT1015ESA	150	2175	100	120	26	31	1450	1740	37,7	45,2	27,7	33,2

2.2 Ambient conditions

The Hawk pumps described in this manual have been designed and manufactured to operate in potentially explosive atmospheres.
The working parameters are specified in the ID plate (see fac-simile in sect. 3.8).
Below is a short list of these parameters.

Parameter	Admitted values
Ambient temperature	-10°C to +50°C
Storage temperature	0°C to +50°C
Humidity	20% to 80%
Max. pumped fluid temperature	+65°C

Le pompe Hawk, oggetto di questo manuale, NON sono state progettate e costruite per lavorare in presenza di un'atmosfera potenzialmente esplosiva.
Per tale tipologia di Pompe consultare il catalogo del Costruttore o contattarlo.

2.3 Vibration

In normal operating conditions, if the installation and assembly procedures described in this document have been followed correctly, Hawk pumps do not generate vibration such as to pose the related risks. Additionally, no contact with the operator is envisaged as the pumps are incorporated in an end machine/system.

2.4 Noise emissions

The equipment has been designed and manufactured so as to reduce the level of noise emissions at source, compatibly with its intended use and operating principle.
The measured noise level is below the min. level prescribed by the existing regulations.

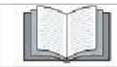
2.5 High temperatures

Mechanical parts are lubricated to prevent overheating due to prolonged friction over time. The lubrication oil, which is specified later on in this manual. Moreover, overheating does not represent a risk in terms of probability if normal maintenance procedures are implemented.
Wear suitable personal protective equipment, such as gloves and work clothes, as supplied to the operators.

2.6 Stability

Pumps from the series *NMT-EBCW, NHDP-EBCH, NMT-EBCH, XLTI-EBCH, MXT-EBCH, NHDP-ESA, NMT-ESA, XLTI-ESA, MXT-ESA* are supplied with the necessary instructions for their stable and safe installation in the machine/system where they are incorporated. The assembler/user shall thoroughly follow and comply with these instructions.

The pumps have been designed and manufactured so that they do not pose any risk in terms of stability when operated normally.



Additional information is provided in Chapter 5 “Installation”.

2.7 Fluids under pressure

The pumps described in this manual are manufactured with suitable materials to resist the required working pressures. Additionally, all components (plugs, valves, pistons, etc.) required for correct operation and fluid recycling have been fitted (see table in Chapter 2 and lubricant oil table). The transmission lubricant products used in the pump body serve the purpose of keeping the mechanical components lubricated, thus ensuring correct pump operation.

3 SAFETY

3.1 Preliminary remarks

Hawk pumps have been designed to be safe during their intended use on condition that they are put into service (incorporated), operated and maintained following the instructions for operation and maintenance given in this manual.

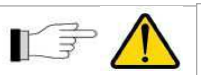
Before installing and operating the pumps, the operator and the other workers shall carefully read and understand the instructions provided in this manual and the installation design information.

	**The equipment must not be subjected to tampering.** If this is the case, the manufacturer declines any and all responsibility for improper operation or damage caused by the product.

Before the equipment is operated, a check must be made that all hazardous situations have been duly eliminated.

In addition, the operators shall follow the instructions below.

	Pump parts must not be disassembled or changed, except for the cases and following the procedures specified in this manual.
	Internal inspections, changes and repairs must be carried out by qualified technicians, who are authorised by the Manufacturer.
	No intervention must be allowed on the equipment by unauthorised personnel.
	Operators shall not wear rings, wrist watches, jewels, unbuttoned or fluttering clothes such as ties, scarves, torn clothes, unbuttoned jackets or blouses with open zips which may get entangled in moving parts.
	Operators shall wear the personal protective equipment specified in the manual, based on the performed operations.
	Operators shall make sure that all operations illustrated in the maintenance chapter are periodically performed.
	Should malfunctions or damage be identified, which may jeopardise correct equipment operation and safety, the pump shall be ***immediately*** put out of service.
	Any case of irregular operation must be reported to maintenance Supervisors.
	Operators shall check that all guards or other protections are in place and all safety devices are fitted and in efficient condition (pump guards and safety devices in the machine/system where the pump is incorporated).
	Operators shall check that the motor rotates in the same direction as the pump when it is started up for the first time or after maintenance is performed on the involved parts.

	**Refer to the User and Maintenance Manual of the end machine where the pump is incorporated for additional safety requirements.**

3.2 Residual risks

The machine has been designed and manufactured with a view to eliminating all risks linked to its use.
Below is a list of residual risks.

a)	Crushing	
The risk of crushing the upper limbs or the hands or the feet may exist when handling and putting the pump in place. Attention must therefore be paid during these operations. Please remember that personal protective equipment (gloves and safety footwear) must be worn and all procedures for correct work cycle execution must be followed.		

b)	Heat-related hazard	
The pump may reach high temperatures during operation depending on the temperature of the pumped fluid. The installation design executor shall take this risk into account and specify suitable protections and warning signs for personnel.		

3.3 Personal protective equipment

	**Failure to wear personal protective equipment, as specified in this section, shall expose the operators to hazards.** **The employer shall give personal protective equipment to the operators working with the machine illustrated in this manual.**

Based on their tasks, the equipment operators shall wear the following personal protective equipment:

- **safety gloves for protection against cuts and abrasions;**
- **accident-prevention footwear;**
- **safety goggles (where needed).**

Following the results of the risk assessment and changes in the production processes, if any, the employer may evaluate whether additional special protective equipment may be required.

3.4 Safe work procedures

To minimise the consequences of the hazards explained in the previous section, operators shall comply with the instructions below.

- **Wear** the personal protective equipment specified in section 3.3.
- **Supervise danger the zone**, do not start any test cycle if persons who are not involved in the work processes are standing in danger zones or in their proximity. If unauthorised persons enter the danger zone during the work cycle, promptly release the commands.

3.5 Safety during lifting and handling operations

	**Before these operations are started, the work area must be organised in such way that material lifting and movement are performed safely.**
	**Unloading, loading, handling and lifting operations must be performed by qualified and authorised personnel who have received specific vocational training.**
	**During lifting and handling operations anyone who is not involved in them must keep at a safe distance.**
	**All lifting equipment used, including attachments (hooks, wire ropes and chains), and all transport vehicles must be of suitable capacity and must be tested periodically, as specified by the existing regulations.**

3.5.1 Description of packing, unpacking and transport procedures

The Hawk pumps, series *NMT-EBCW, NHDP-EBCH, NMT-EBCH, XLTI-EBCH, MXT-EBCH, NHDP-ESA, NMT-ESA, XLTI-ESA*, MXT-ESA are contained in a package that was specifically designed to prevent damage resulting from shocks or vibration during transport or handling.
Each pump is packaged individually, wrapped in something similar to a protective mould which follows the profile of the pump. Any other element is packed in a separate package.
Depending on the quantity of goods to be shipped, packages may be placed on a pallet for easier lifting and handling.

When removing the packaging, check that the components are in good condition and in the right quantity. If they are damaged or missing, contact the dealer or the Manufacturer directly in order to agree upon the measures to be taken.
Packaging material must be disposed of in compliance with the existing laws.

Depending on their destination, Hawk pumps may be shipped by road, railway, ocean or air freight.
During transport the package must be secured to the vehicle in a suitable manner to prevent uncontrolled movements.

	**Failure to comply with the instructions above may result in situations with a high level of hazard.**

3.6 Safety during maintenance

The instructions below must be adhered to while performing maintenance or repairs.

	**The hydraulic system must be depressurised and the pump must be disconnected from all energy sources before maintenance or repairs are started.**

- Hang a signboard reading "**MAINTENANCE IN PROGRESS**" in a clearly visible position on the machine/system where the pump is incorporated before starting work.
- Do not use solvents, flammable products or materials generating electrostatic charges for cleaning.
- Pay attention not to dump lubricant oils and grease in the environment.
- When work is finished, re-place and correctly fasten all the protections and guards that had either been removed or opened.

	**Maintenance/repair operations must be performed by a qualified technician.**

3.7 Products in use

All products used for normal equipment operation such as oils, lubricants and cleaning products must be used in conformity with the requirements laid down in the producer's product data sheets.

The oil used in Hawk pumps, series *NMT-EBCW, NHDP-EBCH, NMT-EBCH, XLTI-EBCH, MXT-EBCH, NHDP-ESA, NMT-ESA, XLTI-ESA, MXT-ESA* is: SAE 10W/40.

As explained in Chapter 2, our pumps are made of *ECOBRASS* and *AISI 316 STAINLESS STEEL, and the* supplied **seals** are made of ***TEFLON (PTFE***), ***FKM (Viton), EPDM, rubber fabric, HNBR and NBR.***

They must be disposed of in compliance with the specific instructions laid down in the existing laws.

	**No other products than those specified herein must be used.** **If you have doubts, contact the Manufacturer.**

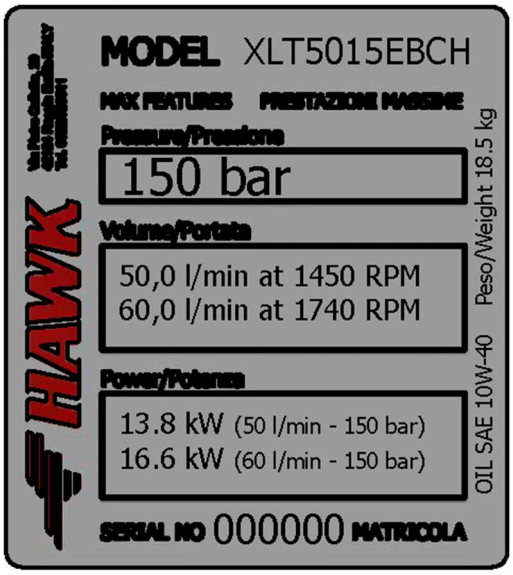
3.8 Signage/ID plate

The danger, warning and obligation signs described in the sections above are affixed near/on the pump.
An exact description of the pump, its model, serial number and technical specifications will help our After-Sales Service (where applicable) to provide our clients with timely and efficient replies.

The pump identification data are specified on the equipment ID plate, as shown below.

	**Under no circumstance should the ID plates and/or decals intended to provide information and/or warnings be removed (or re-placed) from the equipment.**

FAC – SIMILE
Machine ID plate



Additional signs affixed on the equipment

The plate* is located at the blind plug in te top part of the pump.

**The plate on the plug is the same colour as the plug, which varies from pump to pump.*

3.9 First Aid measures

Below are some standard First Aid procedures which are implemented in the event of an accident caused by the use of the pump or the machine/system where the pump is incorporated.

They can be helpful for operators in cases of emergency that occur during equipment use throughout the different stages of the pump service life (transport, installation, operation, maintenance, adjustment, etc.) or otherwise occur to other operators who are working in proximity of the machine.

3.9.1 Tasks of the First Aider

a) To implement First Aid measures (emergency call).
b) To evaluate the condition of the injured person and, where necessary, to support his/her vital functions.
c) To stop external bleeding.
d) To protect wounds and burns.
e) To protect the injured person against further harm.
f) To prevent useless or harmful actions such as to give drinks to the injured person or to move him/her, to reduce dislocations and/or fractures, etc.

3.9.2 Emergency call

The success of a First Ad intervention also depends on how timely the rescuers manage to reach the place of the event.
This is why the first aider in charge of making the emergency call shall precisely specify:

- the address of the place where the accident (or injury) occurred;
- the number of injured (or sick) people;
- the possible cause of the event;
- the condition of the vital functions of the injured person, specifying whether the person is conscious and breathes normally.

During the call it is appropriate:

- to give your details, specifying a telephone number for further contacts;
- to wait for the rescuers outside the company (e.g. at the reception).

The emergency call is the most important intervention. Follow the instructions of the Emergency Service people to make the first aid intervention successful.

3.9.3 Injuries

Treatment of sprains, dislocations and fractures
Block the joint in the current position after the injury using splinting and bandages. Allow the injured person to stay in an antalgic position and avoid hazardous manoeuvres. Apply cold therapy (ice bag or other systems).
If the fracture is exposed, cover the wound with a sterile gauze after compressing the haemorrhage keeping at a distance from the fractured points.

Bruises, crushing
In the event of bruises and/or crushing of the upper and lower limbs (fingers, hand, feet, etc.) the limb must be placed immediately under (cold) running water and an ice bag must be applied on it, also checking whether there are wounds and/or cuts, in which case the involved area must be disinfected.

3.9.4 Haemorrhage

The bleeding point must be compressed directly with a swab of sterile gauzes: the limb must be raised and an emergency tourniquet must be applied for compression of the area immediately above the haemorrhage.

Treatment of shallow wounds
Expose the wound and wash it thoroughly; disinfect it with saline and then cover it with sterile gauzes. Finally, apply a bandage without tightening it excessively in order to allow for proper blood flow.

Treatment of deep wounds
Protection against the risk of contagion is essential: wear gloves and a face protector. Dab at the bleeding point exerting a compression on the haemorrhage directly or on other compression points until bleeding stops or the ambulance arrives. Call the Emergency Service number (specific for each country) and inform the person on the other side of the phone that you are stopping an arterial haemorrhage.
The wound can be treated only after the haemorrhage is under control.

	**DO NOT use cotton wool, denaturated alcohol and antibiotic powder to disinfect the wound.**
	**Always wear latex gloves to prevent direct contact with body fluids during the rescue intervention.**

4 PUMP USE

4.1 Intended use

Hawk pumps, series *NMT-EBCW, NHDP-EBCH, NMT-EBCH, XLTI-EBCH, MXT-EBCH, NHDP-ESA, NMT-ESA, XLTI-ESA, MXT-ESA* must under no circumstances be used for other purposes than those specified in these instructions. Compliance and strict conformity with the conditions of use, repair and maintenance, as specified by the Manufacturer, represent essential elements falling within the equipment intended use.

The Hawk pumps examined in these instructions have been designed and manufactured for incorporation in a machine intended for the high pressure pumping of the listed fluids (e.g. high pressure jet washing machine). They have to be operated in compliance with their specifications (sect. 2.1.1), without being subjected to non-agreed changes, and/or they must not be misused.

	**The pump must be operated EXCLUSIVELY after installation by trained and qualified personnel who are aware of the information provided in this manual.**

4.2 Prohibited use

The equipment must not be used:

- by different users from those specified in section 1.1.2;
- for different uses from those specified in Chapter 2 and section 4.1;
- in different ambient conditions from those specified in section 2.2;
- in different end machines from those specified in section 4.1;
- with different fluids from those listed in Chapter 2;
- in waterworks for drinking water;
- for foodstuff applications;
- for pharmaceutical products.

	**Should the equipment be operated for other uses than those specified above, the Manufacturer shall be entitled to review the warranty conditions.**

5 ASSEMBLY AND INSTALLATION

Read this chapter carefully before installing the machine.

	**Incorrect installation of your pumping system may cause injuries to people and damage to property. So, it is essential to comply with all instructions listed below.**

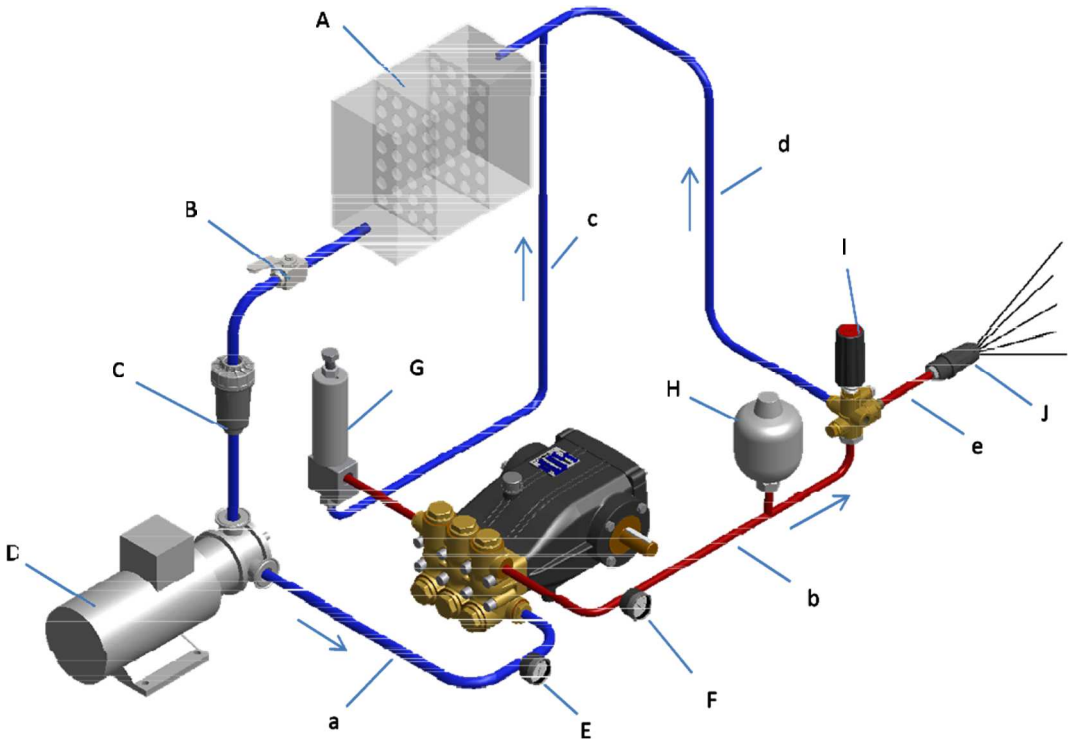
The pumps can be installed in various ways: with pulley drive, direct drive or with flange coupling.

	**Use a suitable flexible coupling for direct coupling with an electric motor**
	**Make sure the pulleys are aligned if pulley driven; adjust the belt tension and provide adequate safety protection.**

	The pump must be installed horizontally to the base to facilitate optimised lubrication on a vibration-free base.
	The motor rotation direction must be the same as the eccentric shaft (direction marked on the shaft).
	The pump inlet line must be sized according to the flow rate and its diameter for fluid flow must in no case be inferior to the inlet diameter. The line must have as little constrictions as possible (elbows, T-fittings, reduced diameter, etc.). Each joint in the inlet line must be properly insulated using Teflon tape or a similar product in order to prevent air leaks or intake (cavitation). Cavitation consists in the formation of vapour bubbles in a liquid whose implosion generates abnormal and very harmful stresses on all the pump components. For longer pump service life fluids with sand or other solid particles must not be circulated in the pump as they jeopardise the efficiency of the valves, pistons and seals. This can be avoided by fitting a filter on the inlet pipe - oversized with respect to the pump flow rate - which shall be subjected to periodic cleaning.
	The delivery line must be suitable to resist the pump working pressure. Very narrow transit areas may cause pressure losses to the nozzle.

	To prevent injuries to people and damage to property, a pressure regulation valve and a safety valve must be installed to stop the pressure from accidentally exceeding the working value. For the selection of these valves consult our engineering department. To keep the pressure in the system under control, we recommend installing a pressure gauge on the delivery line with a suitable full-scale pressure.

	Before starting the pump up, check the oil level. We recommend changing the oil for the first time within the first 50 hours of operation and then every 500 hours. This frequency must be increased if the pump is used in heavy-duty conditions. The type of oil used in our pumps is SAE 10W/40.
	Replace the oil plug used for shipment with the vent plug supplied with the pump.
	All the safety rules described in **Chapter 3** must be adhered to at all times.
	Failure to comply with these operating conditions causes the warranty to be voided.



A)	Tank or waterworks
B)	Shut-off valve
C)	Filter on inlet line
D)	Auxiliary pump
E)	Pressure gauge on intake line
F)	Pressure gauge on delivery line
G)	Safety valve
H)	Pressure reducer
I)	Regulating and bypass valve
J)	Nozzle

a)	Feed pipe
b)	Delivery pipe
c)	Safety valve drain pipe
d)	Bypass pipe
e)	Valve outlet pipe

5.1 Arrangements required from Buyer/User

The client is responsible for the following arrangement.

	Checking the condition of the pump when it is delivered. Contact LEUCO S.p.A. in case of damage conditions that do not match the purchase order
	The assembler/end user is responsible for choosing the type of motor - pump coupling and for following the instructions in this document.
	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.

	**Follow the instructions provided in the Operating and Maintenance Manual for the machine where the pump is fitted for all connections.**

5.2 Preliminary operations before first start-up

A set of checks and inspections have to be made before the pump is started up to prevent errors or accidents during putting into service.

- Check that the machine has not been damaged during assembly, installation and transport (stability, correct screw and/or bolt fixing, correct coupling of mechanical parts and gears).
- If leaks are identified from the pressurised piping, stop the pump immediately and remove the cause of the leak.

	**If the equipment does not appear suitable for correct and safe operation, it MUST BE PUT OUT OF SERVICE until it is repaired or the damaged parts are replaced.**

After making the required connections, the fitter shall carry out a test to check correct operation of all the featured devices.

➢ Start the pump up and keep the delivery line (nozzle) open for easier priming. Do not let the pump run in dry condition. This may cause quick wearing of the seals, thus voiding the warranty.

➢ After use, run the pump with clean water for a few minutes. Do not expose the pump to very low temperatures. Let the pump run dry for approx. 20 seconds to drain the pipes and thus prevent frosting.

5.3 Long pump shutdown

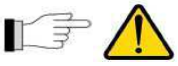
The following measures must be implemented in the event of long shutdowns.

- Let the pump run with clean water for a few minutes.
- Let the pump run without water for 10 seconds with the delivery pipe (nozzle) open in order to drain the pump and the delivery circuit, and to prevent the formation of scaling.
- Wash the pump with water and solvents authorised by the existing legislation.
- Dry the pump with compressed air.
- Grease unpainted parts.
- Prevent the system from coming into contact with corrosive substances.

	**Mineral oils lose their properties when the pump is shut down or not used for over six months, so they must be changed.**
	**The checks performed upon first start-up (sect. 5.2) must be repeated whenever the pump is started after a long shutdown. The oil level too must be checked together with correct tightening of the mounting screws.**

5.4 Putting into service

Except for MXT-ESA series that must be fed at a minimum pressure of 1 bar, for correct operation the pumps must preferably be supplied with a max. pressure of 8 bar. If this is not the case, they must be placed under the head or at the same level as the tank.
The Hawk pumps are supplied complete with first fill oil and a leak-tight plug in order to prevent oil leaks during transport. The leak-tight plug must be replaced with the plug featuring a rod and vent before the pump is started.

	**Poor pressure feeding may cause serious damage to the pump, the symptoms of which are difficult priming, vibration, noise and early seal wear.**
	**The pump must not be operated at pressure values and a rotation speed exceeding the values required and specified on the ID plate for each model.**

NOZZLE TABLE *The table below is used to correctly select the nozzle based on the pump specifications (max. pressure and flow rate factor). The table shows an example (pump with Pmax=100 bar and Flow rate=15 l/min).*

Select the pressure value in the first line and move down the table until the flow rate factor that is closest by defect to the pump rate, then identify the suitable nozzle type for the required values. We recommend selecting the nozzle corresponding to the flow rate factor immediately below the closest value (in the example, the value circled in green with the uninterrupted line) in order to preserve the desired pressure values over time.

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

6 MAINTENANCE

Follow the instructions below to perform maintenance or repairs.

- Hang a signboard reading "**MAINTENANCE IN PROGRESS**" in a clearly visible position before starting work.
- Do not use flammable products and materials.
- Wear mineral oil resistant gloves, an overall (trousers must be worn outside the safety footwear at all times) and safety goggles when handling lubricants.
- Pay attention not to dump lubricant oils and grease in the environment.

	**All maintenance interventions must be carried out by authorised and qualified personnel, and they must be recorded in the relevant logbook.**
	**Always adhere to all the safety rules described in Chapter 3.**

More specifically, to keep the pump efficient over time, we recommend following the preventive maintenance cycle 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

NOTE 1
Maintenance cycles must be performed based on the type of work to which the pump is subjected.
The work cycle, temperature and quality of the pumped fluid, the type and quality of the energy sources and the condition of the used accessories are all significant factors that have an impact on the service life of the pump components.
NOTE 2
The indication in the table refers to water as the pumped fluid. For more accurate instructions on how to replace the seals when the other permitted fluids are pumped, refer to the manual of the end machine in which the pump is incorporated.

If the pump experiences a reduction of its performance levels, immediately check the type of problem using our **Troubleshooting** list as reference. If no problem arises, the pump must be checked after 1000 hours of operation and, then, every 500 hours.

For Hawk pump maintenance, and for seal replacement in particular, use the tool kit supplied by LEUCO S.p.A. and fit genuine spare parts at all times.

6.1 Overall maintenance

Overall, the following checks must be made.

Pump installation elements

- ✓ Check that the pump mounting screws are not loosened.
- ✓ Tighten them at the tightening torque specified in the installation design, if necessary.

Fittings and piping (not included in LEUCO supply)

- ✓ Check for leaks from the fittings.
  Normally, leaks can be eliminated by correctly tightening the fittings.
  If leaks are identified from the fittings in the inlet pipes, the fitting sealing must be restored.
- ✓ Check the condition of the hoses.
  If they appear old and/or show signs of breakage, swallowing, abrasions, etc., they must be replaced.

Filter (not included in LEUCO supply)

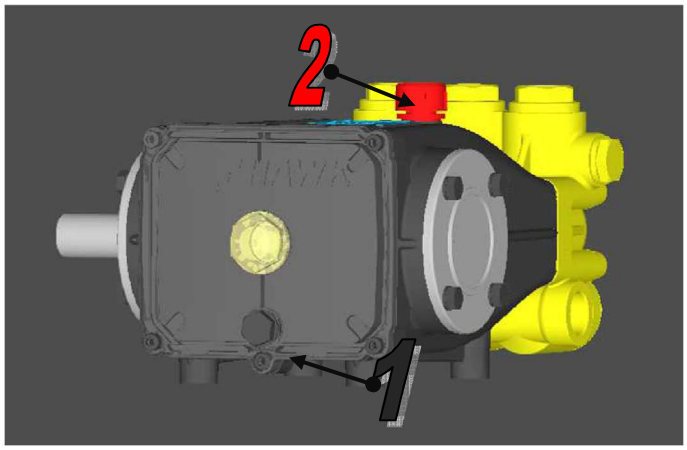
- ✓ Check the condition of the filtering cartridge.
  If the filtering cartridge is clogged or damaged, consult the instructions provided by the filter manufacturer in order to restore the filtering cartridge to its initial filtration condition.

Oil level

- ✓ Make this check after placing the pump on a flat surface and once it has cooled down.
- ✓ Check the amount of oil from the level gauge (located at the back of the pump body, see sect. 2.1, letter G).
- ✓ Top up the oil, if necessary, using the same type specified in sect. 3.7. Fill the oil through the plug featured in the top part of the pump body (see sect. 2.1, letter C).

Oil change

- ✓ Place the machine where the pump is incorporated on a perfectly flat surface: the pump must be slightly hot. Do not dump the oil in the environment. Dispose of it in compliance with the existing legislation.
- ✓ Have at hand a container of suitable capacity to collect the exhaust oil.
- ✓ Unscrew the drain plug (1) and let all the oil flow out.
- ✓ Screw the drain plug.
- ✓ Unscrew the oil plug (letter C, sect. 2.1 or no. 2 in the figure below).
- ✓ Fill the fresh oil through the fill hole until the correct level (as specified in the “Oil level” item).
- ✓ Screw the fill plug.



	**In the event of a malfunction of any type whatsoever, the cause must be identified and the malfunction removed before the machine is started up again.**
	**For other maintenance interventions refer to the internal company specifications and/or procedures and to the end machine user manual.**
	**Contact the Manufacturer for any other maintenance intervention that is not specified in this manual or its annexes.**

7 TROUBLESHOOTING

7.1 Problems and possible solutions

All troubleshooting interventions must be carried out by authorised and qualified personnel.

This chapter is intended to provide the user with solutions to the problems or malfunctions that may occur more frequently. Some of these solutions can be implemented by skilled personnel, while others must be performed at Authorised Workshops as they require using specific tools as well as having an in-depth knowledge of the repair procedures.

Whenever a malfunction is identified on the machine or its components, and the problem has not been resolved, directly contact the Manufacturer for the necessary information.

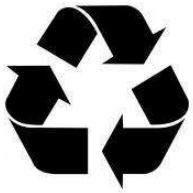
PROBLEM	POSSIBLE CAUSE(S)	SOLUTIONS
The pump runs, but it will not generate noise and pressure.	The pump is not primed and is running dry.	Check for water in the inlet line. Check that the delivery line (gun) is open. Check that the valves are NOT clogged.
The pump runs, but it is excessively noisy and/or will not achieve the desired pressure.	The nozzle is either oversized or damaged. The water supply is not sufficient.	Replace the nozzle. Clean the filter. Replace the filter with a new one of suitable dimensions. Remove any air suction. Check the dimension of the inlet pipe and replace it with a larger diameter pipe, if necessary.
	The pressure regulation valve is not calibrated correctly or it is inefficient.	Calibrate the valve properly.
	The piston seals are worn.	Check the condition of the seal housing. Replace the seals.
	The rotation speed is low.	Check the motor and the transmission.
The pump gets pressurised, but the level of pulsation and vibration is high.	Foreign matter is present in the valves.	Clean the valves.
	The valves are worn.	Replace the valves.
	The inlet water temperature is high.	Reduce the water temperature.
	The piston seals are worn.	Replace the seals.
The pump is very noisy.	The bearings are worn.	Replace the bearings.
	The inlet water temperature is high.	Reduce the water temperature.
	Problems are experienced in the pump-motor coupling.	Check the status of the keys, flexible coupling or the pulley.
The piston seal life is quite short.	There is cavitation or air in the system.	Check the condition and the dimension of the inlet pipe and replace it with a larger diameter pipe, if necessary.
	The ceramic piston is damaged.	Replace the piston.
	The pressure and/or temperature of the pumped water is/are very high.	Check the inlet water pressure and temperature.
There is water in the oil.	The ring in the rod-piston oil seal is worn. If the oil is milky (emulsified), but the level in the guard does not increase, condensate may have formed.	Replace the oil seal ring. Change the oil more frequently.
There is water leaking between the guard and the head.	The seal pack is worn.	Replace the seal pack.
	The piston is worn.	Replace the piston.
	The seal in the piston stop screw is worn.	Replace the seal.
There is oil leaking between the guard and the head.	The ring in the rod-piston oil seal is worn.	Replace the oil seal ring.

The bearing life is short.	Problems are experienced in the pump-motor coupling.	Check the status of the keys, flexible coupling or the pulley.
	The oil was not changed regularly.	Change the oil following the instructions on the pump maintenance manual.
	The pressure of the pumped water is very high.	Check the pressure.

8 DISASSEMBLY AND DISPOSAL

If the pump is removed from the machine to be installed elsewhere or for disposal, the Manufacturer must be contacted directly for the necessary instructions and information.

The pump must be scrapped by skilled personnel in compliance with the laws existing on safety at work.
The disassembled components must be separated based on the type of constituting materials. Polluting materials such as the seals and lubricants must not be dumped in the environment.
Non-ferrous parts, in particular, must be delivered to an authorised disposal company, while ferrous parts can be resold for reuse.
The Manufacturer must be notified about the pump being put out of service or transferred.



Packaging materials are recyclable. Do not dispose of the packaging together with household waste: deliver it to a recycling company.

The pump contains valuable recyclable materials which should be recycled in order to be reused.
The oil must not be dumped in the environment.
Dispose of the used pump at suitable waste collection centres.

9 SPARE PARTS

Replace parts using genuine spare parts only.