DIAPHRAGM METERING PUMPS

INSTALLATION MANUAL **EN**

MANUAL DE INSTALACION **ES**

MANUEL D'INSTALLATION **FR**

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Operation, maintenance and installation manual

DIAPHRAGM METERING PUMPS

Read the instructions carefully before installing and starting the equipment.
The infomation contained in this manual is subject to change without notice and does not represent a commitment.

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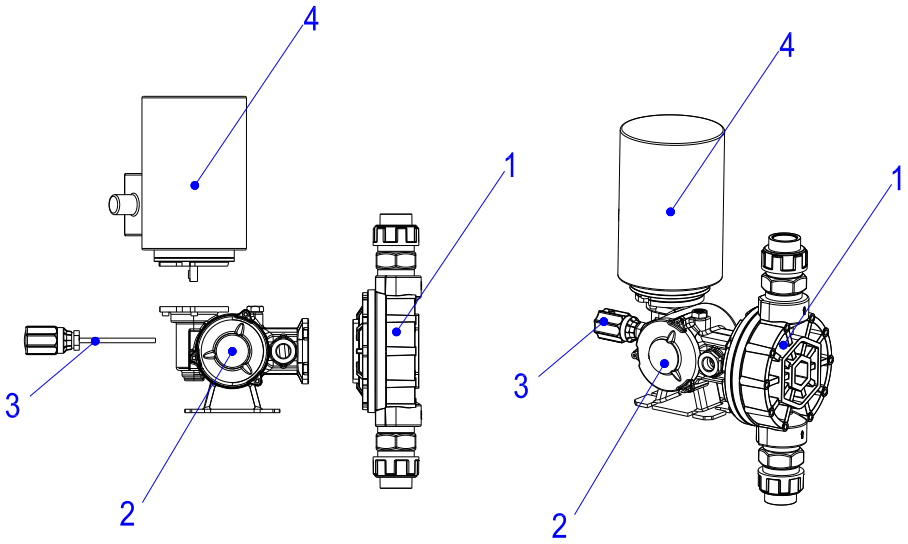
1. DESCRIPTION



1	Testata	Cabeza	Pump head	Tête	Pumpenkopf
2	Meccanismo	Mecanismo	Mechanism	Mecanisme	Triebwerk
3	Regolazione	Regulaciòn	Adjustment	Régulation	Hubeinstellung
4	Motore	Motor	Motor	Moteur	Motor

The metering pump is a reciprocating positive displacement pump; basic components are: the prime mover (generally it is an electric motor), the gearbox, the mechanism, the stroke length adjustment and the liquid end.

⇨ **THE DESIGN OF THE METERING PUMP FULFILLS ITALIAN SAFETY AND ACCIDENT PREVENTION REGULATIONS.**

⇨ **PRODUCT INTENDED FOR PROFESSIONAL USE, BY SKILLED PEOPLE.**

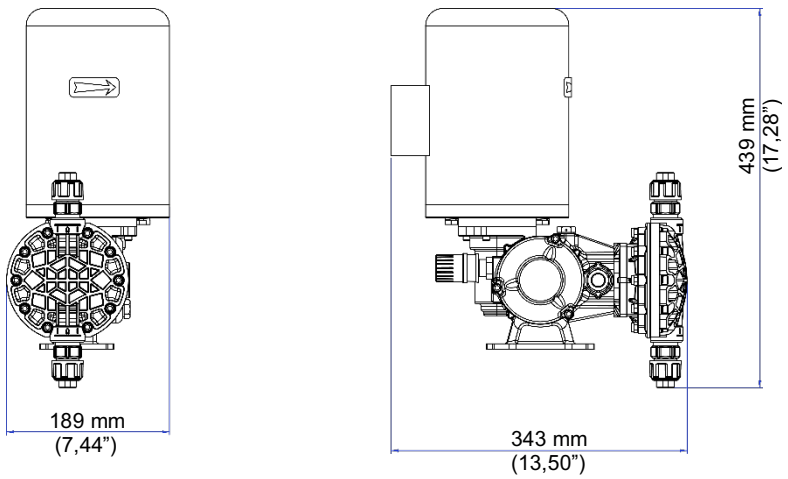
Safety instructions

WARNING

Exceeding the maximum allowed operating pressure must be prevented (e.g. by using a pressure relief valve)

Before starting to work on the metering pump verify carefully the following:

- the drive is disconnected from the power source
- parts such as pumphead and piping are depressurized
- parts in contact with aggressive substances are washed before handling
- personnel protection is carried out according to local regulations



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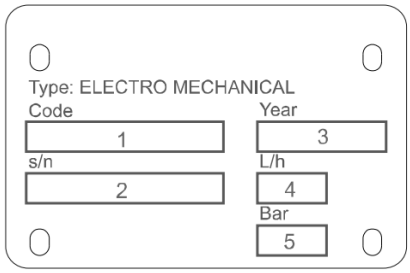
1.1 Applications

Metering pump is a process component capable to transfer defined volumes of liquid with high accuracy, moreover it is possible to vary the flow rate by acting on integral devices.
To obtain the bestperformances, select the pump considering the duty required and the conpatibility of the construction materials of the contact parts.

Before using a pump for a duty different from the original one, please contact our Technical Dept. for information.

1.2 Identification label

Actual dimensions: mm 53x35



1	Modello	Modelo	Model	Modèle	Modell Triebwerks
2	Numero di fabbrica	Número de matrícula	Serial Number	Numéro de fabrication	Baunummer
3	Anno fabbricazione	fabricar año	Manufacture year	Fabriquer année	Fertigen Jahr
4	Portata	Caudal	Flow rate	Débit	Förderleistung
5	Pressione massima	Presión máxima	Maximum pressure	Maximum pressure	Maximaler Druck

1.3 Mechanism and gearbox

Mechanism is the device that permits to transform the electric motor rotary movement in alternate and to actuate the plunger.

1.3.1 Manual adjustment of the flow rate

To obtain high accuracy performances pump must operate at ideal conditions: constant speed, pressure, viscosity.
All pumps having manual adjustment are delivered with the adjustment positioned at 100%.
IN CASE ELECTRIC IS ALSO FITTED TO THE PUMP, READ THE INSTRUCTIONS CONTAINED IN THE SPECIFIC MANUAL.

1.4 Pump head

1.4.1 Operating principle

Mechanical diaphragm models, fig. A,
The rod (5) is mechanically connected to the diaphragm (4).
The diaphragm (4) is actuated by the rod (7) and separates the pumphead (3) from the atmosphere. Suction (1) and discharge (2) valves are operated by positive and negative pressure

Suction stroke :

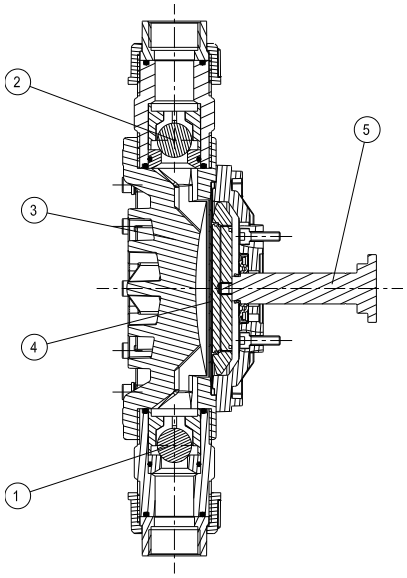
During the suction stroke the difference between the suction pressure and the pressure inside the process head (3) causes the opening of the suction valve (1).
The process liquid is sucked from the suction line into the process chamber (3).

Discharge stroke:

During the discharge stroke the suction valve (1) is closed and the discharge valve (2) will open due to the positive pressure inside the process chamber (3). The process liquid is discharged from the process chamber (3) into the discharge line

- **Fig. A** -

-



	Membrana mecca-nica	**Membrana meca-nica**	**Mechanical diaph-ragm**	**Membrane mecani-que**	**Mechanische Membran**
1	Valvola di aspira-zione	Válvula de aspi-racón	Suction valve	Vanne d'aspiration	Ansaugventil
2	Valvola di scarico	Válvula de impul-sión	Discharge valve	Vanne de refoule-ment	Auslaßventil
3	Testata	Cabeza	Pump head	Tête	Prozeßkammer
4	Membrana	Membrana	Diaphragm	Membrane	Membran
5	Pistone	Piston	Piston	Piston	Kolben

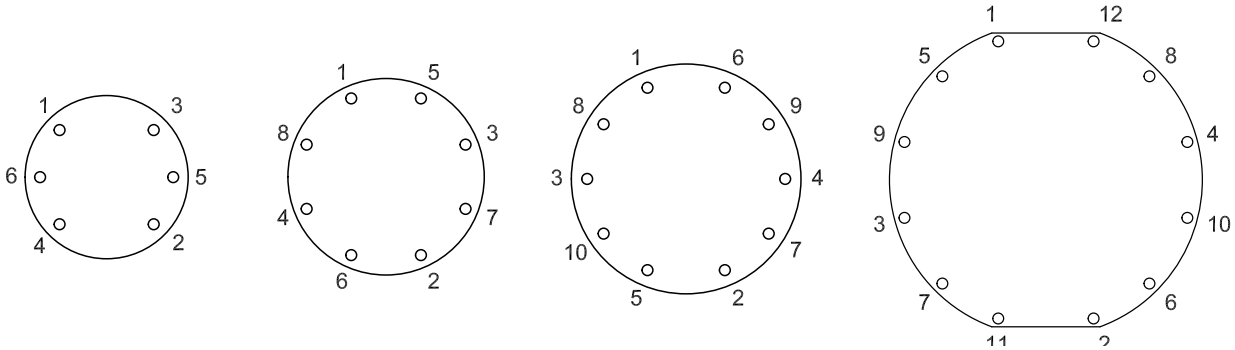
2. INSTALLATION

2.1 Safety precautions

- don't work alone
- install a magnetic starter with overload protection
- connect motor to grounding
- when working on the pump verify that electric motor or servomotor are not connected to mains.
- using electric tools in hazardous areas, pay attention to special regulations
- keep available a first aid kit
- observe local law safety regulations

Installation

- Foundation height should be so as to facilitate maintenance operation, handling, oil refill and drain, easy disassembling of pumphead
- Install the pump **free of strain** on its base, pumphead connections and foundation
- Install the pump levelling the piston axis horizontally and the valve axis vertically
- Make sure that the pump casing's tightening torque of the screws is of 6Nm, otherwise retighten as shown below:



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Electrical connection

> **DANGER**
>
> **Electric motors and electrical components should be connected in accordance with local regulations and by qualified personnel only.**
> **Install overload protection or temperature sensor.**
> **Check voltage, frequency, motor speed and power.**
> **In hazarduous areas special regulations must be applied.**

2.2 General

For a good operation, the correct installation of the pump is fundamental:

- Before carrying out hydraulic connections, make sure that the inside of pipes, tanks, etc. have been thoroughly cleaned/washed. However we recommend the installation of a temporary filter near to suction nozzle in order to stop plant residues and slags.
- Connect pipes avoiding nozzles stretching
- Install pipes correctly sized for the maximum flow rate of the pump, avoid necks and tortuosity where air or gas could be entrapped.
- In case of plastic head, install flexible joints both on suction and discharge sides.
-

> **WARNING**
>
> **To prevent serious damages suction and discharge lines must be properly designed, sized and connected to the pump.**

2.3 Suction line (see installation recommendations table, pag. 20)

- Install pipe as short as possible (fig. 1) and avoid tortuous paths (fig. 2)
- Pipe should be sized considering that the ratio between the maximum instantaneous flow rate and the average flow rate is 3.14.
- Indicatively the installed pipe should have a diameter equal to 1.5 the diameters of the pump nozzles.
- For your guidance the recommended flow speed inside the pipes should be 0,5÷0,8 m/sec with liquids having viscosity near water and specific gravity up 1200 Kg/m^3.
- A permanent suction filter must be installed . The filter should have a filtering cartridge of 80 μm giving a pressure drop less than 0.2 m.w.c. (calculated according to the a.m. coefficients). The filter should be easily accessible and periodically checked and washed.
- In case of long lines and in order to avoid cavitation problems, install, near the pump, an expansion tank or a damper (fig. 3).

- To prevent suction of impurities don't connect suction line to the bottom of the tank (fig. 4)
- Suction from a vacuum tank can be achieved by connecting pipes as per fig. 5. open check valve 2 and verify the filling through the the window 3, close the check valve 2, start the pump; the non-return valve 4 prevents liquid to flow-back when pump is stopped.

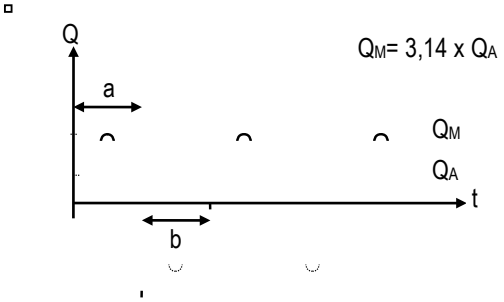

Fig.

	Portata	Caudal	Flow rate	Débit	Förderleistung
Q_A	Portata media	Caudal promedio	Medium Flow rate	Débit moyen	Duchschnittliche
Q_M	Portatamassima	Caudal máximo	Maximum flow rate	Débit maximale	Max. Durchfluss-menge
a	Corsa di scarico	Carrera de impul-sión	Discharge stroke	Course de refoule-ment	Auslaßhub
b	Corsa di aspira-zione	Carrera de aspira-ción	Suction stroke	Course d'aspiration	Ansaughub
t	Tempo	Tiempo	Time	Temps	Zeit

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2.4 Discharge line (see installation recommendations table)

- Verify that between suction and discharge there is a positive pressure of at least 50÷ 100 Kpa; if the plant conditions don't permit a positive pressure difference, install a back pressure valve on pump discharge (fig. 6) or lower suction tank (fig. 7) or raise discharge pipe (fig. 8)

- For safety reasons it is mandatory to install a pressure relief valve in order to prevent dangers as consequence of unexpected overpressure; the pressure relief valve discharge should be visible and/or piped back to the tank or to a drain.
  We do not recommend to pipe the pressure relief valve discharge to the pump suction line (fig. 9).
- In case a back pressure valve is installed the pressure relief valve must be installed as shown in fig. 10.
- It is recommended the installation of pressure gauges having a range of 20% higher than the pressure relief valve setting.
- To reduce flow pulsation, the installation of a pulsation damper near the discharge valve of the pump is highly recommended.

The most used dampers are:

- dampers with direct contact between process liquid and gas/air cushion (air chamber); this type is of simple concept but it needs frequent checks and restoring of the atmospheric air cushion.
- dampers with diaphragm or bag which separates gas/air from process liquid; they are generally precharged at a pressure equal to 60÷75% of the maximum operating pressure of the pump when installed on the discharge side of the pump.

These dampers require periodic checks to verify diaphragm/bag integrity and correct precharge pressure; they must be selected considering the chemical compatibility of the construction material of diaphragm/bag.

If the pump discharges into a pressurized line, the installation of a non-return valve is recommended.

⇨ When installing pump and accessories it is recommended the installation of check valves in order to facilitate maintenance operations. Fig. 13 shows a typical installation.

⇨ Please observe the following instructions when pumping liquids that tend to cristallize or suspensions that tend to sediment:

- keep suspension correctly agitated in order to prevent sedimentation
- avoid installation of vertical lines over the pump discharge nozzle
- before stopping the pump start a washing cycle of the pump and pipes
- design suction and discharge lines should permit complete emptying

3. START-UP

Electrical connection:

- connect electric motor to mains (power source)
- check the direction of rotation of the electric motor; an arrow on the electric motor shows the correct direction of rotation

The electric motor should be connected by qualified personnel only!

WARNING
Don't start the pump with the suction and/or discharge check valves closed **Don't close check valves while the pump is in operation**

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Before starting the pump check the following points:

- Check mechanism for the correct oil filling
- Check pumphead for the correct filling of the hydraulic liquid
- Check metering pump for overpressure protection (pressure relief valve installation)
- Verify that all hydraulic connections are correctly tight
- Position adjustment knob at “zero” flow rate
- Start the pump without discharge pressure and increase progressively the flow rate up to 100%
- Check the hydraulic chamber for possible air bubbles intrapped in the liquid pushing the replenishing valve until no air is blown out
- Keep the pump in operation for few minutes

WARNING

DON’T EXCEED THE MAXIMUM PERFORMANCE STENCILLED ON THE PUMP LABEL

If no pressure gauge is fitted on the plant, the installation of a temporary pressure gauge is recommended in order to check that the actual pressure at the start-up doesn’t exceed the maximum allowable pressure.

⇨ pumps are self-priming, however some priming problem could be encountered with pumps having very low flow rate, small plunger diameter, with back pressure valves installed and in presence of high discharge pressure. In these cases it could be necessary to aid priming purging air from pumphead and suction line.

WARNING

If the pumped liquid is toxic, poisonous, aggressive, flammable or for any reason dangerous, use particular care avoiding accidental leakages through gaskets or pipes during start-up or maintenance operations.

Moreover follow all the recommendations of the manufacturer for handling and the local laws relevant to safety during handling and disposal of dangerous substances.

4. MAINTENANCE

4.1 Precautions

- Before servicing pump or plant verify that all electric connections (power and control) have been disconnected from mains and are no more fed.
- Always work wearing the required safety protections.
- Depressurize completely pump and pipes and drain the section in which maintenance is required
- Don’t pour in the ambient polluting substances such as pumped chemicals, hydraulic liquid, lubricating oil a.s.o.
- Before servicing pump or plant read carefully the technical specification of the handled fluids with particular respect to the actions that must be done in case of accidental contact with a dangerous fluid.

4.2 Mechanism

Pumps are generally supplied complete with the first oil filling; replace oil after 1500 operation hours and afterwards every 4000 hour.

However replace oil every year .
Use the recommended oils listed above or equivalent.
Check weekly the oil level and, when required, restore the correct level using the same oil; check also for possible leakages through the lip seal on the piston rod and if necessary replace the lip seal.

ATTENTION!
Please use only oil with these features:

ISO VISCOSITY GRADE 320

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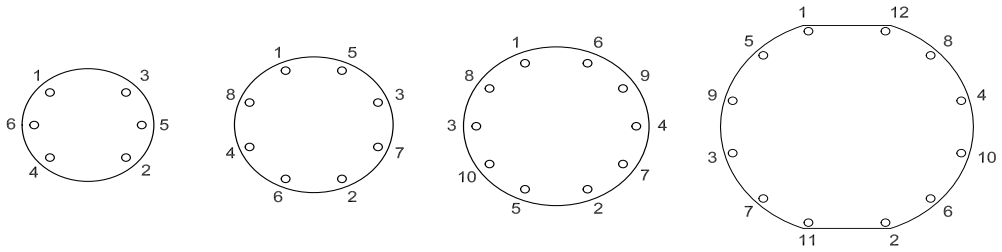
4.3 Pumphead

Don't let the pump running without process liquid.
Every week or 40 working hours check:

- the hydraulic liquid level in the VSR bowl, the correct level is indicated on a label sticked on the bowl, if required top up using the same hydraulic liquid. The first filling at our workshop is generally made using glycol (car antifreeze) diluted with 50% of water, however verify on the test certificate the hydraulic liquid used.
- possible leakage through the plunger packing

As minimum every six months, dismount the pump head as described at para 4.3.1 and carry out the following operations:

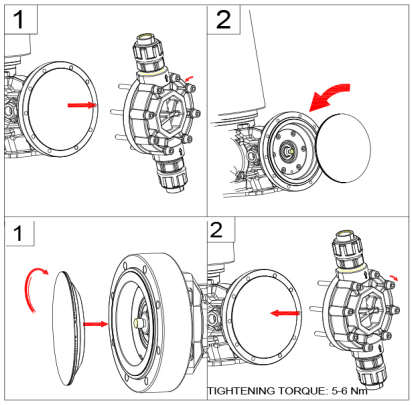
- wash thoroughly the suction and discharge valves and verify whether any part is worn or scratched; replace them if required
- replace plunger packing in case it is worn; grease new seals before assembling
  check the plunger sliding surface where seals operate; the surface should be without scoring or scratches; when damaged replace the plunger and the membrane if worn.
- Retighten the screws of the pump casing with a torque of 3 Nm as shown below; repeat the crisscross pattern with a torque of 6 Nm



4.3.1 Procedure disassembly and reassembly head

Dismounting

Mounting



4.4 Recommended spares

In order to face normal service problems and to avoid possible waste of time, we suggest to keep in stock a small supply of the following spares:

- Suction valve complete
- Discharge valve complete
- One set of diaphragms
- Complete pump head

When ordering spares, please indicate always the model and the serial number of the pump

5. TROUBLESHOOTING		
Trouble	**Possible cause**	**Remedy**
Flow rate too low or no flow rate	Suction tank sealed without vent	Install vent or open tank cover
	Suction of air through fittings, gaskets, etc.	Tighten connections
	Air/gas pockets into the pump or in the pipes	Facilitate air exit
	Suction filter or suction line clogged	Wash filter and/or remove occlusion
	Check valves closed	Open valves
	Excessive suction head	Reposition pump at the correct elevation
	Vapour pressure too high, liquid temperature too high	Cool liquid
	Viscosity too high, liquid temperature too low	Heat liquid
	Pump valves dirty or worn	Wash valves or replace them
	Strokes per minute less than rated	Check speed and electrical feeding
	Suction pipe diameter too reduced	Check suction line for length and diameter
	Pressure relief valve set at a value lower than the maximum discharge pressure	Check pressure relief valve setting and actual operating pressure
	Wrong stroke length	Check stroke length and adjust if required
	Excessive leakage through packing	Tighten packing, check plunger and packing for wear; replace worn parts
	Pressure relief valve in operation or leaking	Check for correct setting and/or clean pressure relief valve
	Diaphragm Pump	
	Integral relief valve or replenishing valve are leaking	Check or clean valves
	Air in the hydraulic liquid	Purge hydraulic chambers
Flow rate too high	Discharge pressure lower than suction pressure	Install a back pressure valve
	Wrong stroke length	Check stroke length and adjust if required
	Back pressure valve faulty or setting pressure inadequate	Reset back pressure valve or replace it
	Strokes per minute more than nominal	Verify electrical feeding
Electric motor overheating	Discharge pressure too high	Check pressure relief valve setting
	Discharge line uncorrectly sized	Check discharge line length and diameter
	Wrong electrical connections	Check and rectify connections
Noisy operation	Lack of lubricant in the mechanism/gearbox	Refill with the correct lubricant
	Excessive wear of the mechanism/gearbox	Overhaul mechanism/gearbox
Pipes vibrations	Pipe diameter too small	Enlarge pipe diameter
	Pulsation damper out of operation or too small	Repair or recalculate damper volume

6. HANDLING AND TRANSPORTATION

6.1 Handling

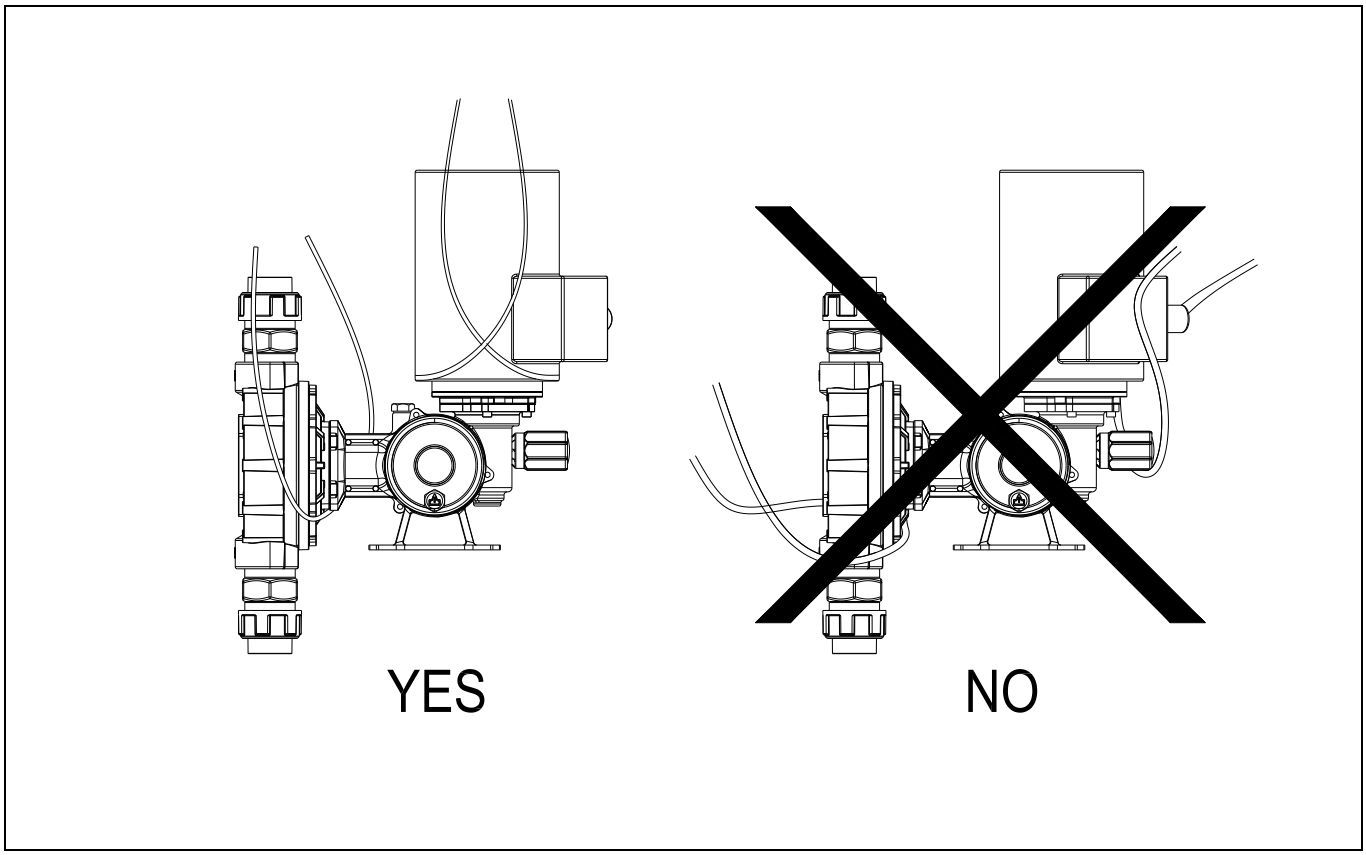
The correct way to handle the pump is shown on the drawing here below.
If the pump is assembled on a baseplate with lifting lugs use them for handling.

⇨ **in any case note the following instructions:**

- **do not sling, pull, push** the pumphead nozzles or flanges
- **do not sling, pull, push** the pressure relief valve bowl
- **do not sling, pull, push** the adjustment knob
- **do not sling, pull, push** the plunger

⇨ **when lifting loads pay attention to the following**

- dress helmet, accident protective shoes and gloves
- do not stand under hanging loads
- do not hand lift overload
- when hand lifting load do not assume position that can be dangerous for the spinal column and dorsal muscles



6.2 Storage and preservation

pumps are delivered completely filled in with lubricant oil into the mechanism and with the hydraulic fluid into the pumphead.

WARNING

During transportation and during storage pump must be protected against moisture, salt water, rain, sand storm and direct sunligth.

Should the pump be stored for a long time, proceed according to following instructions:

A. Storage in a dry and ventilated place

Pump can be stored for a period of one year without taking any special precaution

B. Storage in places with high humidity

Pump must be hermetically sealed and protected against perspiration using an adequate quantity of silica gel; then storage for one year is possible.

C. Storage outdoor

In addition to recommendation of point B, additional protection against rain, sand, dust, dirty and direct sunlight are required.

D. Precaution after installation of a pump

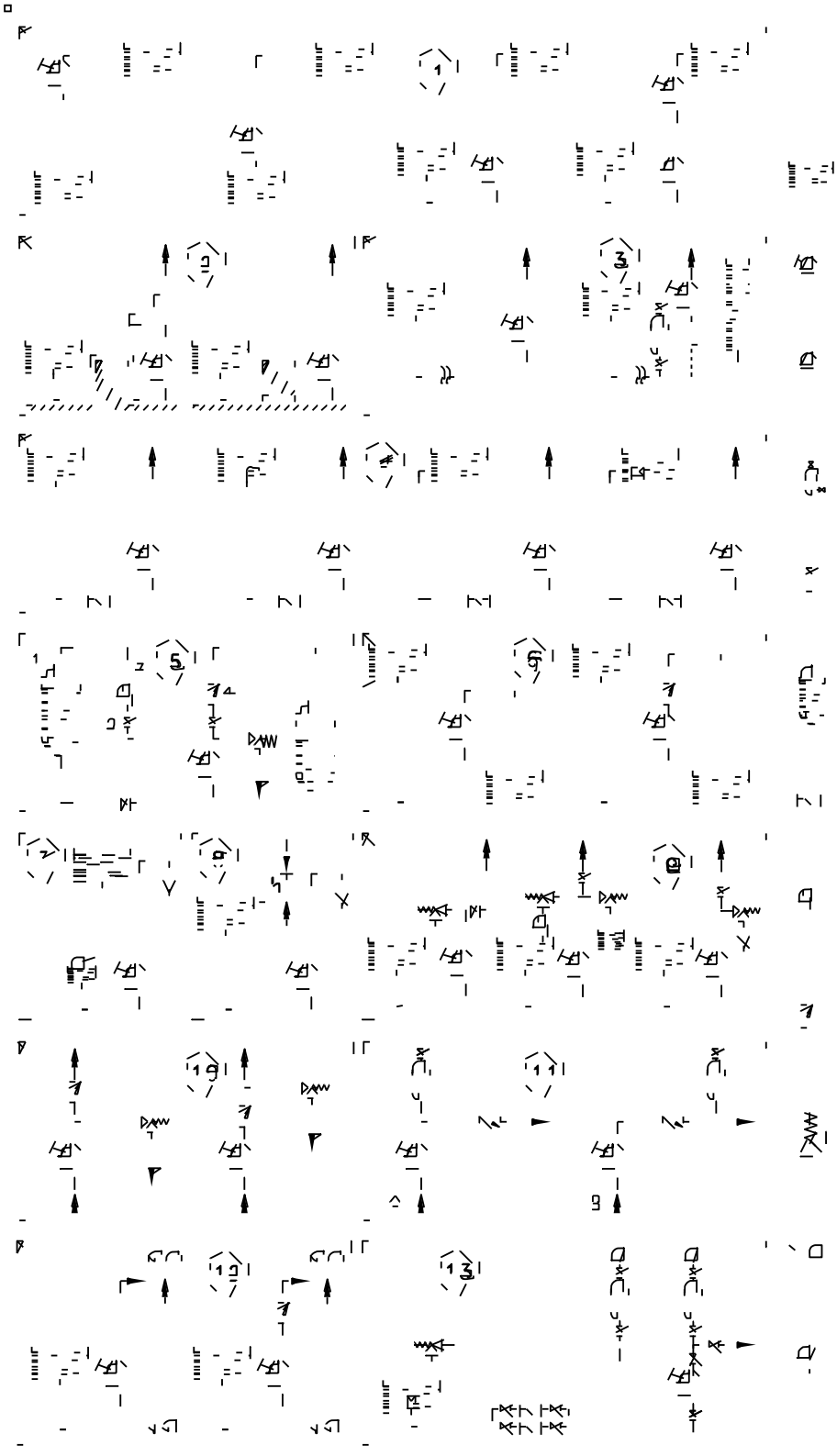
Before start-up check that mechanism and hydraulic chamber are correctly filled in.
If the put in operation is delayed, the metering pump should be started for one hour approx. every month with the stroke length at “zero”, see paragraph 1.3.1.

However the lubricant oil of the mechanism must be changed every year.

Replace again the lubricant oil in the mechanism before the actual start in operation.
Should the pump be out of operation for a long period after installation, the additional following precautions must be taken:

- disassemble pumphead completely and wash all parts carefully
- disassemble, clean and grease the packing; reassemble it without tightening the packing gland
- grease all machined parts
- pour protective lubricant into the movement and gearbox; operate the pump for some minute
- when restarting, drain protective lubricant and refill with suitable lubricant
- keep the pump in a dry place and adequately protected from dust

Installation suggestions table



SERBATOIO TANK TANK	DEPÓSITO RESERVOIR
POMPA DOSATRICE DOSING PUMP DOSIERPUMPE	BOMBA DOSIFICADORA POMPE DOSEUSE
POMPA AUSILIARIA BOOSTER PUMP HILFSPUMPE	BOMBA AUXILIARA POMPE AUXILIAIRE
POLMONE SMORZATORE PULSATION DAMPER PULSATIONDÄMPFER	DEPÓSITO DE COMPENSACIÓN POUMON AMORTISSEUR
VALVOLA ON-OFF VALVE VENTIL	VÁLVULA VANNE
SERBATOIO IN PRESSIONE PRESSURIZED TANK TANK UNTER DRUCK	DEPÓSITO EN PRESIÓN RESERVOIR PRESSUR
FILTRO A “Y” “Y” FILTER “Y” FILTER	FILTRO DE “y” FILTRE A “Y”
SPIA WINDOW SCHAULGLAS	MIRILLA TEMOIN
VALVOLA DI CONTROPRESSIONE CHECK VALVE GEGENDRUCKVENTIL	VÁLVULA DE CONTRAPRESIÓN VANNE DE CONTREPRESSION
VALVOLA DI SICUREZZA PRESS RELIEF VALVE SICHERHEITSVENTIL	VÁLVULA DE SEGURIDAD VANNE DE SECURITE
VALVOLA A GALLEGGIANTE FLOAT-OPERATED VALVE SCHWIMMERVENTIL	VÁLVULA FLOTANTE VANNE A FLOTTEUR
MANOMETRO PRESSURE GAUGE MANOMETER	MANÓMETRO MANOMETRE

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