

# PROCESS HYDRAULIC DIAPHRAGM METERING PUMPS

SERIE

L

POSITIVE RETURN

VERSION

# X9



**HYDRAULIC CIRCUIT WITH BUILT-IN RELIEF VALVE AND  
MECHANICALLY ACTUATED REPLENISHING VALVE**

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OPERATING MANUAL




Issue 2005



English

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CUSTOMER					
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ENCLOSES					
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	CHAPTER	PARAGRAPH	PAG.
1	GENERAL CHARACTERISTICS	1.1 - general characteristics of the metering pumps	1
		1.2 - flow rate	2
		1.3 - to manual adjustment of the capacity	2
		1.4 - to manual adjustment of the capacity by means of gravitational clock	3
2	INSTALLATION OF THE PUMP	2.1 - installation of the pump	4
		2.2 - suction	4
		2.3 - suction line	5
		2.4 - suction side filter	7
		2.5 - suction piping for viscous liquids	7
		2.6 - discharge	8
		2.7 - installation of pulsation dampers	9
		2.8 - safety valve	10
		2.9 - installation of the pressure gauge	11
		2.10 - to fill pump casing with oil	12
3	START UP	3.1 - fixing of the pump	13
		3.2 - pump startup	13
4	MAINTENANCE	4.1 - routine maintenance: check valves LY - LK - LN - LP	14
		4.2 - replacement diaphragm & filling oil chamber	16
		4.2.1 - LY AISI/PVC	17
		4.2.2 - LK AISI/PVC	18
		4.2.3 - LN-LP AISI/PVC	20
		4.3 - preventive maintenance	21
		4.4 - metering pumps type LP-LN knob adjustment friction setting	21
5	 MACHINERY DIRECTIVE	General safety norms	26
		CE conformity declaration	27
ENCLOSES	OVERALL DRAWING	DWG. No. _____ REV. ____	
	SECTIONAL DRAWING	DWG. No. _____ REV. ____	
	DIAPHRAGM RUPTURE DETECTOR	DWG. No. _____ REV. ____	

## 1.1 - GENERAL CHARACTERISTICS OF THE METERINGS PUMPS

Metering pumps are controlled-volume reciprocating pumps. The reciprocating motion generates a sinusoidal delivery of the flow, i.e. the flow of the pumped product is of pulsating nature, not continuous.

### TYPES OF METERING PUMPS:

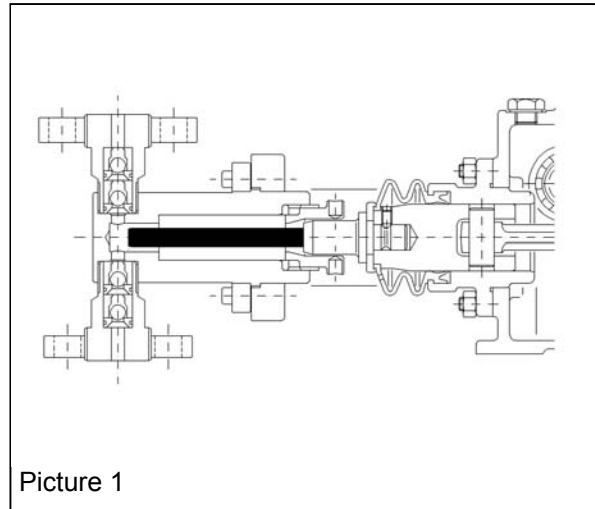
The basic types of metering pumps are:

- **Plunger pumps:**

the process fluid is in direct contact with the plunger and its packing. The plunger sucks the process fluid into the pump head (suction stage) and then discharges it through the pump head discharge valve (compression stage) (**picture 1**).

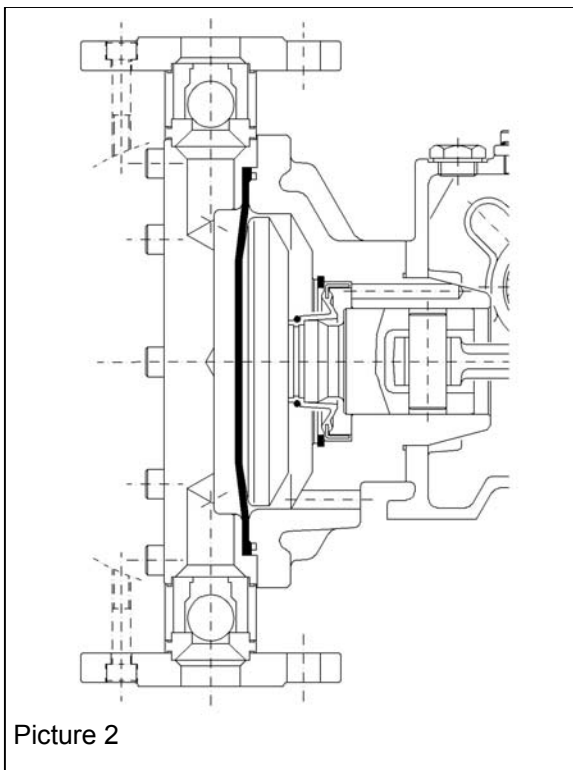
- **Mechanical diaphragm pumps:**

the process fluid is in direct contact with a diaphragm and isolated from the pump's thrust mechanism. The mech is not supported by a hydraulic fluid and therefore bears directly the thrust generated by the process fluid pressure. The mechanical diaphragm carries out the suction and compression stages, its motion transmitted by the pump thrust mechanism is axial (**picture 2**).

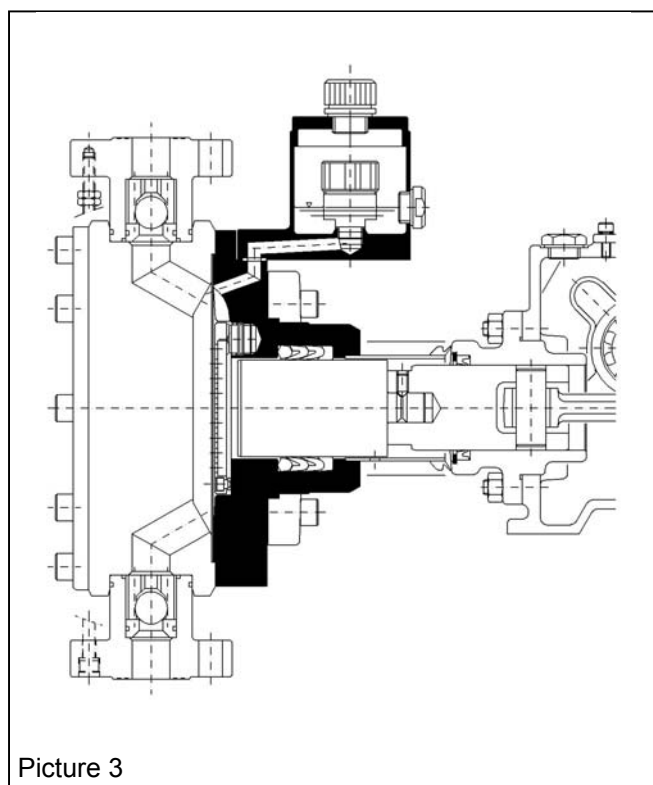


- **Hydraulic diaphragm pumps:**

The pumped product is in contact with a diaphragm and isolated from the pump thrust mechanism. The hydraulic diaphragm is placed between two liquids (process product and hydraulic oil) and is subject to compression on its thickness only. The hydraulic system (behind the diaphragm) transmits the volume displaced by a reciprocating piston causing a regular flexure of the diaphragm resulting in a spherical segment whose volume corresponds to the volume displaced by the piston. Suction and compression stages are carried out by the piston. The hydraulic system of all hydraulic-diaphragm metering pumps is of the "intelligent diaphragm" type, also called "mechanical oil replenish-



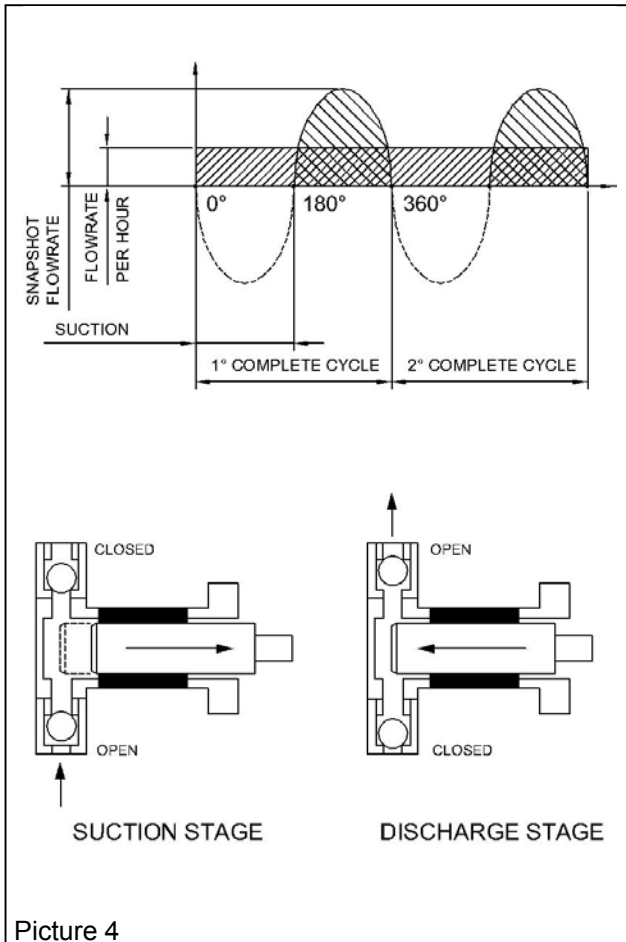
ment". Besides the safety valve, this system is provided with air bleed valve and mechanically operated oil replenishing valve (**picture 3**).



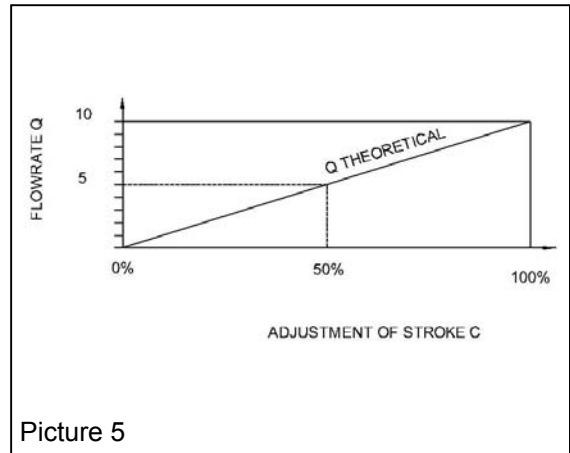
1.2 - FLOW RATE

The reciprocating motion of the metering pump is converted into flow thanks to the inlet and outlet check valves of the pump head (picture 4).

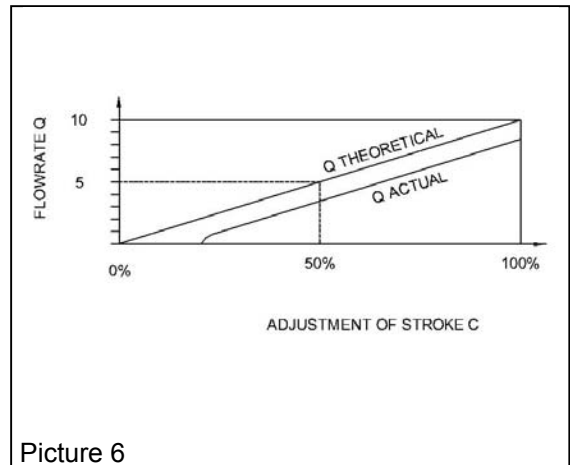
During the suction stage the inlet valve opens because of the vacuum created by the piston (or by the mechanical diaphragm) while the outlet valve remains closed. The product enters the pump head and goes out through the outlet valve when pushed by the piston during the compression stage.



Picture 4



Picture 5



Picture 6

• **Theoretical flow rate**

The theoretical flow rate corresponds exactly to the volume displaced by the piston during its motion. Its graphic representation is a diagonal straight line whose progression is determined by the piston stroke (picture 5).

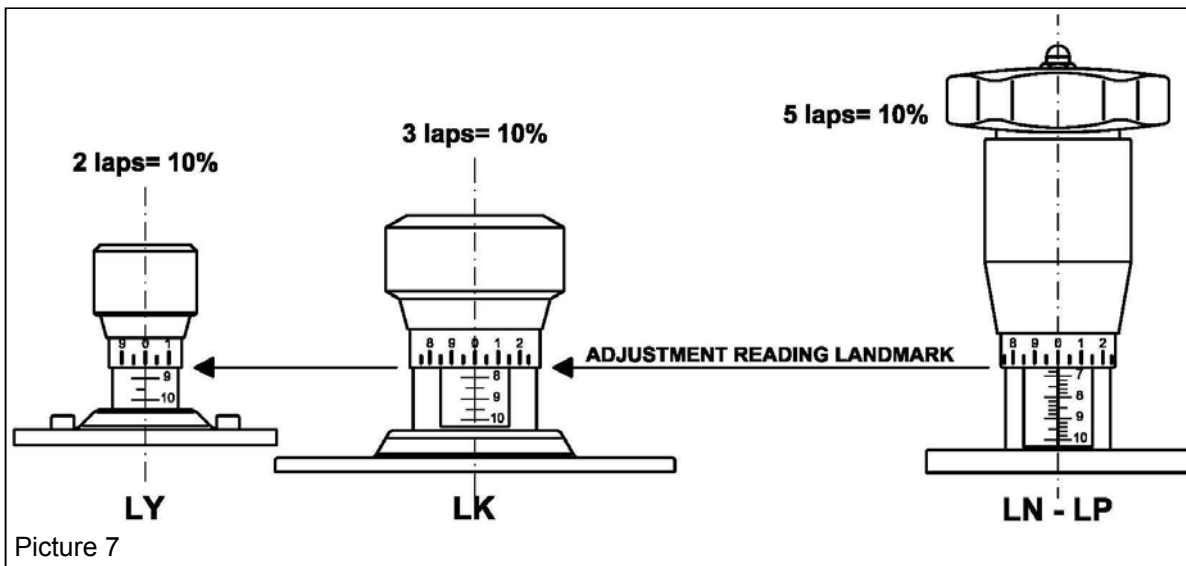
• **Actual flow rate**

The actual flow rate is inevitably less than the theoretical flow rate because of the losses due to the reaction time of the valves. The ratio between these two flow rates determines the volumetric efficiency of the pump. The efficiency depends on pump size, pump head type (plunger or diaphragm), liquid to be pumped, viscosity of the liquid, working pressure, etc. (picture 6).

1.3 - MANUAL ADJUSTMENT OF THE CAPACITY

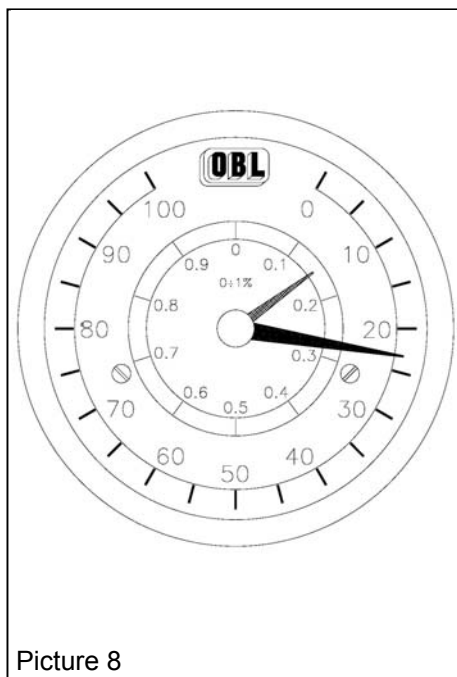
The adjustment of the piston stroke is stepless and regular, and can be carried out at any time, i.e. when the pump stands still or is running. However, the adjustment is easier when the pump is running, specially in the case of models with large-size pistons. The capacity is adjusted by turning the specific knob. Regulation range: linear indexing from 0 to 10 (picture 7).

The lower edge of the adjustment knob establishes the reference with the piston stroke. Graduations are as percentage of the total piston stroke.



**1.4 - TO MANUAL ADJUSTMENT OF THE CAPACITY BY MEANS OF GRAVITATIONAL CLOCK**

The adjustment of the capacity is stepless and regular and can be carried out either when the pump is at rest or in operation. The gravitational clock enables a clear, exact and quick readout. The dial has a scale from 0 to 10. Each turn of the handwheel corresponds to 1% increase of the capacity. (picture 8)



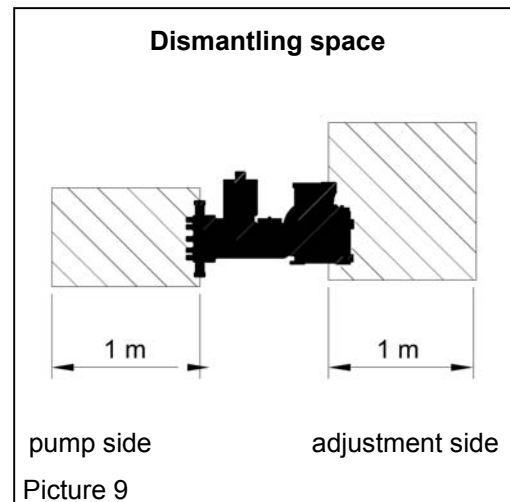
## 2.1 - INSTALLATION OF THE PUMP

Provide adequate clearance areas and safe access for operation and maintenance, in particular in front of the hydraulic side and of the adjustment knob (**picture 9**).

If the pump is installed outdoors, a shelter is recommended, specially when the pump is equipped with controls or other delicate devices.

Fit adequate drains on the discharge piping, close to the pump head, so as to make the disconnection of the pump from the plant easier. When the pumps are provided with vertical axis flanges, fit also a removable joint so as to facilitate the disconnection of the pump (**picture 10**).

PVC pump heads can work properly only at ambient temperatures and metered liquid temperatures lower than 40°C. If necessary, provide suitable protection from sun rays and check the temperature of the metered liquid. Ceramic pistons cannot be used for pumping temperatures above 80°C.



## 2.2 - SUCTION:

Metering pumps can operate with suction lift. However, it is advisable to set the pump under head in order to improve metering accuracy and volumetric efficiency, and to make starting easier. The "under head" setting is practically a necessity when the vapour pressure of the liquid is very high. Following condition is essential for a good performance of the pump:

NPSH plant > NPSH pumps

(NPSH = net positive suction head).

To get a good metering accuracy, it is necessary that the pumps have an NPSH of more than 4 m, i.e. an absolute suction pressure of 4 m.

The NPSH of the plant is obtained from the formula:

$$\text{NPSH} = Pb \pm \frac{Pc}{\gamma} - Tv - Pt \text{ where:}$$

**Pb** = barometric pressure

**Pc** = pressure of liquid column, positive (+) or negative (-)

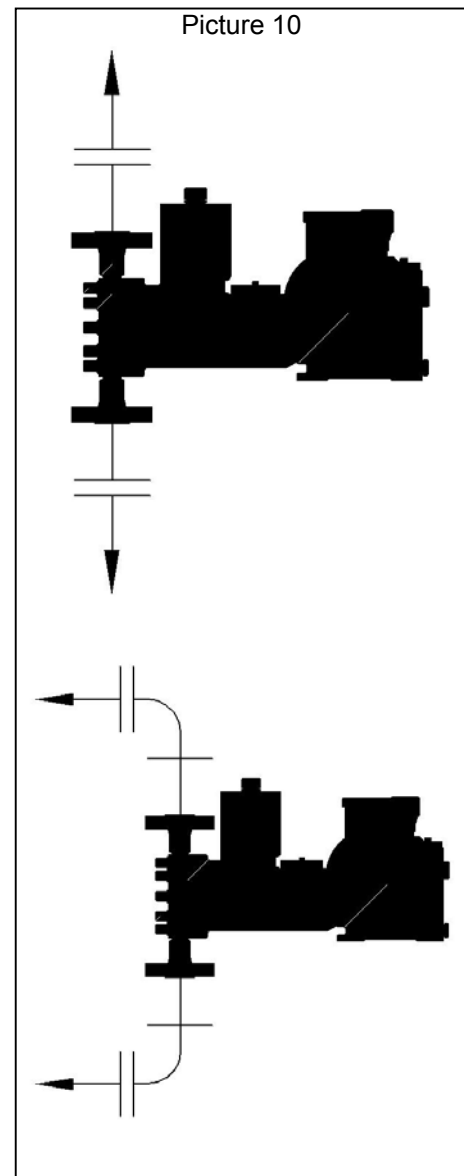
$\gamma$  = density of the liquid

**Tv** = vapour pressure of the liquid

**Pt** = head losses in the suction piping.

When you are designing a plant, consideration should be given to the following factors:

- a metering pump is a displacement pump;
- flow rate and pressure are of pulsating nature, their frequency is determined by the number of cycles of the piston;
- the flow rate is determined by:  
volume generated by the section x piston stroke x number of cycles.



## 2.3 - SUCTION LINE

A proper installation and sizing of the suction line are of particular importance for a correct operation of the pump. The following factors shall be taken into account:

A) Pipe inside diameter

B) Length of the piping

C) Arrangement of the suction line

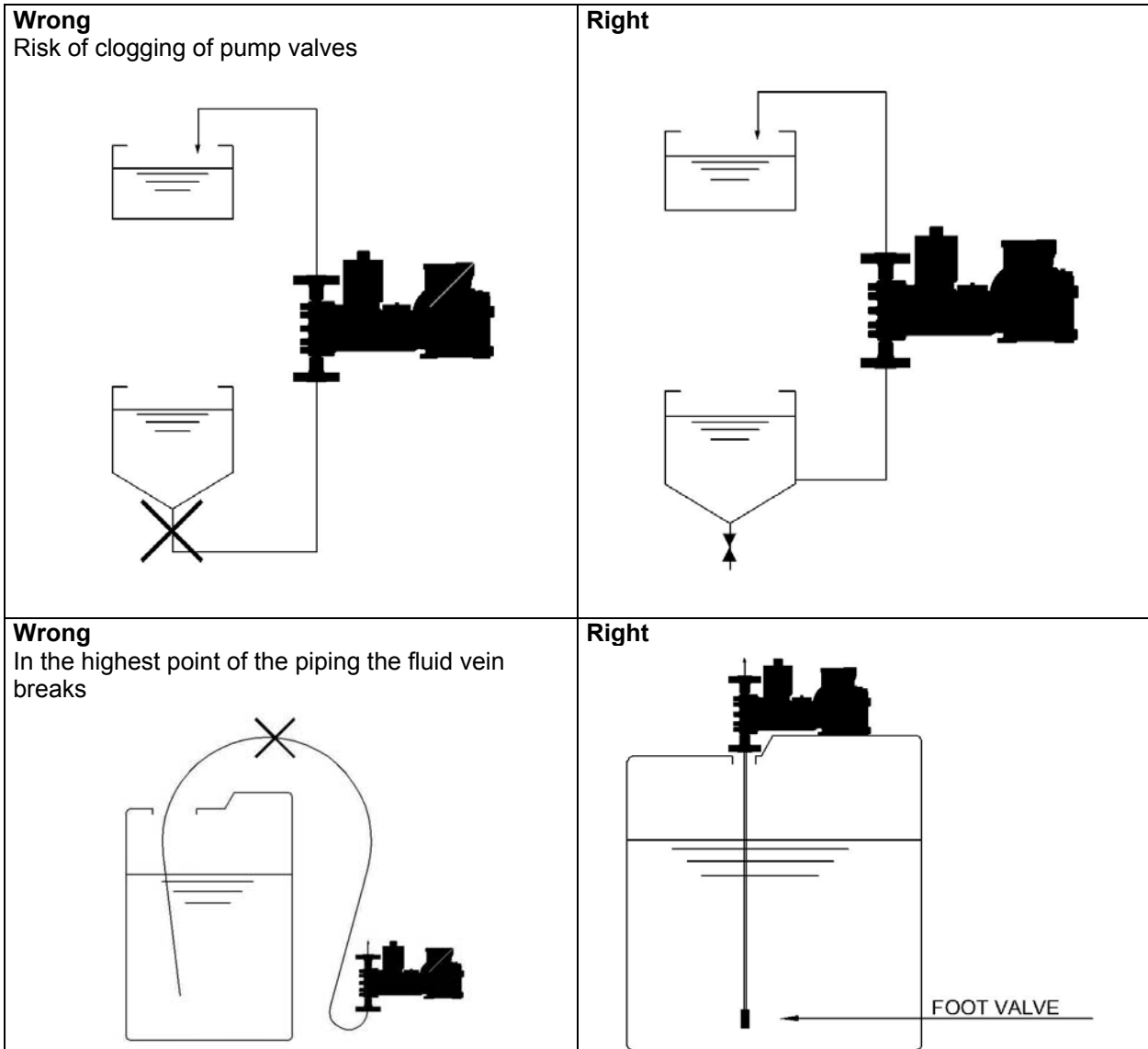
TABLE A	
Relationship between flow rate and pipe size (validi for water)	
Max flow rate L/h	Pipe size
0 ÷ 15	Ø 4x6
0 ÷ 30	Ø 1/4"
0 ÷ 125	Ø 3/8"
0 ÷ 200	Ø 1/2"
0 ÷ 300	Ø 3/4"
0 ÷ 500	Ø 1"

A - The pipe I.D. will be chosen as a function of the pump flow rate (see table A).

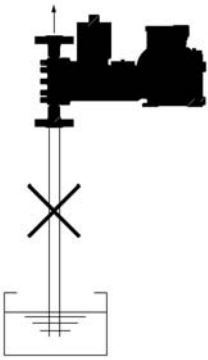
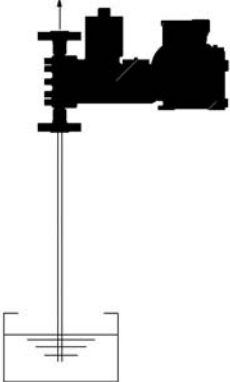
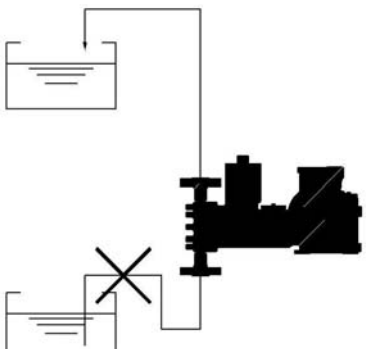
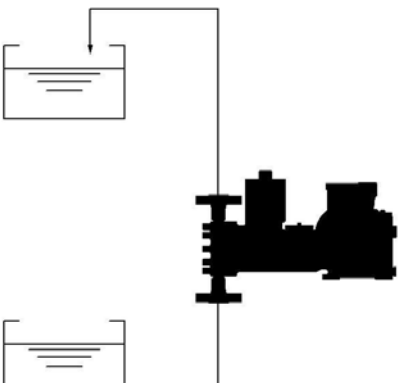
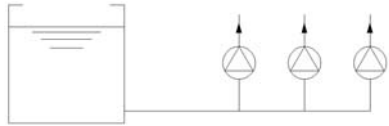
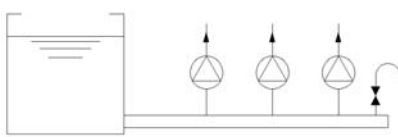
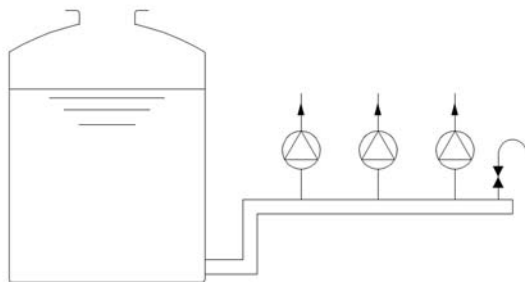
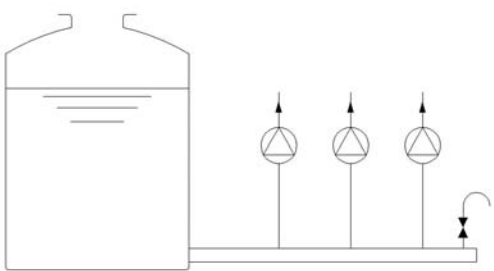


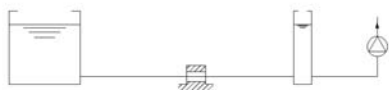
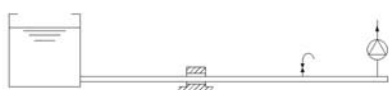
B - The suction piping length should be as short as possible, while the height shall not exceed 3 m.

C - With regard to the arrangement of the suction line see figure 10 below.

Picture 11



Picture 11

<p><b>Wrong</b> Pipe size not in accordance with tab. A</p> 	<p><b>Right</b></p> 
<p><b>Wrong</b> Irregular suction</p> 	<p><b>Right</b></p> 
<p><b>Wrong</b></p> 	<p><b>Right</b></p> 
<p><b>Wrong</b></p> 	<p><b>Right</b></p> 
<p><b>Wrong</b></p> 	<p><b>Suggested installation</b></p>  <p><b>Suggested installation</b></p>  <p><b>Suggested installation</b></p> 



## 2.4 - SUCTION SIDE FILTER

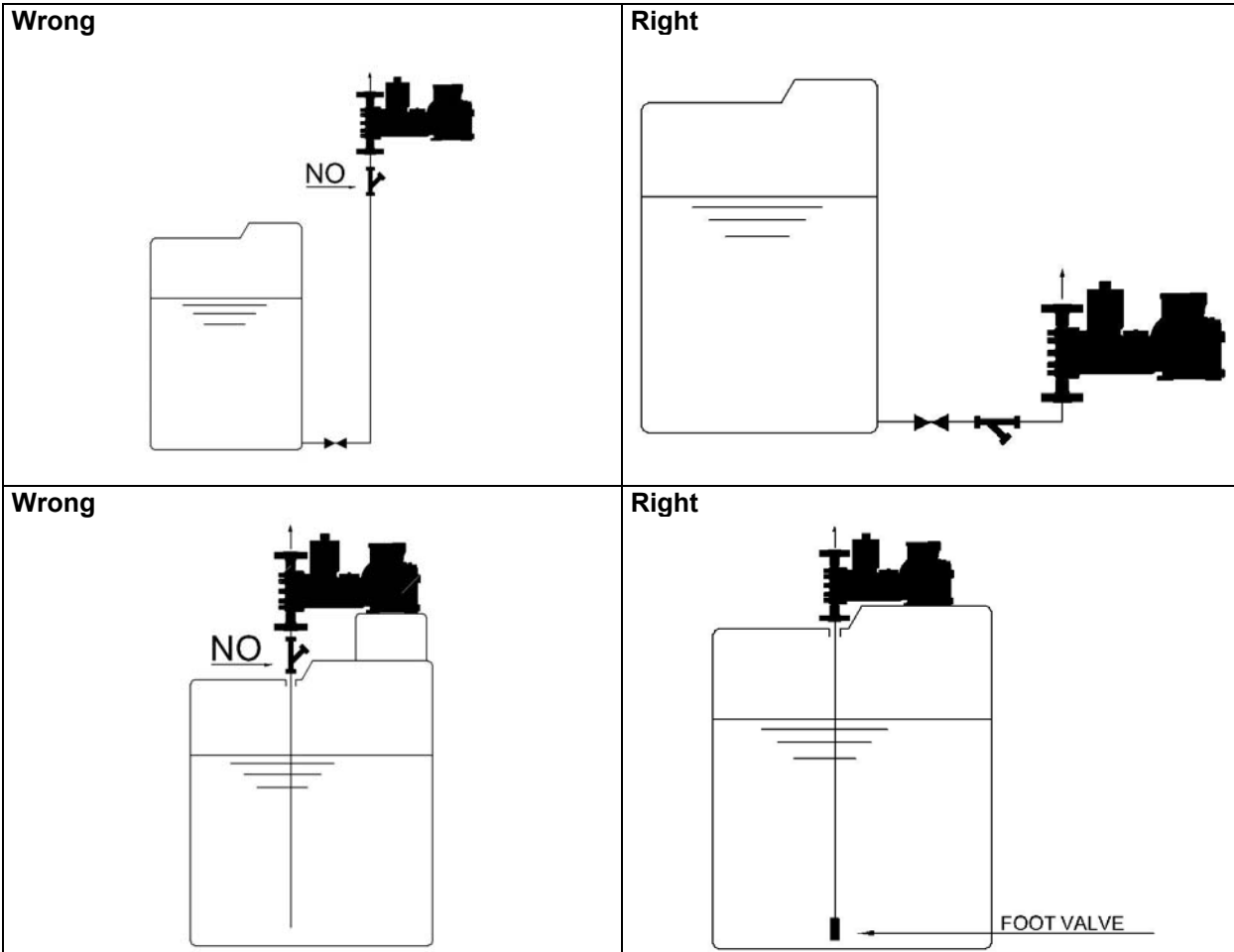
The installation of a filter on the suction side is always advisable, particularly when the liquid to be metered contains suspended particles.

**Caution:** a small-sized filter will affect the metering performances. Use Y-filters with a size larger than the suction pipe diameter. The characteristics of the filter screen depend on the kind of liquid and pump flow rate. For liquids with viscosity not exceeding 200 cp see table B.

To prevent sucking of impurities, specially when liquids with suspended matters are metered, the suction pipe shall not draw the liquid from the bottom of the tank. The suction point should be at a height of 10 cm from the tank bottom (**picture 12**).

TABLE B	
Max flow rate L/h	Mesch
1 ÷ 15	100
15 ÷ 30	60
100 ÷ 300	40
300 ÷ 1000	30
1000 ÷ 3000	20

Picture 12



## 2.5 - SUCTION PIPING FOR VISCOUS LIQUIDS

Specific technical information is required for the installation of pumps intended for metering viscous liquids

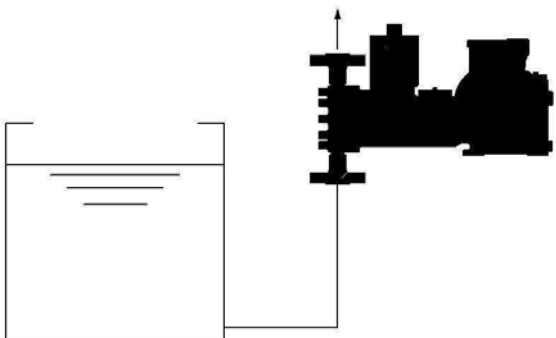
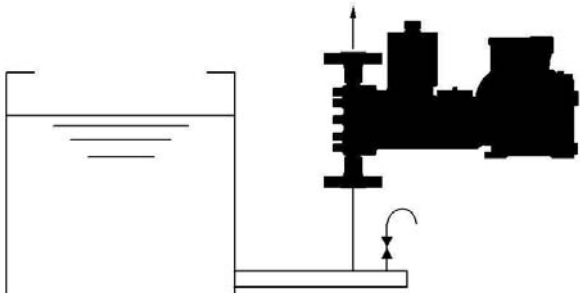
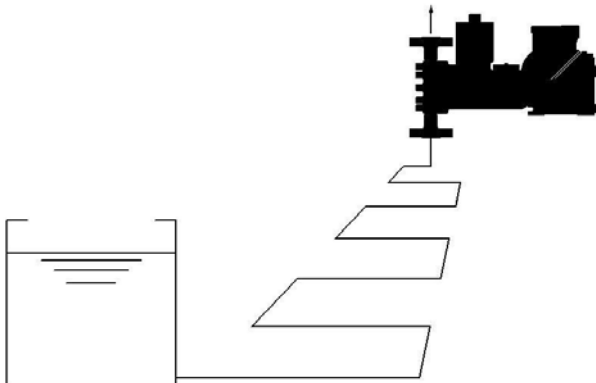
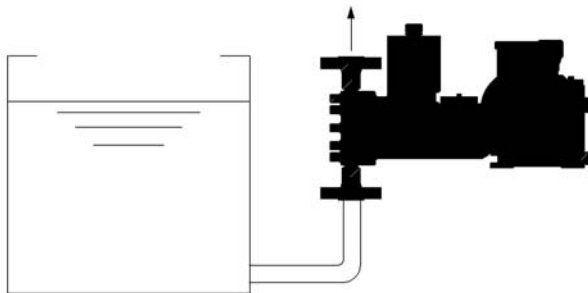
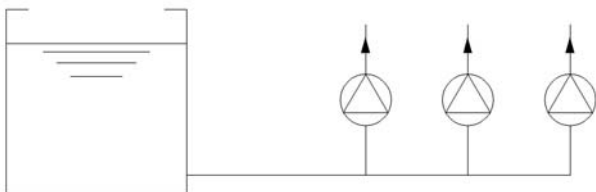
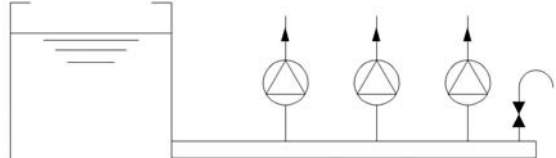
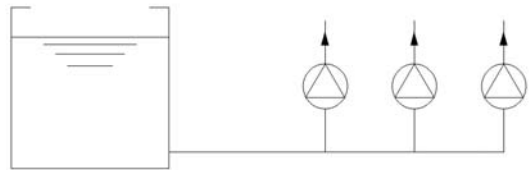
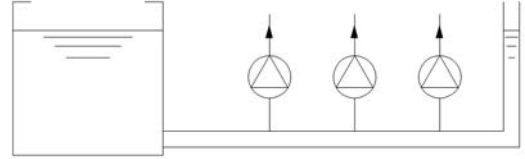
- For this kind of application we recommend stainless steel pumpheads. Spring-loaded discharge valves are also recommended in the event of high-viscosity liquids.
- The suction piping must have an adequate diameter; as a rule, for high-viscosity liquids (2000 cp), select the size immediately above the diameter of the pump suction connections (**picture 13**).

Relationship between strokes per minute "SPM" and viscosity of the liquid "cp" (stainless steel pump head)

TABLE C	
S.P.M.	cp max execution "A"
95 ÷ 104	300
70 ÷ 86	800
50 ÷ 63	1500
36 ÷ 42	2000

- In any case, when viscous liquids are to be metered choose for the pipe at least the same size as that of the pump connections.

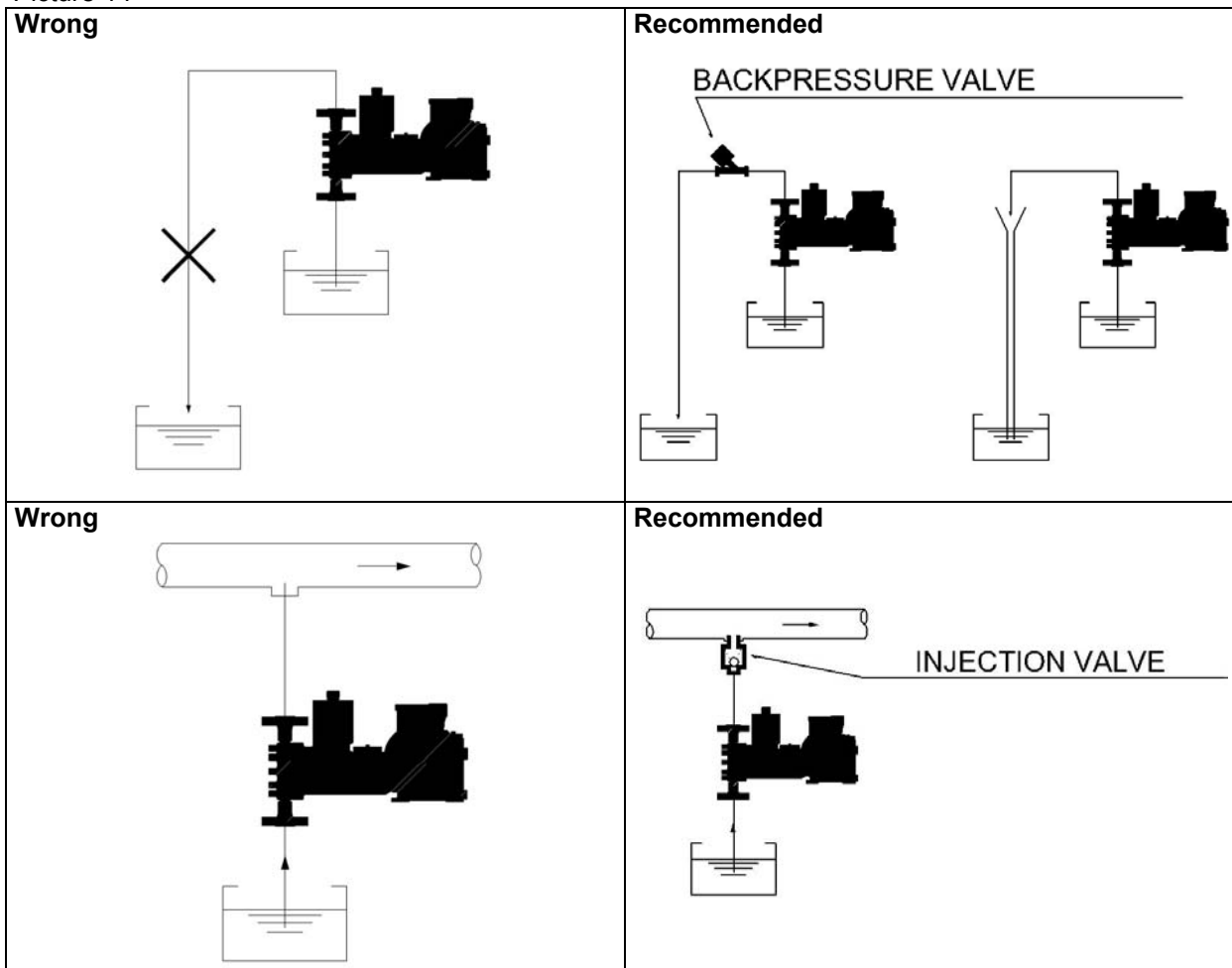
Picture 13

<p><b>Wrong</b></p> 	<p><b>Recommended</b></p> 
<p><b>Wrong</b></p> 	<p><b>Recommended</b></p> 
<p><b>Wrong</b></p> 	<p><b>Recommended</b> Flow rate 0 ÷ 50 l/h</p> 
<p><b>Wrong</b></p> 	<p><b>Recommended</b> Flow rate 50 ÷ 700 l/h</p> 

## 2.6 - DISCHARGE

When the free surface of the liquid in the suction-side tank is at a level higher than the level in the discharge-side tank, a flow from the suction-side tank to the discharge-side tank will occur. To prevent this natural passage of liquid, the discharge pressure must always be at least  $0,3 \text{ Kg/cm}^2$  higher than the suction pressure in case of small flow rates  $0,5 \text{ Kg/cm}^2$ . If for any reason this condition cannot be complied with, it is necessary to create a backpressure by means of a suitable valve, or better to heighten the discharge pipe so as to prevent the siphoning effect (picture 14).

Picture 14



## 2.7 - INSTALLATION OF PULSATION DAMPERS

It is advisable to install a pulsation damper located at the pump discharge connection, specially in case of considerable flow rates (picture 15).

A pulsation damper is indispensable if you want to get a line- or flow rate.

The use of a pulsation damper is recommended because its duration is about 25 times the piston displacement, for "simplex" pumps and when using a damper without gas pre-filling.

The use of this type of self-regulating dampers implies a recharge schedule, in order to compensate the losses due to solution of air in the metered liquid. In the diaphragm-type gas-filled dampers the metered liquid and the chamber are separated by a diaphragm.

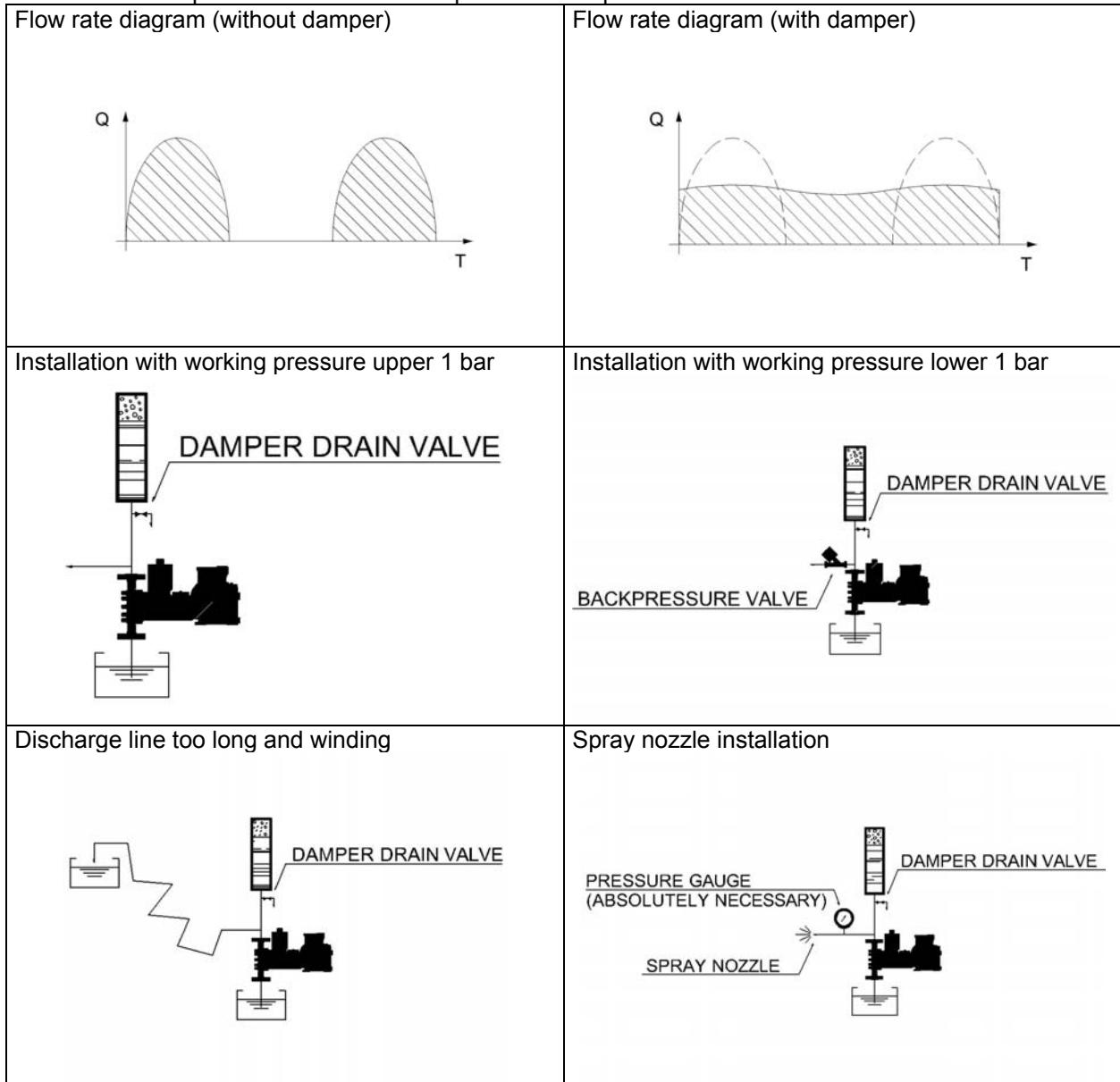
The pulsation damper is an important element for a proper operation of the metering pumps.

The installation of a pulsation damper offers several advantages because this device:

- Protects the metering pump against pressure peaks, thus increasing the duration of life of the pump.
- Prevents vibrations all along the discharge line.
- Makes the flow linear.

The pulsating flow-which is a negative characteristic of all metering pumps - can therefore be prevented by installing a pulsation damper on the discharge line.

Picture 15: examples of installation of the pulsation damper



## 2.8 - SAFETY VALVE

All plunger pumps require a safety valve.

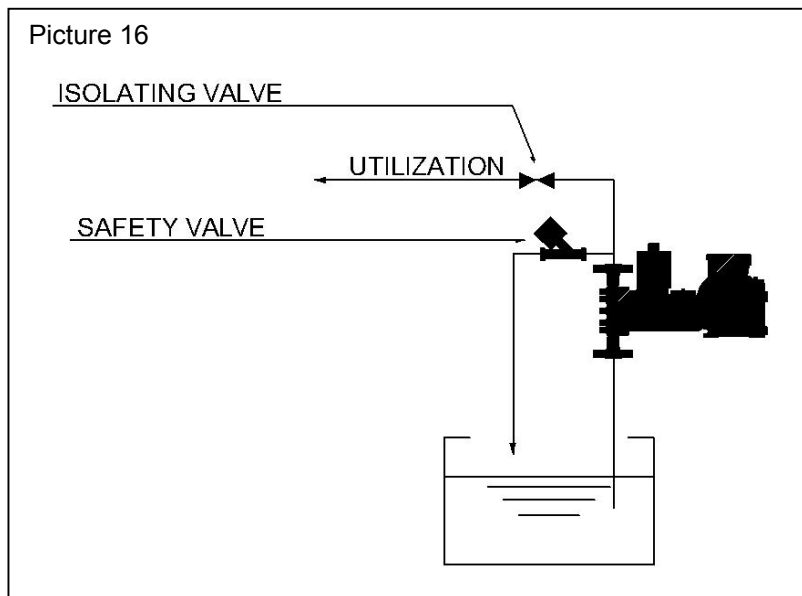
- The safety valve has to be installed immediately after the discharge connection, anyhow before the isolating valve
- The safety valve setting (opening pressure) shall not exceed the pump max. pressure value.
- The safety valve protects the pump from:

**Excessive pressure** (pressure higher than the rated value).

**Operator mistakes** (for ex., stop valve closed on the discharge line when the pump is running).

**Obstruction of the discharge piping** (reduction in section, clogging).

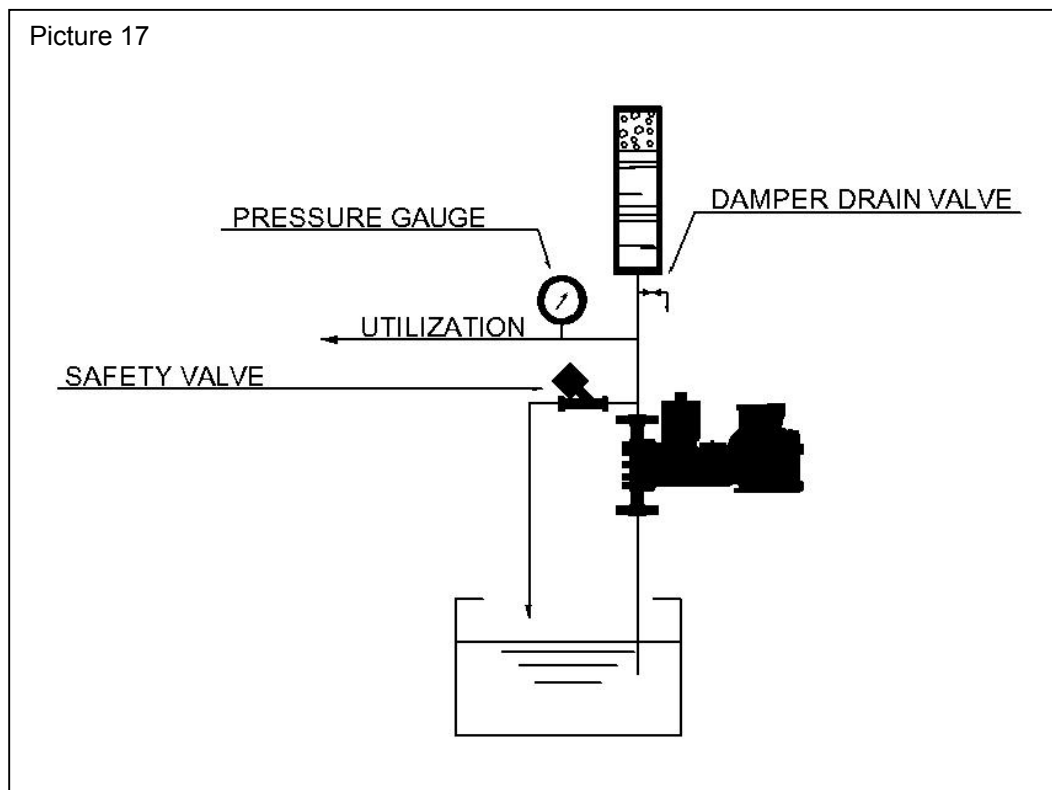
A safety valve is absolutely necessary when an isolating valve is fitted on the discharge line.



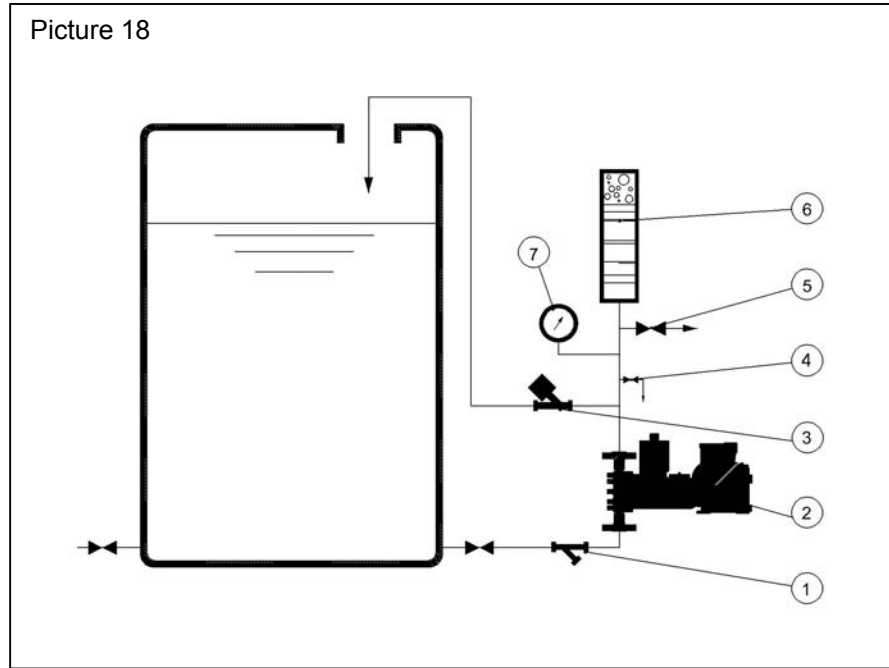
## 2.9 - INSTALLATION OF THE PRESSURE GAUGE

In order to check if the metering pump operates correctly, it is essential to install a pressure gauge on the discharge line, (picture 17).

The pressure gauge shows the actual working pressure of the metering pump. This value shall not exceed the max. allowable pressure of the pump.



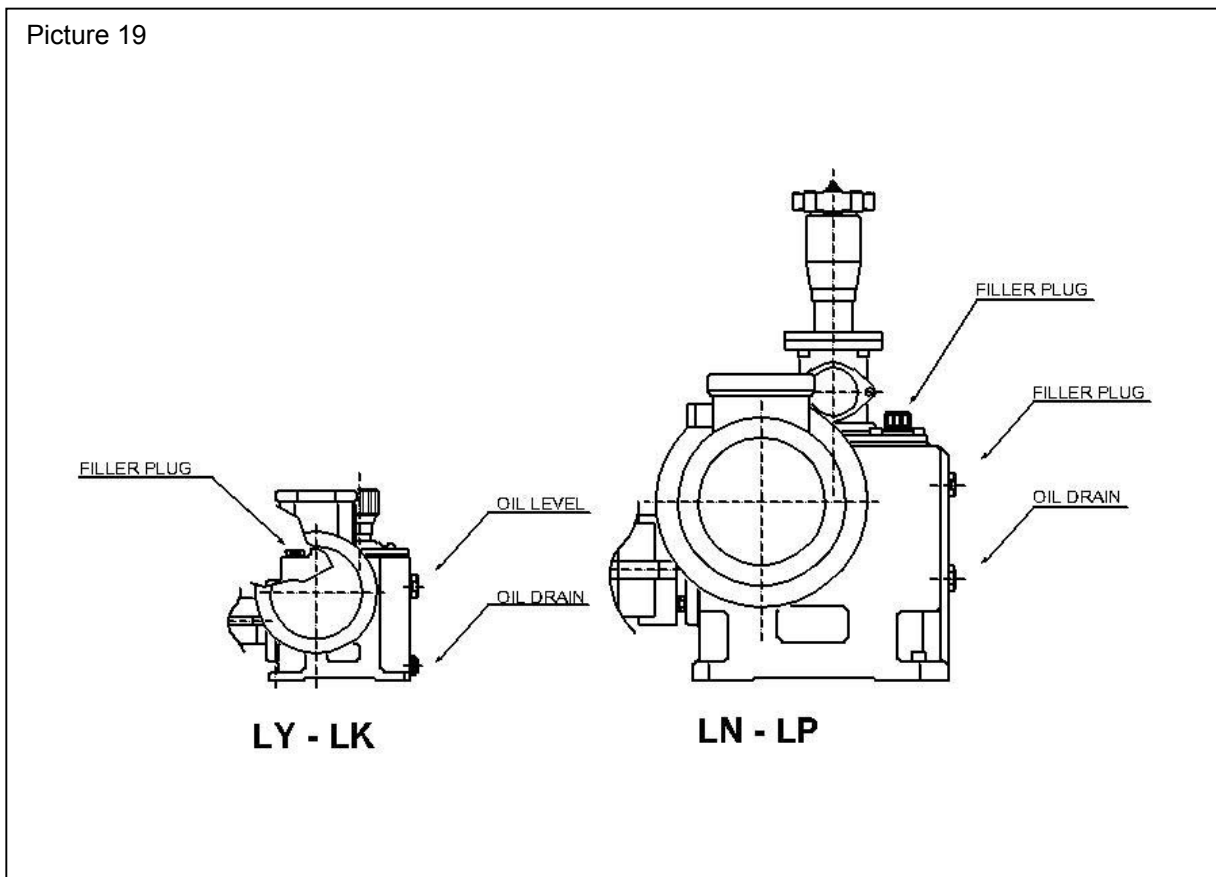
In the figure below shows the correct arrangement of a standard plant.



- 1 - "Y" filter
- 2 - metering pump
- 3 - safety valve
- 4 - drain valve
- 5 - isolating valve
- 6 - pulsation damper
- 7 - pressure gauge

### 2.10 - FILL PUMP CASING WITH OIL

Unscrew the filler plugs located on the pump body and pour lubricating oil into it (picture 19). Pumps are always supplied without oil. For oil type see table **pag. 24**.



### 3.1 - FIXING OF THE PUMP

Before the start up verify the following conditions::

- Make sure that the baseplate is made of steel, stable and even. Do not install the pump directly on a concrete foundation.
- Fix the pump to the baseplate using the specific anchor holes in the pump feet.
- Make sure that the pump valve axis is perfectly upright.
- Before connecting the piping to the pump, it is absolutely necessary to flush the pipelines with water, especially the suction line and relevant feed tank

**This preliminary flushing is often overlooked by the installator; if this operation is not properly carried out, the pump will become a collector of all foreign matters contained in the pipeline and tank, such as weld drops, gasket scraps, soil and other stuff.**

- The pipelines must be independently supported, so as to prevent stresses on the pumphead. Therefore, besides the baseplate, the pump needs a supporting framework for both suction and discharge pipelines.
- It is advisable to fit a cross after the discharge flange. This fitting will facilitate the removal of the pump from the baseplate and can be used for the installation of pressure gauges, safety valves and dampers.
- Make sure that the pump mechanism moves freely. To do this, act manually on the motor fan.
- Make sure that the pipeline fittings and flanges are perfectly tight and in particular that no air enters the suction line, as this would hinder the priming of the pump.

### 3.2 - PUMP STARTUP

The following checks must be carried out before starting the pump:

- Check the oil through the oil window.
- Check all electric connections and also the direction of rotation of the motor (shown by the arrow on motor body).
- Make sure that all on-off valves on the suction and discharge lines are open or closed, according to their function. **It is recommended to seal those valve which could be dangerous if tampered.**
- Make sure that the liquid to be metered has not solidified or frozen inside the piping.
- Carry out the first startup with discharge pressure as low as possible and with adjustment knob set to 20%; keep these conditions about 3 ÷ 5 minutes. Increase gradually the flow rate up to the maximum value, then set the pump to the required working conditions (flow rate and pressure).
- During the first stage check the pump discharge pressure by means of the pressure gauge: the pressure value (max. oscillation of the pointer) shall not exceed the max. pressure indicated on the pump rating plate.

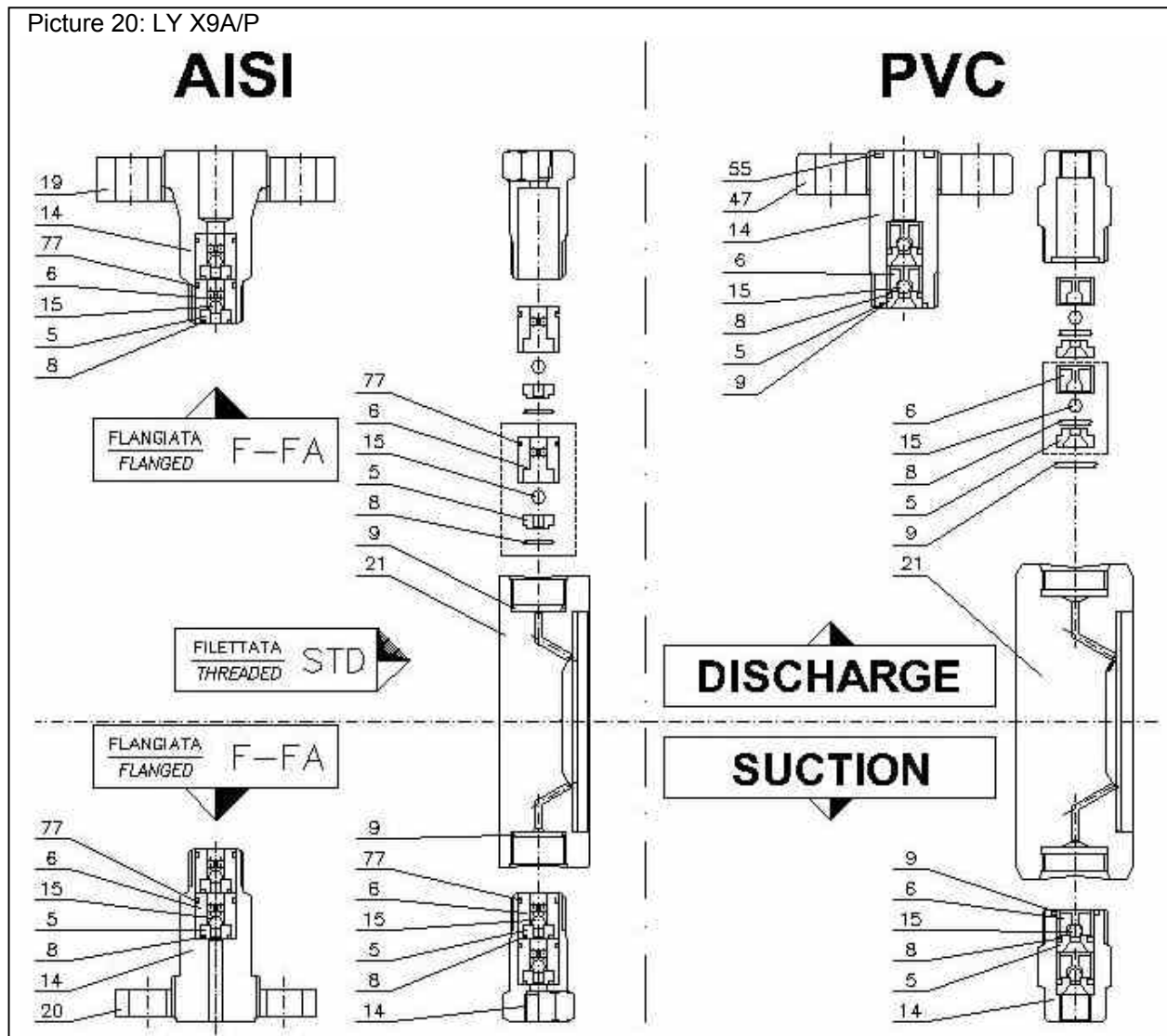
#### CAUTION !

**The pump cannot stand pressures higher than those indicated on the rating plate.**

## 4.1 - ROUTINE MAINTENANCE: CHECK VALVES LY- LK - LN - LP

In case of working defects, before dismantling the hydraulic system, first act on the check valve only. The matters stuck inside the valve cages (6) are the most likely causes of dosing defects. For a correct check act as follows:

Picture 20: LY X9A/P



## A) LY :

(picture 20); To dismantle the valves it is necessary unscrew, first the valve housing (pos.14) and take off the valve balls.

Assuming, that cleaning of the valves is required, proceed as follows on the valve units one at a time:

- Unscrew valve housing (pos. 14) Take note off the arrangement of the various components of the valve unit.
- Extract the valves.
- Clean carefully their seat.(pos. 5)
- If necessary, replace seats and valves.
- Reassemble valve unit exactly as before noted.
- Screw back valve housing (pos. 14)

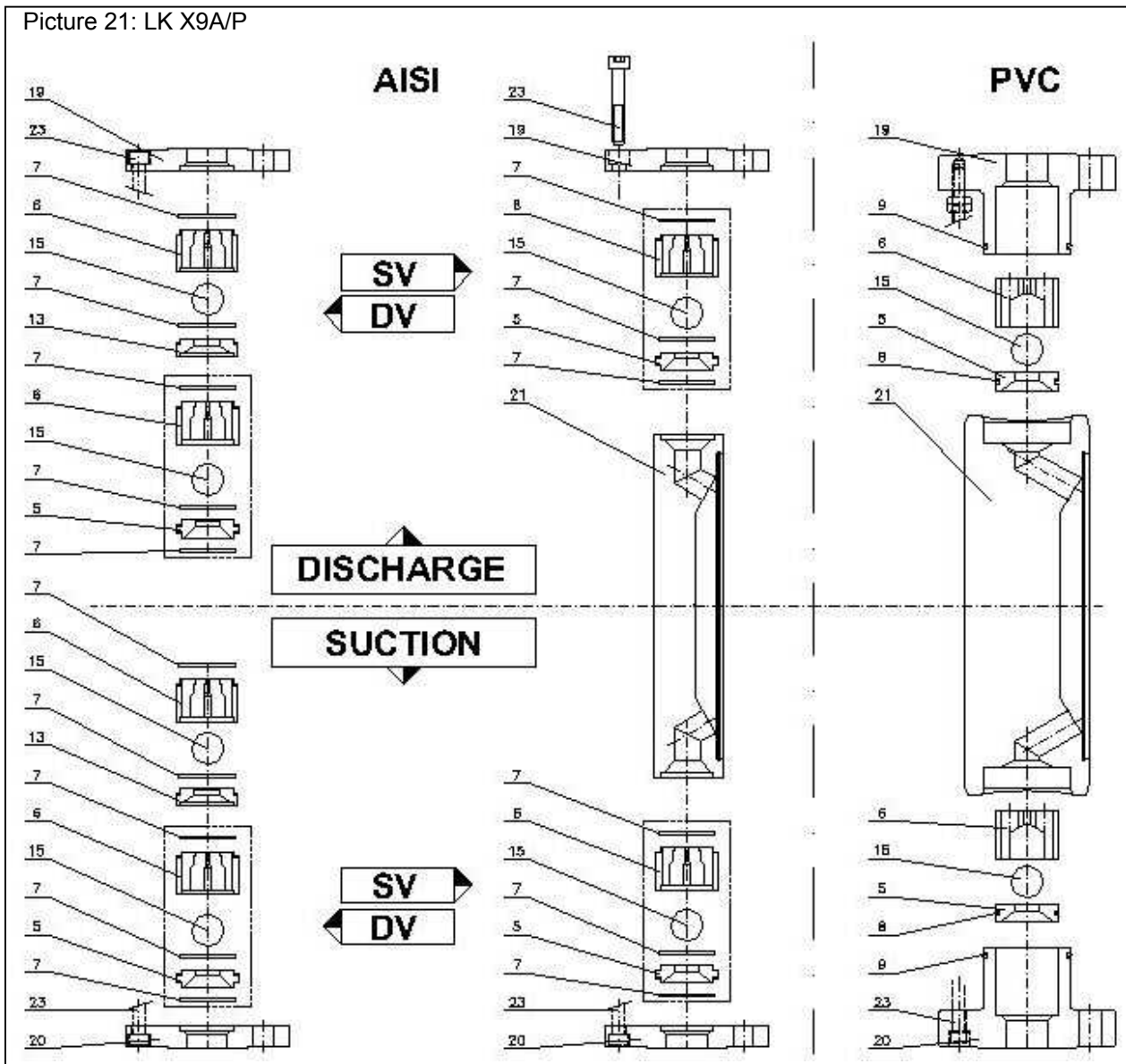
PUMPHEAD COMPONENTS	
DENOMINATION	POSITION
VALVE SEAT	5
VALVE GUIDE	6
VALVE GUIDE O-RING	7
VALVE SEAT O-RING	8
VALVE HOUSING O-RING	9
"DV" VALVE SEAT	13
VALVE HOUSING	14
BALL VALVE	15
UPPER FLANGE	19
LOWER FLANGE	20
HEAD BODY	21
VALVE STAY BOLT	23
FLANGE	47
O-RING	55
VALVE GUIDE O-RING	77



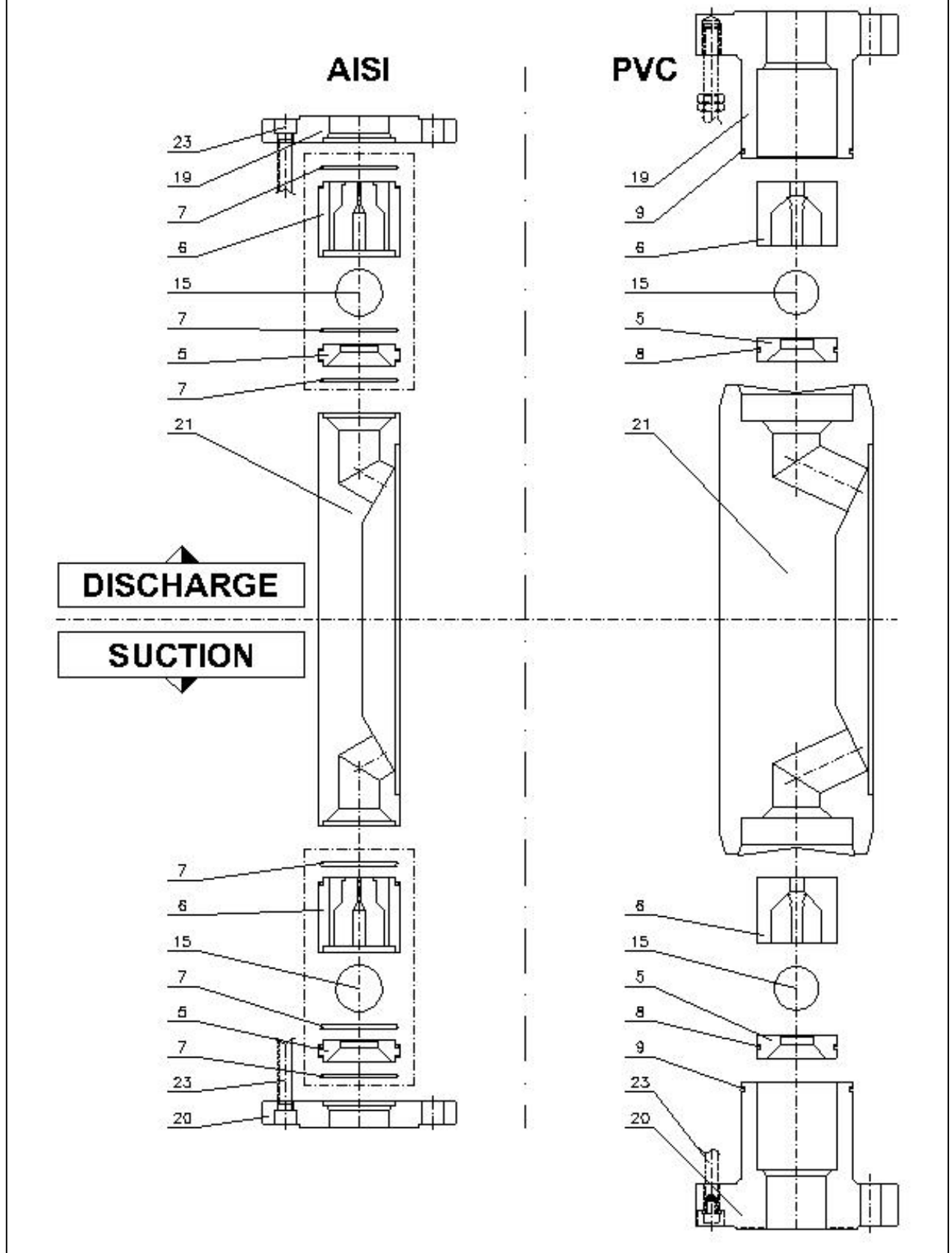
### B) LK - LN - LP: (pictures 21/22)

- Ease the pump from the suction and discharge pipes.
- Unscrew the tie rods (23) and extract the different items.
- To free the internal elements use plastic tools so as not to damage the seals surfaces, valves (15) and lapped seats.
- Before reassembling, check the conditions of seals (7), valves and valve seats (5), (clean with a tissue the valves and valve seats surfaces, they have to be without scratches and specular)
- valves (15) and valve seats (5) have to be replaced together

**Attention:** follow carefully the sequence and arrangement of the valve components as shown in the pictures. Notice that details number 5, 6, 15 have the same arrangement both in suction and discharge side.



Picture 22: LN-LP X9A/P



## 4.2 - REPLACEMENT DIAPHRAGM & FILLING OF OIL CHAMBER

### Foreword:

All X9 pumps are supplied with oil chamber pre-filled with hydraulic oil and ready for installation.

X9 hydraulic system has three valve-system: air-bleed valve, mechanically actuated replenishing valve and built-in pressure relief valve on oil circuit.

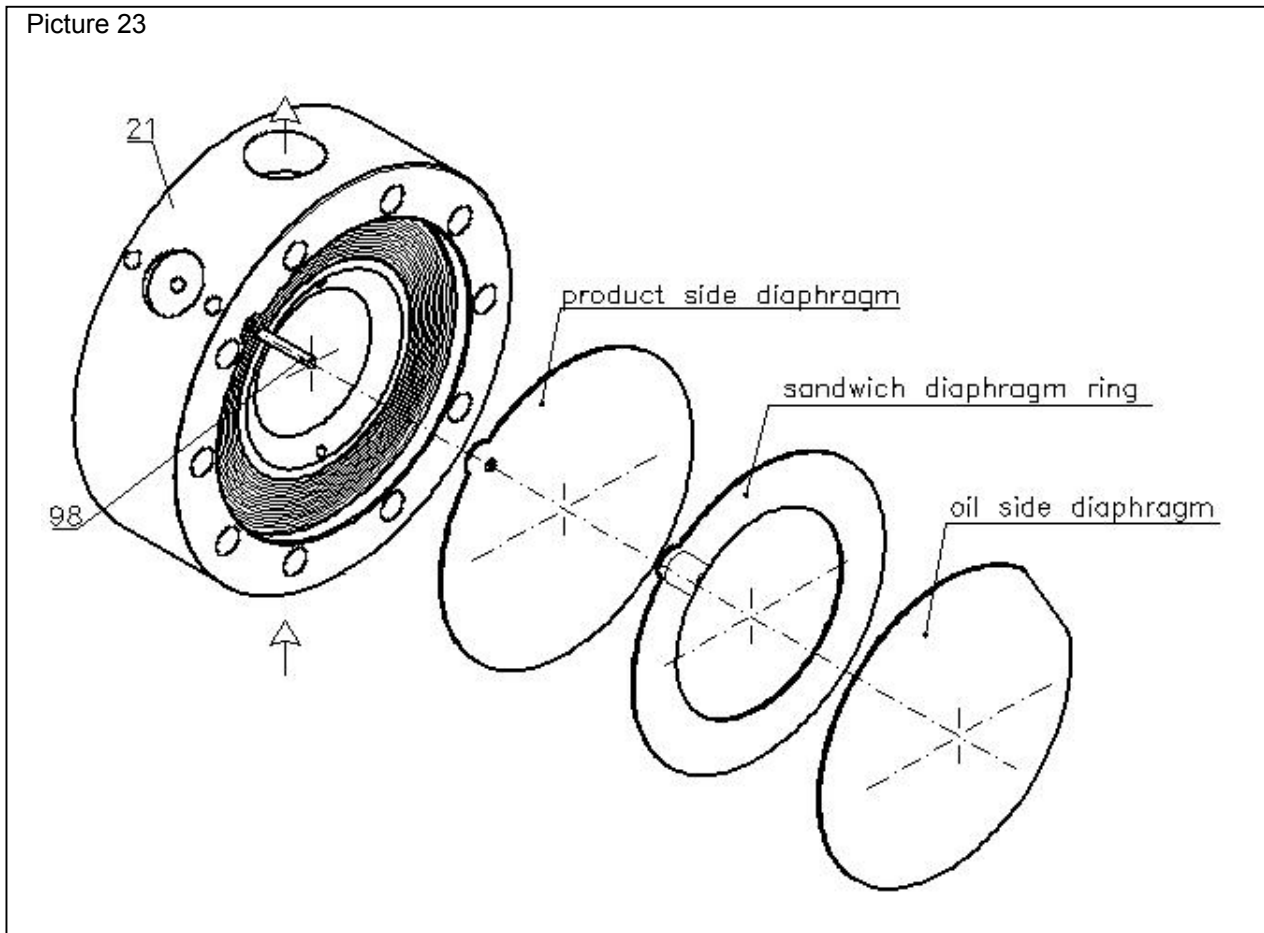
This three-valves-system guarantees a perfect hydraulic balance and allows a no air bubbles working (air-bleed); no possibility of oil over-replenishing because of possible obstruction or stop valve closing on suction pipe line, danger of diaphragm impact on internal front face of pumphead (mechanical reinstat-

ment); no overpressures (capacity discharge for overpressure or stop valve closing on discharge pipe line).

Diaphragm has a working life in excess of 40.000 hours. Possible diaphragm breaking might be caused of dosed media (abrasive, solid content, etc...).

In case of diaphragm breaking follows these steps:

Picture 23



#### 4.2.1 LY AISI / PVC(pictures 23/24)

- 1) Dismantle diaphragm rupture detector from pump head. Remove nut-covers (78) and unscrew locking-nuts (100) and remove liquid end (21)

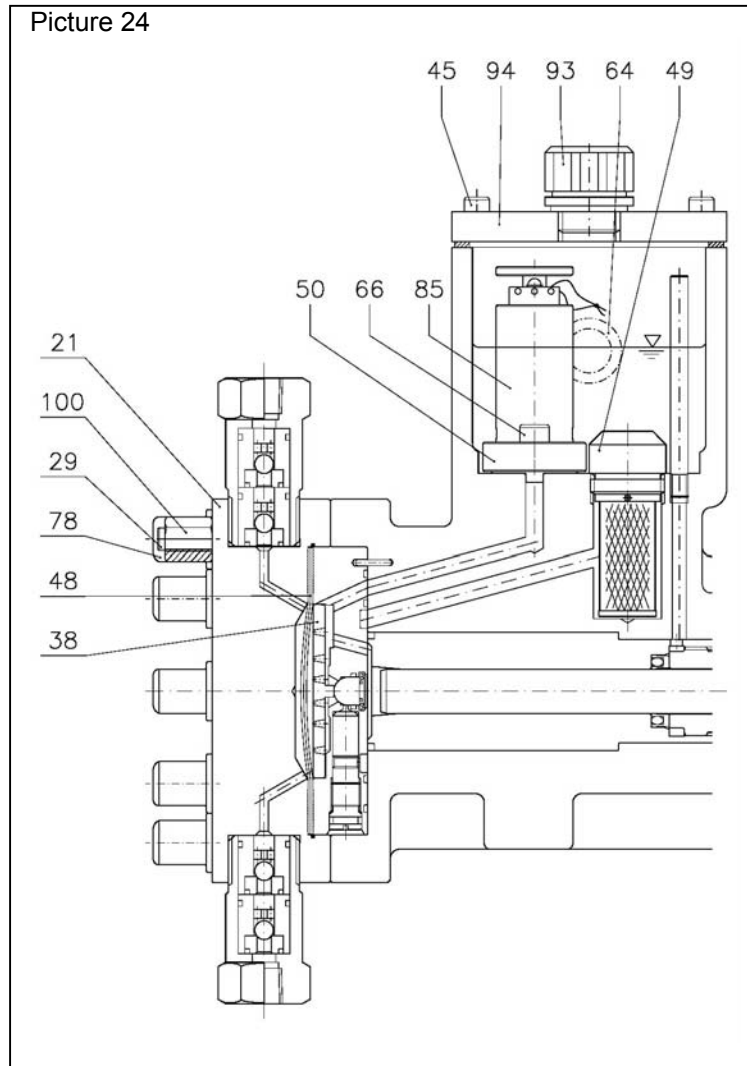
#### **!!! ATTENTION !!!**

**During this operation protect yourself from a possible outlet of the metered fluid.**

- 2) Replace diaphragms (48) as shown in the picture below. Pay attention to insert the hole of the sandwich diaphragm ring towards the pump head (21) and the product diaphragm in the groove. Make sure that reinstatement disc (38) and check valve detector shutter (98) are in their position. Clean and replace the pump head (21), then fasten locking nuts (100) (fastening torque 25 Nm).
- 3) Hydraulic oil filling: unscrew safety valve locking screws (66) and slip of the safety valve from the oil tank, to ease air outgoing from oil chamber (33) while re-filling.
- 4) With pump running and adjustment of capacity to 20% pour on the oil tank the hydraulic oil (low viscosity oil 2÷3 °E) over oil level plug (64). Hydraulic oil, going through the relief valve circuit, will fill the oil chamber (33) as well as other conduits, expelling air.
- 5) Let the pump run on for 5 minutes.
- 6) Put back in its position the safety valve and fasten safety valve locking screws (66).
- 7) With adjustment set to 100%, top up oil till half-level of the oil window (64). Close upper reservoir with relevant cover (94)
- 8) Seal hermetically discharge valve. Through suction port, apply compressed air into pump head (6-10 bar g). Pressure will free diaphragms from air trapped between them.
- 9) Apply compressed air for at least 5 minutes. Reassemble diaphragm rupture detector onto pump head.

10) Pump is ready to work.

**ATTENTION:** Before pump reaching his best working status wait till hydraulic oil (before in the oil chamber) has got rid of air through air-bleed valve (88) and become homogenous  
In reason of plunger diameter, pumps should need from 2 hours (diam. 25-30) to 8 hours (diam. 10) of running.



#### **4.2.2 LK AISI / PVC(pictures 23/25)**

In case of diaphragm breaking follows these steps:

- 1) Dismantle diaphragm rupture detector from pump head. Remove nut-covers (78) and unscrew locking-nuts (100) and remove liquid end (21)

#### **!!! ATTENTION !!!**

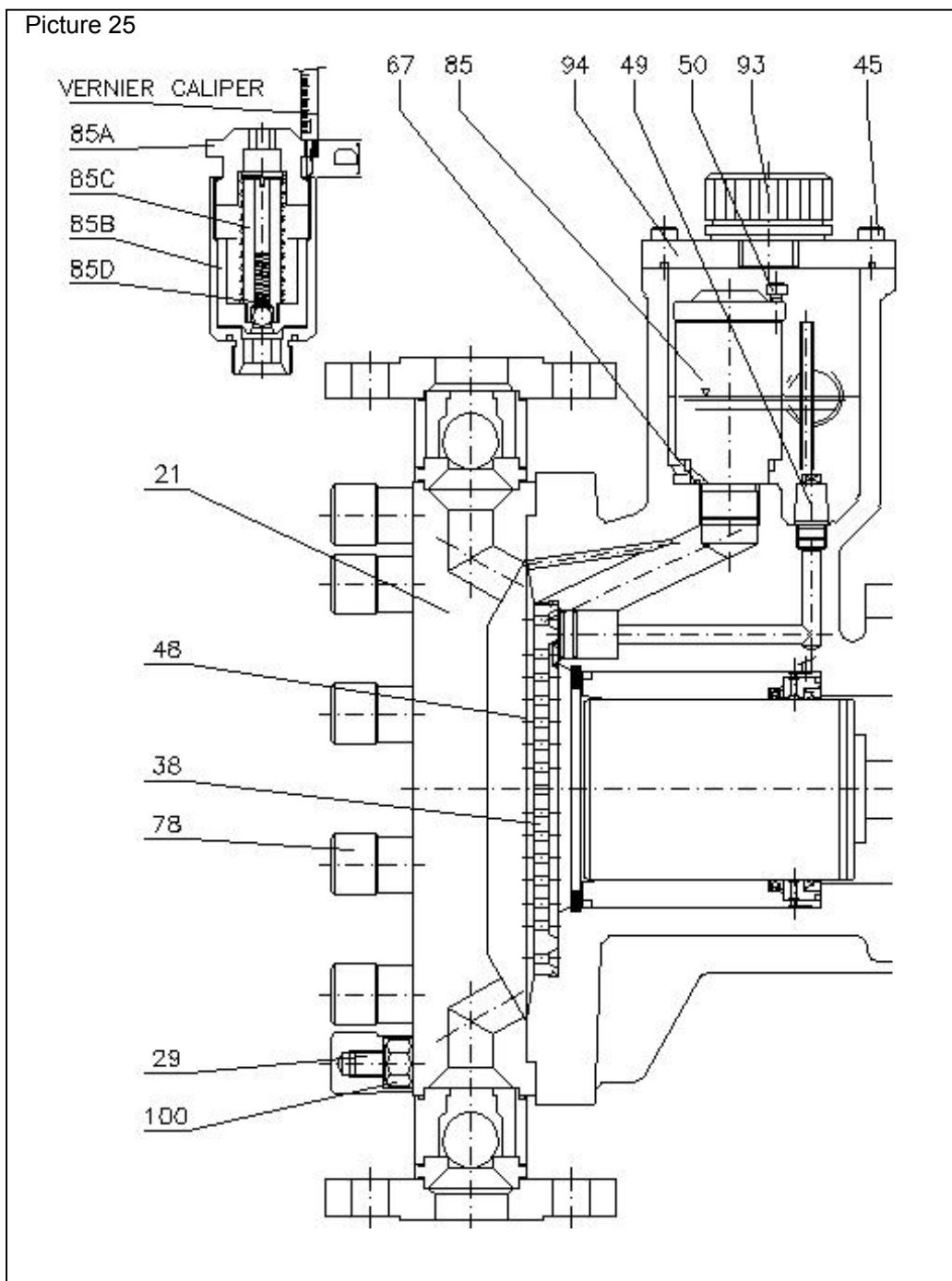
**During this operation protect yourself from a possible outlet of the metered fluid.**

- 2) Replace diaphragms (48) as shown in the picture below. Pay attention to insert the hole of the sandwich diaphragm ring towards the pump head (21) and the product diaphragm in the groove. Make sure that reinstatement disc (38) and check valve detector shutter (98) are in their position. Clean and replace the pump head (21), then fasten locking nuts (100).
- 3) Hydraulic oil filling::
  - a) unscrew safety valve screw (50)
  - b) remove the setting nut (85A) (making sure to properly measure dimension "D" with a caliper, reference hole of screw 50).
  - c) remove the shutter (85C) with air-bleed valve (85E/F), making easy air expulsion from the oil chamber (33).

- 4) With pump running and adjustment of capacity to 20% pour on the oil tank the hydraulic oil (low viscosity oil 2÷3 °E) over oil level plug (64). Hydraulic oil, going through the relief valve circuit, will fill the oil chamber (33) as well as conduits, expelling air
- 5) Let the pump run on for 5 minutes
- 6) Put back in its position the shutter (85C) and following backward desmantling instructions at point 3.
- 7) With adjustment set to 100%, top up oil till half-level of the oil window (64). Close upper reservoir with relevant cover (94)
- 8) Seal hermetically discharge valve. Through suction port, apply compressed air into pump head (6-10 bar g). Pressure will free diaphragms from air trapped between them.
- 9) Apply compressed air for at least 5 minutes. Reassemble diaphragm rupture detector onto pump head.
- 10) Pump is ready to work.

**ATTENTION:** Before pump reaching his best working status wait till hydraulic oil (before in the oil chamber) has got rid of air through air-bleed valve (88) and become homogenous

In reason of plunger diameter, pumps should need from 2 hours (diam. 25-30) to 8 hours (diam. 10) of running.



### 4.2.3 LN-LP AISI / PVC(pictures 23/26)

In case of diaphragm breaking follows these steps:

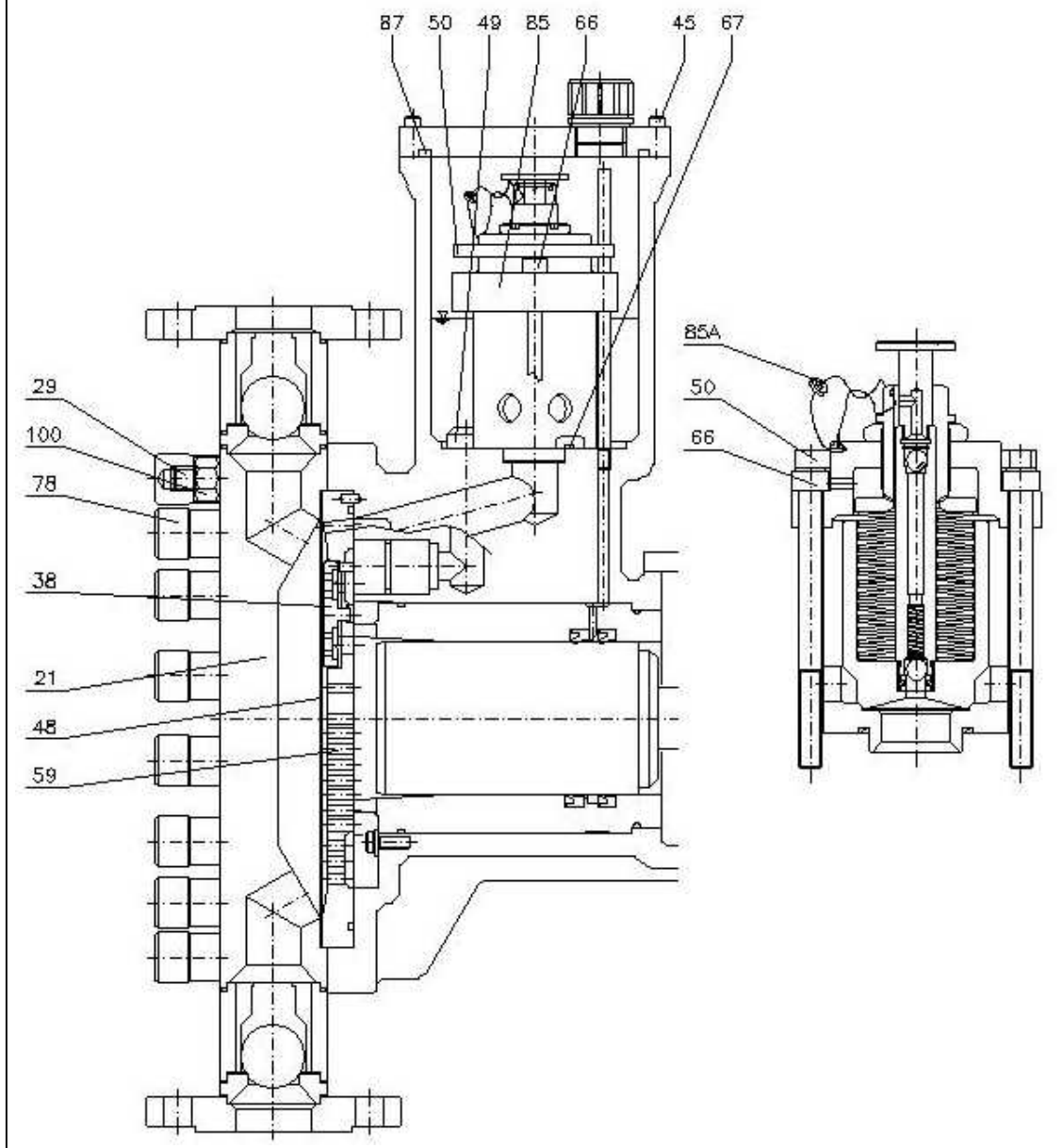
- 1) Dismantle diaphragm rupture detector from pump head. Remove nut-covers (78) and unscrew locking-nuts (100) and remove liquid end (21)

#### **!!! ATTENTION !!!**

**During this operation protect yourself from a possible outlet of the metered fluid.**

- 2) Replace diaphragms (48) as shown in the picture below. Pay attention to insert the hole of the sandwich diaphragm ring towards the pump head (21) and the product diaphragm in the groove. Make sure that reinstatement disc (38) and check valve detector shutter (98) are in their position. Clean and replace the pump head (21), then fasten locking nuts (100) .
- 3) Hydraulic oil filling::
  - a) Remove lead seal (85A) and safety valve locking flange (50).
  - b) Unscrew the safety valve locking screw (66) and remove the safety valve.
- 4) With pump running and adjustment of capacity to 20% pour on the oil tank the hydraulic oil (low viscosity oil 2÷3 °E) over oil level plug (64). Hydraulic oil, going through the relief valve circuit, will fill the oil chamber (33) as well as other conduits, expelling air
- 5) Let the pump run on for 5 minutes

Picture 26



- 6) Put back in its position the safety valve (85) and following backward desmantling instructions at point 3
- 7) With adjustment set to 100%, top up oil till half-level of the oil window (64). Close upper reservoir with relevant cover (94)
- 8) Seal hermetically discharge valve. Through suction port, apply compressed air into pump head (6-10 bar g). Pressure will free diaphragms from air trapped between them.
- 9) Apply compressed air for at least 5 minutes. Reassemble diaphragm rupture detector onto pump head.
- 10) Pump is ready to work.

**ATTENTION:** Before pump reaching his best working status wait till hydraulic oil (before in the oil chamber) has got rid of air through air-bleed valve (88) and become homogenous  
In reason of plunger diameter, pumps should need from 2 hours (diam. 25-30) to 8 hours (diam. 10) of running

FASTENING TORQUE POS. 100	
VITE	Nm
M8	25
M10	50
M12	85
M16	205

### 4.3 - PREVENTIVE MAINTENANCE

We suggest the purchase of a series of essential details for the preventive maintenance of the diaphragm pump head (table D)  
For the position see pump head sectional drawing.

TABLE D		
DENOMINATION	POSITION	PIECES NO.
DIAPHRAGM	48	1
VALVE SEATS	5	2
VALVE SEATS	6	2
VALVE	15	2
VALVE SEAL	7	6
PLUNGER SEALS	2	2

### 4.4 - METERING PUMPS TYPE LP-LN KNOB ADJUSTMENT FRICTION SETTING

#### **OPERATING TROUBLE CASE A:**

The adjustment knob does not stay steadily on the determined position when the pump is running.

#### **CAUSE/STEPS TO BE TAKEN:**

The friction on the adjustment spindle is weak. It has to be increased as shown below:

- 1) Unscrew and keep the locking cap screws (pos.152);
- 2) Remove and keep the window cap (pos.220), and single out the ring nut locking dowel (pos.195);
- 3) Unscrew, almost completely, the ring nut locking dowel (pos.195);
- 4) In order to increase the stiffness adjustment up to the required value, screw the ring nut (pos.150) by 5° max. at time checking each time, by means of the adjustment knob, the friction extent;
- 5) As the required stiffness is achieved, lock the ring nut (pos.150) by screwing, not tightly, the locking dowel (pos.195);
- 6) Reassemble the cap (pos.220) by means of the screws (pos.152).

#### **OPERATING TROUBLE CASE B:**

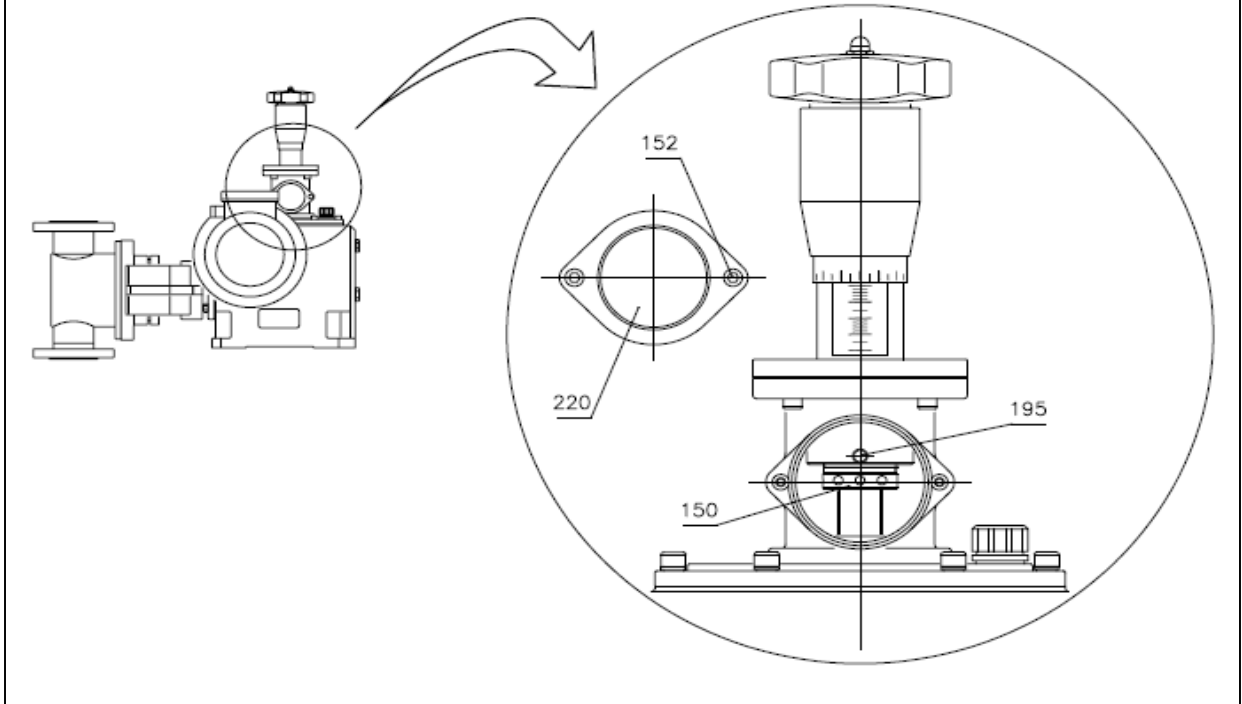
The adjustment mechanism is too stiff and the knob drive turns out to be difficult.

#### **CAUSE/STEPS TO BE TAKEN:**

- 1) Unscrew and keep the locking cap screws (pos.152);
- 2) Remove and keep the window cap (pos.220), and single out the ring nut locking dowel (pos.195);
- 3) Unscrew, almost completely, the ring nut locking dowel (pos.195);

- 4) In order to reduce the stiffness adjustment down to the required value, unscrew the ring nut (pos.150) by 3° max. at time checking each time, by means of the adjustment knob, the friction extent;
- 5) As the required stiffness is achieved, lock the ring nut (pos.150) by screwing, not tightly, the locking dowel (pos.195);
- 6) Reassemble the cap (pos.220) by means of the screws (pos.152).

Picture 27





FLOW RATE LOWER THAN EXPECTED	
CAUSES	SOLUTIONS
Air enters the suction piping through the fittings:	Check.
Air trapped inside the pump:	For a short while, keep flow rate to maximum.
Too high suction head:	Reduce it.
Vapour pressure of the liquid too high:	Vapour pressure of the liquid too high:
Pumping temperatures too high:	Increase hydrostatic head on suction side.
Viscosity of the liquid too high:	Install a suction piping of larger diameter. Increase hydrostatic head on suction side.
Feed tank hermetically sealed and with no vent:	Make a vent in the tank upper part.
Suction piping clogged or valves shut:	Check.
Filter on suction side clogged:	Clean it.
Pump valves jammed because of dirt:	Dismantle the valves and clean them carefully.
Relief valve setting pressure too low:	Check.
Damaged plunger seals:	Check oil leak (routine maintenance)

FLOW RATE IRREGULAR OR HIGHER THAN EXPECTED	
CAUSES	SOLUTIONS
Suction pressure higher than discharge pressure:	Increase the discharge head of at least 0.3÷0.5 kg/cm <sup>2</sup> (3÷5 m) respect to the suction pressure.
Back pressure valve stuck in open position because of dirt or setting pressure too low:	Check.
Pump valves jammed in open position:::	Check.

OVERHEATING OF PUMP BODY AND MOTOR	
CAUSES	SOLUTIONS
Incorrect wiring:	Check.
Overheating due to pump working pressure higher than allowed	Check max pressure by means of a pressure gauge fitted on the discharge pipeline.
Pressures higher than allowed:	(see max pressure indicated on pump nameplate) reduce the discharge pressure or install a damper in case of excessive narrowing on the discharge pipeline.
Stresses on pump flanges:	Ease the connection to the pump head to verify those stresses
Discharge pipeline clogged or valve shut:	Check.
Back pressure valve set to a pressure higher than allowed:	Check.
Oil level in the gear box is low:	Add suitable oil..

## 4.6 - LUBRICANT TABLE

METERING PUMPS LUBRICATED PARTS		FIRST FILLING		LUBRICANT CHANGE FREQUENCY h (1)	RECOMMENDED LUBRICANTS								
					MANUFACTURER	LUBRICANT INTERNATIONAL NAME	OIL					FLASH POINT °C	DENSITY kg/dm <sup>3</sup>
							VISCOSITY °E 50 °C	VISCOSITY cSt 40 °C	VISCOSITY INDEX	POUR POINT °C			
											MAIN CHARACTERISTIC		
REDUCER GEAR	LY	0.85	1000	15000	ESSO	SPARTAN EP 320	25	331	97	-15	237	0.898	
	LYH	2.490			MOBIL	MOBILGEAR 632	23	310	100	-18	236	0.900	
	LK	3.25			SHELL	OMALAOIL 320	24	320	100	-15	238	0.903	
	LN	4.75			ESSO	NURAY 32	4.3	32	107	-12	207	0.869	
	LP	5.5			ESSO	NUTO H32	2.9	30.7	107	-31	206	0.869	
HYDRAULIC CHAMBER <sup>(2)</sup>	LY-LYH 10÷50	0.4	20000		MOBIL	RUBREX 400	3	32.5	113	-27	220	0.869	
	LK 20÷40	0.5			SHELL	VITREA OIL 68	3	32	109	-30	220	0.872	
	LK 50÷80	1.3											
	LN-LP 25÷50	1.3											
	LN-LP 65÷80	2.5											
LN-LP100÷120	3.5												

REMARKS:

(1) MAX ALLOWABLE OPERATING HOURS

(2) The pumps are always supplied with lubricant oil



**POMPE DOSATRICI**  
METERING PUMPS



**MACHINERY DIRECTIVE**

**THE MACHINES SAFETY**

EUROPEAN COMMUNITY DIRECTIVE 98/37/CEE AND SUBSEQUENT MODIFICATIONS

INSTRUCTIONS ABOUT THE RESIDUAL RISKS ELIMINATION AND THE SAFETY AT WORK

GB

**GENERAL SAFETY NORMS**

Please read and save these instructions.



# METERING PUMPS

## GB

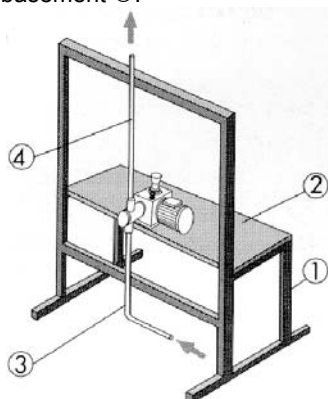
### GENERAL SAFETY NORMS

Please read and save these instructions.

## INSTRUCTIONS

### INSTALLATION

- The pump has to be installed on a basement ①.



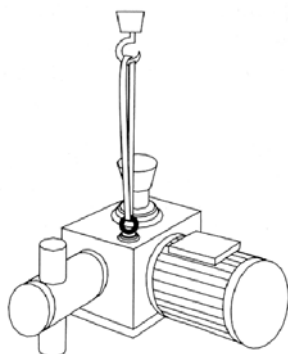
- The basement has to be made of electric welded steel and fit for the pump dimensions, with leveled face ②.

- The pump has to be strongly fastened to the basement by clamping screws.

- The basement has to have a frame to support the suction ③ and discharge ④ pipeline and possible accessories (pulsation dampeners, pressure gauges, valves) and not vibrate while the pump is working.

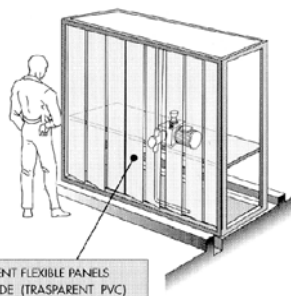
#### ATTENTION:

To lift the pump use the appropriate eyebolts located in the pump upper part or on the base.



### OPERATOR PROTECTION

Protection against accidental leakages of aggressive pressurized fluids

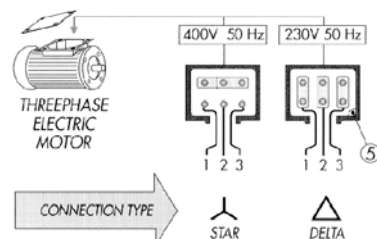


TRANSPARENT FLEXIBLE PANELS  
PLASTIC MADE (TRANSPARENT PVC)

### ELECTRICAL CONNECTIONS

- For a proper connection of the electrical motor follow the illustrated instructions.

TERMINAL BOX DISPOSAL ACCORDING TO THE LINE VOLTAGE



- Protect the motor by installing a magnetothermic device, fit to the power input values of the motor, knowing that the motor nominal power

- Earth the terminal of the motor casing using a cable with at least 6 mm<sup>2</sup> section ⑤.

- Check the direction of rotation of the motor (see the arrow on the motor body); if the direction of rotation is not in accordance with the arrow, interchange two wires: 1 on 2, 2 on 1.

#### ATTENTION:

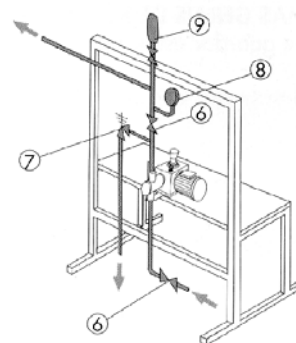
Start the motor only when the terminal box is closed.

### SETTING INTO OPERATION

- Check the oil-level.
- Open all the on-off valves both along the discharge and suction pipeline ⑥.
- Check the safety valve installation and its discharge into the feeding tank ⑦.

- Check the pressure gauge installation ⑧ (essential to check the pump status).

- Check the pulsation dampener ⑨.



#### ATTENTION:

Before startup make sure all the operating manual sections are read and fully understood.

- Start the pump with adjustment set to 20%; increase gradually the flow rate (acting on the adjustment knob) and find the relevant pressure on the pressure gauge.

#### ATTENTION:

La pressione di esercizio non deve superare il valore di targa.

- Check during the first three working hours the pump body temperature (max 60°C) as well as the motor temperature (max 80°C).

### ROUTINE MAINTENANCE

- Check periodically the oil-level through the oil-window located on the pump body. First three months, once a month afterwards, once every four months.
- Check periodically (once every four months) the pump status:
  - Pump body temperature (max 60°C).
  - Motor temperature (max 80°C).
  - Working pressure (must not exceed the rating plate value).
  - Noise (within normal conditions must not exceed 85dbA).



# POMPE DOSATRICI

## METERING PUMPS



OBL s.r.l. – 20090 Segrate – MILANO – Via Kennedy, 12 – Tel. +39 02 269191 – Fax +39 02 2133893  
E mail: info@obl.it

### DICHIARAZIONE DI CONFORMITÀ CE

#### CE CONFORMITY DECLARATION

Modello/Model/Modèle/Modell/Modelo/Modelo/Model/Model/Typ/Model/Malli/Μοντελο

POMPE DOSATRICI SERIE  
METERING PUMPS SERIES

L

#### I DICHIARAZIONE DI CONFORMITÀ CE

Noi, OBL s.r.l., MILANO ITALIA, dichiariamo sotto la nostra unica responsabilità che il prodotto cui questa dichiarazione si riferisce, è conforme alle seguenti direttive e successive modifiche:

- Direttiva Macchine 98/37/CE;
- Direttiva Bassa Tensione 73/23/CE;
- Direttiva Compatibilità Elettromagnetica 89/336/CE.

#### GB CE CONFORMITY DECLARATION

We, OBL s.r.l., MILAN ITALY, declare under our sole responsibility that the product relevant to this declaration complies with the following directive and subsequent modifications:

- Machinery Directive 98/37/EEC;
- Low Voltage Directive 73/23/EEC;
- Electromagnetic Compatibility Directive 89/336/EEC.

#### F DECLARATION DE CONFORMITE CE

Nous, OBL s.r.l., MILAN ITALIE, déclarons sous notre seule responsabilité que le produit auquel cette déclaration se rapporte, est conforme au suivantes directives et successives modifications:

- Directive Machines 98/37/CEE;
- Directive Basse Tension 73/23/CEE;
- Directive Compatibilité Electromagnétique 89/336/CEE.

#### D EU-KONFORMITÄT SERKLÄRUNG

Wir OBL s.r.l., MAILAND ITALIEN, erklären unter unserer Verantwortung, dass unser produkt, auf das sich diese erklärung bezieht, den folgenden EU-richtlinien und deren änderungen entspricht:

- Maschinenrichtlinie 98/37/EWG;
- Richtlinie über die Niederspannung 73/23/EWG;
- Normen über die Elektromagnetische Verträglichkeit 89/336/EWG.

#### E DECLARACI3N DE CONFORMIDAD CE

Nosotros, OBL s.r.l., de MILAN ITALIA, declararamos bajo nuestra sola responsabilidad que el producto al que se refiere esta declaración, cumple con las siguientes directivas y sucesivas modificaciones:

- Directiva de Máquinas 98/37/CEE;
- Directiva de Baja Tensión 73/23/CEE;
- Directiva de Compatibilidad Electromagnética 89/336/CEE.

#### P DECLARAÇ3O DE CONFORMIDADE CE

N3s, OBL s.r.l., MIL3O IT3LIA, declaramos sob nossa inteira responsabilidade que o produto ao qual se refere esta declaraç3o se encontra de acordo com as seguintes directivas e sucessivas modificaç3es:

- Directivas Máquinas 98/37/EEC;
- Directivas Baixa Tens3o 73/23/EEC;
- Directivas Compatibilidade Electromagnética 89/336/EEC.

#### NL EG-VERKLARING VAN OVEREENKOMST

Wij, OBL s.r.l., MILAAN ITALIÉ, verklaren voor onze uitsluitende verantwoordelijkheid dat het product waarop deze verklaring betrekking heeft, in overeenstemming is met de volgende richtlijnen en navolgende wijzigingen:

- Machinerichtlijn 98/37/EEG;
- Laagspanningsrichtlijn 73/23/EEG;
- Richtlijn Bestendigheid tegen Elektromagnetische Storingen 89/336/EEG.

#### DK CE-OVERENSSTEMMELSES ERKLÆRING

Vi, OBL s.r.l., MILANO ITALIEN, erklærer os ansvarlige for at produktet, som denne erklæring henviser til, stemmer overens med følgende direktiver og påfølgende modificeringer:

- Maskindirektiv 98/37/EEC;
- Lavspændingsdirektiv 73/23/EEC;
- Direktif for Elektromagnetisk Forenelighed 89/336/EEC.

#### S EG3 VERENSSTÄMMELSEF3RKLARING

Vi, OBL s.r.l., MILANO ITALIEN, förklarar under eget ansvar, att produkten, till vilken denna förklaring hänför sig, överensstämmer med följande normer och deras respektive ändringar:

- Norm för Maskiner 98/37/EEC;
- Norm för Lågspänning 73/23/EEC;
- Norm för Elektromagnetiks Förenlighet 89/336/EEC.

#### N CE-OVERENSSTEMMELSESERKLÆRING

Vi, OBL s.r.l., MILANO ITALIA, erklærer under eget ansvar at produktet som omfattes av denne erklæringen er i overensstemmelse med følgende direktiver og senere endringer:

- Maskindirektivet 98/37/EU;
- Lavspenningsdirektivet 73/23/EU;
- Direktivet vedr. Elektromagnetisk Kompatibilitet 89/336/EU.

#### FIN YHDENMUKAISUUSTODISTUS

OBL s.r.l., MILANO ITALIA, vakuuttaa omalla vastuullaan, että tässä todistuksessa mainittu tuote vastaa seuraavien direktiivien ja niihin tehtyjen muutosten vaatimuksia:

- Laitedirektiivi 98/37/EU;
- Pienjännittdirektiivi 73/23/EU;
- Direktiivi 89/336/EU joka käsittelee sähkömagneettista yhteensopivuutta.

#### GR ΔΗΛΩΣΗ ΣΥΜΜΟΡΦΩΣΗΣ CE

Η υπογεγραμμένη εταιρεία, OBL s.r.l., MILANO ITALIA, δηλώνει υπευθυνα ότι το εν λόγω προϊόν είναι κατασκευασμένο σύμφωνα με τις παρακάτω οδηγίες και τις τροποποιήσεις αυτών:

- Οδηγία περί Μηχανών 98/37/ΕΟΚ;
- Οδηγία περί Χαμηλής Τάσης 73/23/ΕΟΚ;
- Οδηγία περί Ηλεκτρομαγνητικής Συμβατότητας 89/336/ΕΟΚ.

Nome e posizione del dichiarante / Name and rank of issuer /  
Nom et fonction de l'émetteur / Name und position des erstellers /  
Nombre y cargo del expedidor / Nome e cargo do emissor /  
Naam en functie van de uitgever / Udsteder, navn og stilling /  
Utsteders navn og stilling / Utfærdarens namn och befattning /  
Ilmoituksen antajan nimi ja asema / Όνομα και θέση εκδότη

Segrate - MILANO  
01.01.1995

**Benito LEONETTI**  
Responsible of the "TECHNICAL MANAGEMENT"

Firma del dichiarante / Signature of issuer / Signature de l'émetteur /  
Unterschrift des erstellers / Firma del expedidor / Assinatura do  
emissor / Handtekening van de uitgever / Udsteder, underskrift /  
Utsteders signatur / Utfærdarens namnteckning / Ilmoituksen antajan  
allekirjoitus / Υπογραφή εκδότη

*Benito Leonetti*



**POMPE DOSATRICI**

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