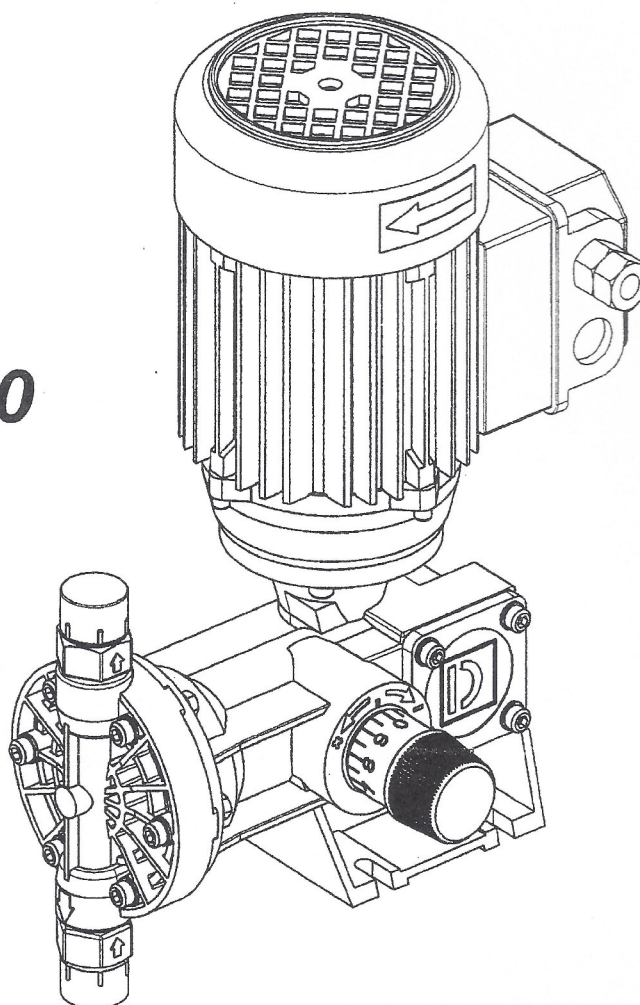


INSTRUCTION AND MAINTENANCE MANUAL



Series FM Model FM - 50



**ALTERNATIVE DIRECT DIAPHRAGM DOSING PUMP
WITH SPRING RETURN**

Safety notes for metering pumps:

- Metering pumps are positive replacement pumps and must not be run with closed or even partially blocked discharge lines. If applicable, install a safety valve on the discharge side with a return line. The nominal size of installed dosing lines must suite the flow-rate capacity of the pump.
- Attention: Make sure the correct electrical supply is connected to the pump.
- Before starting maintenance work, flush the pump with suited flushing liquid and disconnect electrical supply.
- Before opening or dismantling liquid contacted pump parts carry out pressure relief of pump, accessories and dosing lines.

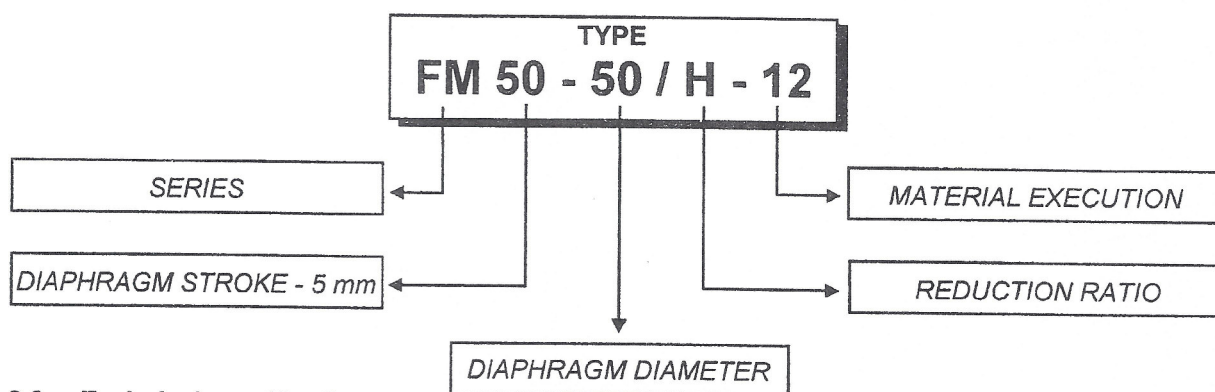
1 PUMP DESCRIPTION

- Direct diaphragm dosing pump – series **FM 50**.
- The capacity adjustment is carried out manually.
- The installed motors have a single-phase voltage 230V (220-240V) 50Hz, three-phase 400V (380-415V) 50Hz or (440/480V) 60Hz, power 0,09 kW. Different voltages are available upon request.
- The following accessories are supplied with the pump built in compliance with execution 12:
 - * N° 1 injection valve for hose Ø 4/6 or hose Ø 10/14.
 - * N° 1 foot valve strainer for hose Ø 4/6 or hose Ø 10/14.
 - * N° 2 PVC connectors with locking ring for hose Ø 4/6 or hose Ø 10/14.
 - * Mt. 1,5 PVC crystal suction hose Ø 4/6 or Ø 10/14.
 - * Mt. 1,5 PE Polyethylene delivery hose Ø 4/6 or Ø 10/14.

2 IMPORTANT PUMP TECHNICAL DATA

2.1 Pump's code interpretation

Characteristic data are mentioned on the plate of the pump; for an easy interpretation follow the example reported here below.



2.2 Technical specifications

The following table reports the technical data of the series **FM** pump. The maximum pressure mentioned on the plate must not be exceeded.

Table I Characteristic data series FM pump

FREQUENCY	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	PRESSURE <i>bar (Kg/cm²)</i>
REDUCTION RATIO	H = (1/34)		F = (1/24)		D = (1/17)		B = (1/12)		
STROKES <i>min/1'</i>	41	50	58	70	82	100	116	140	
CAPACITY <i>L/h</i> FM 50 - 50	21	25	28	33	42	50	56	67	
	19	22	26	31	38	45	52	62	0 min. 2 med.
	17	20	23	27	34	40	47	56	5 max.

The capacities reported on the table are obtained when working at a constant pressure, with water at 15°C and with the pump placed 30 cm above the watermark. The real value of the capacity depends on the viscosity, specific gravity of the pumped liquid and losses of head.

3 INTENDED AND UNINTENDED USE OF THE PUMP

This machine is designed for dosing clean liquids. This machine is also suitable when:

- The liquid being pumped contains suspended solid or abrasive particles.
- The liquid cannot come in contact with the atmosphere.
- The machine is not designed for use with fluids other than those designated.

Example: a pump with a PVC head, designed to pump acid solutions, cannot be used to dose solvents which will quickly corrode its parts beyond repair.

WHEN IN DOUBT, THE CLIENT SHOULD CONTACT OUR TECHNICAL OFFICE FOR FURTHER INFORMATION ON THE PUMP IN QUESTION AND ITS PROPER USE.

4 RESIDUAL RISKS

Whenever breaks are found, the equipment should first be emptied and the head of the pump depressurised. A capillary cleaning should be done with the proper equipment (hoses) and the correct cleaners. Only after this the pump should be disassembled, keeping in mind that the operator must use proper protection (gloves, glasses, boots, overalls, etc.).

5 TRANSPORT, MOVEMENT AND STORAGE

Since the client chooses the transporter "on its own", these two parties (the client and the transporter) are responsible for transportation.

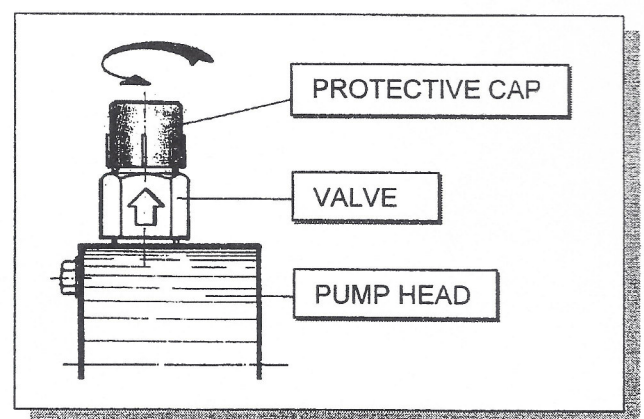
A correct packaging is provided for any type of shipment and it is understood that the client itself is free to define the shipment mode and type. The client is, in any case, always responsible for specifying the type of shipment (via land, sea or air).

Pumps made of plastic must be stored in a dry, ventilated environment, away from heat sources and at a temperature between +10°C and +30°C.

6 INSTALLATION OF THE PUMP

6.1 Removing the blocks

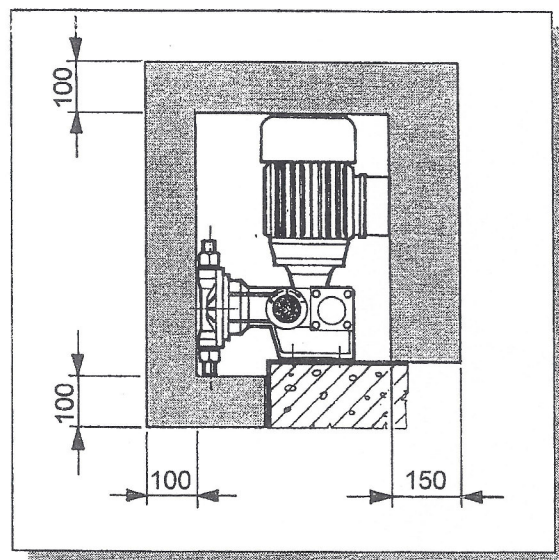
- Before installing the pump, the protective caps on suction and delivery points of the valves must be removed.



DWG. 1

6.2 Pump set-up

- Allow sufficient space (operating area) to be able to check and disassemble the pump, especially on the hydraulic side (pump head) and near the capacity regulation knob.



DWG. 2

- Place the machine in a vertical position (DWG. 2) and on a sturdy-resting place (made of metal, concrete, etc.).
- If the pump must be installed outside, it is essential to provide adequate covering.
- Provide adequate drainage for the delivery hose near the pump head, in order to facilitate removing the pump from the installation.
- PVC pump heads can only work correctly at room temperature and with the dosing liquid from 0°C to +40°C. If necessary, provide adequate protection from direct sunlight and monitor the temperature of the liquid being dosed.

6.3 Tubing on the machine

The following describes recommendations that the user should consider for a correct installation and a proper functioning of the pump.

- The size of the hoses normally must be (especially for suction and handling viscous liquids), one size larger in diameter than the openings of the pump's suction and delivery valves.
- The speed overage of the liquid in the hoses must not exceed 0,7 m/s for liquids in a viscosity range up to 100 cPs.
- Suction hose must be kept to a minimum, while making wide corners at each bend of the hose.

6.4 Positioning

The following describes the necessary steps for a proper pump's positioning:

- Be sure the base is sturdy and well levelled, then attach the pump securely, without creating tension on its axis.
- Before connecting the hoses to the pump attachments, the hoses should be washed inside to remove any foreign body, (welding pellets, off-cuts from gaskets, etc.).
- The hoses must be independently supported and cannot weigh on the pump head. Furthermore, the hoses must be attached in such a way that any possible expansion due to exposure to heat do not push against the head of the pump head.
- It is always advisable to have after the delivery valve of the pump one or more "T attachments" which can be used for mounting gauges, safety valves and hydro-pneumatic accumulators.
- Make sure that the machine rotates freely by turning the fan on the motor by hand. Should the fan be blocked, check the positioning and the alignments.
- Make sure that the hoses are perfectly sealed and that the air is not entering in suction, which would hinder priming of the pump.

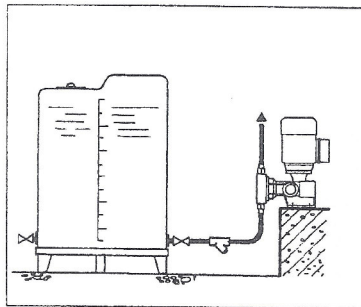
7 INSTALLATION EXAMPLES

7.1 Suction hose

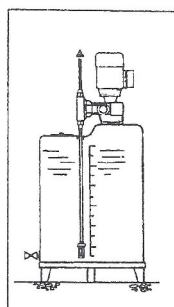
The suction hose is very important for a proper functioning of the pump, the essential details to be considered are:

- Hose inner diameter must be in accordance with the capacity of the pump and the viscosity of the liquid.
- Hose length must be to a minimum; anyway it must not exceed 2 meters.
- Hose path must be as linear as possible.
- Effect connections with junctions at wide range and make sure that it is perfectly sealed.

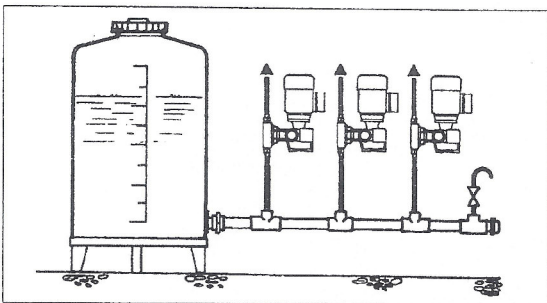
CORRECT APPLICATION



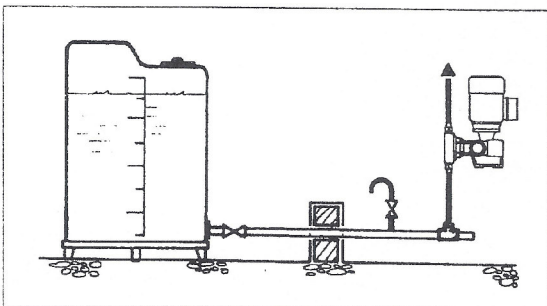
DWG. 3



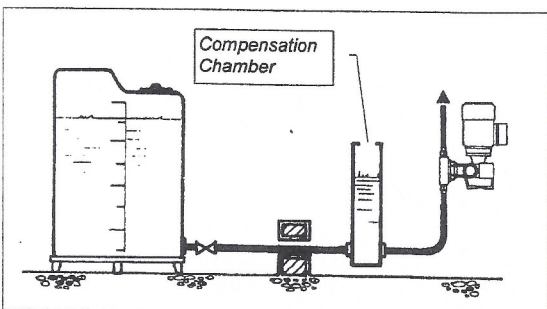
DWG. 4



DWG. 7

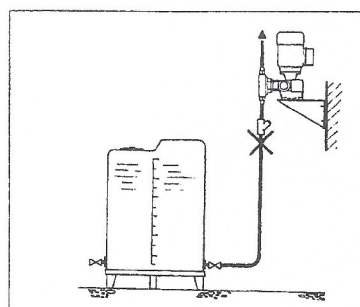


DWG. 8

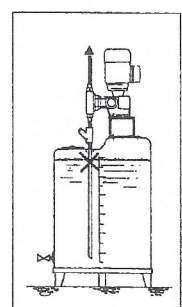


DWG. 9

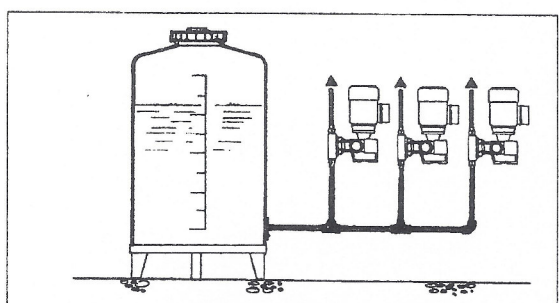
WRONG APPLICATION



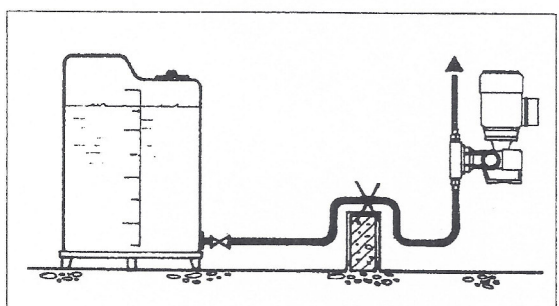
DWG. 5



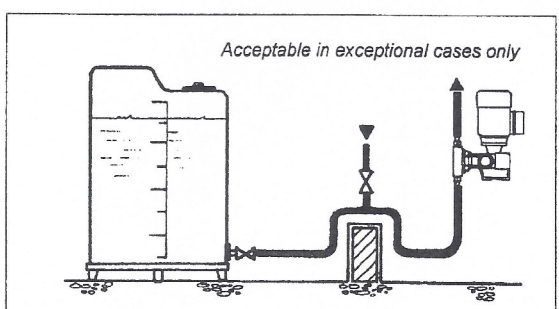
DWG. 6



DWG. 10

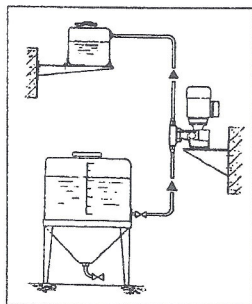


DWG. 11

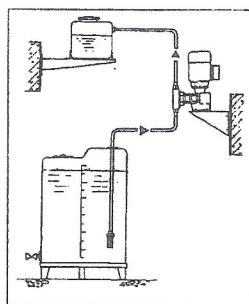


DWG. 12

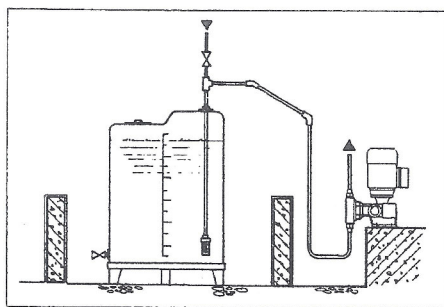
CORRECT APPLICATION



DWG. 13

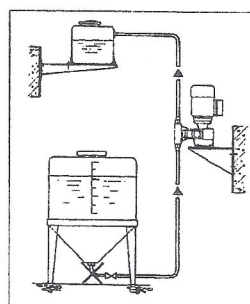


DWG. 14

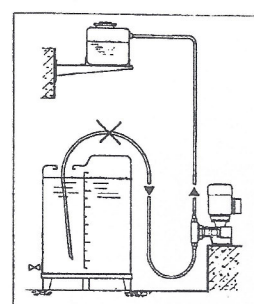


DWG. 17

WRONG APPLICATION



DWG. 15



DWG. 16

Suckup deposits from bottom

Break off the fluid vein

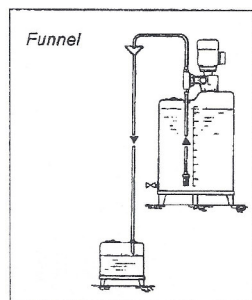
Acceptable execution in exceptional cases only

7.2 Delivery hoses

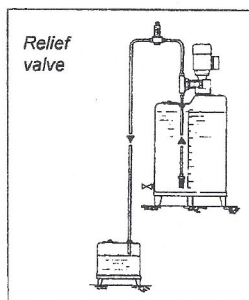
A correct realisation of the delivery hose path is essential for a proper functioning of the pump, therefore the following important details are to be considered:

- The hoses must be independently supported.
- The hose path must be as linear as possible.
- Effect connections with junctions at wide range, avoid counter slopes to make evacuation of possible water bubbles easier and make sure that the hoses are perfectly sealed.

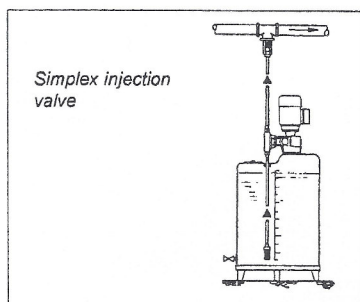
CORRECT APPLICATION



DWG. 18

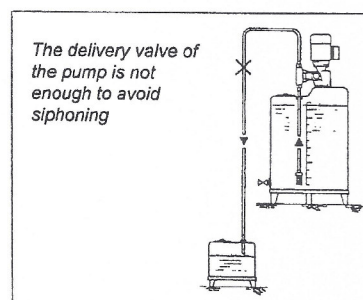


DWG. 19

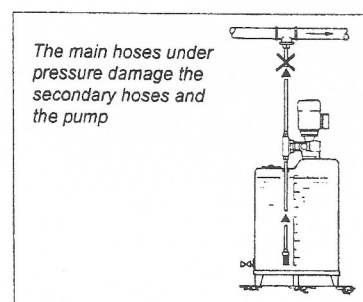


DWG. 21

WRONG APPLICATION



DWG. 20



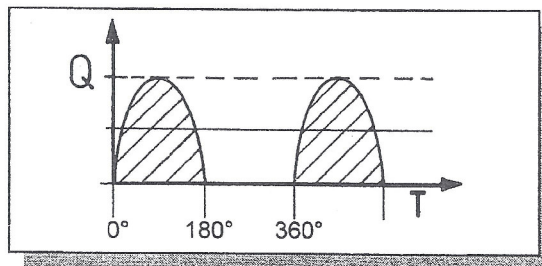
DWG. 22

8 HYDRO-PNEUMATIC ACCUMULATOR INSTALLATION

8.1 Installation example

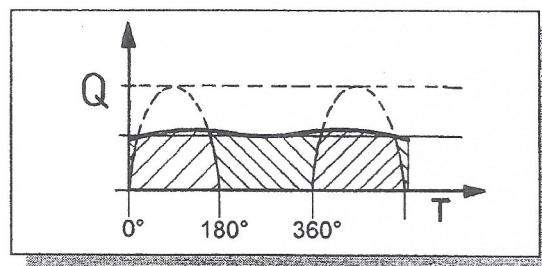
It is recommended that a hydro-pneumatic accumulator is installed immediately after the pump. The benefits will be numerous.

- Capacity with more linear flow.
- Elimination of vibration on the whole line.
- Protection from pressure peaks.



DWG. 23

Diagram of the pumping flow without hydro-pneumatic accumulator



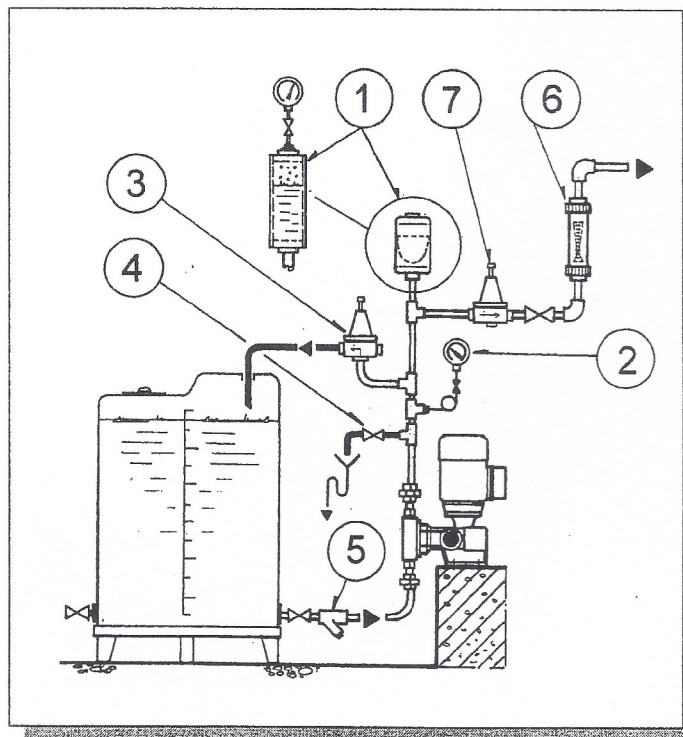
DWG. 24

Diagram of the pumping flow with hydro-pneumatic accumulator

Suggested installation example

NOMENCLATURE

1. Pulsations damper
2. Gauge
3. Relief valve or over-pressure
4. Drawing of a sample
5. "Y filter" 45°
6. Capacity gauge
7. Back pressure valve



DWG.2

9 DISASSEMBLY

To disassemble the machine and to install it in another place, read the information given in section 4 **RESIDUAL RISKS**.

Special attention must be paid for the possible presence of pressurised liquids.

- **Disassembly of the pump's hydraulic parts (head and valves).**

The disassembly of the pump head requires a special care: the drawing for the specific section of the pump (DWG. 29) should be consulted before taking any action.

The replacement of the O-ring gaskets of the pump head is left to the discretion of the user.

Both the suction and delivery valves (Pag. 16) always operate on a vertical axis (gravity closure). They are held to the seat as shown in the attachment. The valves must be replaced, along with their seats, if they are dented. Keep always in mind that the valves must never be lubricated, but rather cleaned of any trace of lubricant which can cause blockages.

10 PREPARING THE PUMP FOR START-UP

10.1 Pump body or gearbox lubricant

The series FM pumps are supplied already filled with a lithium lubricating grease.

10.2 Connecting the pump to external power sources

WARNING!

Before installing and starting-up the pump, it is necessary to verify that the details mentioned on the motor plate correspond to the characteristics of the current network. The sense of rotation of the motor must be anti-clockwise as indicated by the arrow on the fan cover.

The standard electric motors installed are: three-phase or single-phase synchronism - protection IP 55 - insulation class F - building form V18 - ventilated from outside.

The connection of electric motors to power sources can be:

Three-phase motors 400V (380/415V) 50Hz or (440/480V) 60Hz, star connection (Y). (DWG.A)

Three-phase motors 230V (220/240V) 50Hz, triangular connection (Δ). (DWG.B)

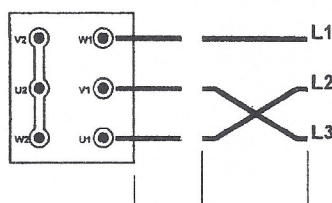
Single-phase motors 230V (220/240V) 50Hz. (DWG. C-D)

The scheme for attachment to electrical power of DWG. A-B-C-D is inside the motor terminal board.

THREE-PHASE

Star connection (Y)

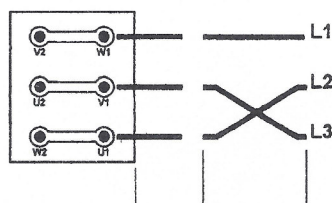
DWG. A



To reverse the direction of rotation, cross the electric cables L2 - L3

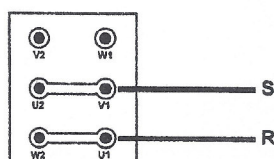
Triangular connection (Δ)

DWG. B



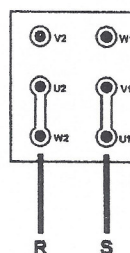
SINGLE PHASE

DWG. C



To reverse the direction of rotation, move the links as shown in DWG. C or D

DWG. D



DWG. 25

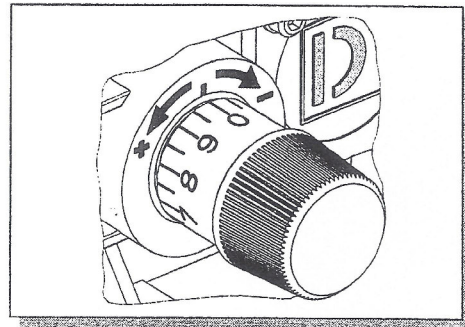
11 ADJUSTMENT AND CONTROLS

11.1 Adjusting the machine

The only adjustment required by the machine is the capacity.

The adjustment of the pump's capacity, from 0% (zero) to 100%, is carried out by rotating the regulation knob clockwise one complete revolution (DWG. 26), which is divided into 20 parts. Each division of the knob, therefore, is equivalent to the variation $1:20 = 5\%$ of the pump's maximum capacity.

FM pumps are not provided with servo-controls.



DWG. 26

11.2 Adjusting accessory devices: relief valve or over-pressure

The following describes the necessary steps to correctly calibrate a relief or over-pressure valve:

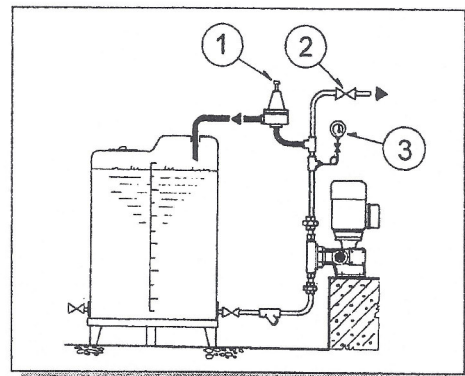
- Install the valve as shown below (DWG. 27).
- Loosen the calibration screw (Pos. 1).
- Start the pump and let it remove all air from the hoses.
- Close the on-off valve (Pos. 2).
- Tighten slowly the calibration screw of the valve on the top (Pos.1), until the desired pressure is shown on the pressure gauge (Pos. 3).
- Open slowly the on-off valve (Pos. 2).
- To check that the calibration was performed correctly, just close the on-off valve again (Pos. 2) and the pressure shown on the pressure gauge must be the same as before.

In order to calibrate the **RELIEF** or **OVER-PRESSURE** valve, follow the indications reported here below:

For **OVERFLOW** functioning:
Installation pressure + 10% of the same.

For **OVER-PRESSURE** functioning:
Installation pressure +15% of the same.

N.B. The calibration percentages mentioned are just as an indication, anyway at the operator's discretion.



DWG. 27

12 START-UP AND USE OF THE PUMP

12.1 Control devices

The pump's control devices are shown in the attached drawings (overall dimension and section of the pump body DWG. 30).

Remember that the pumps are normally equipped with only a manual control (DWG. 26).

12.2 Description of the operations

Follow the steps below to start-up the pump:

- Check the electrical connections and that the motor rotates in the direction shown by the arrow on the fan cover of the motor.
- Make sure that the liquid to be dosed is not solidified and dried in the hoses.
- Make sure that all on-off valves along the path of the hoses are open.

- Start the machine for the first time with the lowest pressure and capacity 0 (zero), and gradually increase it to the maximum capacity, rotating the regulation knob so that the hoses can be degassed quickly and safely.
- Dosing pumps are self-priming. Some priming difficulties can nevertheless arise in pumps having a small diaphragm diameter or with high delivery pressures, or, still, back-pressure valves mounted directly on the pump head.

13 TAKING THE MACHINE OUT OF SERVICE

Before taking the machine out of service or replacing hydraulic parts, a thorough cleaning is necessary using cleaners which are compatible with the pumped liquid, since there could be toxic, caustic or acid liquid residues. Attention must be given to the possible presence of pressurised liquids in the installation, in which case the hoses near the pump must be "sectioned-off" by closing the on-off valves near the pump. Any legal requirements on the recycling and disposal of metal and plastic parts of the pump must also be taken into consideration.

14 MAINTENANCE, REPAIR AND ADJUSTMENT

14.1 MAINTENANCE

WARNING!

BEFORE PERFORMING ANY MAINTENANCE PROCEDURE, THE FOLLOWING STEPS MUST BE OBSERVED:

- ❖ *The pump must be at rest and disconnected from all electrical power.*
- ❖ *The installation must be emptied of used liquids.*
- ❖ *The pump head must always be depressurised.*
- ❖ *The service personnel must wear proper protection, such as: gloves, mask, glasses, boots or anything else necessary to prevent the skin from coming in contact with the liquid being pumped.*

- In order to maintain the safety, reliability and performance of the pump over the time, it must undergo to periodical and programmed maintenance procedures.
- Checks and controls are essentially visual in nature. The internal and external parts of the pump must be checked for pits, corrosions and other signs of decay. Special attention must be given to plastic materials, especially with regards to cracks, chinks and breaks. These phenomena obviously require replacement of the affected parts.

Table II – Suggested spare parts

- Parts subject to wear must be checked periodically. Check the following tables for spare parts.

SPARE PARTS SERIES FM PUMP			
Design N°	Reference	Denomination	
XZSIEMM0000001000	223	Push-rod gasket	DWG. 30
	226	Push-rod spring	DWG. 30
XESIETM0000002099	20	Diaphragm	DWG. 29
•	AB 5 - AB8	Complete suction valve set	
•	AB5 - AB8	Complete delivery valve set	

• It depends on the type of valve (see attachment pag.16)

- The user is advised to schedule the checks after the initial start-up and keep the results in a separate register (Maintenance Register). The user can then set the optimum maintenance interval based on the results collected.
- A special attention must always be given to inspections of diaphragm which must be replaced at the first sign of ageing and/or decay.
- The following anomalies or malfunctions are cause for extraordinary service procedures or an operational check-up or adjustment:
 - **Valves blocked by impurities.**
 - **Worn valves.**
 - **Worn gaskets.**
- Are there suction filters in the installation? Service personnel are responsible for periodically cleaning and replacing them when necessary.

14.2 REPAIR AND ADJUSTMENT

WARNING! *BINDING CONDITIONS FOR THE ACCEPTANCE OF ANY MATERIAL TO BE REPAIRED IN OUR WORKSHOP ARE THE FOLLOWING.*

- ❖ *Any liquid or incrustation inside or over the equipment must be removed, with a special care for the hydraulic part (pump head and valves), so that the staff will be able to handle the machine eventually bare-handed without running any risk.*
 - ❖ *The customer must send the material together with a declaration that the equipment has been carefully cleaned for a safe handling.*
 - ❖ *The equipment delivered without this declaration and which does not comply with the above rules will be returned not repaired and at customers' charges.*
- After repairs, the steps of section 13 START-UP AND USE OF THE PUMP must be followed in order to put the machine back into service. Special attention should be given to the electrical power connections.
 - In the vast majority of the cases, replacement of worn parts is not very difficult, but the instruction given in the drawings must be carefully followed.
 - Since check-ups, repairs, adjustment and maintenance can pose danger to personnel, the following recommendations must be kept in mind:
 - High temperatures can be encountered on the surfaces of motors, as well as the hydraulic parts when they form a heating circuit, or when the pump is dosing high temperature liquids. Considering the type of material used for the pump (DIFFERENT THERMOPLASTICS) temperatures higher than 50/60°C must not be reached. Protective gloves should therefore be worn by service personnel. Furthermore, it is the responsibility of the installer to provide proper installation.
 - In addition to the normal cautionary measures of which the user should already be aware (they are widely available), the installer and/or operator is advised that the floor of the installation should be industrial (incline, tile material, etc.). This protects the structures from any leaks of the liquid being pumped, either during operation or while performing maintenance on the pumps.

15 NOISE AND VIBRATIONS PRODUCED BY THE PUMP

The results of phonometric measurements taken on a series FM pump when it is working are reported here below.

In the more general context of European Directive 89/392, it is provided to check the noise and vibration levels of the machine in question.

The verification methods are those given in ISO (International Standard Organisation) 3744 "Acoustics - Determination of sound power level of noise source - Engineering methods for free-field conditions over a reflecting plane" and in ISO 2631 "Guide for evaluation of human exposure to body vibration".

Table III – Phonometric investigation

SERIES FM PUMP		
Conditions of the pump under pressure		
Maximum sound level emitted	Average surface pressure level	Sound power level
<i>dB(A)</i>	<i>dB(A)</i>	<i>dB(A)</i>
71.3	68.5	72

More detailed information is available contacting our Technical Office.

Table IV – Vibration analysis
(vibration acceleration values)

SERIES FM PUMP		
Frequency	Vibration	
<i>Hz</i>	<i>dB(A)</i>	<i>m/s²</i>
1.00	//	//
1.25	//	//
1.60	//	//
2.00	//	//
2.50	//	//
3.15	46.1	0.0002
4.00	63.3	0.0015
5.00	54.3	0.0005
6.30	60.2	0.0010
8.00	62.2	0.0014
10.0	65.3	0.0018
12.50	70.4	0.0033
16.00	76.6	0.0068
20.00	75.7	0.0061
25.00	74.8	0.0055
31.50	86.7	0.0216
40.00	93.4	0.0486
50.00	118.7	0.8610
63.00	108.1	0.2541
80.00	108.4	0.2630

16 USING THE PUMP IN AN EXPLOSIVE ATMOSPHERE

In no case, the series FM pump can be used in an explosive atmosphere.

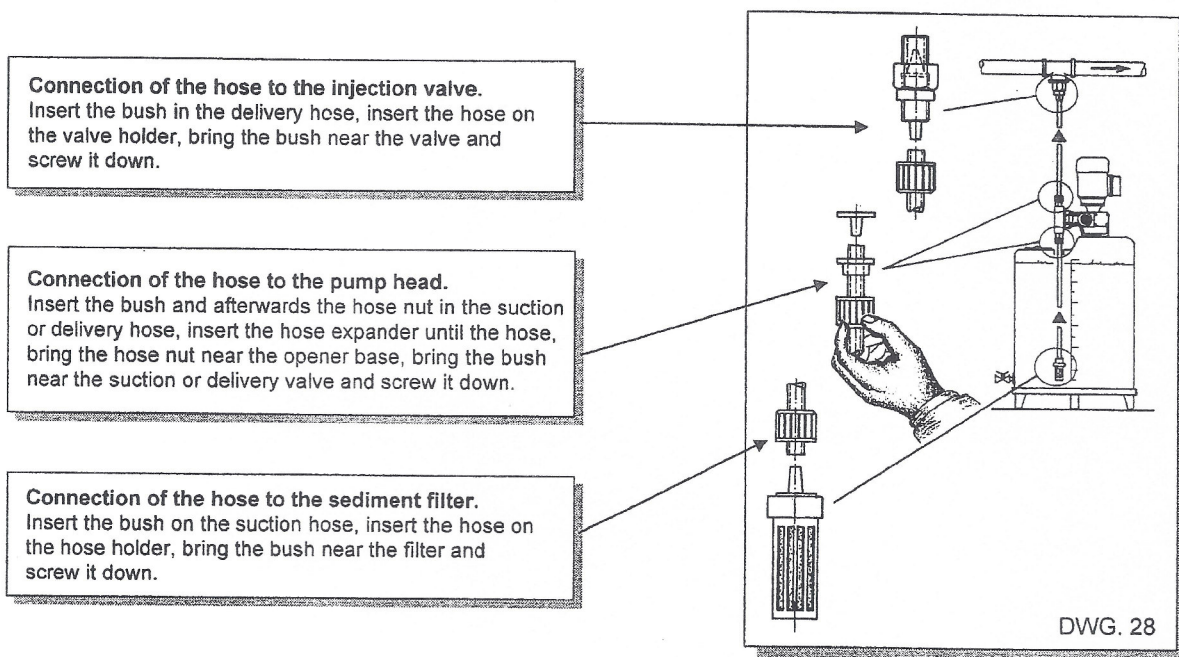
17 DISPOSAL OF HARMFUL SUBSTANCES

The user is reminded that all liquid and solid, harmful, toxic or otherwise substances must be disposed according to the laws in force.

18 ACCESSORIES ASSEMBLY PROCEDURE

18.1 Installation example

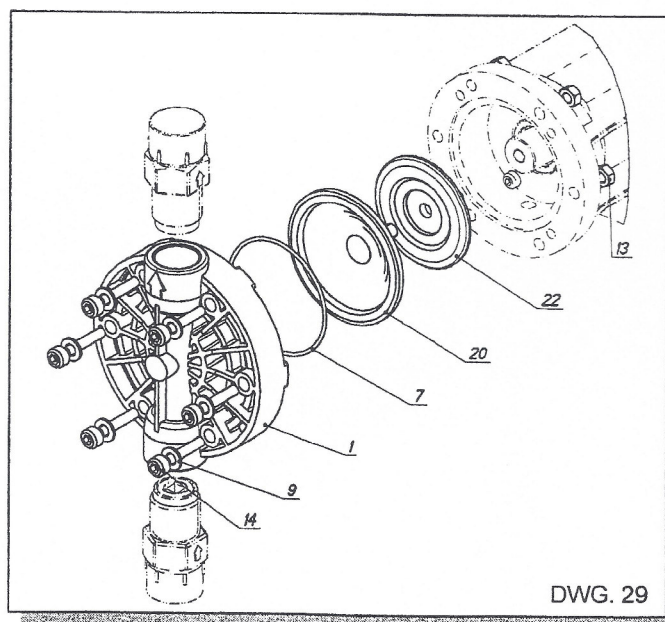
The series "FM" pump built in compliance with execution 12, is supplied with sediment filter, flexible hoses (suction side in PVC crystal, delivery side in PE polyethylene), injection valve and hose holders connectors in PVC.



19 PUMP HEAD DRAWING

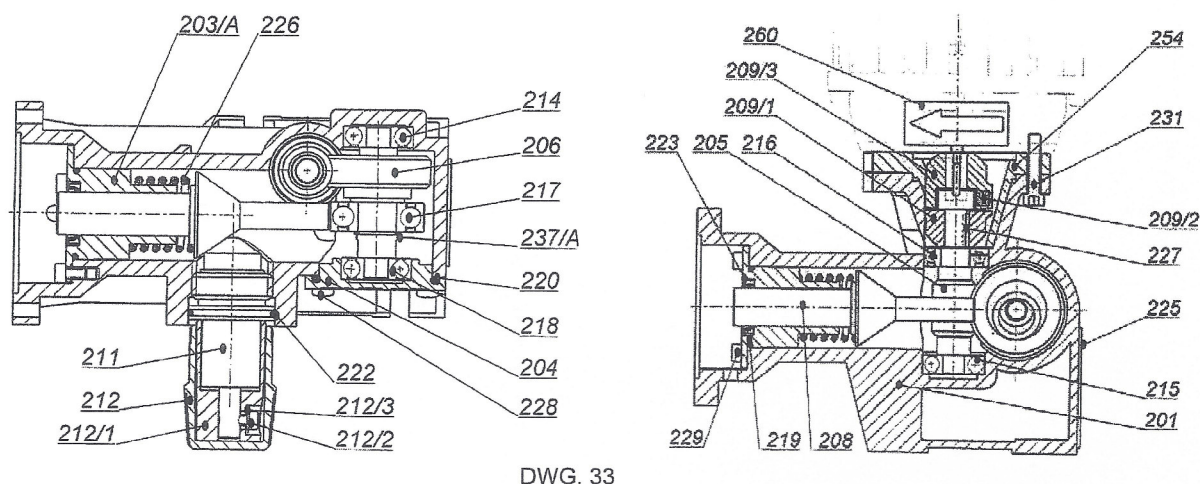
Model FM 50 pumps

PUMP HEAD DESCRIPTION		
Ref.	Q.	Denomination
1	1	Pump head
7	1	O - Ring gasket
9	6	Flat washer
13	6	Nut
14	6	Screw
20	1	Diaphragm
22	1	Diaphragm shield



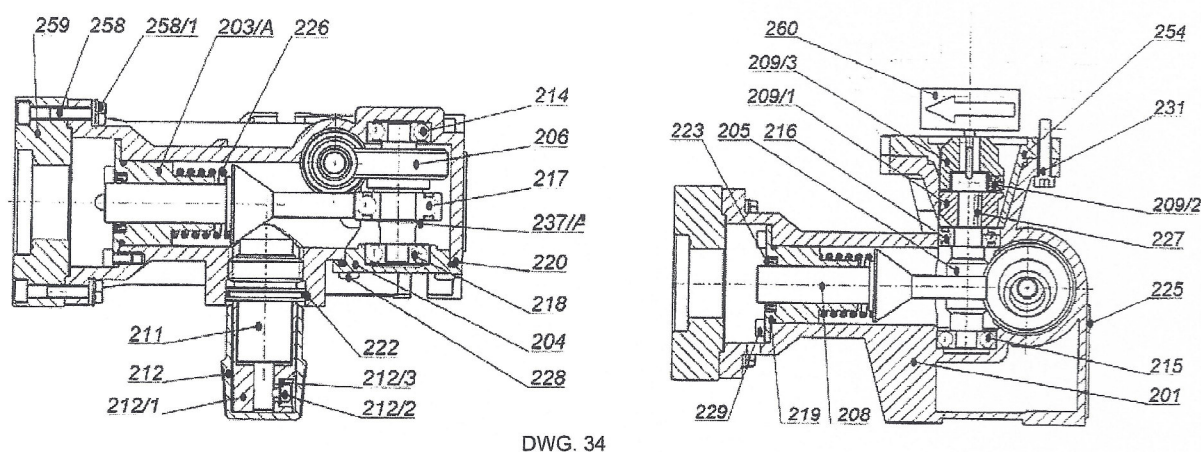
20 PUMP BODY SECTIONAL DRAWING

Model FM 50N - 50 pumps, sectional drawing of the pump body, components description.



DWG. 33

Model FM 50N - 30 pumps, sectional drawing of the pump body, components description.



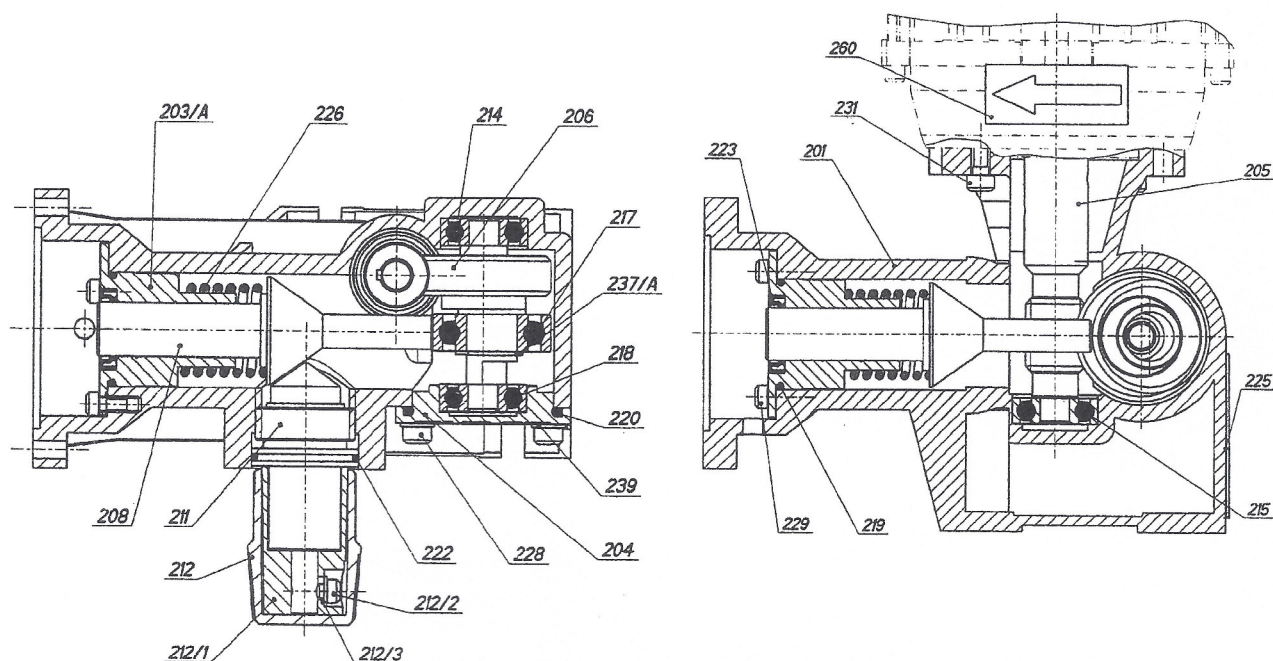
DWG. 34

PUMP BODY DESCRIPTION					
REF.	Q.	DENOMINATION	REF.	Q.	DENOMINATION
201	1	Pump body	218	1	Cover side ball bearing type - 629
203/A	1	Push-rod support	219	1	O-ring gasket type - 2118
204	1	Cover	220	1	Cover O-ring gasket type - 3162
205	1	Worm screw	222	1	Adjustment screw O-ring gasket type - 2112
206	1	Worm wheel	223	1	Push-rod MIM gasket type - 16-24-5
208	1	Push-rod	225	1	Adhesive label
209/1	1	Elastic joint (inferior)	226	1	Push-rod spring
209/2	1	Elastic insert	226/1	1	Shim spring
209/3	1	Elastic joint (superior)	227	1	Key
211	1	Adjustment screw	228	4	Cover screw
212	1	Outside knob	229	3	Push-rod support screw
212/1	1	Internal knob	231	4	Motor screw
212/2	1	Locking screw	237/A	1	Shaft snap ring
212/3	1	Toothed washer	254	1	Bearing holding flange
214	1	Wheel side bearing type - 629	258	6	Screw reducer ring
215	1	Worm screw ball bearing type - 629	258/1	6	Nut
216	1	Worm screw ball bearing	259	1	Reducer ring
217	1	Shaft ball bearing type - 6202	260	1	Adhesive arrow

20 PUMP BODY SECTIONAL DRAWING

Model FM 50 pumps

Sectional drawing of the pump body, components description.



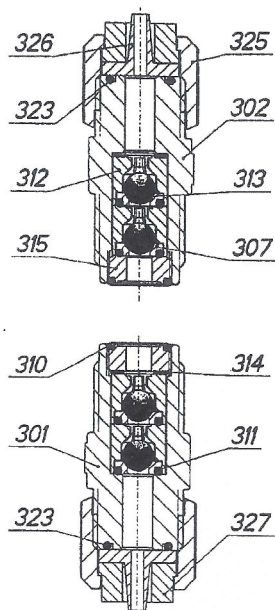
DWG. 30

PUMP BODY DESCRIPTION	
Reference	Denomination
201	Pump body
203/A	Push-rod support
204	Cover
205	Worm screw
206	Worm wheel
208	Push-rod
211	Adjustment screw
212	Outside knob
212/1	Internal knob
212/2	Locking screw
212/3	Toothed washer
214	Wheel side bearing type - 629
215	Worm screw ball bearing type - 629
217	Shaft ball bearing type - 6202
218	Cover side ball bearing type - 629
219	Push-rod support O-ring gasket type - 2118
220	Cover O-ring gasket type - 3162
222	Adjustment screw O-ring gasket type - 2112
223	Push-rod MIM gasket type - 16-24-5
225	Adhesive label
226	Push-rod spring
228	Cover screw
229	Push-rod support screw
231	Motor screw
237/A	Shaft snap ring
239	Flat washer
260	Adhesive arrow

21 PLASTIC VALVES SECTIONAL DRAWINGS

Standard installation execution 12 or 14 DV

AB 5
DWG. 31



DELIVERY

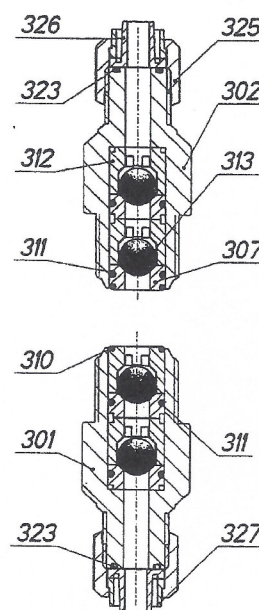


SUCTION



Larger valves execution 14 DV

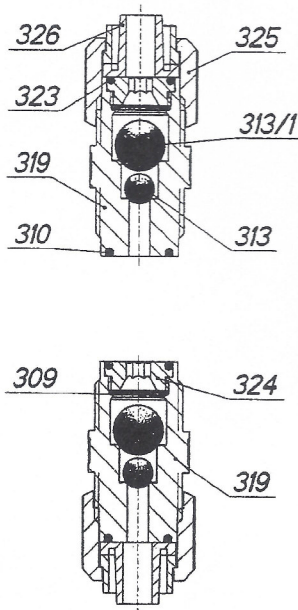
AB 8 - DV
DWG. 32



22 METALLIC VALVES SECTIONAL DRAWINGS

Standard installation execution 11

AB 5
DWG. 33



DELIVERY

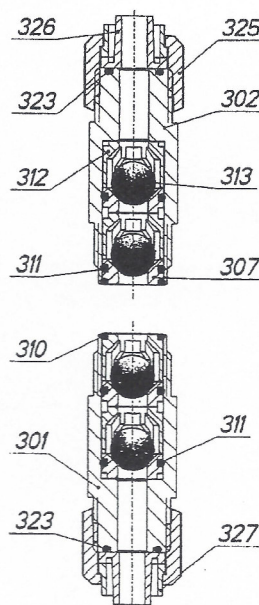


SUCTION



Standard installation execution 11 DV

AB 8 - DV
DWG. 34

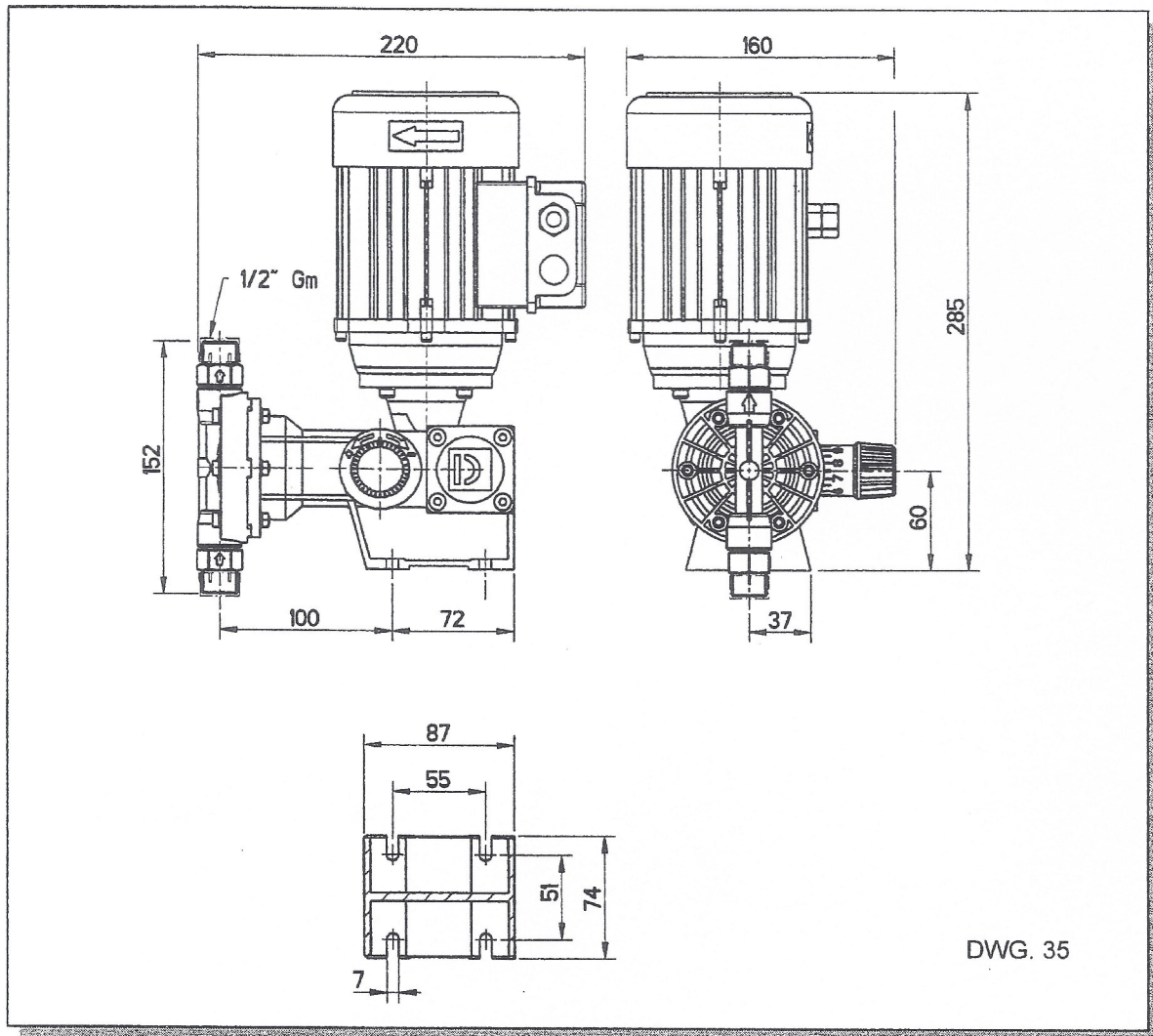


Ref.	Denomination	Ref.	Denomination
301	Suction housing	314	Flat Gasket
302	Delivery housing	315	Locking bush
307	Valve seat	319	Double valve housing
310	O-Ring gasket	323	O-Ring gasket
311	O-Ring gasket	324	Gasket support
312	Valve guide	325	Tube lock nut
313	Ball	326	Hose expander
313/1	Ball	327	Tube nut

23 OVERALL DIMENSION DRAWINGS

Model FM 50 pump

PUMP HEAD *EXECUTION 12* (plastic material)



Model FM 50 pump

PUMP HEAD

EXECUTION 11 (metallic material)

EXECUTION 14 (plastic material)

