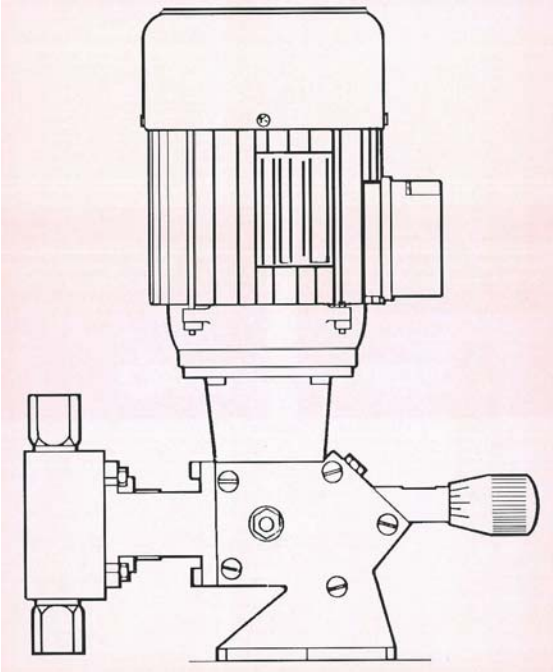
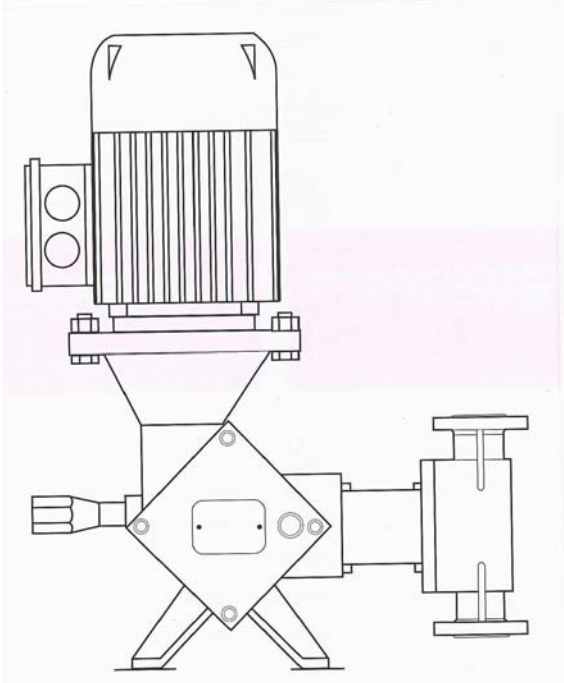
CRAIND IMPIANTI

METERING DOSING PUMP

OPERATING MANUAL





GENERAL FEATURES OF METERING PUMPS

Metering pumps are alternatively moving pumps. Pump output is fixed by piston's alternative motion operated by an eccentric or a rod system. In order to reproduce this alternative motion on pump chamber, some no return valves are fidded in suction and delivery ports. In this way the pump output is intermittent and its frequency is fixed by the number of piston's strokes. The valves are ball-type and closing by gravity.

WORKING PRINCIPLES

1) Inlet stroke

During inlet stroke, the piston allows the no return valve placed in delivery port to close (by its weight or by possible liquid pressure); at the same time the no return valve placed in suction is opened by the positive pressure we have in inlet stroke. The liquid flows through the chamber and the volume is the same as the piston displacement.

2) Compression

The piston in compression phase allows the no return valve placed in suction port to close (by its own weight and by the pressure by the compressed fluid; in the same time the no return valve placed in delivery port opens (by the pressure of the compressed fluid). The fluid from the pump's chamber flows through the delivery pipe and its volume is like the piston's displacement.

TEORETICAL DELIVERY

The theoretical delivery corresponds exactly to the product of the volume of fluid moved by piston by the number of strokes in time unit.

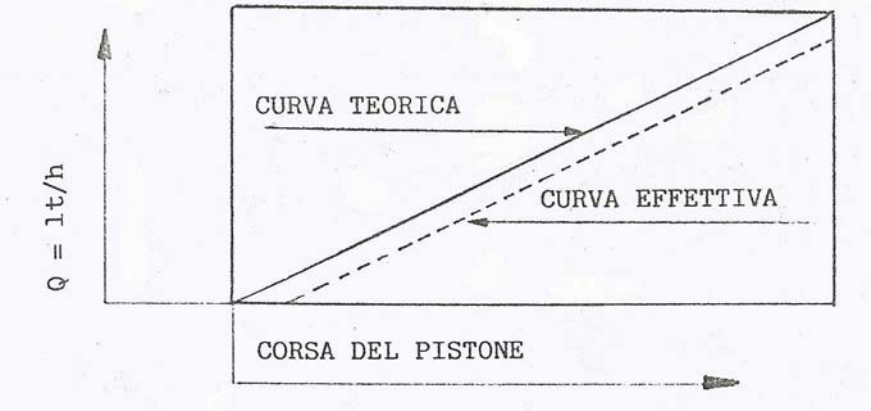
$$Q\ (teor) = \frac{S * C * C1 * 60}{1000}$$ where

S = Piston surface (sq cm)
C = Piston strokes (cm)
C1 = Piston strokes per minute
60 = Ratio hours-minutes
1000 = Ratio cubic cm/cubic dm

Consequently the plot of volume versus piston's stroke will be a slooped straight line.

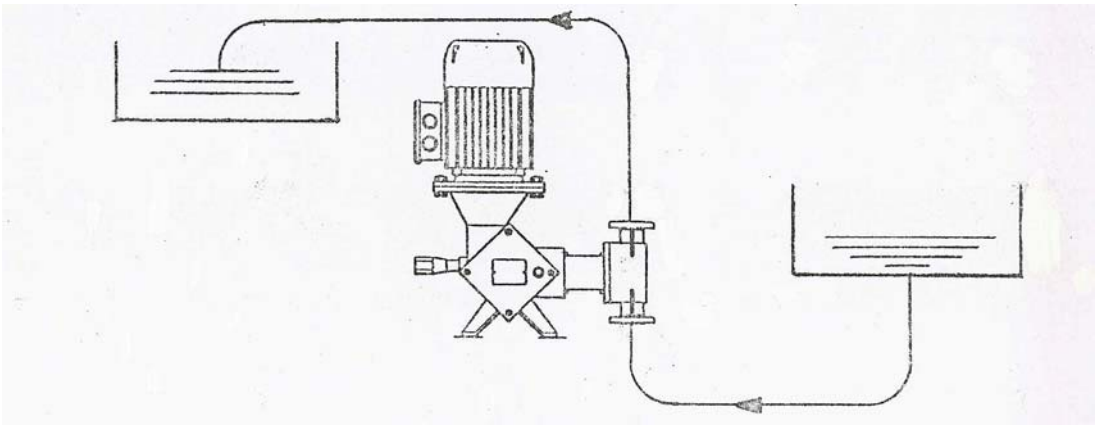
ACTUAL DELIVERY

Actual delivery is less than the theoretical one owing to the losses due to the drawing of the fluid through the valves. The ratio : actual to theoretical delivery is the volumetric efficency of the pump, ranging from 90 to 98%. This performance varies according to the valve's the type of chamber (piston or membrane), the liquid to be pumped, the working pressure, ect. (fig.1)



1) IDEAL INSTALLATION

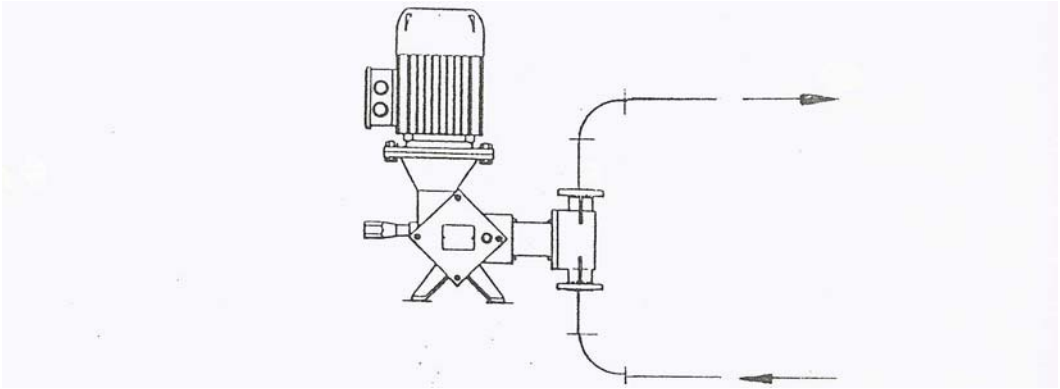
- Low suction head
- Delivery head higher than the suction one



2) GOOD INSTALLATION

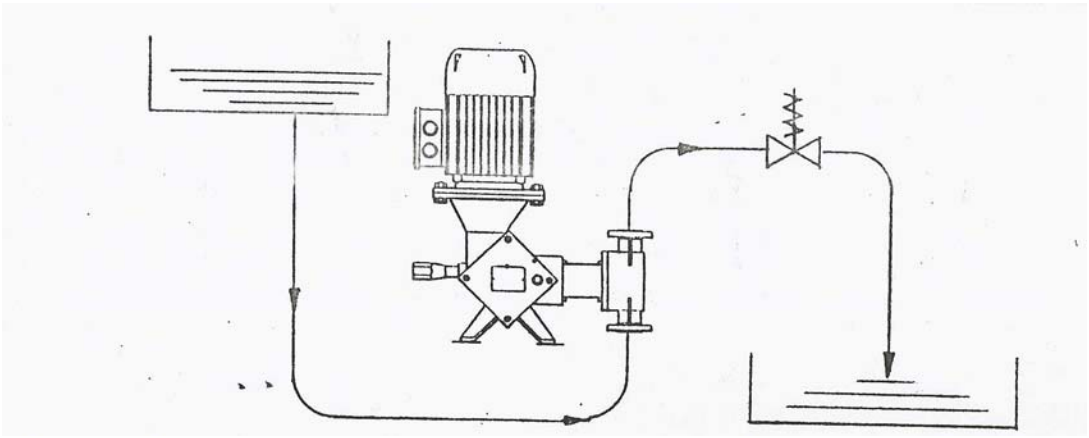
Pipes must be sized (especially the suction one), taking as general rule, for viscous liquids, the diameter immediately superior to the one of the suction ports. The average speed of the fluid in the pipes must not be over 0.7 m/sec (12 f/min) for liquid with viscosity to 100 cp.

2.1) The suction pipe must be as short as possible with large clbows.



3) INSTALLATION WITH DELIVERY HEAD LOWER THAN STATIC SUCTION HEAD

When the liquid level in suction tank is higher than delivery's one my occour a flow of fluid from the suction tank to delivery one. In order to avoid this, delivery pressure must always be higher than the static head. If this does not happen in the plant, it is necessary to make a counter-pressure by a suitable valve calibrated at the pressure rised from the head in suction plus 10% of the same.



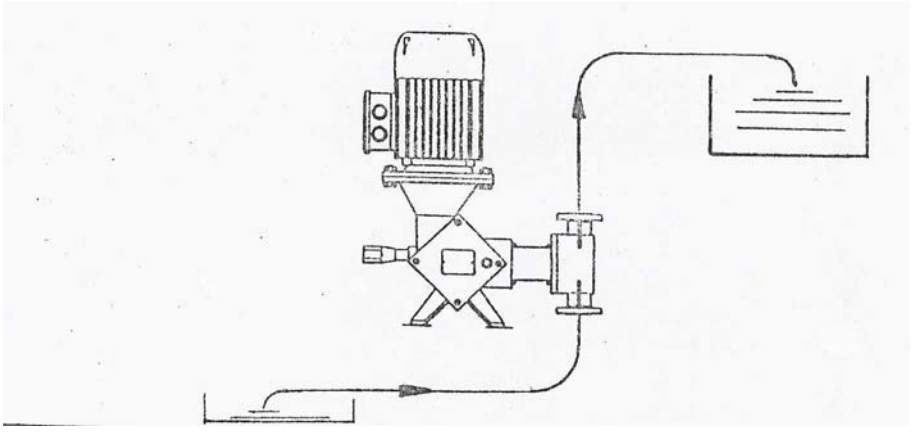
3.1) INSTALLATION WITH STATIC SUCTION LIFT

Being the NPSH of metering pumps changing according to the execution of the pump chamber, in order to obtain a good run it is necessary that NPSH allowable NPSH request
NPSH = net positive suction head
The allowable NPSH is given from the following formula:

$$NPSH - Pb + \frac{Pc}{Y} - Tv - Pt$$

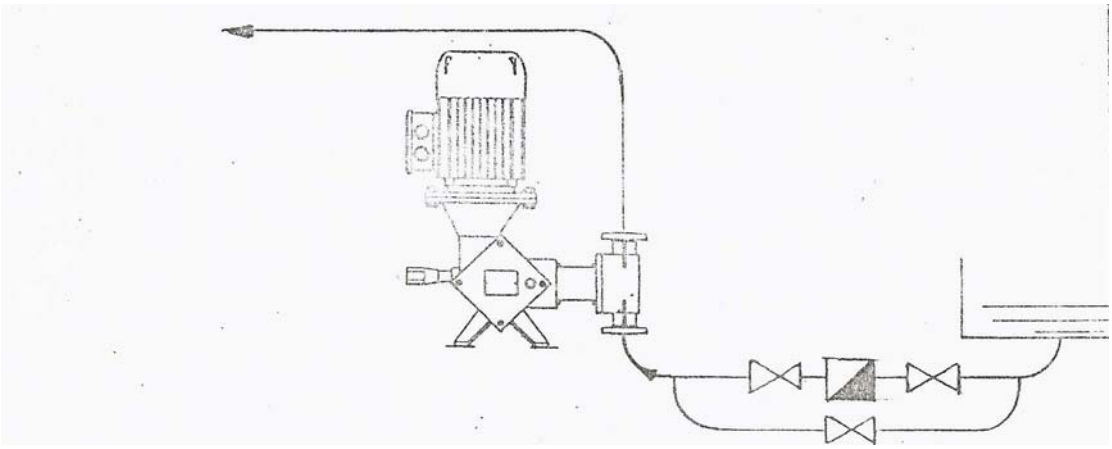
Where:
Pb =Barometric pressure
Pc = Height of the liquid column:
- positive or suction haed (+)
- negative or suction lift (-)

Y = specific weight of fluid
Tv = vapour pressure of liquid
Pt = friction loss of suction pipe
Note: for pumps with low capacity it is necessary to consider the time used by the pump to fill the suction pipe in priming phase.



4) INSTALLATION FOR METERING OF LIQUIDS WICH COULD CONTAIN SOME IMPURITIES

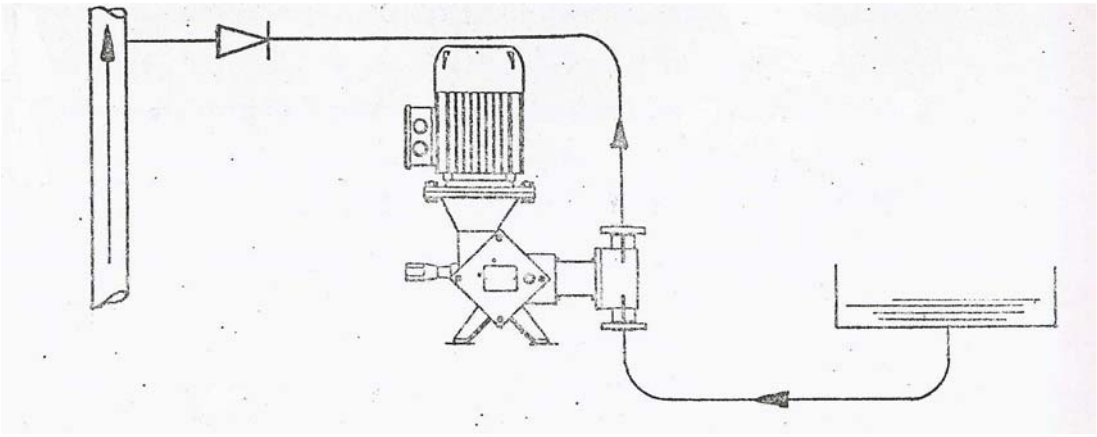
It is necessary to foresee an adeguate suction filter with filter mesh of 0,1 mm according to the pump's size and net filter surface 10/20 times suction pipe area.
In difficult filtering conditions due to the considerable impurity in the liquid, or to the high viscosity, is recommended to use basket filters with large surface (100 time the suction pip's area) which allows to extend the filter life. Besides a large filtering surface reduces negative drop for the pump's volumetric efficency.
If the pump is used continuosly a by-pass us suggested.



In case of slurry metering, the pipe layout must be studied to avoid solid settling expecially near the pump. Consequently it is necessary to avoid delivery vertical strectch and foresee washing of pump and pipes immediately after every stop.

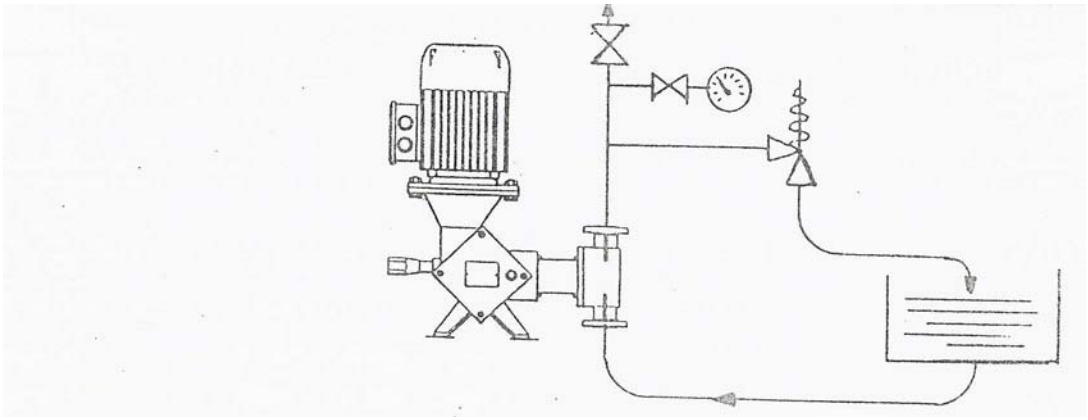
5) INSTALLATION WITH DELIVERY IN PIPE WHERE THERE IS CONTINUOSLY FLOW OF LIQUID

It is necessary to foresee a no return valve near the pipe's entry.



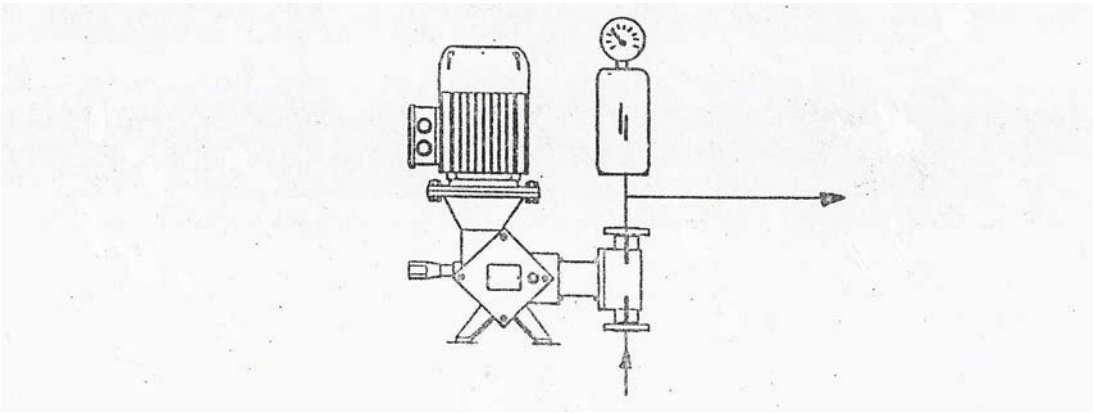
6) NECESSITY OF INSTALLATION OF SAFETY VALVE

Being volumetric pumps, the metering pumps must be protected against the danger of running with closer valve occluded delivery pipe.
Consequently it is necessary to foresee suitable safety valve. The valve discharge must be casily controllable for a greates control of the valve loss and than of metering precision. The discharge of the safety valve ought to be connected to the suction tank or to a drain.
Note: The safety valve must be always mounted in branch on the delivery pipe between pump and first check valve or, in any case, as soon as possible near the pump chamber. Besides it is recommended the installation of a gauge with gauge holder valve near the safety valve.



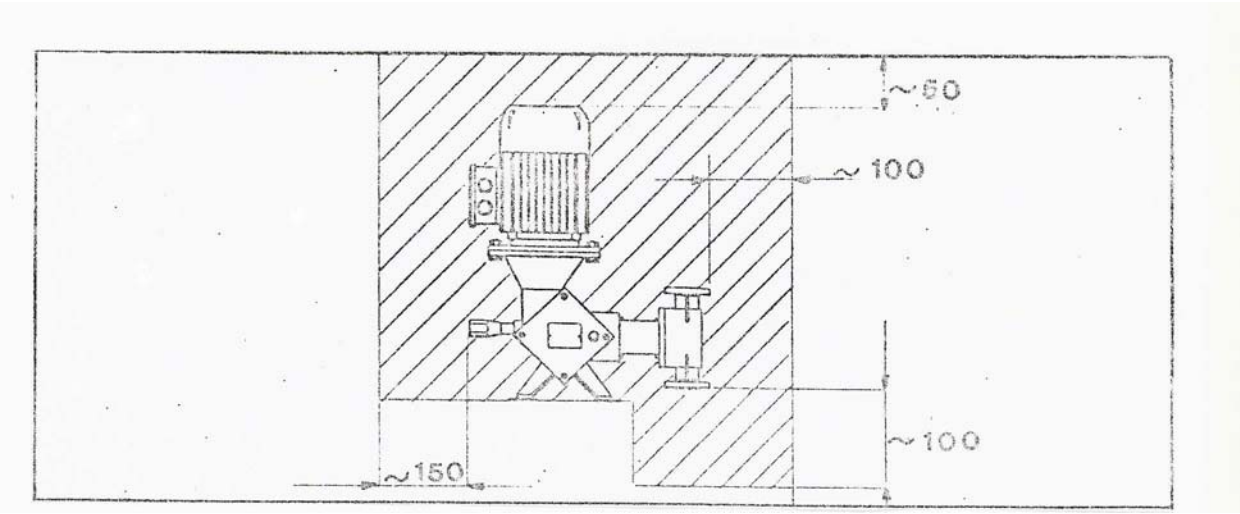
7) INSTALLATION OF PNEUMATIC ACCUMULATOR OR DAMPER BAG OF PULSATIONS

In case of volumetric pumps, it is necessary, immediately after the pump, a surge suppressor in delivery, especially with high capacity and it is indispensable if we want a continuos delivery. The use of a suppressor is always suggested as it increase the pump life and eliminates vibrations and inertias in the plant.



8) PUMP MOUNTING

8.1) It is advisable sufficient clearance in order to control and remove the pump particulary with regards to the pipe connection and to handle the stroke adjustement knob.



8.2) If the pumps must be located in the open, it is necessary an adeguate protection roof, above all if the pump is equipped with actuator or other delicate equipments.
8.3) It is advisable to foresee suitable drain on delivery pipe near the pump chamber in order to make easy the pump moving from plant. In case of pump equipped with vertical flanges, it is necessary to foresee feeder lines to make easy the moving.
8.4) The pump chamber manufactured in PVC can work correctly only at the room temperature and with liquid temperature less than 40°C. It is consequently necessary an adequate protection from sunlight and control of the metered liquid's temperature.

9) PUMP INSTALLATION

9.1) It is necessary to be sure that base plate is stable and well levelled and then to position the pump firmly avoiding stress on its axis.
9.2) Before connecting the pipes to pump fastenings wash the pipes to eliminate any foreign substance, soldering drops, packings cuttings or other rubbish.
9.3) The pipes must be supported independently and they must not force on the pump. Besides the pump connections must be executed in such a way that eventual expansions, due to heat source, do not exercise their thrust on the pump's head.
9.4) Foresee always, after delivery flange, a cross connection which can be used to mount manometers safety valves, pulsations dampers.
9.5) Check the free pump rotation moving manually the motor fan. In case of block, control installation and alignment.
9.6) Control that the pipes are perfect tight and particulary that there is no suction of air at inlet which would prevent pump suction.

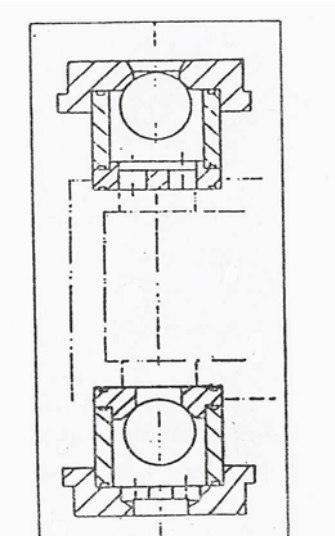
10) PUMP STRAT UP

10.1) Check the oil level through special sight-flow gauges. Pumps are always supplied without oil.
10.2) Check the electrical connections and motor rotation sense which must be as indicated by arrow placed on motor.
10.3) Make sure that all interception valves along suction and delivery pipes are open.
10.4) Make sure that liquid tube metered be not solidified or frozen in the pipes.
10.5) Start with delivery pressure as low as possible, increasing it gently to the maximum. Start pump with no delivery, increasing it gently to maximum in order to desaereate the pipe in rapid and sure way.

10.6) Even if metering pumps are self-priming one, it is possible to have some starting difficulty owing to very reduced piston diameter, or high delivery pressure or counterpressure valves. In these cases it is advisable to fill suction line and pump chamber with the liquid to be pumped.

11) MAINTENANCE

11.1) Lubricant
Fill to level indicated by special sight-flow gauge-plugs all the oil bath carters. As lubricant oil we recommend a type SAE 140 to be found easily. Commercial products are suitable and have the same characteristics.
Replace first lubricant after first 500 exercise hours and successively every 3000 working hours.
11.2) Protection
In case of pump out work for long time, expecially before starting, it is necessary to fill the gear box, links and pumping heads with protective oil. Wrap the whole unit in protective plastic material sheet.
Before restarting remove protective oil.
11.3) Stuffing box
All metering pump chambers are equipped with automatic packings – V – shaped in PTFE. Their shap allows consequently an automatic expansion in stuffing box underidraulic pressure thrust. Therefore it is advisable not to tighten the seal excessively as the relevant thrust charges uselessly the piston with consequent braking action on the whole mechanism.
It is suitable, on the contrary, to work gradually with many hours intervals so that packings have time to settle down.
11.4) Dismantling
Pump chamber dismantling requires particular attention. It is advisable to examine with attention the drawing in pump section before beginning any action. The smooth packings among valves must be replaced after any disassembling. The assembler will advise if O-rings are to be changed.
The valve balls, cither in suction or in delivery, work vertically: they are tight on the scat as per figure. The balls are worked very carefully and must be replaced togheter with relative scats in case of crish. Never lubricate valves or scats; on the contrary clean off any lubricant trace which could case locking.



WORKING BREAKDOWNS AND TROUBLES

DELIVERY LESS THAN EXPECTED

Generally the causes are due to the plant :
- suction air infiltrations through connections.
- insufficient suction head (due to vapour pressure, fluid temperature, viscosity).
- suction pipe stopped up.
- filter obstructed.
- safety valve set at a pressure less than exercise one.

WHEN IT IS NECESSARY TO HANDLE PUMP

-Valves locked by impurities.
-Valves worn out.
-Piston and packing worn out.

HIGHER OR IRREGULAR DELIVERY

- Too high suction lift.
- Counterpressure valve locked by impurities.

DIAPHRAGM PUMPS

Instructions for filling intermediate fluid (type GULF ARMONY 32 AW)

1) Disassemble the head.
2) Changing the diaphragm.
3) Reassemble the head.
4) Regulate the stroke to 1 mm.
5) Start up the pump.
6) Filling the oil chamber.
7) Use the pump for some minute with the open plug (to remove the air from the chamber).
8) Stop the pump.
9) Add the further missing oil.
10) Close the plug.
11) We recommend to use oil type GULF HARMONY 32AW, FIAT TUTELA or similar.

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