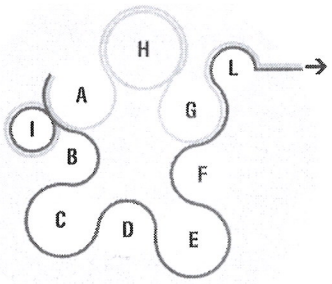
6.6 Capsule handling

*Capsule handling means a set of units designed to **infeed, position, open, transfer** and **close** the capsules.*



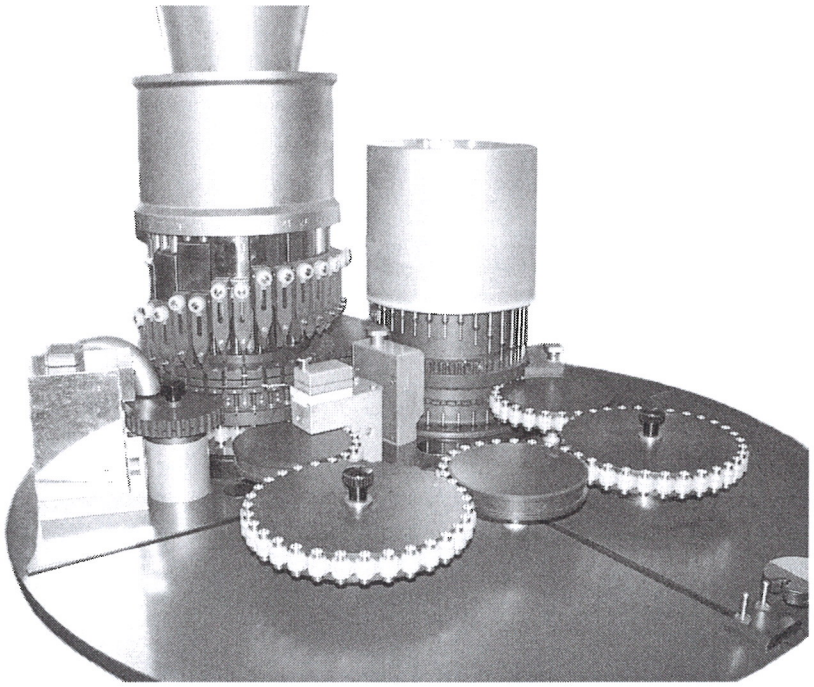


Figure 5 – The photo shows the various machine zones in which the capsules are handled.

Capsule infeed, Positioning and Opening The pre-assembled empty capsules are fed into the machine, i.e. with the lid and body assembled but not closed. The **capsule infeed/positioning/opening unit** feeds the empty capsules to the tubes, ensuring that the capsules are in a vertical position with the bodies below.

Capsule infeed transfer wheel The positioned capsules are transferred to the capsule infeed transfer wheel where the capsule presence sensor or ECCS in case of presence of the NETT system) detects their presence.

Capsule opening The capsules return to the infeed unit, where they are opened. The lid and body from each capsule are separated and then transferred to two completely different handling stations. The lids are conveyed to the lid transfer unit, which transfers them to the joining, closing unit. The bodies are conveyed into the capsule body bushes on the conveyor belt. The belt transfer the bodies to dosing and then to closing.

Dosing The bodies, located in the capsule body bushes, are transferred to the dosing unit where the product is dosed in the preset quantity.

Capsule closing The filled bodies are transferred to the closing unit where they are positioned below the lids coming from the lid transfer unit. The body and lids are then reassembled before the capsules are definitively closed.

Capsule outfeed The dosed and closed capsules go to the capsule outfeed transfer wheel, where they are detected by the capsule presence sensor (or FCCS if present), and are then ejected.

📖 *For more information on capsule handling, see the specific paragraphs in this **CHAPTER** of the manual.*

6.7 Motor and drives

*The drive motor for the machine units is a **three-phase electric motor** whose speed can be varied in a continuous manner. It can also be stopped in phase.*

Motion is transmitted from the motor to the capsule dosing and handling units by a **toothed belt** that transmits motion and keeps the motor in phase with the units. The belt is connected to two pulleys: one fit to the motor shaft ***Pu*** and one fit to the fast shaft of the reduction gear ***F***.

The **reduction gear** ***Ri*** (see photo below) transmits motion to **main gear unit** ***Ce*** located in an upper air space (transmission support) by means of **flexibile joint** ***G***.

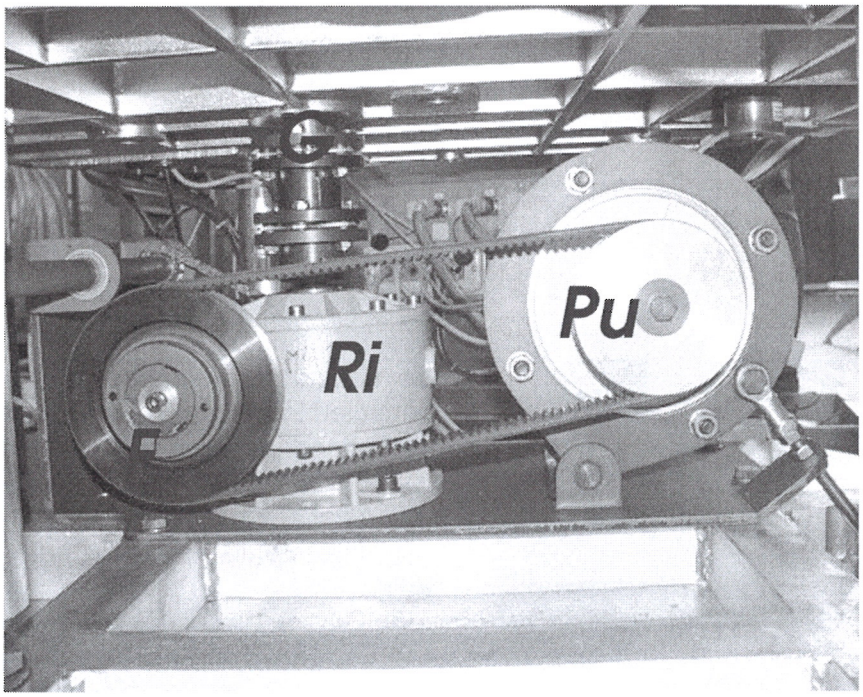


Figure 6 – Motor with pulley and reduction gear secured to the machine base.

The main gear **Ce** is connected to the other gears which transfer the drive to the units. The gears are contained in a space in the base (see photo below).

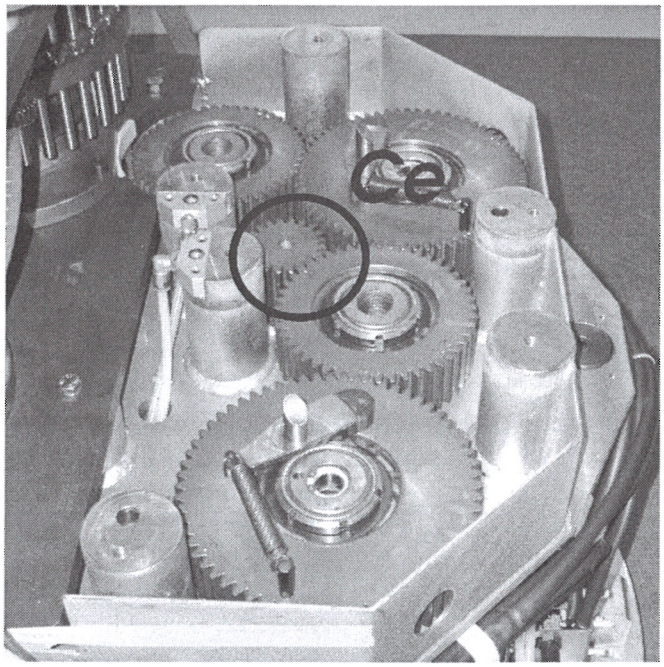
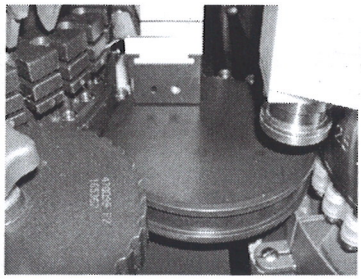


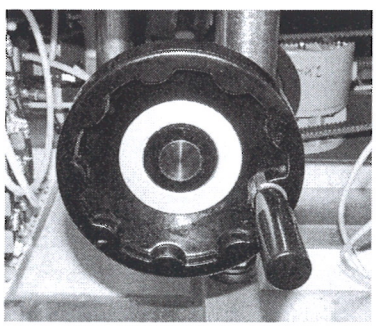
Figure 7 – Gear and drive components.

6.8 Motorised units and idle units



The motor transmits motion to the units by means of gears connected to the main gear. These units are defined as **"motorised"**. There are also some units or wheels which are not driven by the gears. These are driven by the movement of the bush transfer belt which connects all the units. These units are defined as **"non- motorised"** or **"idle"**.

6.9 Handwheel



The handwheel enables the machine to be operated manually.

This device must be used when motor functioning is overridden and a short slow movement is required, e.g. when removing and fitting parts.

One precise turn of the handwheel corresponds to one forward step of the bush belt.
There are two handwheels, one on each side of the machine, and are positioned in side the base.
They are accessed by opening the guards.

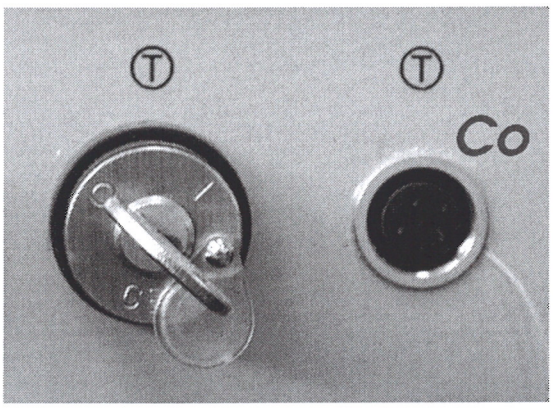
The manual control handwheel must be used ONLY when the machine is stopped and the mains switch is OFF.

***IMPORTANT:** A mechanical security device disengages the manual control handweel when the machine is working.*

6.10 JOG control

A jog control is supplied as standard. This enables machine functioning by overriding the start controls on the panel. This machine functioning mode enables accurate movement control. Therefore the control should only be used during maintenance operations or to perform tests following faults. The jog control is connected to the machine using the special connector ***Co*** on the control panel.

Figure 8 – Using the jog control.



Safety devices remain enabled during jog control functioning.

*For further details on how to install and enable the jog control refer to the "**Preliminary operations**" section in the "**SYSTEM CONFIGURATION**" chapter.*

Production cannot be guaranteed during jog control functioning. Therefore, any capsules produced cannot be classified as a production lot.

7. Air treatment in the machine

*Correct machine functioning requires **compressed** air distributed by the pneumatic system and air in **suction** and **vacuum** distributed by the suction and vacuum system.*

***COMPRESSED AIR** is used mainly where air jets are needed*

***VACUUM** is used mainly for opening the capsules and to hold them during closing.*

***SUCTION** is used in all zones requiring cleaning and handling.*

7.1 Pneumatic system

*The pneumatic system **distributes the compressed air** supplied by the customer's main compressed air system to the various air jets on the machine units. The system is housed in the machine base.*

The compressed air supplied by the customer's main system enters the machine through a quick-release coupling.

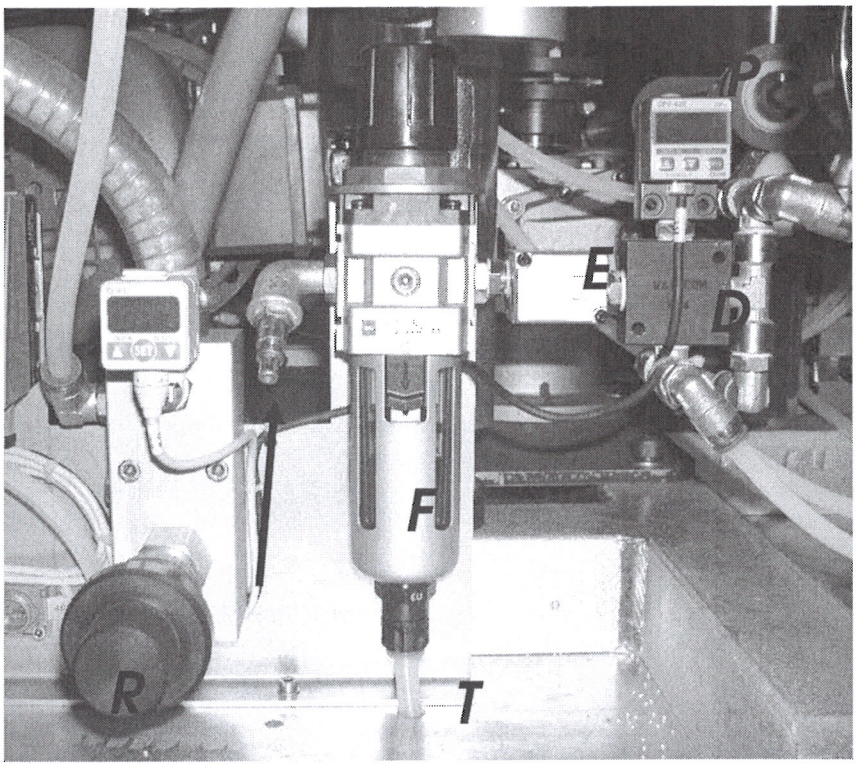


*Figure 9 – The photo shows the air infeed coupling (**arrow**), regulator (**R**), filter (**F**), ON/OFF solenoid valve (**E**) , distributor (**D**), condensation discharge tube (**T**) and pressure switch (**P**).*

The compressed air is fed into the machine from the customer's mains supply via a quick-release coupling (arrow) and is sent to the various machine components by a distributor fitted with regulators and pressure switches.

The air is filtered by **filter** *F* and any condensation is eliminated by small tube *T* below the machine base.
The pressure can be adjusted using **regulator** *R*.

The system is fit with **ON/OFF solenoid valve** *E* to guarantee complete emptying in case of electrical power failure. This is to prevent air returns and movements of machine parts when the machine stops.

A **pressure gauge** *P* is fitted to measure the working pressure in the system and to set the correct pressure on the regulator *R*.

Distributor *D* then directs air to the **columns** *Co* from which the various units begin (see photo below).
Some of these units require an additional adjustment with the

dedicated pressure regulators ***Re*** on the column. Other units require a reduction in flow rate which is achieved by pressure reducers.

The columns also have regulation plugs ***Ta*** where a pressure gauge can be fit to measure pressure at the unit.

A set of hoses is connected to the column to transfer air to the individual machine units from below the machine deck.

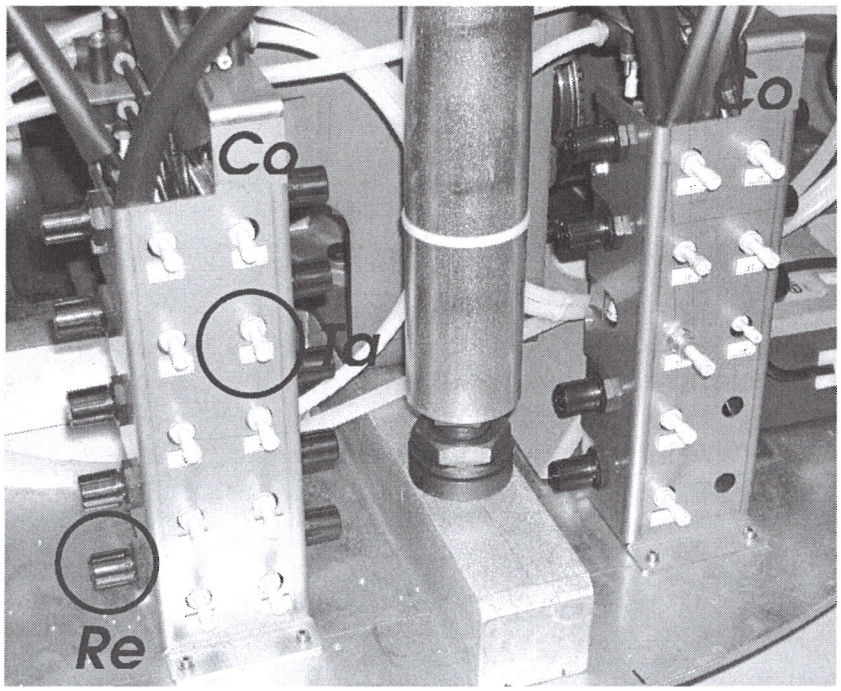


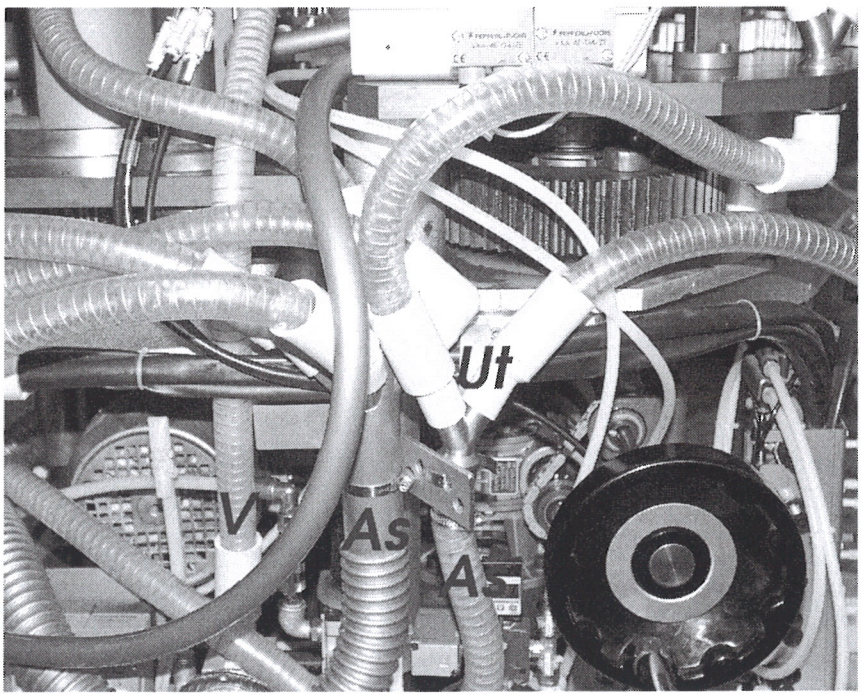
*Figure 10 – The example photo shows the columns **Co** for distribution of the single units with individual pressure regulators **Re** and regulation plugs **Ta**.*

📖 *For further details on the pneumatic system and relative adjustments, refer to the relevant **pneumatic drawing** and the **LINE INSTALLATION** chapter.*

7.2 Suction and vacuum system

*The **suction and vacuum** system supplies adequate suction and vacuum flows to the line for the various capsule handling phases.*
*The **suction units** are used to clean the machine. They recover the product particles and capsule fragments dispersed inside the capsule-filling machine during production.*
*The **vacuum** is used on the capsule-filling machine during capsule opening to separate the capsule lid and body. Furthermore, the vacuum holds the capsule lids in their seats as they are transferred and in closing. The system consists of the **service control cabinet** outside the machine, compressed air **hoses** and the part of the system inside the machine.*

Figure 11 – The photo shows a detail of the distribution zone of a suction and vacuum system.



The photo shows a hose ***As*** coming from an outside suction unit in the control cabinet, the connection of the various units ***Ut*** served by the suction unit, and in the background vacuum unit ***V***.
There is one hose ***As*** for each suction head in the services control cabinet (see the example of a services control cabinet shown at the side).
There is one vacuum hose ***V*** for the vacuum pump located in the services control cabinet.
There is a unit ***Ut*** for each suction head on the machine.

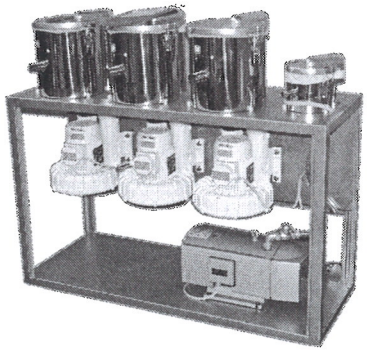


Figure 12 – The photo shows an example of a services control cabinet with three suction heads and a vacuum pump.

📖 *For a detailed explanation of the **SERVICES CONTROL CABINET,** refer to the relevant section in this chapter of the manual.*

📖 *For further details on the pneumatic system and relative adjustments, refer to the specific **pneumatic and vacuum drawing** for the machine and to the "**LINE INSTALLATION**" chapter.*

7.3 Pneumatic system for capsules not opened rejection

This separate part of the pneumatic system supplies the air flow for the rejection of the not opened capsules in the feeding unit. To do this, the system has a ***"Booster"*** *device that can double the air pressure at infeed, and a* ***tank*** *that stores the air and distributes it when needed by the individual component.*

Functional description

Booster ***Bos*** is fed at infeed by the main pneumatic system. Air pressure doubled at outfeed can be regulated at booster outfeed with regulator ***R***. Output air flow from the booster is used on demand by means a PLC command. The air flow is used to remove a capsule not opened in the feeding unit.

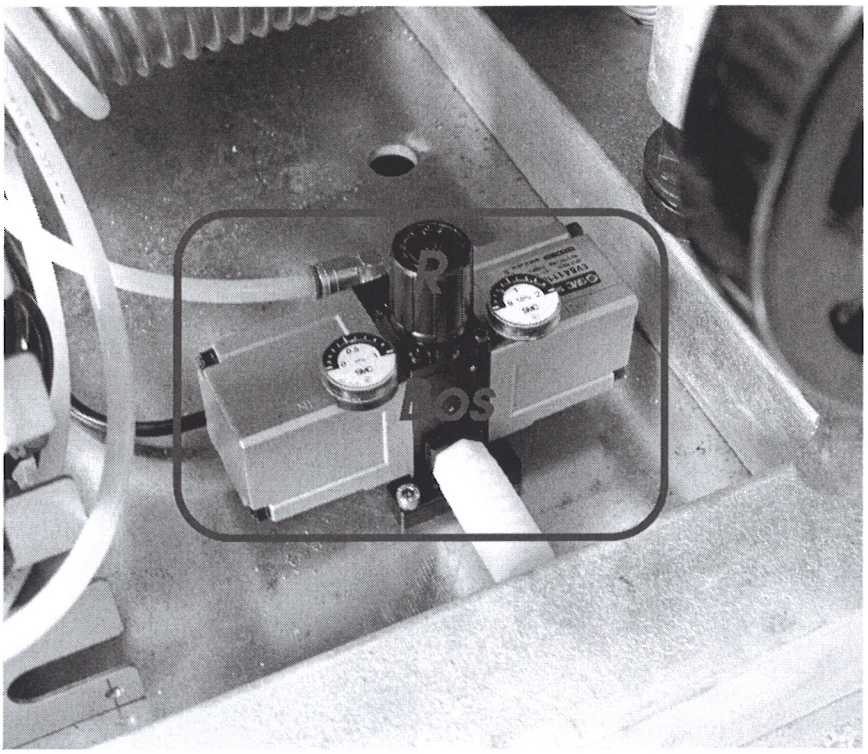


Figura 13 – The photo shown the booster ***Bos*** *and the pressure regulator* ***R***

7.4 Services cabinet

*The services cabinet generates and supplies the **suction** and **vacuum** services necessary for the functioning of the capsule-filling machine to which it is connected.*

☞ ***NOTE:** The structure of the cabinet complies with the requirements of Directive EEC 98/37 and is based on GMP (Good Manufacturing Practice) standards.*

☞ ***NOTE:** If the machine is supplied without a service unit, the customer must provide suction and vacuum upplies.*

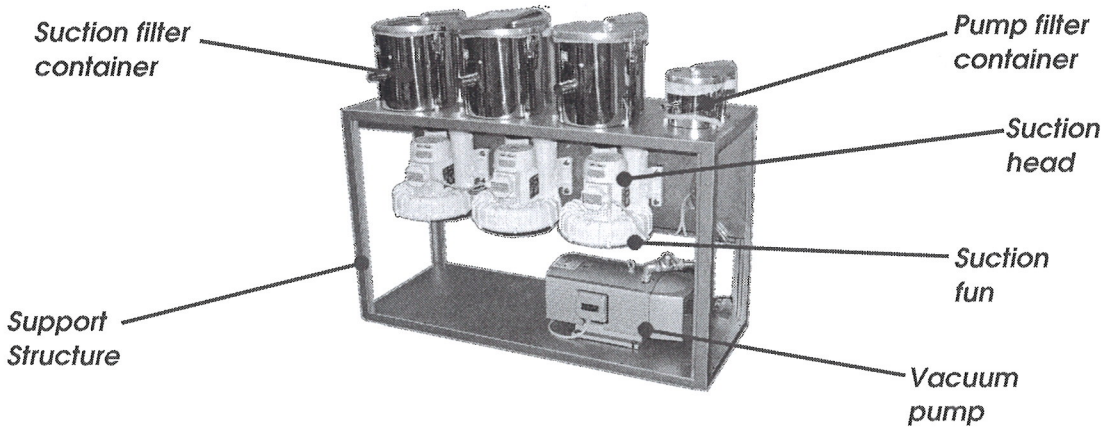
Cabinet structure

The modular structure of the cabinet means that is can be configured to meet the production demands of the customer. The main elements are:

- ***Support structure***
- ***Suction system***
- ***Vacuum system***
- ***Electric system and emergency devices***
- ***Cable bridge***

Support structure

The support structure consists of a stainless steel unit housing the pumps, and the suction unit and vacuum pump containers. Each suction unit has an electric motor connected to relevant fun and a filter system contained in a special container with the cap.



The cabinet structure is modular. It can be **UNCOVERED** or **COVERED** (enclosed in stainless steel guards).
In other cases, there are two support structures: one for the suction fans and one for the filters.

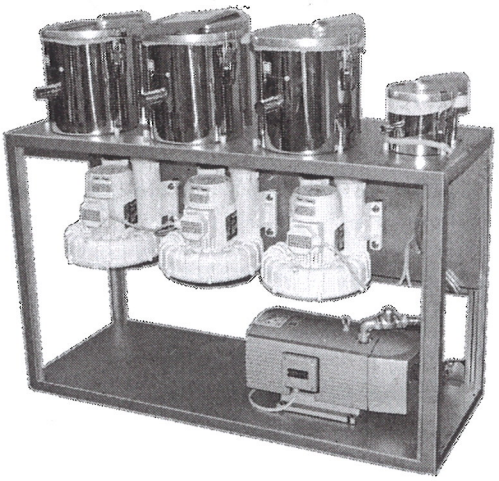


Figura 14 –Photos show various vacuum cabinet models.

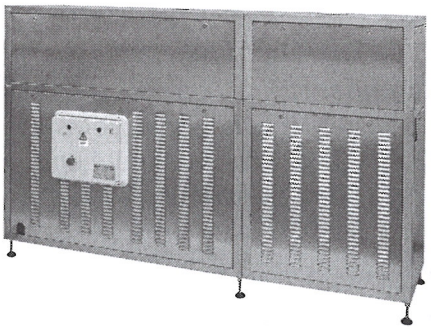


Figure 15 – example of vacuum cabinet with guards and electric panel.

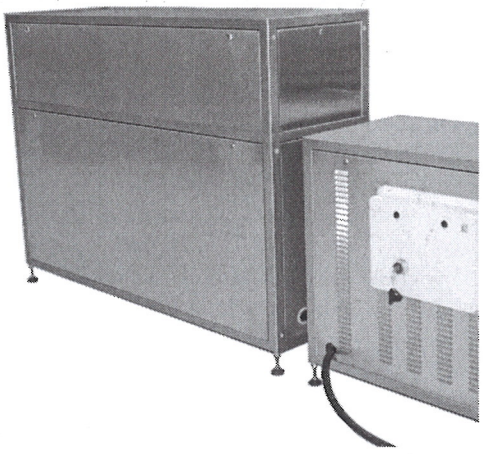
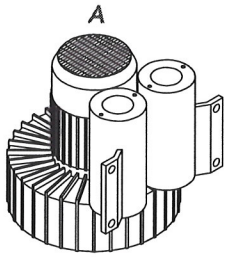


Figura 16 – Example of vacuum cabinet with guards and subdivided in two support structures, one for the motors and funs and the other for the filtering systems.

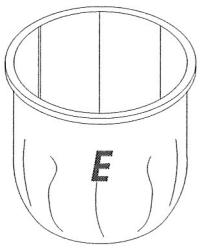
Suction system

The suction system consists of:



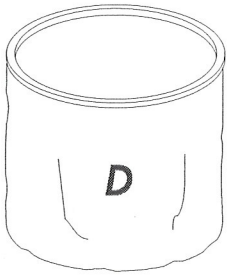
Suction head (A)
This consists of a pump that generates a suction air flow. The number of suction units can vary from two to six as required by the capsule-filling machine model and configuration.

Connection sleeve (B)
This connects all the suction units to the container.



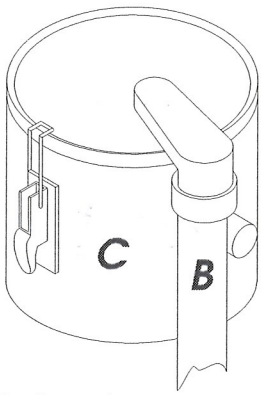
Suction filter container (C)
This contains the filter and pre-filter.

Paper pre-filter (D)
The aspirated air encounters this filter first. It ensures increased performance and duration of the inner filter as it reduces its saturation.



Dry filter (E)
This filters the air and collects the particles.
The standard filters are cotton felt filters. Synthetic fibre filters are available on request.

Suction hoses (F)
These connect each suction unit to the capsule-filling machine and convey air; each end has a sleeve for connection to the units.



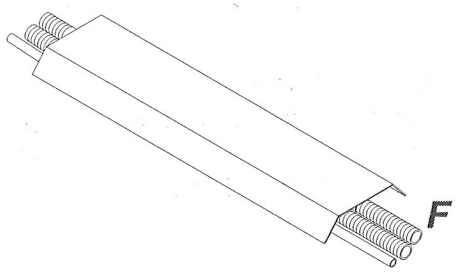
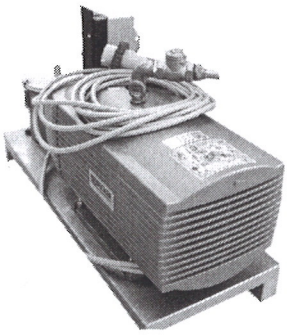


Figure 17 – Suction system

Vacuum system

The vacuum system consists of:

Vacuum pump (G)
This is a vane pump that generates a vacuum.



Connection sleeve (H)
This connects the vacuum pump to the container.

Vacuum filter container (S)
This contains the filter and pre-filter.

Paper pre-filter (I)
The aspirated air encounters this filter first. It ensures increased performance and duration of the inner filter as it reduces its saturation.

Filter (M)
This filters the air and collects the product particles.

Vacuum hose (N)
This connects the vacuum pump to the capsule-filling machine and the vacuum is conveyed through it. Each end has a securing strap.

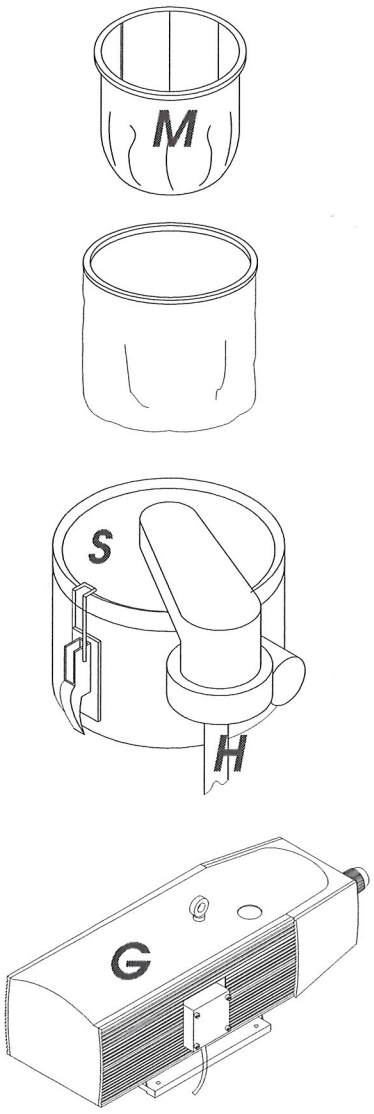
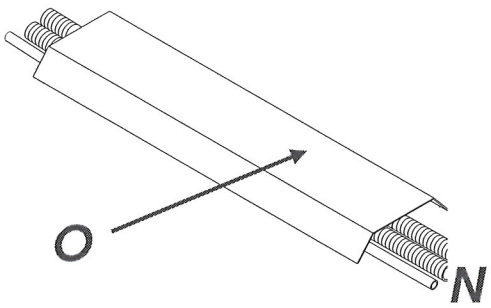


Figure 18 – Vacuum system

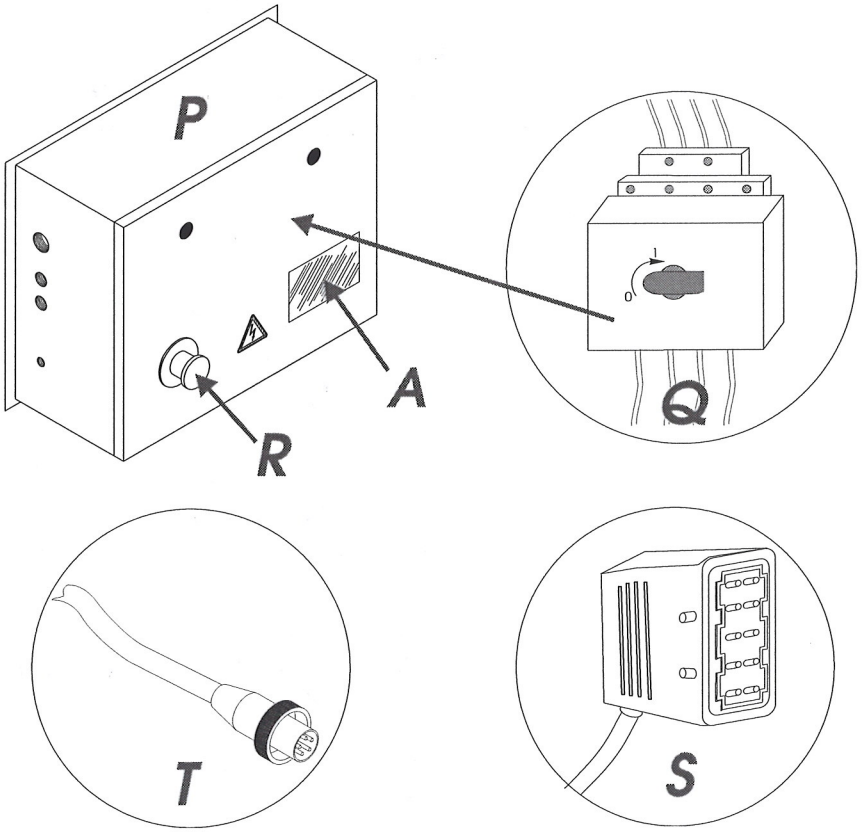


Metal cable bridges are supplied to protect the pipes and cables on the ground (***O***)

Electric system and emergency devices

The services cabinet electrical system (see diagram) consists of:

Figure 19 – Electrical system components

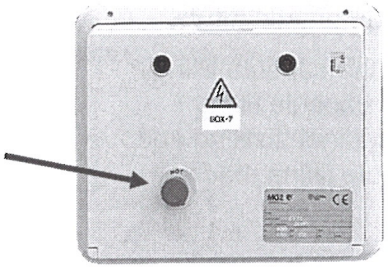


Electrical box (P)
This contains the electrical control system.

Overload switches (Q)
The vacuum pump and the suction units are all supplied with a safety overload switch (inside the electrical box).

If there is an overload during use of the cabinet, the safety overload switch is triggered and the services cabinet and the capsule-filling machine to which it is connected are stopped immediately.

When the cabinet is operated in manual mode, each overload switch can be used to start and stop the relative pump and suction unit.



Mushroom-head emergency stop button (R)
The services cabinet has an emergency stop button to disable the unit. It is located on the outside of the electrical box.
This immediately disables the cabinet and stops the capsule filling machine connected to it. It should only be used in emergency situations. When the cabinet is operated in manual mode, the emergency stop button only disables the services cabinet.

Power cable (S) (T)
If the cabinet is connected to the capsule filling machine, the power supply cable has a connector ***S*** already fitted for this purpose.

(OPTIONAL) When the cabinet is connected directly to the mains power supply, the cable is fitted with a three-phase plug ***T*** for this purpose.

Rating plate (A)
This is attached to the electrical box and shows the following data:
- Serial number of the machine to which it is connected
- Voltage (Volts)
- Mains frequency (Hz)
- Weight (kg.)

Cabinet functioning

Automatic functioning

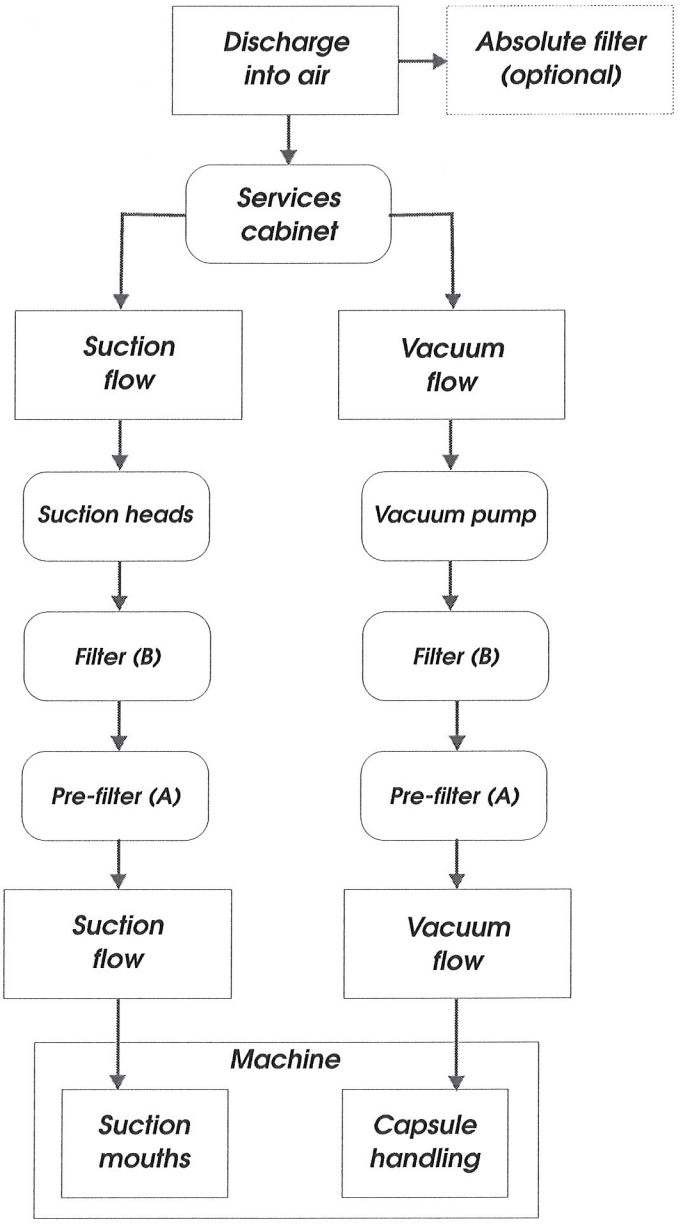
In the standard configuration, it runs in automatic mode.

The cabinet is connected electrically to the capsule filling machine and starts and stops when the capsule filling machine starts and stops. In this way, cabinet starting and stopping automatically depend on capsule filling machine function.

Manual functioning (OPTIONAL)

The services cabinet can also function in manual mode. On request it can be connected directly to the mains power supply. When the cabinet is connected directly to the mains power supply, the cable is fitted with a three-phase plug for this purpose. This means that the start and stop commands are independent of the capsule filling machine.

Figure 20 – Suction/vacuum flow.



The air generated by the fans and the vacuum pump circulates in the suction and vacuum system.
There are suction mouths located in various parts of the machine (refer to the suction and vacuum system layout).

The **suction unit** removes the product particles and capsule fragments produced by the capsule filling machine.

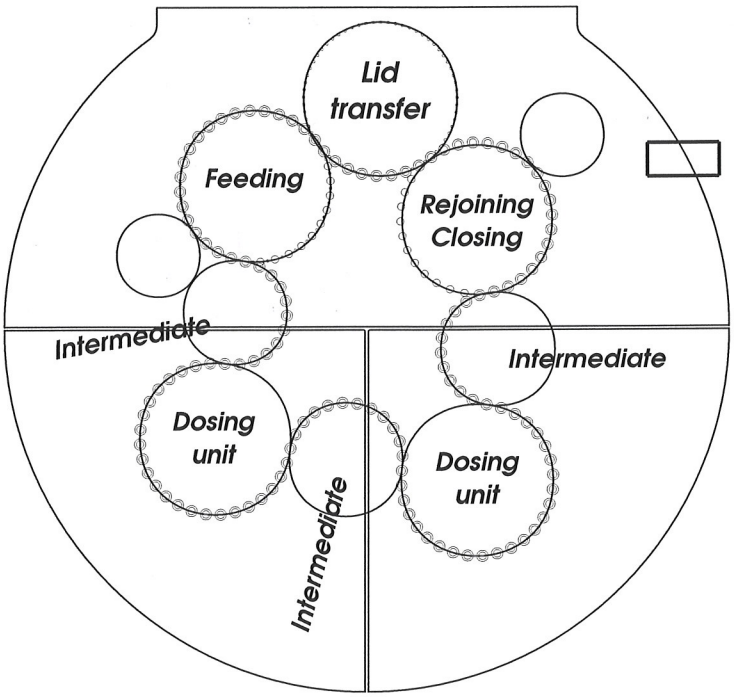
The **vacuum** enables capsule opening during capsule handling.

The air is conveyed through the system of hoses to the services cabinet.
Here the air passes through filters in each suction head and on the vacuum pump.
The filters trap any residue.

If expressly requested by the customer, the services cabinet can be fitted with a device **C** to filter the air exiting the cabinet before it is discharged into the environment.
As the air exits the cabinet it passes through the filter (if present) and is dispersed in the environment.

8. Capsule handling

*Capsule handling means a set of units designed to **infeed**, **position**, **open**, **transfer** and **close** the capsules. The capsule handling units differ from the dosing units which are designed to dose the capsules.*



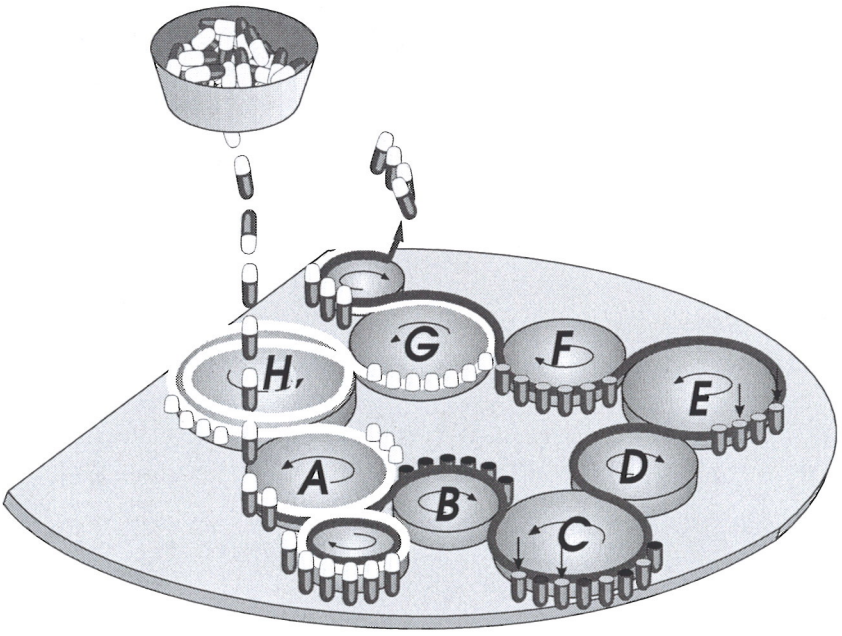


Figure 21 - The drawing shows the complete capsule cycle:
***A** infeed, positioning, opening;*
***B** transfer of capsule bodies,*
***C** odd capsule dosing,*
***D** transfer,*
***E** even capsule dosing,*
***F** body transfer,*
***H** lid transfer,*
***G** joining and closing.*

The individual units and phases are described below.