

**Lesson 24**

**Packaging Machines for Milk**

**Introduction:**

The Form Fill Seal(FFS) machines are a genre of filling equipment that can fill in a flexible packing material. The product should be free flowing type, either liquid or even granular. The equipment may be controlled electro-pneumatically or mechanically.

The process involves certain steps, which will take place cyclically in auto operation.

There is option for variation in size and quantity of the product packed. To a large extent, the market milk is now being sold by packing in these machines.

The following are the operations that go cyclically.

1. Forming of tube of packing material from film in rolled state
2. Simultaneous operation of filling and sealing
3. Movement of film to form next package
4. Simultaneous separation of filled and sealed packet while filling of next packet.

**Sequence of Operation:**

With reference to the fig. the film roll is loaded at the backside of the filling machine on a sliding platform. The film edge is passed over end of role contact lever, dancer roller, UV tube and brought to the front side over to forming plates. The forming plates rolled the flat film in to tube a certain band of overlap. Within the tube is the fluid filling pipe enveloped. The tube then passes over to vertical seal jaws that are engaged and disengaged with the help of an air operated piston, or in machines by mechanical means. In between the jaws, the overlapped

part of the film tube passes. The set of jaws have one stationary and one moving jaw. The moving jaw has a nichrome rod, supplied with variable voltage such that the heat is generated when the current passes intermittently. During the period when the current does not pass, when the jaws are disengaged, the cooling water being circulated in the moving jaw, cools it and prevents continuous over heating of the sealing rod. The film is supported by Teflon cloth and rubber cushion, as well as protected by Teflon cloth from sealing rod. This arrangement prevents electricity passing on to the film and other parts, while allowing only the heat to pass on to the film and partly melting and fusing the vertical joint.

Lower down the film tube, there are a pair of nip rollers giving a holding and pulling down action, when the jaws are disengaged, making the film to move to seal the next portion of vertical overlap.

Further lower down the film tube is engaged by horizontal jaws, at a sufficiently below the lower edge of fluid filling pipe. This arrangement allows the formation of lower seal of the packet, while the fluid is being filled to a known quantity. The quantity of flow is controlled by a valve operated by a rod which is lifted by a solenoid coil position at the top of machine, just at the feeding line from the over head tank carrying the fluid to be filled. While filling is taking place, a pair of flat blades operated by spring keeps the film perfectly flat at horizontal edge so that there is no folds and horizontal seal is perfect.

When the filling of fluid and the horizontal sealing is complete, the horizontal jaws (as well as vertical jaws) get disengaged, and the nip rollers start rolling to bring the next length of film tube to be filled for next packet. While the second packet is being filled, the first packet already filled will be getting the horizontal seal of top portion of the filled packet. When the next time the jaws open, the first packet drops down by its own weight and weakened connection to the rest of the tube.

The above cycle of operation is repeated when the controls are in automatic operation, while single action takes place when in manual operation during initial adjustment of time and temperature combination for obtaining proper seal.

### **Controls:**

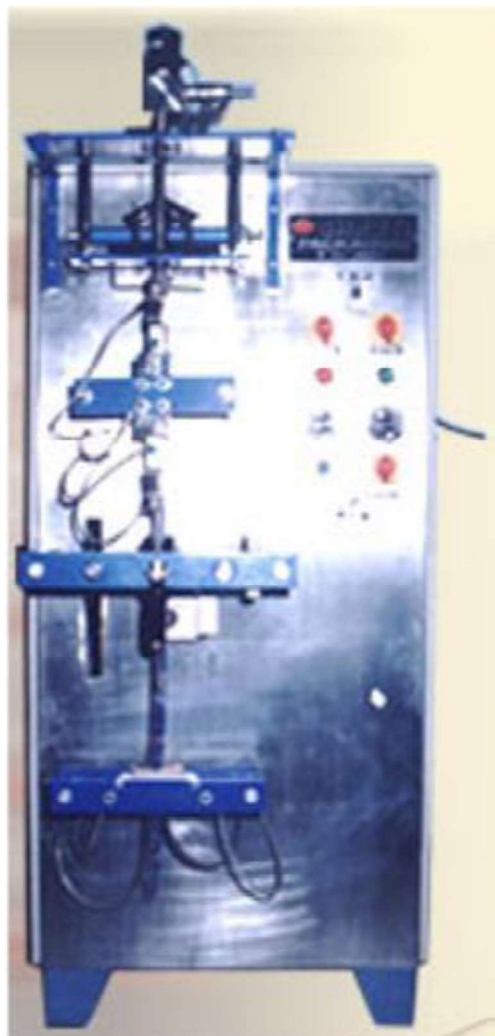
The Form Fill Seal Machine has various controls for the following operations.

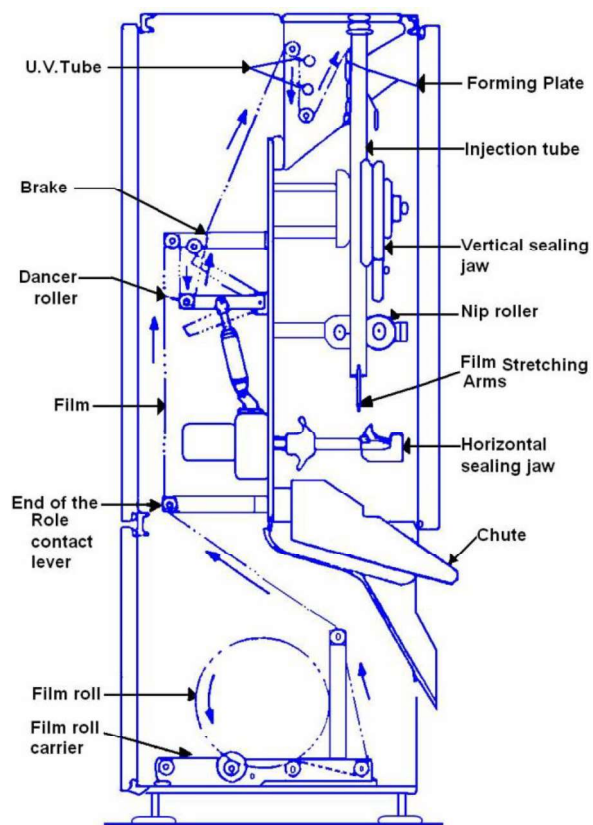
1. Adjusting the temperature of sealing rod by controlling the electric supply, to match to the thickness of the film to be sealed.
2. Adjusting the timing for the jaws to be engaged and simultaneously filling operations to take place, with a known quantity of fluid.
3. Adjusting the quantity of fluid to be filled when jaws are engaged
4. Adjusting the timing for the jaws to be engaged and allow time for movement of film to the required length of package.

The other useful instrumentation are the end of film indicator (gives audio signal), so that the new film roll can be changed easily, fine adjustments for the quantity of fluid filled in few grams range, fine adjustment of timings, etc.

The equipment will require water for cooling the jaws at a fixed flow rate and of low temperature. Also, compressed air is required which is at required pressure and free of condensed moisture.

**Fig. 24.1 Film feed circuit**





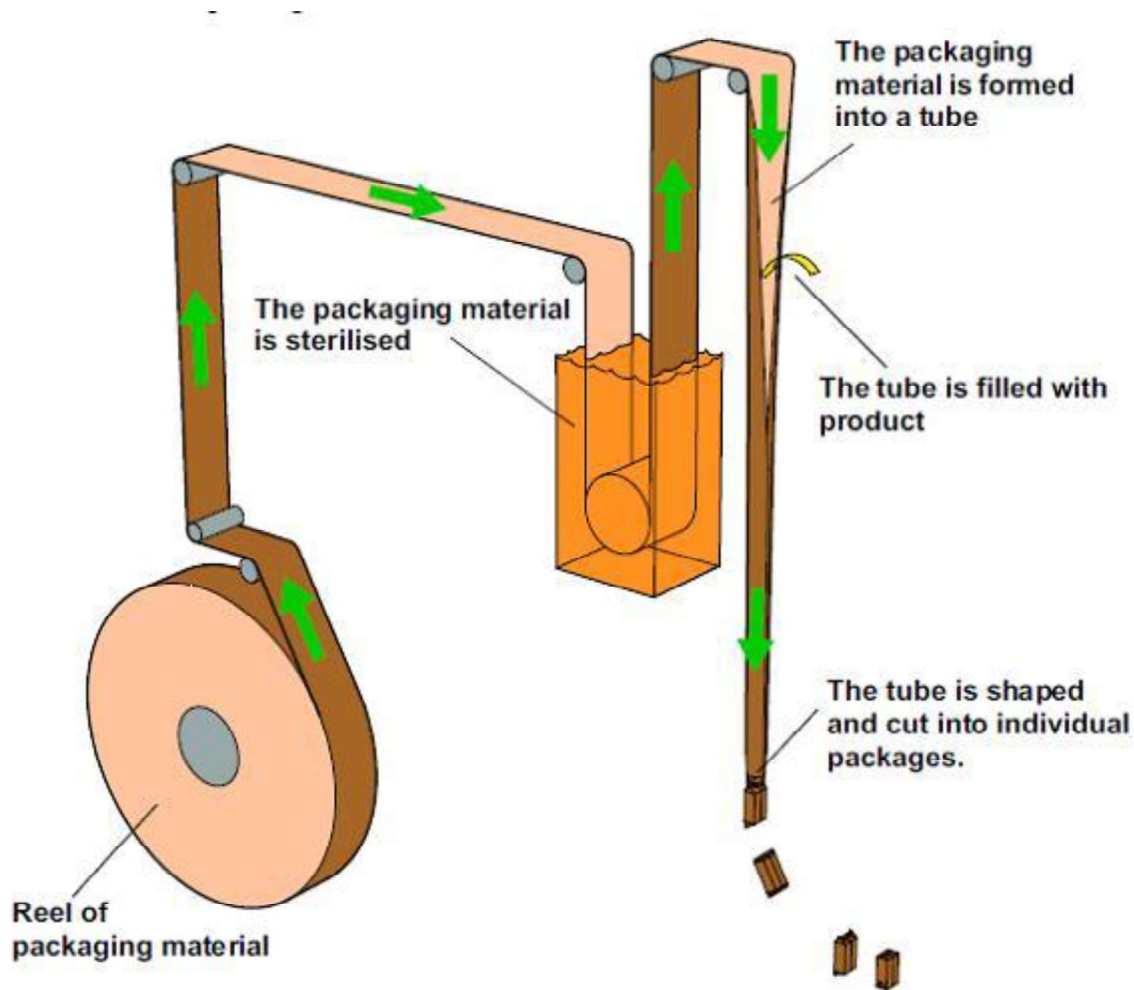
**Fig .2 Film feed Circuit**



**UHT milk packing machine**

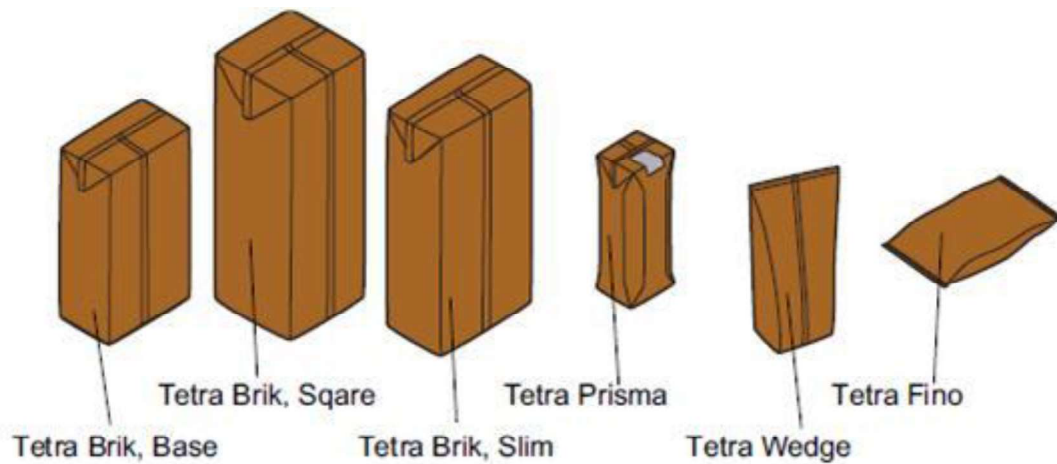
## Introduction

The UHT milk packing machine is different than the usual FFS machine in that the packaging material is multi layered, and the filling is done in an absolutely aseptic condition. The filling room is kept in a positive pressure, and the air inlet is through HEPA filters. Starting out from a reel of packaging material, the Tetra Brick Asceptic (TBA ) filling machine produces filled packages. The packaging material is first sterilized and then formed into a tube. The tube is filled with product and then shaped and cut into individual packages.



## The package

There is a range of Asceptic packages , all deriving their origin from the same forming technique. In India, the commonly available Asceptic packaging machine is from Tetrapak company.



### **Package terminology**

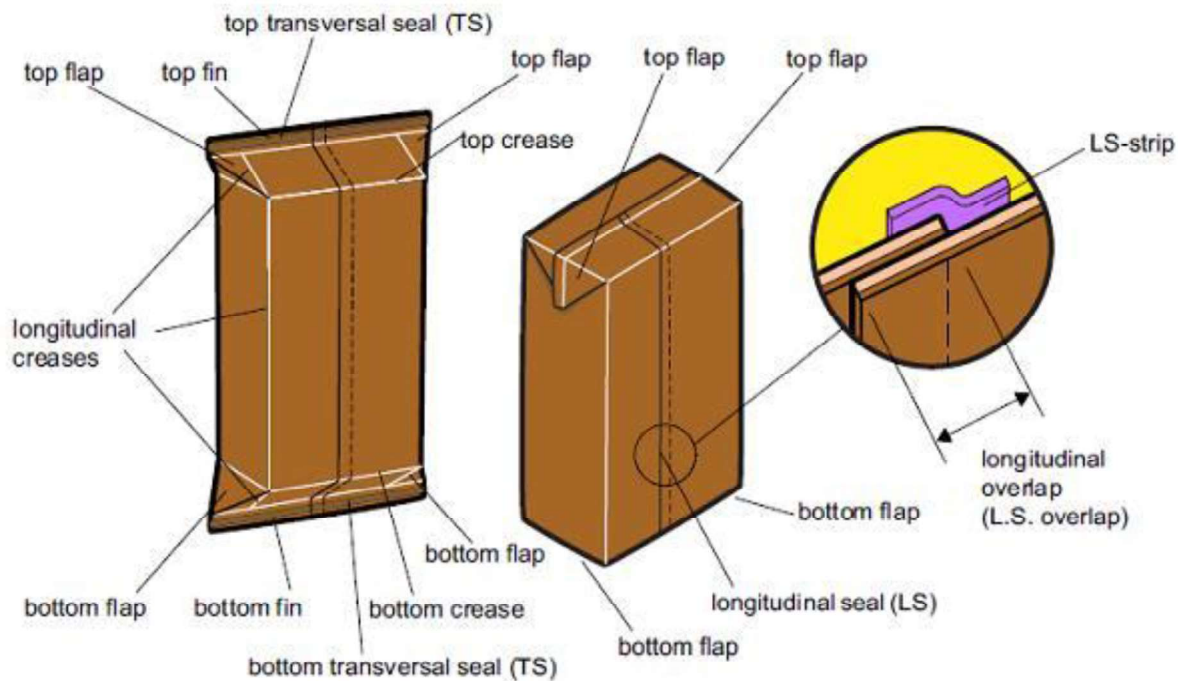
**Creases** are the folding instructions on the packaging material, to ensure the Creases package's final shape. The creases are pressed into the material by the creasing tools in the converting process.

**The longitudinal seal (LS)** is accomplished when forming the packaging material seals into a tube. It seals the package along the side. A strip of laminated plastic, the LS-strip, covers the seal on the inside. The area of the overlap joint is called the longitudinal overlap.

**The transversal seal (TS)** is made when the tube is filled with product. It seals the package at top and bottom. The sealing takes place below the product level in the tube.

**The fins** are the areas, at top and bottom of the package, where it is sealed and Fins cut.

**The flaps** would be the corners of the package, if you flattened it out. When Flaps shaping the package, the flaps are folded down and in, and then sealed to the package body.



### Machine introduction

Tetra Brik filling machines are built from so called modules or main groups with similar functions in the various machines. The machines may also have different additional equipment and accessories.

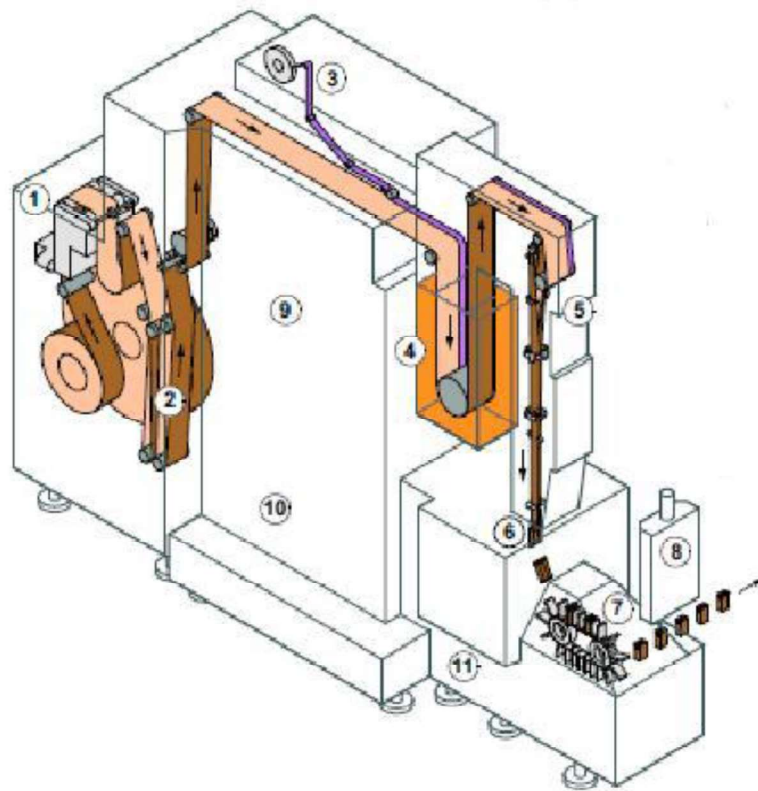
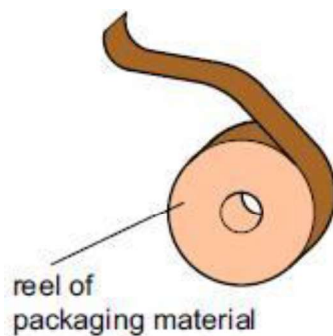


Fig: **Tetra Brik Aseptic (TBA) filling machine.**



**1**

**. ASU Automatic splicing unit(ASU):** The

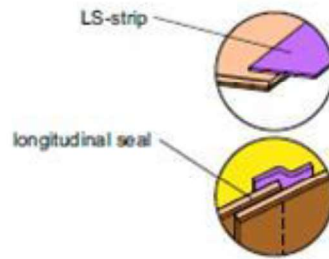
automatic splicing unit splices reels of packaging material. This means that production can continue uninterrupted when one reel of packaging material comes to an end.

- 2.** During splicing though, the packaging material has to remain still in the splicing head. The magazine provides the necessary supply of material so that the machine does not have to stop.

**PullTab unit**

The PullTab unit is additional equipment, providing the packaging material with a PullTab opening before it enters the peroxide bath. The PullTab opening is created by punching a hole in the packaging material. The hole is

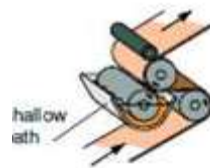
sealed with plastic on the inside and aluminium on the outside.



3.

**Strip applicator:** The strip applicator

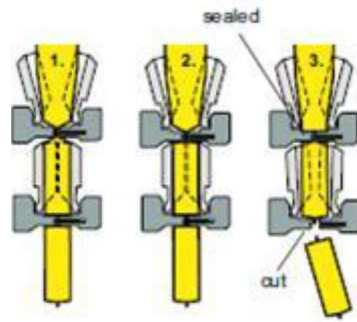
applies a plastic strip, the LS-strip, along one edge of the packaging material. The strip is applied on the inside of the packaging material and is intended to prevent product from being soaked into the raw paper edge of the longitudinal seal. The strip will also support the seal. Only half of the LS-strip is sealed to this edge of the packaging material. The other half will be sealed to the other edge later, when the packaging material is formed into a tube.



**. Peroxide bath:** The packaging material will be sterilized in

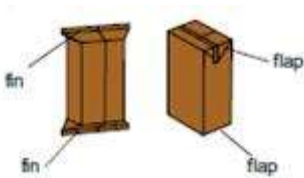
the peroxide bath. In machines with deep baths, as shown in the example, the packaging material will be immersed into warm peroxide and both sides will be sterilized. In machines with shallow baths the inside of the packaging material will merely be covered with cold peroxide and the sterilization will be finished in the tube heater.

**5. Aseptic chamber:** The packaging material will be dried with heated air. In machines with deep baths, as shown in the example, an aseptic environment around the sterilized packaging material is maintained with an overpressure of heat-sterilized air. This takes place in the aseptic chamber. Machines with shallow baths, which have no aseptic chamber, heat-sterilized air will be blown into the tight tube. This way a sterile area is maintained where the tube is to be filled with product. The packaging material will be formed into a tube and sealed longitudinally. Finally, the tube will be filled with product.



**Jaw system:** In the jaw system the tube is sealed transversally and cut into separate packages. The sealing is made by induction heating, using the aluminum in the packaging material to melt the plastic. It is important that the package design, with the creases, appear in accordance with the jaws.

This is controlled and corrected by the jaw system.



**7. Final folder:** In the final final shape. The fins are sealed. Hot air is used to on the package material is heated and the flaps are pressed against the sides and the bottom of the package. When the plastic gets cool the flap is sealed.

folder the separate package gets its folded and the flaps are folded and seal the flaps. The plastic outer coating

**8. Operator panel:** The operator panel allows the operator to communicate with the machine. It is used to start and stop or make the machine take any other action.

**9. Electrical cabinet:** In the electrical cabinet a great part of the electrical components are included, such as:

- Temperature regulators
- Control system
- Contactors
- Induction Heating unit, etc.

**10. Service unit:** The service unit includes parts and supply systems needed for the machine function, for example:

- Water and air system
- Lubrication and hydraulic oil system
- Pneumatic and peroxide systems

**11. Drive system:** The drive system includes motor, gear and cam. These parts run the jaw system and also the final folder on certain machines.



## **Lesson 25**

### **Packaging Machines for Milk Products**

#### **Introduction:**

The wide varieties of milk products packaging makes the choice of packing machines. The requirement of each product is different, as well as the size and shape. Some of them are to be stored at low temperatures, while others are kept in ambient temperatures. The packing material also different, and the information to be given on packages may be a legal requirement in most of the cases. Some products are further processed while in the packaging itself, like sterilization, curd setting etc. The packaging machine working principle will also depend on the physical nature of the product, like liquid, solid, semi solid.

#### **Cheese packing**

#### **Specific Applications**

When packaging food products those are sensitive to spoilage or loss of freshness, it is important to seal the product in containers that allow a tight seal. It is typical to evacuate the chamber to a target vacuum level, thus removing air and oxygen. Higher vacuum levels remove more air, but require larger vacuum systems, higher attainable vacuum levels, and more time for the evacuation process. The target vacuum level is a function of the product being packaged and is determined by the packager and/or government regulations. Speed is an important factor in many packaging operations, and machine manufacturers are often rated on how many packs per hour their machine can perform, while meeting a set of specifications. Higher speed usually means higher vacuum system capacities, and/or a secondary vacuum system to “pre-evacuate” the vacuum packaging chamber. Sometimes, purge gases are introduced during the packaging operation to help displace air and oxygen, retard spoilage, and further enhance shelf life and appearance. Appearance is vitally important in the packaging industry.

#### **Machine Types**

#### **Chamber Packaging Machines**

Chamber machines are typically used to seal meats and cheeses in film pouches. In appearance, they have a base and a swinging top cover (sort of like a Xerox machine). The product is placed into the machine, and the swing lid is closed. Where the lid and top of the machine meet, a seal is formed. At this point vacuum evacuation begins and the rest of the sealing process occurs under vacuum. When the lid is lifted, the product is fully packaged and ready to be removed.

#### **Small Chamber Machine (Desk Model)**

Chamber up to 50 liters, rotary vane pump 3 to 25 m<sup>3</sup>/hr.

### **DoubleChamber (Mobile)**

Two chambers, each up to 150 liters, rotary vane pump 40 to 300 m<sup>3</sup>/hr

### **Big Chamber Machine (Non Mobile)**

Chamber up to 400 liters, pump combination rotary vane pump 340 to 1000

m<sup>3</sup>/hr. Booster pumps 500 to 2000 m<sup>3</sup>/hr

### **RotatingChamber Machine (Non Mobile)**

Multiple rotating chambers (step evacuation) rotary vane pump 160 to 630

m<sup>3</sup>/hr

Multiple rotating chambers (step evacuation) rotary vane pump 160 to 630

m<sup>3</sup>/hr and booster pump 500 to 2000 m<sup>3</sup>/hr

### **TraySealing Machine**

With Tray type machines, the user purchases a tray (Styrofoam, plastic, etc), loads the product onto the trays and places them into the machine. At this point the chamber is evacuated to achieve a “skin pack”. These machines are typically used by small packagers.

### **InertGas-Flushed Packaging (Snorkel Machines)**

MAP (Modified Atmosphere Packaging) involves packaging the food product in an gas atmosphere other than standard room air to achieve specific goals not otherwise possible. Common atmospheres include:

Nitrogen

80% Nitrogen- 20% CO<sub>2</sub> mixture

Saturated oxygen greater than 80%.

The machine pulls a vacuum and reduces oxygen content down to 0.3 to 1% to remove Anaerobic Bacteria. When this occurs, meat becomes purple. Back flushing with the appropriate gas maintains product color for an attractive and appetizing appearance. All machines that use a chamber can be fitted with gas flush option, and approximately 25% of machines on the market do so.



**Fig. 25.1 Different types ofcheeses**



**Fig. 25.2 Different types ofwrapped cheeses**



**Fig. 25.3 Cheeses packingmachine**

**ChamberPackaging Machines**

**SmallChamber**

**PackagingMachines**

**(desktopand portable)**



**Fig. 25.4 Chamber packingmachine (small size)**

**Mid SizeChamber**

**PackagingMachines**

**Forhigher production rates**



**Fig. 25.5 Chamber packing machine (medium size)**

*Large, fully Automatic*

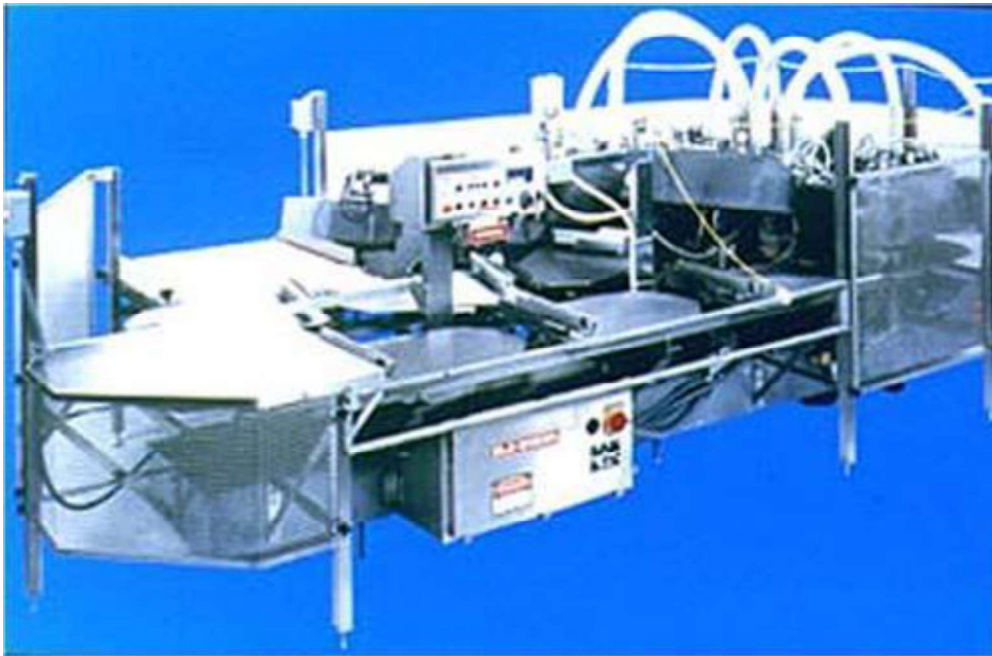
*Chamber Packaging*

*Machines for High*



**Fig. 25.6 Chamber packing machine (large size, automatic)**

**Fig. 25.7**



**Fig. 25.8 High speed rotary chamber machine**

### **Vacuum Packaging:**

Key factors in vacuum packaging of food products include consistent vacuum levels, fast pump down times and low maintenance. Rietschle pumps are capable of operating cooler than our competition's models, due to our superior design. Cooler operation contributes to reduced oil breakdown, less oil misting, reduced maintenance and better pump life. Bush claims our cooler operation is a disadvantage, saying that we will condense water vapor inside the pump. That is pure marketing spin on their part. All our oil-lubricated rotary vane pumps come with adjustable gas ballast valves that eliminate the likelihood of any condensation in the pump. It is a non-issue. General Volume and Pressure Requirements: 5 to 1535 CFM, usually at 1 Torr. Pumps are usually rated @ 1 Torr when purchased. After use, and due to pressure drop for piping lines, 2 to 3 Torr will still produce a good pack. Often, end users cannot reach 2 to 3 Torr even after the OEM service tech visits, and they may believe their pump is undersized for machine. Offer to work on these projects if ROI is good. Many user customers can speed up cycle time for their machines by putting a larger volume pump on the machine. Our VC Product line, with its many sizes and increased volume for same HP, is perfect for this purpose. Some users have old, worn, or undersized pumps that cannot attain the ultimate required vacuum or have cycle times that are longer than standard. Look for these opportunities to sell new pumps with more CFM per HP than our competitors. Busch parts prices are higher than ours and in some cases, double! Busch does not include some parts in their standard rebuild kits and these required parts must be purchased as adders. This can be a Rietschle advantage, especially if the customer is feeling he has been gouged. (You might even want to suggest this). Some customers buy "pirate" non-OEM parts from other sources, but they can have genuine Rietschle parts at a reasonable price. Busch requires serial numbers before they will sell any parts; this is an inconvenience to most users. We will provide test units with special terms for large projects. Please inquire with the Rietschle Inc. Sales Department for assistance, terms & conditions.

## **Lesson 26**

### **Ultra-filtration**

#### **Introduction**

Membrane processing is used in the dairy industry for non-thermal processing , to retain most of the nutrients and is mainly used for manufacture of health and functional foods, through concentration and fraction of various components. This involves, Ultra Filtration, Reverse Osmosis, Micro Filtration and Electrodialysis.

#### **USES OF MEMBRANE FILTRATION:**

1. Changing pattern of milk consumption is stressing on individual use of its components.
2. Whey which has high BOD value is being efficiently concentrated form protein . Then, the lactose in the permeate solution can also be handled by RO.
3. It saved energy in transportation, due to concentration.
4. Cheaper method of drying. Pumping is involved, as against evaporation of moisture.
5. Possibility of incorporating whey proteins into cheese.
6. Pollution due to whey is controlled, as whey contains lactose.
7. Milk also can be concentrated without damage to protein or changing flavour unlike in concentration and drying.
8. Other industrial uses, like water purification, fractionation & concentration in Food and Pharmaceuticals, recovery of various components of waste for further use.