

MachinePoint[®]
Food Technologies

Storage Tanks

Gemina[®]

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Storage Tanks

STORAGE TANKS FOR RAW MILK

Raw milk, that is, without treatment (whole milk), is stored in large vertical tanks (silo tanks) which have capacities ranging from 25.000 to 150.000 liters.

The most common range for these tanks varies from 50.000 and 100.000 liters.

The smaller tanks are placed inside the factories, while the larger tanks are placed outdoors to reduce building costs.

Outdoor tanks are rather special, since they have a double wall construction with insulation, with a minimum thickness of 70mm between walls. The insulator can be either polyurethane or mineral wool.

The inner wall is made of polished AISI 316 stainless steel, while the outer wall can vary in its construction, it can also be made of stainless steel or be built with a lesser quality steel coated with corrosion resistant paint. This difference serves only to economic reasons.

To ease draining, the bottoms of tanks have a minimum tilt of 6% towards the outlet.

The number of tanks and their size is determined according to various factors, such as the amount of incoming milk per day, number of working days per week, working hours per day, number of different products to be manufactures and involved amounts.

STIRRING IN SILO TANKS

At GÉMINA we equip these tanks with a stirring system which avoids cream separation by gravity. This is a very mild but continuous stirring.

An excessive stirring causes milk aeration and fat globule disintegration; this exposes fats to attack of lipase enzymes in the milk.

Therefore, a mild and gentle stirring is a basic rule in the treatment of milk.



These stirrers, unlike those used in industries such as juice production, are formed only by a small helix located at the bottom of the tank. Large tanks are equipped with two helixes placed at different heights to achieve the desired effect.

The tanks have a control panel with all the auxiliary equipment.

TANK TEMPERATURE INDICATOR

Temperature inside the tank is shown on the tank's control panel. Temperature sensors transmit the signals to the PLC for the automatic control of system temperature.

LEVEL INDICATION

There are various methods available to measure the level in a tank.

The most significant methods are either by **pressure transducers** or by **load cells**.

LOW LEVEL PROTECTION

The stirring of milk is gentle; therefore the agitator will never start unless it is completely covered with milk to avoid the aeration of the product.

A **level detector** controls the start and stop of the agitator, so that if the milk level falls below a set point, the stirrer stops immediately.

OVERFLOW PROTECTION

The top of the tank is equipped with a level detector in order to protect the tank from overflowing.

This level detector controls a valve opening and closing, depending on whether the tank needs more incoming milk or is already full.

In case the tank is full, milk is diverted towards another empty tank.

EMPTY TANK INDICATOR

During the emptying process, it is important to know when the tank is completely empty.

Otherwise, any remaining milk will be lost when the cleaning procedure becomes operational.

An automatic valve controls the tank emptying process and the flow passing to the cleaning system. Also thanks to this valve, air is suctioned if the emptying continues after the tank drying process.

If not done this could cause problems at later stages.

To avoid these problems, it is necessary the installation of another detector to control the emptying of the tank.

INTERMEDIATE STORAGE TANKS

These tanks are used to store the product during a short period along the production line.



They are used as **buffer tanks** to level and balance flow variations. After the hot and cold treatment, milk is pumped into the buffer tank and from there it is taken to the filling stage. If the filling is interrupted, the processed milk is buffered into the tank until the operation can be finished.

Similarly, the milk stored in these tanks can be used during a temporary halt in the process.

Intermediate storage tanks of capacity ranging from **1000 to 50000 liters** are built with two intermediate insulation layers, so that the tank is protected against temperature changes and the temperature is kept constant. Both the inner and outer layers are made of **AISI 316 stainless steel**.

The storage tank is equipped with a stirrer and can also be equipped with other elements such as cleaning systems and control of level and temperature.

The equipment is basically the same as that described under Storage tanks.

As a basic rule we can assume that the process require an intermediate storage acting as a buffer for a maximum capacity of 1.5 hours of normal operation, for example, $1.5 \times 20.000 = 30.000$ liters of intermediate storage.

MIXING TANK

As its name suggests, these tanks are used to mix various products and for the addition of ingredients to the products.

In this case, tanks could be insulated or have a simpler construction with a single layer of stainless steel.

They can be equipped with **temperature control** systems.

Besides, tanks insulated with mineral wool between the inner and outer layers have another layer enclosing a heating/cooling system and a hot or cold medium is pumped through that circuit.

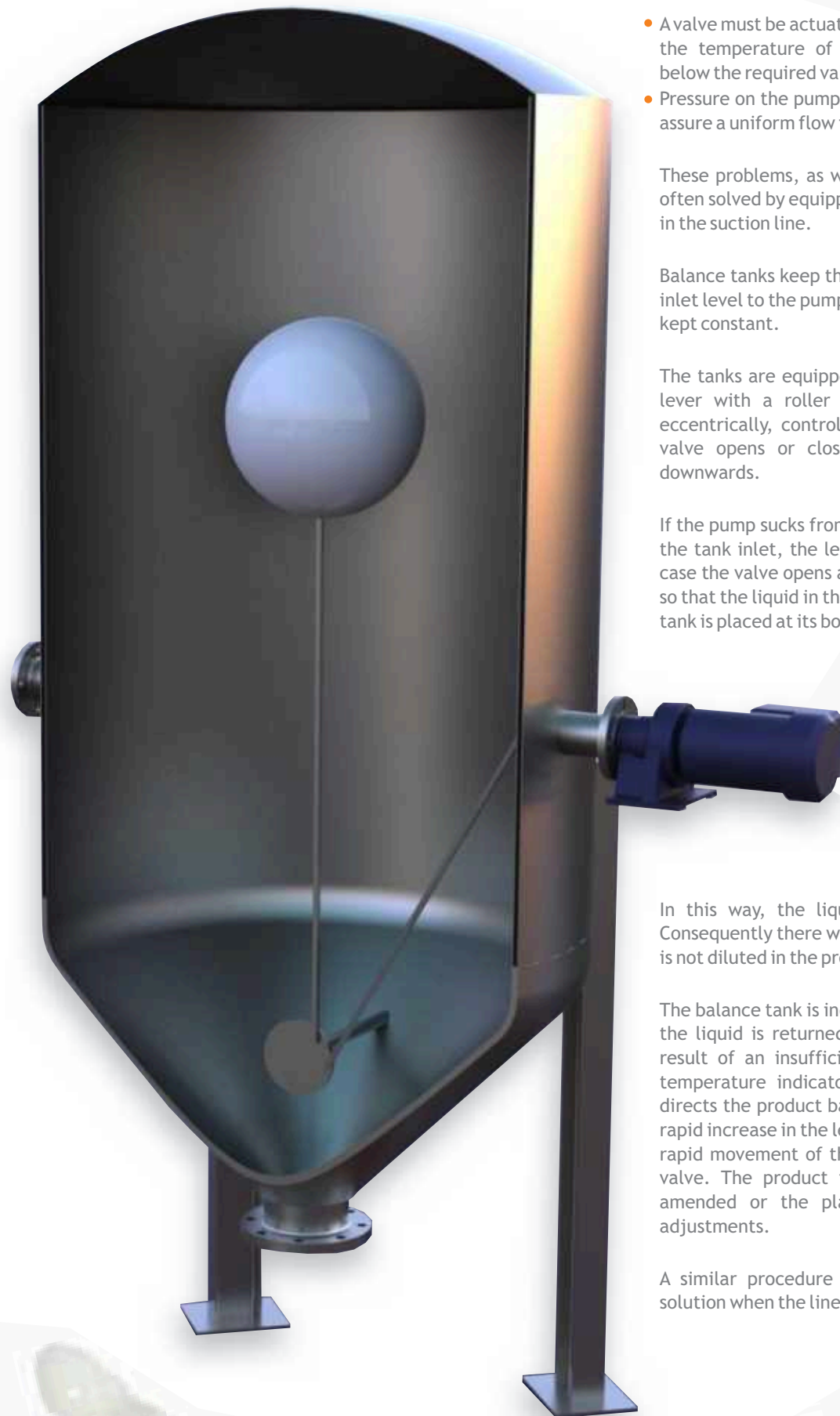
In this type of mixing tanks, **GÉMINA** has developed a wide range of stirrers designed to suit specific needs, according to the product and ingredients.

BALANCE TANKS

There are a big number of problems associated with the transport of product throughout a process line:

- The product must be free from air or other gases for the proper operation of centrifugal pumps.
- To prevent pump cavitation, the pressure at all pump inlets must be greater than the pressure of the steam of the liquid.





- A valve must be actuated to redirect the untreated product if the temperature of the product thermally treated falls below the required value.
- Pressure on the pump suction side must be kept constant to assure a uniform flow in the line.

These problems, as well as other not considered here, are often solved by equipping the installation with balance tanks in the suction line.

Balance tanks keep the product at a steady level, above the inlet level to the pump. In other words, the suction column is kept constant.

The tanks are equipped with a float switch connected to a lever with a roller at the end whose shaft is pivoted eccentrically, controlling the inlet valve to the tank. The valve opens or closes as the level moves upwards or downwards.

If the pump sucks from the tank more fluid than available at the tank inlet, the level falls and so does the float. In this case the valve opens and allows the entrance of more liquid so that the liquid in the tank is kept constant. The inlet to the tank is placed at its bottom.

In this way, the liquid enters from below the surface. Consequently there won't be any splashes, and above all, air is not diluted in the product.

The balance tank is included in a recirculation system where the liquid is returned for its recycling, for example, as a result of an insufficient heat treatment. In this case, a temperature indicator activates a diverter valve, which directs the product back to the balance tank. This causes a rapid increase in the level of liquid in the tank and an equally rapid movement of the float mechanism to close the inlet valve. The product then flows until the fault has been amended or the plant has stopped for the necessary adjustments.

A similar procedure is used for circulating the cleaning solution when the line is being cleaned.

ASEPTIC TANKS

Aseptic tanks are used primarily for **intermediate storage** of thermally treated products in the dairy industry.

An aseptic tank may be used in different ways in **UHT processing lines**, depending on plant design and capabilities of the various units in the process and packaging lines.

For example:

- If there is a stop on a packaging line, the aseptic tank stores the surplus heat treated product without losing its aseptic condition.
- Simultaneous packaging of two products. The aseptic tank is firstly filled with enough volume of product for the duration of a full turn of packaging containers. Then the UHT plant switches to another product that is packaged in line directly in the packaging machines.

One or more aseptic tanks included in the production line offer flexibility in the production planning.

The direct packaging from a **UHT unit** requires a recirculation of a minimum extra volume of approximately 300 liters per hour to keep the pressure constant in the filling machines. For this reason, sensitive products to heat re-processing cannot tolerate this and the required overcapacity must be fed in from an aseptic tank.

The biggest advantage of aseptic tanks is that the product is only processed once, and in optimal conditions. This will always ensure the best quality in the products.

The optimal layout of the **UHT plants**, aseptic tanks and packaging machines must be decided individually for each process.



Process tanks of different configurations.

PROCESS TANKS

In these tanks, the product is treated in order to produce changes in its properties. They are widely used in the dairy industry, for example, the maturation tanks for butter cream and culture products like yoghurt, crystallization tanks for cream and culture preparation tanks.

There are different types of process tanks; each application determines the design of each.

They can have common characteristics such as the design of the agitator and the temperature control.

They are equipped with stainless steel liners with or without insulation, depending on the application.

They can also be equipped with or without a monitoring and a control system.

Process tanks of different configurations:



MachinePoint®

Food Technologies

MACHINEPOINT FOOD TECHNOLOGIES was created as a result of a joint-venture between **MACHINEPOINT GROUP** and **GÉMINA**.

MACHINEPOINT FOOD TECHNOLOGIES designs, manufactures and integrates lines, equipment and processes for the food industry, more specifically for the beverage processors, the dairy industry and processors of fruits and vegetables.

MACHINEPOINT FOOD TECHNOLOGIES belongs to an international group specialized in industrial equipment for plastic, packaging and food industries.

The group is headquartered in Spain (Valladolid) and has sales offices in Turkey, Mexico, France, India and North Africa. The engineering center is also located in Spain (Murcia). It is at the engineering center where we manufacture our equipment and have our R & D + I department.

GEMINA PROCESOS ALIMENTARIOS S.L. is a leading equipment manufacturer that provides innovative solutions for the food industry. It has over 25 years experience in designing, manufacturing, assembling, automating and implementing lines and processes.

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