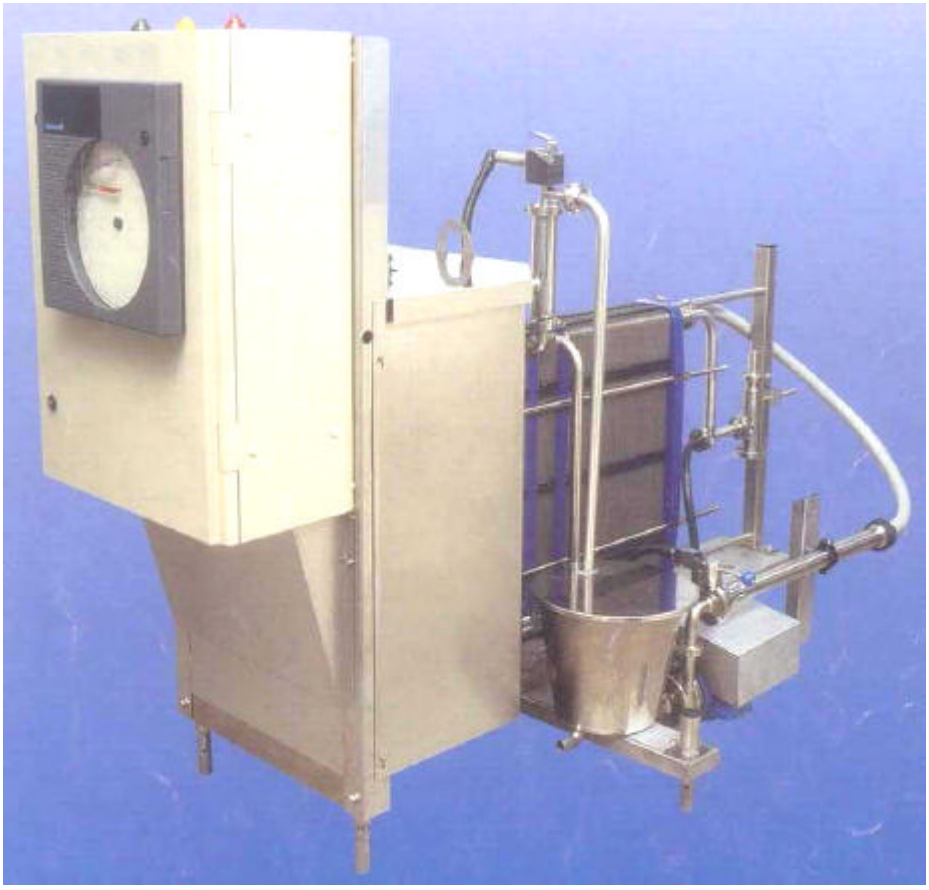
Encotherm
Continuous Pasteuriser



The *Encotherm Pasteuriser is* designed for continuous pasteurisation of milk. It is equipped with monitoring and control circuits to maintain high quality and fulfil demands of regulations. It includes one feeding and one booster centrifugal pump, and electrical heating system, as well as a control and monitoring system for the pasteurisation process.

Technical data

Process temperature	: + 72°C to + 85°C
Cleaning temperature	: 85°C
Temperature of incoming milk	: + 4°C/ + 35°C
Temperature of outgoing milk	: + 4°C
Heat recovery	: 93 %
Capacity	: 330 l/h to 1000 l/h
Max. ambient temperature	: + 45°C/104°F
Pipe connections	: SMS 025 mm
Cleaning	: CIP circulation cleaning

System Component Exported by:

ENCON Consulting Engineers
M-28, Marigold, Krishnakeval Township,
Kondhwa Khurd, Pune 411048. INDIA
Tel/Fax: +91 20 26831210 / +91 94 220 02758.
Email: encon@vsnl.com / enconindia@hotmail.com

Encotherm Mk II Pasteuriser Specifications:

Description

The *Encotherm MkII Pasteuriser* is designed for continuous pasteurization of milk. It is equipped with monitoring and control circuits to maintain high quality and fulfil demands of regulations.

Control and monitoring equipment:

Two-pen recorder, recording:

- Pasteurisation temperature after the holding cell.
- Temperature of outgoing milk.

The recorder also indicates:

- If the Encotherm goes into recalculation mode during operation in process mode.
- If the Encotherm is running in cleaning mode.

Temperature controller:

- For setting the correct heating temperature corresponding to the pasteurisation temperature.
- For setting the correct heating temperature for circulation cleaning.

Semiautomatic diversion valve:

- Changes into recalculation mode if the pasteurisation temperature drops below the preset value. To be manually restored when correct pasteurisation temperature is reached. Has a locked position for cleaning mode, where part of the cleaning liquid is re-circulated.

CIP/PROC switch:

- For setting the Encotherm in process or cleaning mode.

Technical data

Process temperature	:	(+) 72°C to (+) 80°C
Cleaning temperature	:	(+) 85°C
Temperature of incoming milk	:	(+) 4°C/ (+) 35°C
Temperature of outgoing milk	:	(+) 4°C/43 °C
Holding Time		16 Sec.
Heat recovery	:	90 %
Capacity	:	500 l/h
Max. ambient temperature	:	(+) 40°C
Pipe connections	:	SMS Ø25 mm
Cleaning	:	CIP circulation cleaning

The scope of supply shall include:

1 No. **Balance Tank**: 30 liters, manufactured in AISI 304 material complete with float for feeding the Encotherm Pasteuriser.

1 No. **Feed Pump**: centrifugal, mono-block, sanitary design type milk pump manufactured in AISI 304 material for all product contact parts shall be supplied to circulate the milk through the Pasteuriser. The pump shall be complete with electric motor suitable for operation 3 Ph, 415 V, 50 Hz, AC Power supply.

1 Set **Restriction Valve**: diameter 25 mm SMS butterfly valve manufactured in AISI 304 to control the flow rate of milk passing through the Encotherm Pasteuriser.

1 No. **Filter**: tubular filter, manufactured in AISI 304 pipe provided with strainer.

1 Set **Plate Heat Exchanger**:

The plate heat exchanger shall consist of regeneration, heating and cooling section. Heat transfer plates shall be corrugated in design to have more heat transfer area and better heat transfer co-efficient. The plates manufactured in AISI 304 shall be supplied with food grade clip-on type glue free rubber gaskets to prevent inter-mixing of product and heating/cooling media. The plates shall be compressed between frame and pressure plate made of special aluminum alloy casting.

One spanner for tightening the nut, One spanner for tightening the unions.

1 No. **Booster Pump**: centrifugal, mono-block, sanitary design type milk pump manufactured in AISI 304 material for all product contact parts shall be supplied to increase the pressure of the milk after the first stage of Heat Exchanger. The pump shall be complete with electric motor suitable for operation 3 Ph, 415 V, 50 Hz, AC Power supply.

1 Set **Hot Water Circuit**: comprises of hot water pumps to control and monitor the hot water flow to the plate heat exchanger.

1 Set **Holding Cell**: the holding cell consists of a coiled 25-mm dia. AISI 304 1.25-mm thick pipe. The holding cell consists of a length suitable enough to ensure that it takes minimum holding time while the milk passes through the holding cell.

1 Set **Flow Diversion Valve**: specially designed flow diversion valve manufactured in AISI 304 material. The operation of the valve is explained in detail under the functioning of system.

1 set **Counter Pressure Valve**: made in AISI 304 material comprising of weight ensures that the pressure on pasteurized milk is always more than un pasteurised milk, eliminating the possibility of contamination of pasteurized milk in case of leakage.

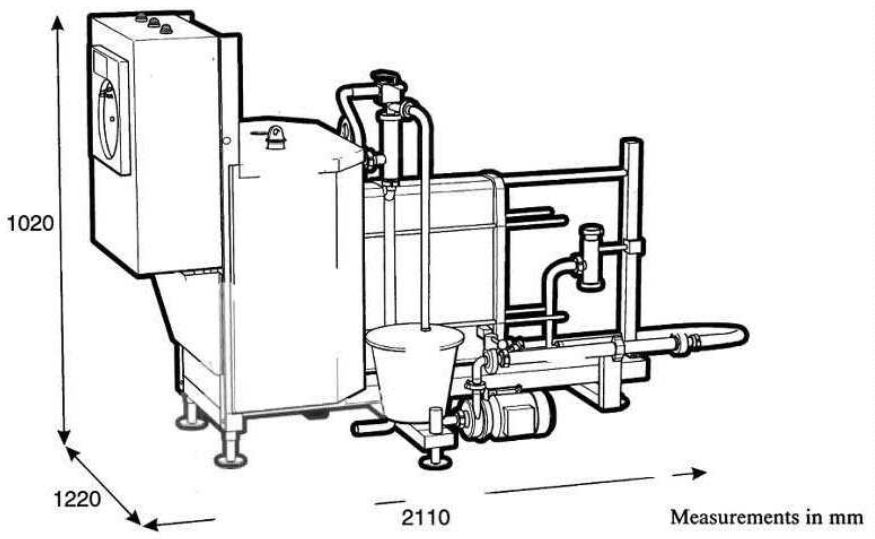
1 set **Control & Monitoring Unit**: comprises of Temperature sensor for pasteurized milk, Temperature Sensor for outgoing milk, Temperature of sensor for heated milk, Sensor for diversion valve position, sensor for restriction valve position. The unit also comprises of necessary circular type time & temperature chart with color pens to indicate & record various parameters of the process.

The unit shall be complete with necessary indication lamps specially to indicate if there is a drop in milk temperature passing through the holding cell.

All the control & Monitoring system is housed inside a reinforced fiber plastic panel board.

1 Lot **Interconnecting Pipes & Fittings**: to connect above process equipment for milk flow. Also, will include set of pipes & fittings for connecting Separator in line with the Pasteuriser in a loop.

1 Lot **Base Frame**: to mount the complete pasteurization unit on a base frame manufactured in AISI 304 stainless steel channels and sheets and shall be standing on spherical foot with legs.



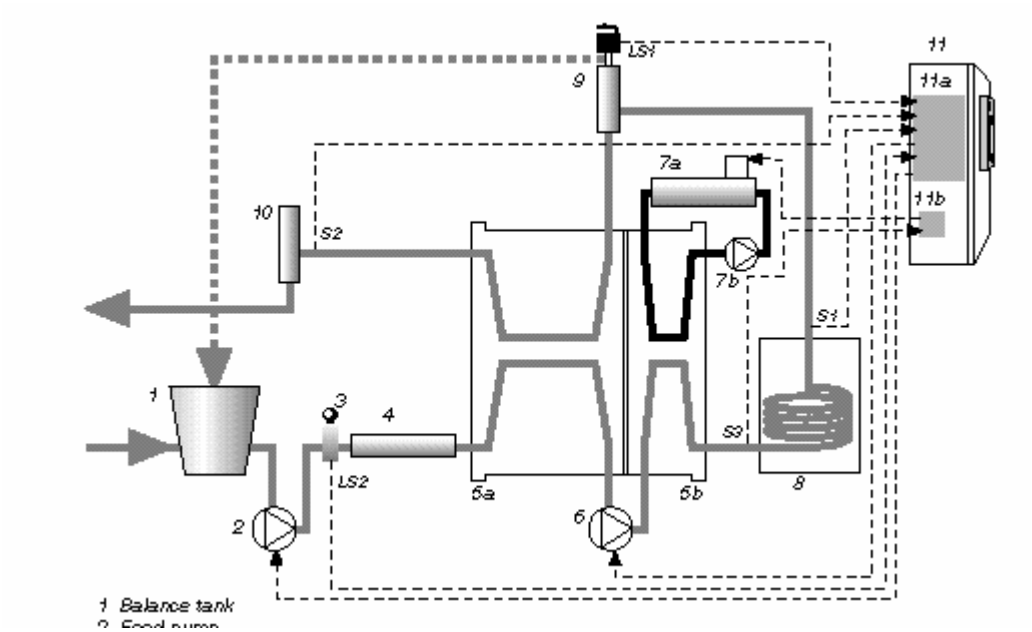
System Component Exported by:

ENCON Consulting Engineers
M-28, Marigold, Krishnakeval Township,
Kondhwa Khurd, Pune 411048. INDIA
Tel/Fax: +91 20 26831210 / +91 94 220 02758.
Email: encon@vsnl.com / enconindia@hotmail.com

Encotherm
Continuous Pasteuriser

Function

The *Encotherm MkII Pasteuriser* is designed for continuous pasteurisation of milk.
It operates in two modes, process and cleaning. In process mode it either operates in the normal pasteurisation process, or in re-circulation, where the milk is not allowed to leave the Encotherm, but instead is fed back to the inlet or runs through the Encotherm again.
In cleaning mode the Encotherm operates at higher through-flow, higher temperature and with a partial re-circulation.
The process is monitored and controlled by sensors and control circuits to make sure the correct pasteurisation conditions are fulfilled.



Parts List:: (Pic.) above

1. Balance tank
2. Feed pump
3. Restriction valve
4. Filter
5. Heat exchanger
   - 5a Regenerative section
   - 5b Heating section
6. Booster pump
7. Hot water circuit
   - 7a Water heater with temperature control
   - 7b Water pump
8. Holding cell
9. Diversion valve
10. Counter pressure valve
11. Control unit
    - 11a Temperature recorder
    - 11b Heater temperature controller

S1- Temperature sensor for pasteurised milk
S2- Temperature sensor for outgoing milk
S3- Temperature sensor for heated milk
LS1- Sensor for diversion valve position
LS2- Sensor for restriction valve position

PROCESS:

Feeding

The milk is fed, by an external feed pump, to the Encotherm balance tank (1). The inflow is controlled by a float control in the tank. From the balance tank the milk is pumped through a restriction valve (3) which limits the flow through the Encotherm to 1000 liters per hour, and further through an in-line filter (4) to the plate heat exchanger (5).

Balance tank

The Balance tank includes a float valve. During pasteurisation, the float opens and closes the valve according to the milk level. During cleaning, the valve must be open all the time.
In the tank for pump feeding you lock the valve in open position by turning the cleaning handle upwards, which presses the float down.

Pre-heating and heating

The principle of the plate heat exchanger is that two liquid flow in opposite directions through channels formed by thin, corrugated plates. The warmest liquid transfers heat to the colder.
In the Encotherm heat exchanger the milk is first warmed by the outgoing pasteurised milk in the regenerative section (5a) and then heated by hot water in the heating section (5b).
The hot water section heats the milk to the temperature set on the heater temperature controller (11b). A sensor S3, checks the temperature of the milk where it leaves the heat exchanger, and the temperature of the water is adjusted to provide the desired milk temperature.

Holding cell

After heating, the milk passes through the holding cell (8) where it is kept at high temperature. The holding cell consists of a coiled pipe with a length adapted to the through flow in the Encotherm and the desired pasteurisation time. With a flow of 1000 l/hour it takes minimum 16 seconds for the milk to pass the holding cell.

The milk temperature sensed by S1 after the holding cell is actually the pasteurisation temperature, and is recorded on the temperature graph.

Diversion valve Cooling / Re-circulation

The temperature after the holding cell, sensed by S1, is compared with the desired pasteurisation temperature, programmable in the Control Panel (11a). If the temperature is approved, the milk passes through the diversion valve (9) and back to the heat exchanger. There it meets the incoming hot milk and is cooled to about 4°C above the temperature of the incoming milk before it leaves the regenerative section.

Should the temperature after the holding cell is too low, the diversion valve automatically goes into re-circulation position and the milk is fed back to the balance tank (1).

Booster pump and counter-pressure valve

The booster pump (6) increases the pressure of the milk after the first stage of the heat exchanger. The pump works against the constant counter pressure formed by the weight in the counter-pressure valve (10) at the outlet. This means that the pressure of the pasteurised milk is always higher than the pressure of the un-pasteurised milk. If a leakage should occur in the plate heat exchanger, there will be no risk that un-pasteurised milk leaks over and contaminates the pasteurised.

Cleaning

When the Encotherm is put into cleaning mode the following is different from the normal process:

⇒ The heating temperature (S3) is controlled according the cleaning temperature set in the heater controller (11b).

⇒ The flow restriction valve (3) must be in cleaning position. Thus the cleaning is performed at a higher flow than the pasteurisation process.

⇒ The diversion valve (9) must be set and locked in cleaning position. This means that a part of the hot cleaning liquid is fed back to the balance tank for re-circulation, in order to keep up the temperature of the system.

⇒ The weight of the counter-pressure valve (10) must be removed and the valve of the balance tank (1) must be open, either by removing the float (gravity feeding tank) or by turning the locking handle upwards (pump feeding tank).

Control & Monitoring

The tasks of the control and monitoring equipment are:

⇒ to keep the pasteurisation temperature at the correct level

⇒ to make sure that only properly pasteurised milk can leave the unit

⇒ to create a record of each process occasion, which can be filed and checked at request. The following is recorded:

- pasteurisation temperature
- temperature of outgoing milk
- if the Encotherm is put into re-circulation mode during the process.

The record also indicates if the Encotherm operates in cleaning mode.

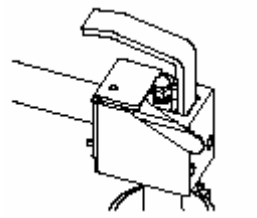
Water heater control

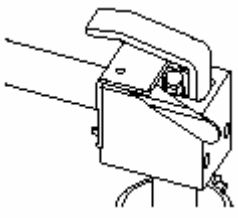
The temperature of the milk after the heating section (S3) is compared with the desired heating temperature set on the heater temperature controller (1). This is normally set to about 1.5 degrees higher than the desired pasteurisation temperature. The heater temperature controller adjusts the water temperature to keep the milk temperature at the desired value.

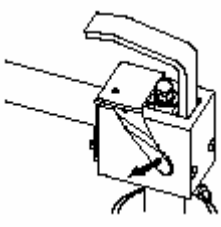
Two temperatures are set on the controller, one for process and one for cleaning.

Diversion valve

The diversion valve has three positions:







Up = Process.
The milk flows from the heating section back through the regenerative. The diversion valve is kept open by the milk pressure caused by the pumps and counter pressure valve.

Down = Re-circulation
If the pumps stop, the pressure drops and the diversion valve falls down to re-circulation position, where the milk flows back to the balance tank.

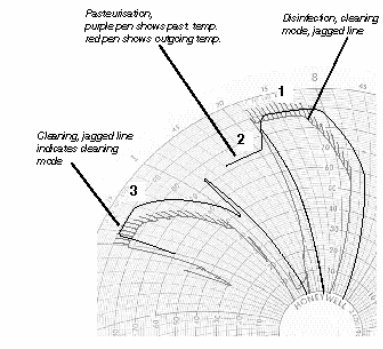
Middle = Cleaning
At cleaning, the valve is locked by the lock arm between up and down. This opens the valve both to the regenerative and the balance tank. Some of the cleaning solution goes to the balance tank to ensure cleaning of the pipe between the diversion valve and balance tank.

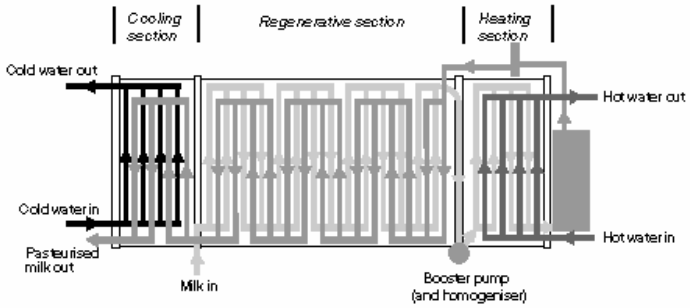
Pasteurisation temperature control
The pasteurisation temperature after the holding cell (S1) is compared with the desired pasteurisation temperature set in the recorder.
If the temperature at S1 is too low, the pumps are stopped (C1, C2). The pressure drops, which causes the diversion valve to fall down and close its bottom outlet. Instead, the milk goes back to the balance tank for re-circulation. As soon as the diversion valve is down, which is indicated by sensor LS1, the pumps start again. The pump stoppage will thus be very short and does not cause any stop of the flow.
The same thing happens if the temperature at S3 should be too low (since then it will also be too low after the holding cell).
When the pasteurisation temperature (S1) is normal again the diversion valve can be manually lifted and the process continues.
During cleaning, there will be no action if the temperatures drop below the set values.
Restriction valve with sensor LS2 must be set in processing position “closed” when pasteurising, and the weight must be inserted in the counter-pressure valve. If not, it is not possible to set the diversion valve in process position.

Recording
The pasteurisation temperature after the holding cell (S1) is recorded by pen 1, purple.
The outlet temperature (S2) is recorded by pen 2, red. The red pen also indicates if the Encotherm goes into re-circulation mode. If this happens, the red pen goes out towards the periphery of the paper.
Cleaning mode is indicated by the red pen, which then makes a jagged pattern. Outgoing temperature, recorded by red pen Pasteurisation temperature (temperature after holding cell) recorded by purple pen

Example of temperature recording:
1. Disinfection, heating up.
   The Encotherm is heated up in cleaning mode indicated by a jagged line.
2. Pasteurisation.
   The Encotherm is in pasteurisation mode. The outlet temperature pen writes the actual outlet temperature.
   - Temperature drop If the pasteurisation temperature drops below the allowed, the Encotherm goes into re-circulation mode. Then the red pen goes out towards the periphery of the paper.

3. Cleaning:
   The recorded line is jagged, indicating that the Encotherm is operating in cleaning mode.





Flow control
A sensor indicates the position of the restriction valve. When the valve is closed (restricted flow) the Encotherm can only operate in process mode. When the valve is open (full flow) the Encotherm can only operate in cleaning mode.
Pressure control
If the weight of the counter-pressure valve is missing, the pressure will not be high enough to keep the diversion valve up. Thus the Encotherm will then only operate in re-circulation mode.

Plate heat exchanger

The figure below shows how the milk flows up and down between the plates in the heat exchanger, basic version.

In the first section, the regenerative, the incoming milk that has a temperature of +4°C is heated by the pasteurised milk to about 65 °C. In the heating section the milk is heated by hot water to about 73,5°C before it goes to the holding cell. After the holding cell it flows back through the regenerative section, where it is cooled from 72°C to +8°C by the meeting incoming milk The temperature difference between the outgoing and incoming milk, ? T, is 4°C. (The temperatures are typical values and may differ in different processes.)

Homogeniser versions (Optional)

In Encotherm versions with homogeniser, the homogeniser is connected after the booster pump, so that the milk flows in to and out from the homogeniser before it goes into the heating section.

Added cooling version (Included)

The figure below shows the milk flow in the heat exchanger of an Encotherm with an added cooling section. When the outgoing milk has passed the regenerative, it goes to an added section where it is further cooled by chilled water.

Separator version (Optional)

The figure below shows the milk flow in the heat exchanger of an Encotherm with separator. The separator is connected in the regenerative section. The milk has reached about 50 °C when it goes out to the separator. After separation the milk goes back into the regenerative.

System Component Exported by:

ENCON Consulting Engineers
M-28, Marigold, Krishnakeval Township,
Kondhwa Khurd, Pune 411048. INDIA
Tel/Fax: +91 20 26831210 / +91 94 220 02758.
Email: encon@vsnl.com / enconindia@hotmail.com