THE CONCEPT OF " EVOLI QUALITY CHEESE"

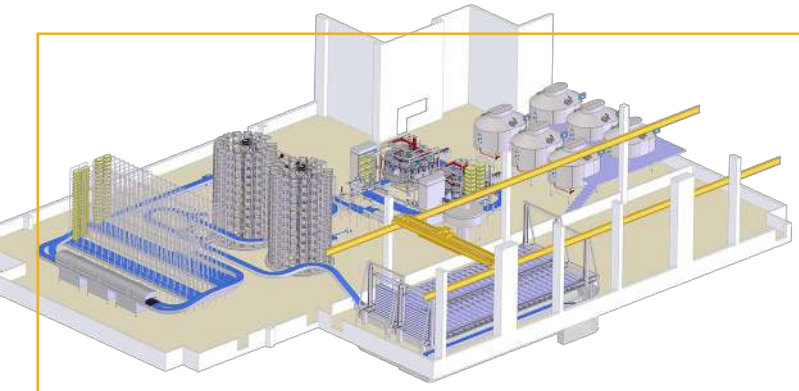
# HOW TO MAKE *the best* HARD / SEMI-HARD CHEESE

GUIDE

ÉVOLI

GROUPE STEAP STAILOR

FRANCE



# To technology with love

In the world of cheese making industry, the category of hard/semi-hard cheese is the most common and well studied. But there is one global problem:

*How to produce cheese different from others? The best cheese ever?*

The solution is simple:
Equipment should follow technology, not vice versa

The equipment should satisfy all the production and hygenic criteria of the technological process, and thus a cheesemaker, having determined his technology, will be able to produce the highest quality cheese steadily all year round. It must respect the special demands of technology: high speed heating of curd, variability of stirring, possibility to take the whey out of curd, very fast molding and fast start of pressing.

French cheese production technology sets the main goal: to obtain a stable final product - cheese with the same characteristics, throughout the year. The main way to achieve it is to strictly follow the acidification curve of each type of cheese.

Using the centuries-old experience of french cheesemakers, EVOLI engineers have created a range of cheesemaking equipment which meet carefully the specific requirements of hard/semi-hard cheese technology at all critical points and in the same time have the widest possibilities of adjustments to each individual case.

## Hard/semi-hard cheese technology

FEATURES

- rennet coagulation priority
- long ripening ability: 2-12-24 months
- moderate yield (7-15kg/100 kg of milk)
- flexible and elastic cheese texture, mineralised curd
- High dry matter content: 50-65%
- curd heating/stirring for more efficient whey drainage from curd
- Step of curd pressing is present

## Steps of technology of hard/semi-hard cheeses:

MILK PREPARATION → COAGULATION → MOULDING →
PRESS & ACIDIFICATION → SALTING → DRYING OUT → RIPENING

# Attention to milk

The particularity of the acidification curve for hard and semi-hard cheese **is that pH of milk and then cheese whey should not decrease before the cheese pressing is started.** Therefore, milk should be fresh, without cold ripening

*The "golden ratio" of protein to fat content in the milk is 1:1,15-1,2*

Amount of protein in milk should be at least 3%.

**Starter cultures:** Thermophilic to mesophilic culture's ratio should be 80:20 or close to it. Thermophilic play only an acidification role, all while mesophilic provide acidification and give the taste and aroma to the ripened cheese.

**Coagulation agent:** to keep the **setting time** of coagulation constant, quantity of coagulation agent needs to be adjusted to the protein content of the milk all around the year. It provides a constant humidity in the ripened cheese.

**Example of calculation of coagulant agent's quantity in respect to the variation of protein content in milk (for cheese vat 12000 l)**

| % protein in milk | Coagulant dose (ml / 12,000 l) |
|---|---|
| 3,4 | 722 |
| 3,5 | 744 |
| 3,6 | 765 |
| 3,7 | 786 |
| 3,8 | 807 |
| 3,9 | 828 |

## PAY ATTENTION:

- Understanding the composition of the microflora of raw milk is very important, even despite the intended pasteurization process. During pasteurization, the bacteria themselves die, but their various enzymes remain, which take an active part in the processes of cheese ripering.
- Be sure to add calcium chloride (10 - 15 ml / 100 l of milk) to compensate for the transition of calcium into the colloidal phase - each time after the temperature treatment of milk.
- The composition of the silo may contain butyric bacteria, which cause bloating of the cheese during ripening - add lysozyme hydrochloride if the spore content is more than 400 units per liter of milk.
- The optimal standardization of the protein level in the mixture is 4.1- 4.2%, using UF retentate or using dry casein.

**MILK PREPARATION** → COAGULATION → MOULDING →
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# EVOLI Cheese vat

## CHEESE MOISTURE AND YIELD MANAGEMENT

Moisture content of cheese is determined by **setting time** of coagulation in the cheese vat.
Total coagulation time = **setting time** + hardening time.

Hardening time is a calculated derivative from the setting time.

### The following steps take place in a cheese vat:

- hot maturation of the milk - by adding starter cultures
- coagulation by adding a coagulant agent
- cutting of curd
- heating of curd
- taking out of whey and adding of pasteurised water
- stirring and discharging to moulding unit

} *Provides a stable moisture content in cheese*

} *Regulation of drainage of whey out of curd, and control of acidification curve.*

Setting time can be regulated (increased or decreased) by adjusting these factors in the moment of adding a coagulation agent:

| temperature of milk | pH of milk | dose of coagulation agent |
|---|---|---|

**Evoli cheese vats have unique characteristics complying with all the requirements of the technology:**

**IMPORTANT**

The total coagulation time for hard / semi-hard cheese should not exceed 50 - 60 minutes (otherwise, there will be deterioration of the acidification curve)

**IMPORTANT**

**Cheese yield** depends on **setting time** and protein content in milk, as well as the quality of work of cutting-stirring tools, and quality of curd's heating in a cheese vat

- Powerful cutting and stirring tools have a withstand load 7 times more than the mass of milk in cheese vat - to be able to treat UF retentate to produce cheese.
- Fast and uniform heating of the curd by a high-precision direct steam in the double jacket - heating rate of 1 ° C per minute.
- Homogeneous grains with the same size - there are no local problems of post-acidification in cheeses.
- An automation system to get the most accurate and quick answer to a request for changing the speed of cutting, heating, and stirring.
- Self-sharpening blades and their configuration minimize protein and fat loss during curd cutting and stirring. (less than 0,5%).

MILK PREPARATION → **COAGULATION** → MOULDING →
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# EVOLI Moulding bells (GME)

## SPEED, QUALITY AND MOULDING ACCURACY

The moulding process must be as quick as possible to maintain the temperature of the curd and prevent pH level from falling down. Otherwise there will be a change in the acidification curve.

**Moulding bells EVOLI are perfectly suited to main requirements of the high quality cheese moulding:**

| Moulding time (strictly less than 15 min) | Moulding accuracy (less than 1% of weight deviation) | Moulding under a heavy mass of whey (no air inclusions in curd) |
|---|---|---|

### Key features of EVOLI Moulding Bells (GME):

- Filling and moulding are very fast, less than 10 minutes. There is no buffer tank between the cheese vat and GME - so no waiting time before molding and no changing of acidity of the curd.
- Moulding system is completely closed to maintain the temperature of the curd. It's very important for the cheese like Parmesan, Emmental, Maasdam, Gruyere, etc. - to keep right acidity before pressing is started.
- Circle position of the moulding bells provide a high accuracy in a cheese curd distribution in to moulds. With a centrally located distribution small vat, all the bells are at the same distance and with the same diameter of the distibution pipes from the distribution vat. It means that in each bell there is the same quantity of curd, and weight deviation of each mould is less than 1%.
- Bells are ideal to shape the traditional round cheese, as well as euroblock (500*300*100). For euroblock case, there is a specially shaped cone with a flat top that allows equal distribution of curd in a euroblock mould.
- For the cheeses without holes, bells provide the perfect moulding under a heavy mass of whey (approx 80 cm - height of bells), which guarantee the final cheese without any air inclusions or mecanical holes.
- For the cheeses like Tilsiter or Manchego - which need to be moulded with drained grains - there are two special grilles inside the bells - to get a possibility to extract as much whey as needed before moulding. Both grilles are managed by automatic valves.

| | | |
|---|---|---|
| To change a cheese mould - no need to change tools | Fully CIP cleaning | Fully automatic system - no manual work |

MILK PREPARATION → COAGULATION → **MOULDING** →
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# EVOLI Rotary Press

**IMMEDIATE AND INDIVIDUAL**

2 main functions of hard/semi-hard cheese press:

| | |
|---|---|
| To remove residual free whey from a cheese head | To obtain right pH for demoulding |

## IMPORTANT:

Demoulding should take place only when the lowest possible pH level is achieved (means that there is no more lactose in the cheese). If the pH is good for demoulding but there still some lactose in the cheese, the post-acidification defects will take place at cheese ripening.

### Key features of EVOLI Rotary Press:

- The consept of "EVOLI Quality Cheese" is based on the moulding/pressing/salting of cheese head up to 100 kg- press is completely robotic.
- All press cylinders are independent. As soon as the mould is in place, it's immediately pressed. Thus saving the temperature of the curd, and within a quick moulding, the acidification of curd starts only at the beginning of the press step.
- Press is closed and it helps to keep the right temperature of the hard cheese curd.
- To increase its capacity (number of pressing places), it only needed to build its upper part.
- Fully CIP cleanable.
- Possibility to press differents cheese formats/weight in multiforms, without tools changing.

For semi-hard cheeses: pressing time is 2-3h only and it's enough to get right humidity and right pH for demoulding.
For hard cheese with high temperature of curd heating: acidification takes much more time than pressing time, and normally the time and place, specificly for acidification, has to be organised.

MILK PREPARATION → COAGULATION → MOULDING →
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# EVOLI Salting, Drying Out and Ripening

Salting and drying out of cheese head after salting are the most important steps for creating a vital membrane - rind of the cheese - even if cheeses will be placed in a film for ripening after.

**Salting has the following main functions:**

- Create a rind of the cheese
- Favor a microbiological selection for ripening
- Drain the whey out of cheese head: 1 kg of salt taken gives 2,5l of whey out
- Cheese yield increase
- Cheese taste intensification

**Key features of EVOLI salting system:**

- The line is fully automatic. Cheese is immersed directly in brine and come out only at the end of salting period. Containers move in brine.
- Whole brine circulation solution and control of salt concentration.
- CIP cleaning of the containers out of the brine pool, each time after each salting.
- Linked with a micro-filtration unit for online filtration - for the cheese packed in film for ripening.
- Fully adapted for different cheese format/weight.

## IMPORTANT

- pH of brine = pH of cheese
- Acidity in Dornic degrees - 45 max for semi-hard cheeses
- Cheese temperature=brine temperature
- Brine solution - oversaturated with salt (26%)
- Microbiological purity - no Salmonella , Listeria, E. Coli, Staph. aureus.

After salting, the next step is drying out of the cheese head surface. Takes 24h with a temperature of 10C and humidity of 85-90%. This will secure the rind of cheese created during the salting, and prevent microbiological problems during ripening. Also it helps to minimize the weight loss of cheese head during ripening and thus saving a lot of money.

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# EVOLI PRODUCTION HYGIENE

Since we recommend the intensive use of EVOLI lines - up to 7 full turns of EVOLI cheese vat a day - its' more than important to keep the highest standard of industrial hygiene.

## Key features of EVOLI cheese making line design:

- Absence of dead zones and sharp corners
- No agitator's fixation inside the cheese vat
- All working mechanisms are taken out of the contact with milk/product
- Fully CIP-cleanable

**Important**

Within intensive use, cheese microperforated moulds are the main sourse of microbiological contamination and have to be cleaned after each use imperatively

## High quality cleaning of microperforated molds:

- Duration of cleaning is 2 minutes minimum in a washing tunnel
- Sufficient pressure in rotating washing heads
- Better have a separate cleaning of molds and lids - two levels washing tunnels

**Fages - how to fight?**

The best solutions is to collect and pump out immediately all the whey at each step of production. All conveyors, moulding bells and presses EVOLI are equipped with special trays for whey collection and pumping continuously.

If you want to learn more about hard/semi-hard cheese technology and the concept of "EVOLI Quality Cheese", you're welcome to the annual training at French national cheese school ENILV and Actalia company, in France, la Roche-sur-Foron. Availibly in French language with live translation to English, Russian or Portuguese.

**Always yours, EVOLI team, France**

**www.evoli.fr**