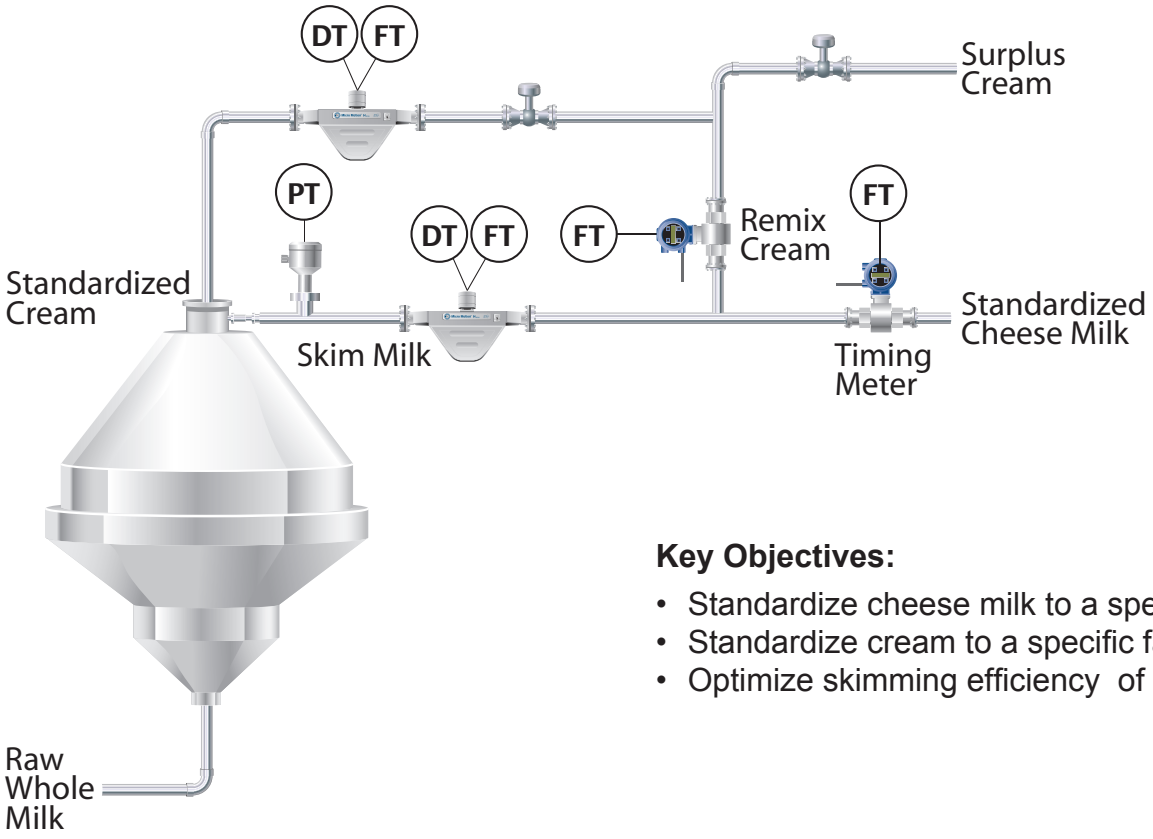
CHEESE – STANDARDIZATION

Solutions Sales Training Reference

EMERSON
Process Management



Key Objectives:

- Standardize cheese milk to a specific fat content
- Standardize cream to a specific fat content
- Optimize skimming efficiency of separator

Separation and Standardization Process Description

Standardization is simply the process of adjusting the fat content of milk and cream (or protein content of milk) to standardized values depending on the type of cheese being produced. The final fat, protein and dry solids ratios are important factors in the yield and quality of the cheese. Fat standardization is accomplished by first separating cream from skim milk, and then blending cream back into the milk in the appropriate ratio. The process unit used for fat standardization is called a separator. Fresh, raw milk containing 3.8 – 4.1% fat is introduced into the unit and two flows emerge through throttling valves; skim milk at a constant fat content of approximately 0.02% (depending on the efficiency of the equipment) and cream. The fat content of cream varies based on the position of the cream throttling valve, and is controlled to a preset value.

The separator for cheese milk standardization is located after the pre-heating or regeneration stage of the heat exchanger (pasteurizer) since heat facilitates separation. The separator is a centrifuge, so heavier skim milk will flow radially outward while cream flows up the center of the unit. Standardization of cream (typical targets are 35-40% milk fat) is accomplished within the process unit by controlling the back pressure of skim milk and the flow of cream through the cream throttling valve. By allowing more flow out of the cream valve you will reduce the fat content in that line, since skim milk will be forced out that line following the cream (by regulating the back pressure valve on the skim). Standardization of milk is accomplished by blending cream back into the skim milk after it emerges from the separator, in proportion to the desired fat content (3.25% or “whole” milk for cheddar; 2% for mozzarella). In-line blending is the most efficient method and requires careful measurement and control of the fat content of cream out of the separator, as well as flow out of the skim milk line. Flow of the final, blended “cheese milk” is controlled by the PMO-approved timing meter to the pasteurizer, and the remix flow is adjusted to achieve the appropriate ratio. The remix flow is controlled by the surplus cream valve; there are no other factors affecting the surplus cream flow. Some cheese plants need to standardize fat to solids non-fat (SNF). A density measurement placed on the skim milk line can be converted to SNF, and is then available for the cream remix controller. Protein standardization is accomplished with membrane filtration, and is not covered in this training.

CHEESE – STANDARDIZATION

Select Measurement and Control Points in Separation and Standardization

Standardized Cream Discharge
The cream discharge line is carefully measured and controlled to a standardized fat content, based on the downstream use of surplus cream. The milk-fat in this line is key to in-line fat standardization of cheese milk.

Skim Milk Discharge
Density measurement on this line is used to calculate SNF, if a fat to SNF standardization is required. This flow can be used to control throughput; throughput will change the efficiency of the separator.

Standardized Cheese Milk
Milk-fat in this line is carefully controlled based on the type of cheese being made. In-line blending of skim milk and standardized cream is typically used. The flowmeter on this line is the timing meter for pasteurization.

Density variation of milk and cream with temperature

	Composition	Density (g/cm³ at)			
	%Fat / %SNF	4.4˚C	10˚C	20˚C	38.9˚C
Skim Milk	0.02 / 8.9	1.036	1.035	1.033	1.026
Whole Milk	4.0 / 8.95	1.035	1.033	1.030	1.023
Light Cream	20.0 / 7.2	1.021	1.018	1.012	1.000
Heavy Cream	36.6 / 5.55	1.008	1.005	0.994	0.978

Standardized Cream Discharge %Fat

Control Point Challenge:
To control the fat content of cream out of the separator to a standardized value, set by the downstream processing equipment for surplus cream. Target is typically 36-40%.

Solution:
Milk-fat in cream discharged from the separator is controlled by the regulating valve on the cream line out of the separator. Opening the valve will force more skim milk up the cream line, reducing fat content of the cream. This is aided by the back pressure valve on the skim milk discharge line. The simplest control schemes set the valve to a position based on milk-fat measured in the received milk, and that position is fine-tuned with lab analysis of a sample of the discharge cream. On-line measurement of milk-fat ensures real-time compensation to any process upset or change in the raw milk. This is typically a 1” line.

Micro Motion H-Series Coriolis Meter
- 3A and EHEDG approved
- Direct mass flow and density measurement
- Inferred %fat measurement
- Mass flow accuracy to 0.10%

Standardized Cheese Milk % Fat

Control Point Challenge:
To control the fat content of cheese milk based on the type of cheese being produced.

Solution:
A magnetic flowmeter is placed on the remix cream line to properly ratio the cream to the skim milk. Since the fat content of cream out of the separator is known (or assumed constant in simple control schemes) and skim milk flow is known (or assumed constant with simple control schemes) a ratio controller can perform in-line blending by manipulating the surplus cream valve and give the proper remix cream flow to achieve the desired fat content of the cheese milk.

Rosemount 8721 Magmeter
- 3A and EHEDG approved
- 0.25% accuracy
- Full diameter; no pressure drop
- Isolated electronics and LOI for long term reliability

CHEESE – STANDARDIZATION

Skim Milk Solids Non-Fat

Control Point Challenge:
To standardize cheese milk by the fat to solids non-fat (SNF) ratio.

Solution:
A density measurement placed on the skim milk line can be converted to SNF, and used as in input to the ratio controller that controls the proper amount of remix cream to achieve the desired fat to solids non-fat ratio.

Micro Motion H-Series Coriolis Meter

- 3A and EHEDG approved
- Direct mass flow and density measurement
- Inferred %fat measurement
- Mass flow accuracy to 0.10%

Skim Milk Back Pressure

Control Point Challenge:
Back pressure of the skim milk outlet is controlled to enable accurate standardization of cream out of the separator.

Solution:
Plants use either a pressure regulating valve or a pressure transmitter that manipulates an outlet valve to control the back pressure.

Rosemount 4500 Temperature Transmitter

- Designed for Food and Beverage
- Small, stable, and reliable
- Conforms to 3-A and EHEDG standards.
- Withstands CIP and wash-down.

Standardized Cheese Milk Flow

This is the PMO regulated timing meter for raw milk going to the pasteurizer; please see “Pasteurization.”