Cheese Technology

Tetra Pak® Cheese Vats and developments leading to YieldMaster Cheese Vat Coagulation Sensor

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Tetra Pak® Cheese Making Vats

The heart of cheese making.

FAT RETENTION & MOISTURE CONTENT
- Low fat and fines losses
- Higher yield

INGREDIENTS ADDITION
- Homogeneous
- Ingredients distribution

CURD SIZE DISTRIBUTION
- Precise and repeatable cutting
- Predictable curd size distribution

HEATING AND COOKING
- Gentle and effective stirring
Tetra Pak® Cheese Making Vats

The complete portfolio for every need!

- Double Vertical Shaft
  - Flexible Capacity
  - Tetra Pak® Cheese Vat OO
  - Flexibility

- Single Horizontal Shaft
  - ~ +1.0 % Fat Retention
  - Tetra Pak® Cheese Vat OST
  - Repeatability

- Double Horizontal Shaft
  - ~ +1.0% Fat Retention
  - Tetra Pak® Cheese Vat HCV
  - Profitability

- Dual Horizontal Shafts
  - ~ +2.0% Fat Retention
  - Tetra Pak® Cheese Vat Yieldmaster 2
  - Highest Profitability
Tetra Pak® Cheese Vat Portfolio

Horizontal Vats

► Several Vat Arrangements
► Yield and Performance Choices
► Capital Investment Choices

Tetra Pak® Cheese Vat OST 6 CH
Tetra Pak® Cheese Vat HCV-H
Tetra Pak® Cheese Vat Yieldmaster 2
Single Shaft or Dual, Counter Rotating Shafts

- Single shaft design results in a higher rotational speed at the end of the blade compared to near the shaft.
- Results in less consistency in curd particle size and more fines.
- Single shaft blades are longer and have higher rotational speed than dual shaft blades.
Tetra Pak®
Cheese Vat Yieldmaster 2
Tetra Pak® Cheese Vat Yieldmaster 2

Overview

► Barrel shaped body with flat internal head
► Minimized agitator speed differential between the inner and outer agitator range
► Efficient agitation with minimal rpm speeds
► Dual center outlets reduces vat length and assists rinse out with reduced water use
► Ease of rinse out, 75% less time to rinse
► Capacities from 25,000 to 39,000 KG
Tetra Pak® Cheese Vat Yieldmaster 2

Machine Overview

► Heating jackets on body and flat ends
► Dual shaft counter rotation with leak detect
► Each shaft includes blade panels for cutting and stirring
► Fixed pre-draw connection at customer specified level or top variable draw
► Rennet nozzle with local header
► CIP
YM Vat – Internal Flat Head

- Flat vat heads have better flow dynamics to improve consistency and yield in all processes.
Tetra Pak® Cheese Vat Yieldmaster 2

Agitators

- Dual horizontal shafts that operate in a counter rotation arrangement
- Three panels per shaft
- 30% less blade material surface area vs. standard HCV
- Improved yields due to vat and blade geometry
- Efficient cutting/stirring at low RPM
Tetra Pak® Cheese Vat Yieldmaster 2

Heating

- Hot water heating
- Low $\Delta T$ between product and hot water (max. of 33° C $\Delta T$)
- Gentle efficient heating
- Precise Temperature Control
Tetra Pak® Cheese Vat Yieldmaster 2

Gentle and Accurate Cooking

- Dimple jacket on sidewalls and flat ends, reinforced with a dome for support
- Less thermal expansion = less stainless steel stress
Dual Shaft Tetra Pak® Cheese Vat
Proven Performance

Average Fat Retention (%) by Vat Type

<table>
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<th>Vat Type</th>
<th>1/25/11</th>
<th>1/26/11</th>
<th>1/27/11</th>
<th>1/28/11</th>
<th>1/29/11</th>
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</table>

Note: 5/23/11 Special Make

May 1st thru 29th: Vat Comparisons

- HCV
- Modified HCV
- Yield Master
Curd Distribution – Tetra Pak® Cheese Vat Yieldmaster 2

Curd Distribution
LM Cheddar
YM Vats (October 31)

Note: 81% of curd particles between 3.35 to 8.00 mm
Make Procedure

Why Yieldmaster?

► **Rennet and Mixing**: Vigorous Mixing (10-11rpm), rennet inject nozzles with direct stream into vat, very short anti-swirl to “quiet vat” allows additional mixing time before agglomeration phase begins.

► **Cutting**: First Question: “When is the best time to start vat cutting?”

    **Better Question**: “What is the optimum “cut window” to complete all of the cut revolutions?”

We want to accomplish the 25-35 total cut revolutions in a short, efficient amount of time to optimize moisture & fat retention plus curd size distribution, while preventing tearing and pushing of the curd.
Make Procedure

Why Yieldmaster?

- **Heal/Forework**: may/may not be required. YM low stir @ 1-2 rpm keeps curd suspended while early syneresis and healing occur.

- **Cook**: Very efficient; up to 0.5°C/minute: with hot water low Δ°T; Example: Cook temp 35-40°F, hot water temps 40-65°F

- **Stirring**: Very efficient, less damage to curd, lower rpm required.

- **Curd Transfer**: Homogeneous curd/whey mixture throughout entire pumpout; promotes even curd depth on draining belts; better moisture and pH control. Vat stir and curd pump recipes required.

- **Primary belt inlet screen**: Best test of our PROCESS is to monitor whey fat at primary screen inlet; vat whey fat is not the whole story!
Top Mounted Pre-Draw

- Allows for pre-draw to a variable height.
- Saves time and maintains process variables by starting pre-draw step earlier
# Product Range

<table>
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<tr>
<th>Models</th>
<th>YM 2 55</th>
<th>YM 2 70</th>
<th>YM 2 85</th>
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<tr>
<td>Maximum Capacity</td>
<td>55,000 lbs</td>
<td>70,000 lbs</td>
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<tr>
<td></td>
<td>25,000 kg</td>
<td>32,000 kg</td>
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<tr>
<td></td>
<td>24,000 L</td>
<td>31,000 L</td>
<td>38,000 L</td>
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</table>
Tetra Pak® Cheese Vat Yieldmaster 2

Highlights

► Largest capacity of any cheese vat
  - Dual center outlets allow the vat to sit level, increasing capacity.

► Efficient agitation with minimal rotational speed
  - Dual barrel shape means minimized agitator speed differential between the inner and outer agitator range as compared to a single shaft vat
  - Dual rotating agitators/ stirrers that operate in a counter rotation arrangement

► Assists rinse out with reduced water use and 75% less time to rinse
  - Centrally located outlets reduce rinsing time
  - Welded blade design provide less area to rinse

► Mechanical strength and durability for higher total solids in cheese milk

► Uniform product quality
  - Dual center outlets allow the vat to sit level, giving consistent processing of coagulum

► Highest yields through increased fat retention and reduced fines generation

► Efficient heating design
Working Principle

- Milk and culture enters the vat via a filling port
- Rennet is added through spray nozzles along the length of the roof while being quickly and effectively stirred into the vat with the agitators
- After the coagulum has set it is cut by the counter-rotating knife blades
- Cooking of the curd occurs via precise heating with a hot water jacket
- Whey is pre-drawn through a fixed or variable level outlet
- Uniform curd and whey mixture is pumped out to downstream process
Dual Counter-Rotating Agitators

- Dual horizontal shafts that operate in a counter rotation arrangement
- Three panels per shafts
- Improved yields due to vat and blade geometry
  - 30% less blade material surface area vs. standard HCV
  - Efficient and uniform cutting/stirring at low RPM
- Maximum “lift” during cut/stir keeps curds suspended
Tetra Pak® Cheese Vat Yieldmaster 2
Blade Panel
Knives
Tetra Pak® Cheese Vat Yieldmaster 2

Dual Shaft Drive Arrangements

- Center drive gear motor
- Two cone drive gear reducers
- Reliable couplings
- Robust internal idler support and bearing
- Easy to maintain and CIP-able seal assembly
- Easily removable gear reducers
Dual Shaft Agitator Seal Assembly/ Seal Inspection
Tetra Pak® Cheese Vat Yieldmaster 2
Dual Shaft Agitator Seal with CIP Attached
Dual Shaft Gear Box Shaft Boot

- Keeps liquid from entering the shaft/gearbox interface
- Eliminates Seizing
Coagulation Sensor Option for Tetra Pak® Cheese Vat Yieldmaster 2

Milk coagulation control technology
Why Coagulation Sensor for Tetra Pak Cheese Vat HCV?

► Optimizes cutting-time selection
► Reduces cost of failure
► Safeguards coagulation speed
► Lowers moisture variation
► Repeatable results
► Easy to connect
► Frees operator time
Visualizing the coagulation process will make it easier to synchronize the optimum cutting moment with the requested cutting moment.

Measurement of the variation in product and production circumstances.

Learn how to prevent these variations.

Less difference between the curd vats reduces standard deviation of finished product.
Light reflectance changes as coagulation progresses
Agglomeration of casein micelles and increase of light reflectance

The measured reflectance pattern is related to agglomeration reactions
A scientific method for measuring coagulation
The sensor measures backlight scattering during milk coagulation

LED light is shone into the curds and whey mixture
Backlight is measured by means of optical fibres
Tetra Pak® Yieldmaster 2
Installed Base

Over 108 Tetra Pak Cheese Vat Yieldmaster’s installed and running around the world:

USA
Ireland
Oceania
Moving food forward. Together.
Processing with Tetra Pak