

# Cheese Technology

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

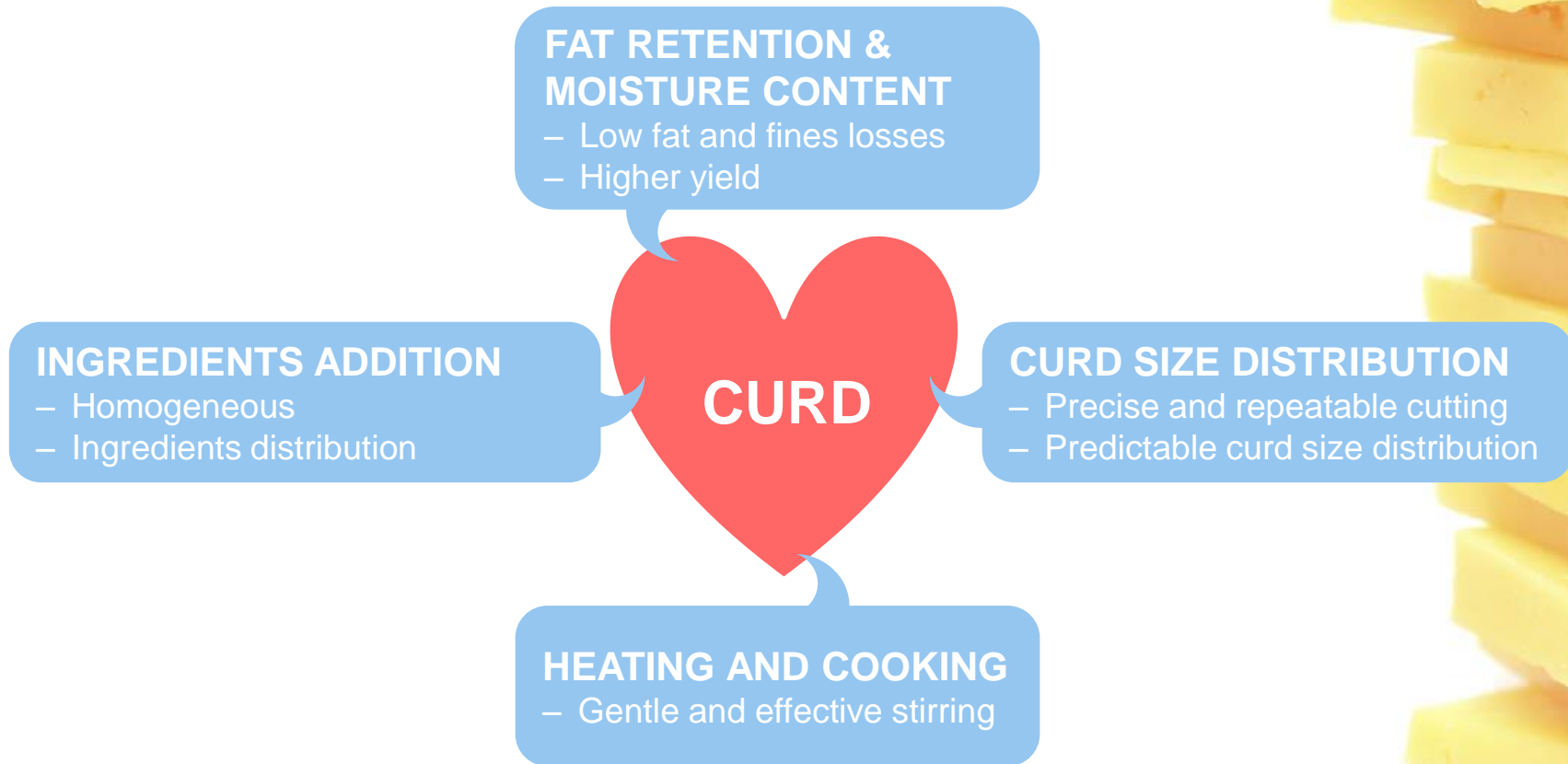
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# Tetra Pak® Cheese Making Vats

## The heart of cheese making.





## Tetra Pak® Cheese Making Vats

# The complete portfolio for every need!



Double Vertical Shaft  
Flexible Capacity

Tetra Pak® Cheese Vat OO

**Flexibility**



Double Horizontal Shaft  
~ + 1.0% Fat Retention

Tetra Pak® Cheese Vat HCV

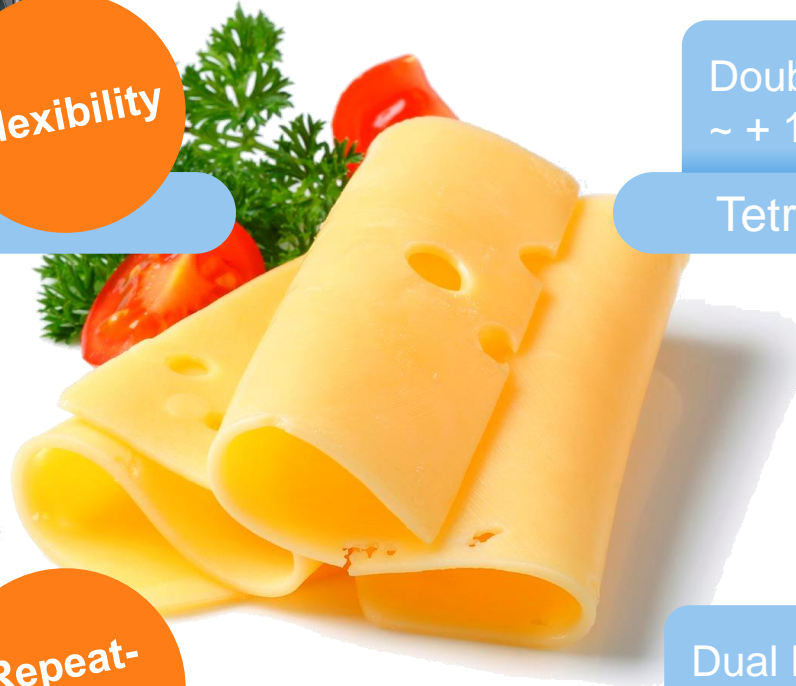
**Profit-ability**



Single Horizontal Shaft  
~ + 1.0 % Fat Retention

Tetra Pak® Cheese Vat OST

**Repeat-ability**



Dual Horizontal Shafts  
~ + 2.0% Fat Retention

Tetra Pak® Cheese Vat Yieldmaster 2

**Highest Profit-ability**



# Tetra Pak® Cheese Vat Portfolio

## Horizontal Vats

- ▶ Several Vat Arrangements
- ▶ Yield and Performance Choices
- ▶ Capital Investment Choices



Tetra Pak® Cheese Vat OST 6 CH

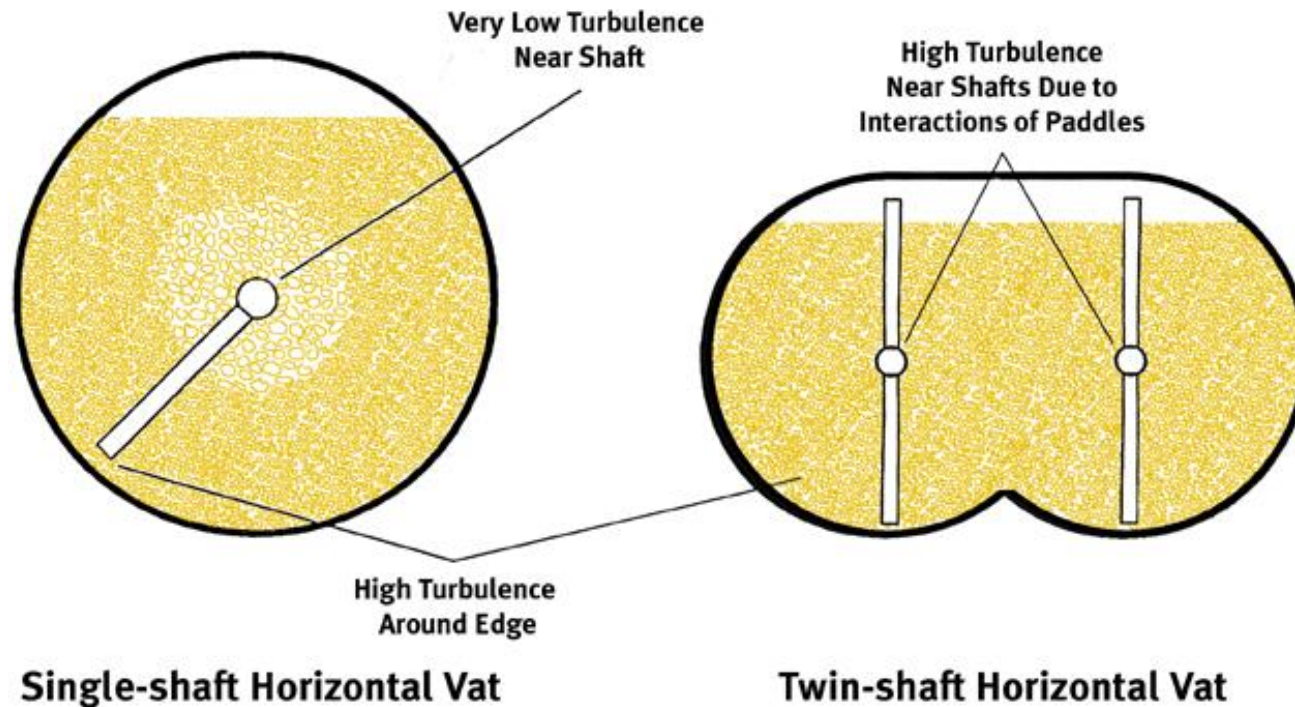
Tetra Pak® Cheese Vat HCV-H

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.

Yieldmaster Blades

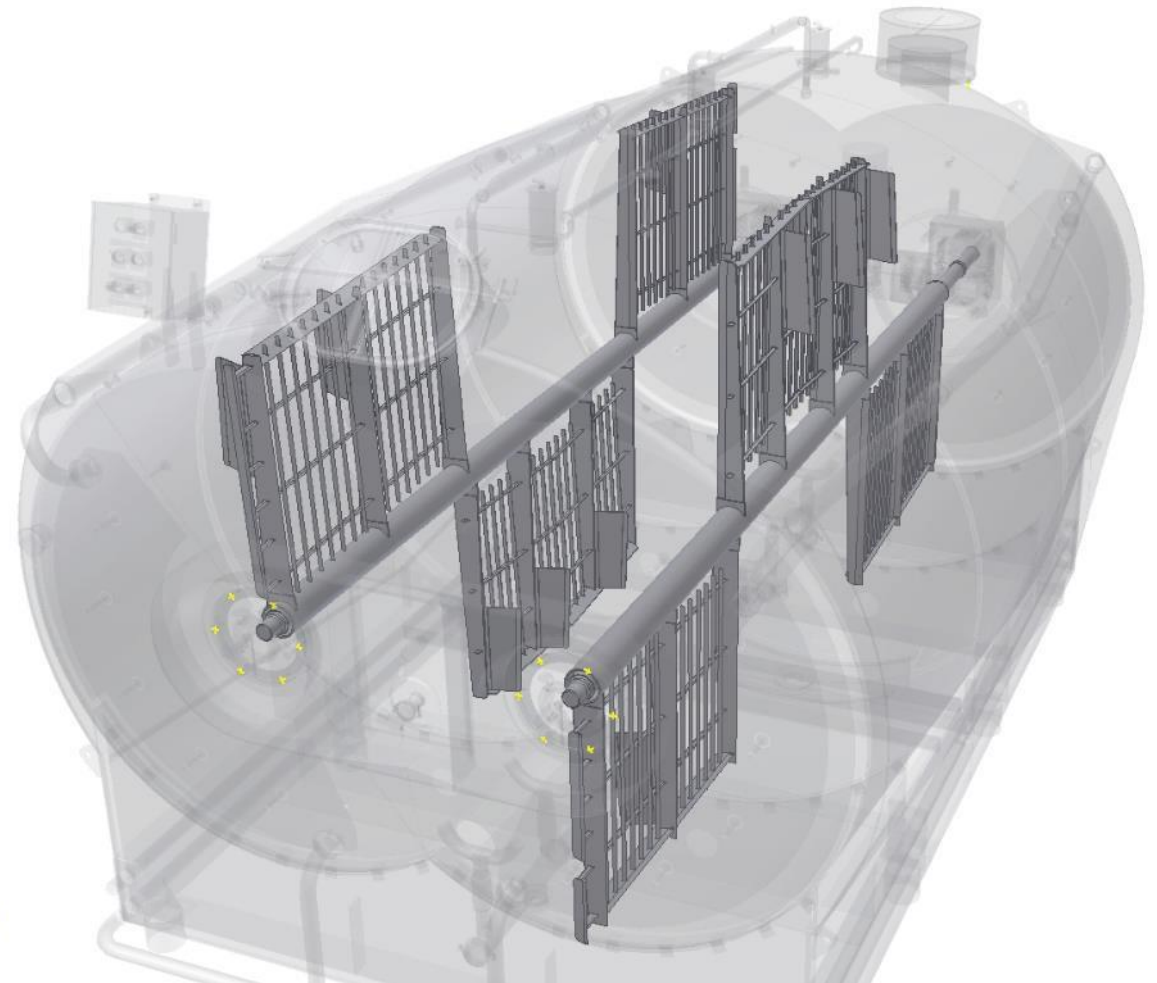




# Tetra Pak® Cheese Vat Yieldmaster 2

## 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

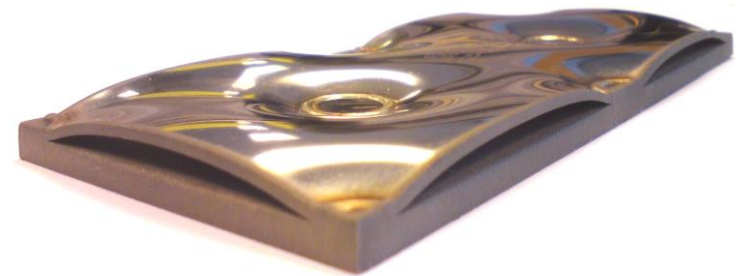
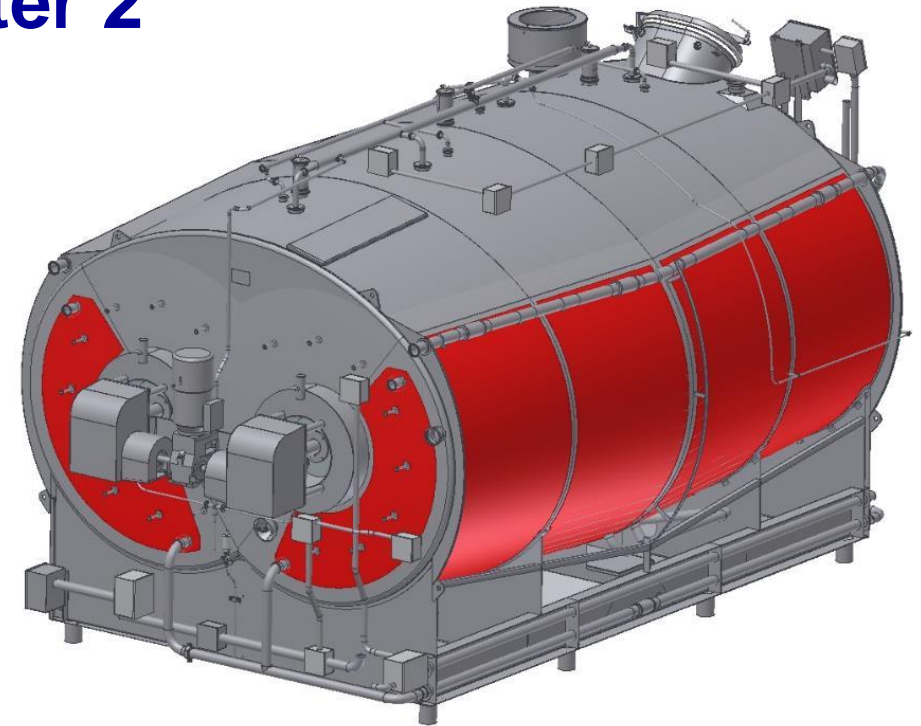




# Tetra Pak® Cheese Vat Yieldmaster 2

## Heating

- ▶ Hot water heating
- ▶ Low  $\Delta T$  between product and hot water (max. of 33° C  $\Delta T$ )
- ▶ Gentle efficient heating
- ▶ Precise Temperature Control

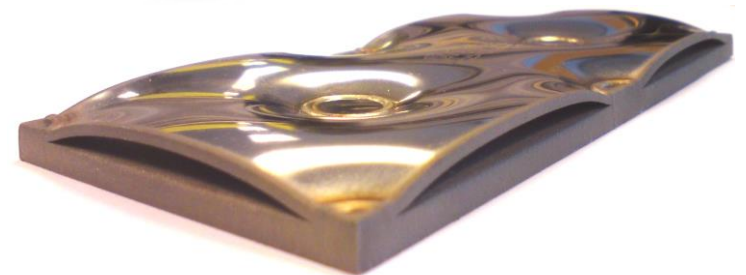
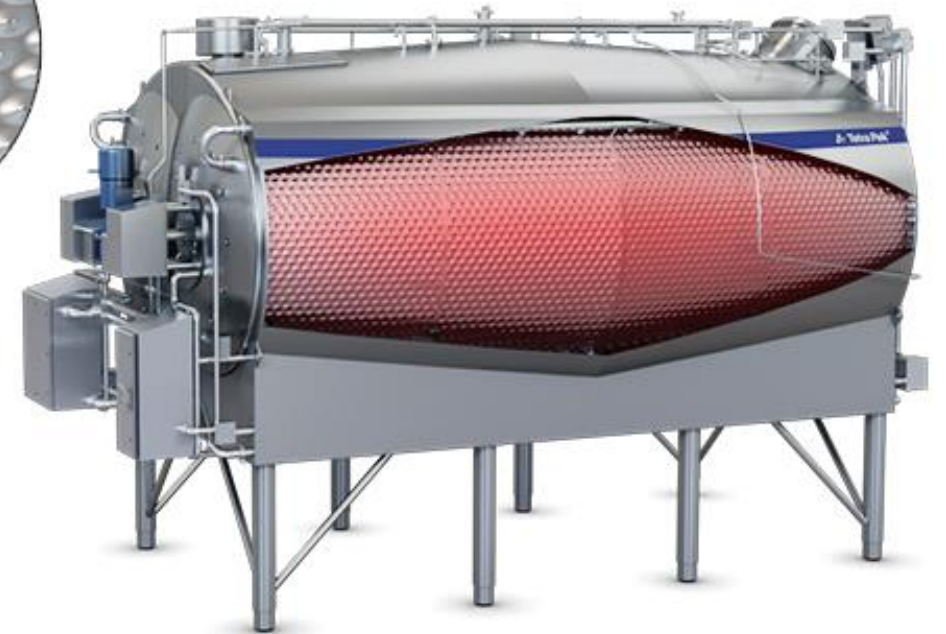




## Tetra Pak® Cheese Vat Yieldmaster 2

# 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



### Tetra Pak Cheese and Powder Systems

Vat Comparison Data  
Cheddar Types

Classification: Internal

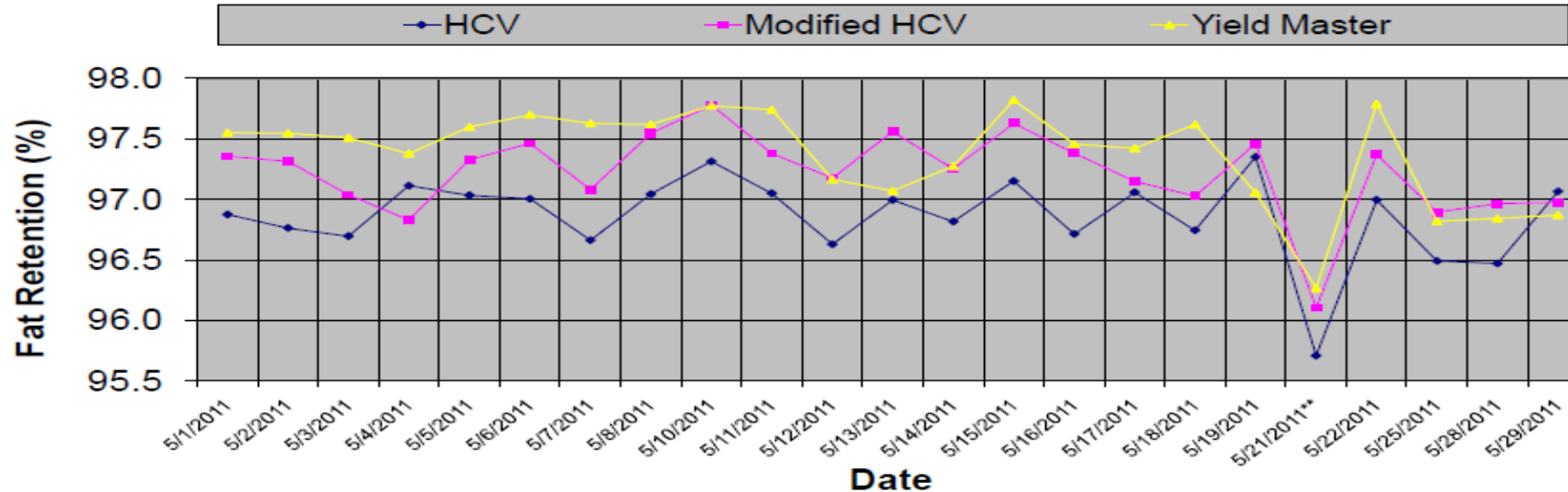
Revision: 2010-08-02, SJT

### Average Fat Retention (%) by Vat Type

Physical Vat	5/1/2011	5/2/2011	5/3/2011	5/4/2011	5/5/2011	5/6/2011	5/7/2011	5/8/2011	5/10/2011	5/11/2011	5/12/2011	5/13/2011	5/14/2011	5/15/2011	5/16/2011	5/17/2011	5/18/2011	5/19/2011	5/21/2011**	5/22/2011	5/25/2011	5/28/2011	5/29/2011	5/1 to 5/29 Ave
HCV	96.9	96.8	96.7	97.1	97.0	97.0	96.7	97.0	97.3	97.0	96.6	97.0	96.8	97.2	96.7	97.1	96.7	97.4	95.7	97.0	96.5	96.5	97.1	96.9
Modified HCV	97.4	97.3	97.0	96.8	97.3	97.5	97.1	97.5	97.8	97.4	97.2	97.6	97.3	97.6	97.4	97.1	97.0	97.5	96.1	97.4	96.9	97.0	97.0	97.2
YieldMaster	97.6	97.5	97.5	97.4	97.6	97.7	97.6	97.6	97.8	97.7	97.2	97.1	97.3	97.8	97.5	97.4	97.6	97.1	96.3	97.8	96.8	96.8	96.9	97.4

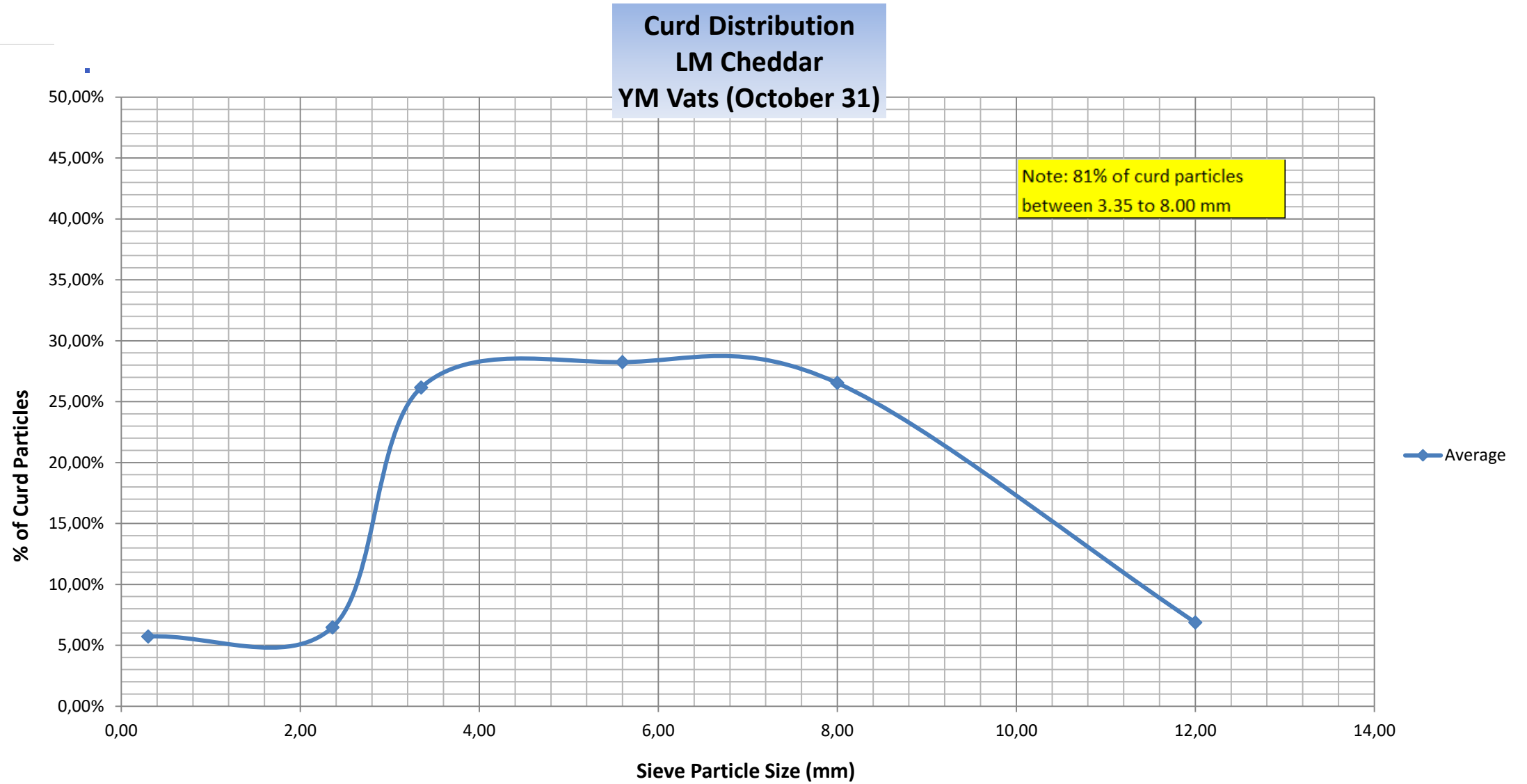
Note: 5/21/11 Special Make

### May 1st thru 29th: Vat Comparisons





# Curd Distribution – Tetra Pak® Cheese Vat Yieldmaster 2





# 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.



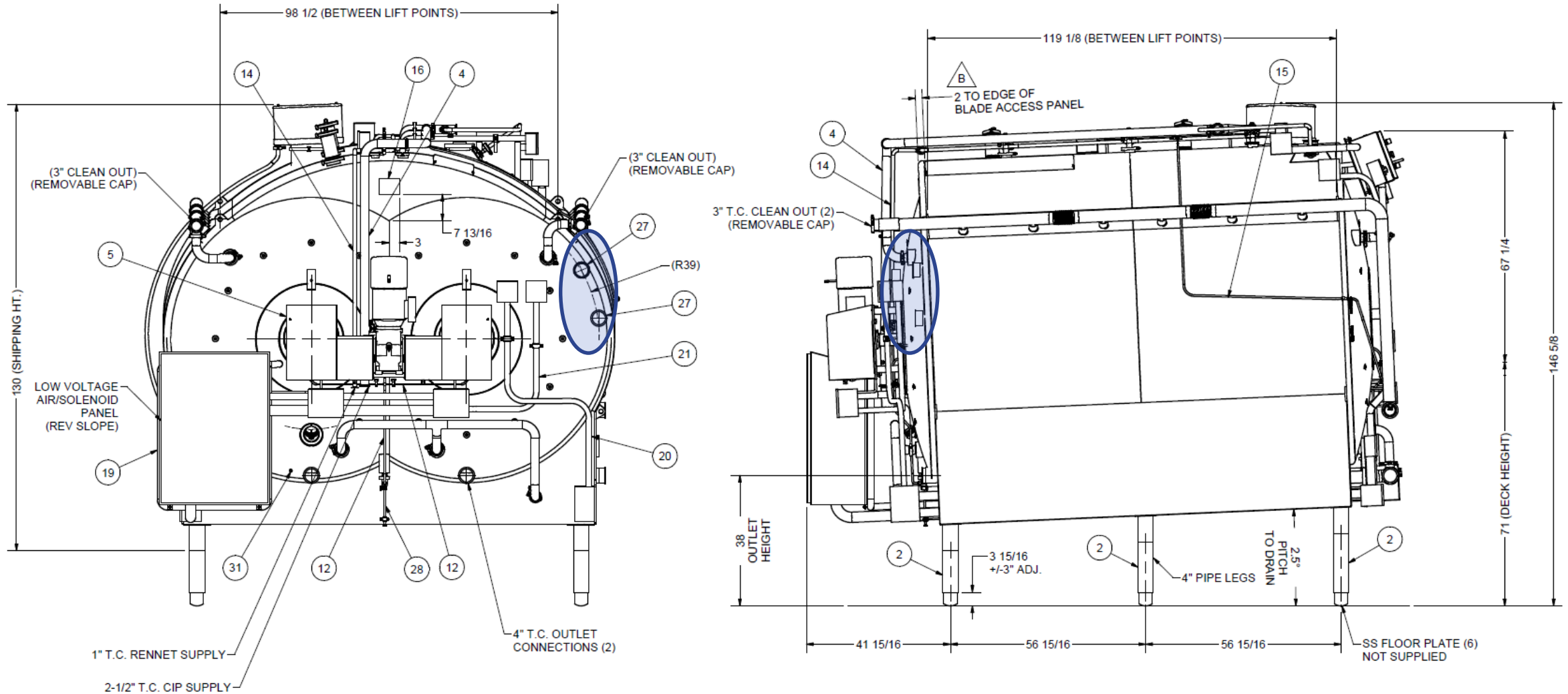
# Make Procedure

## 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  $\Delta^{\circ}T$ ; 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!



# Tetra Pak® Cheese Vat HCV-H Dual Fixed Pre-Draw

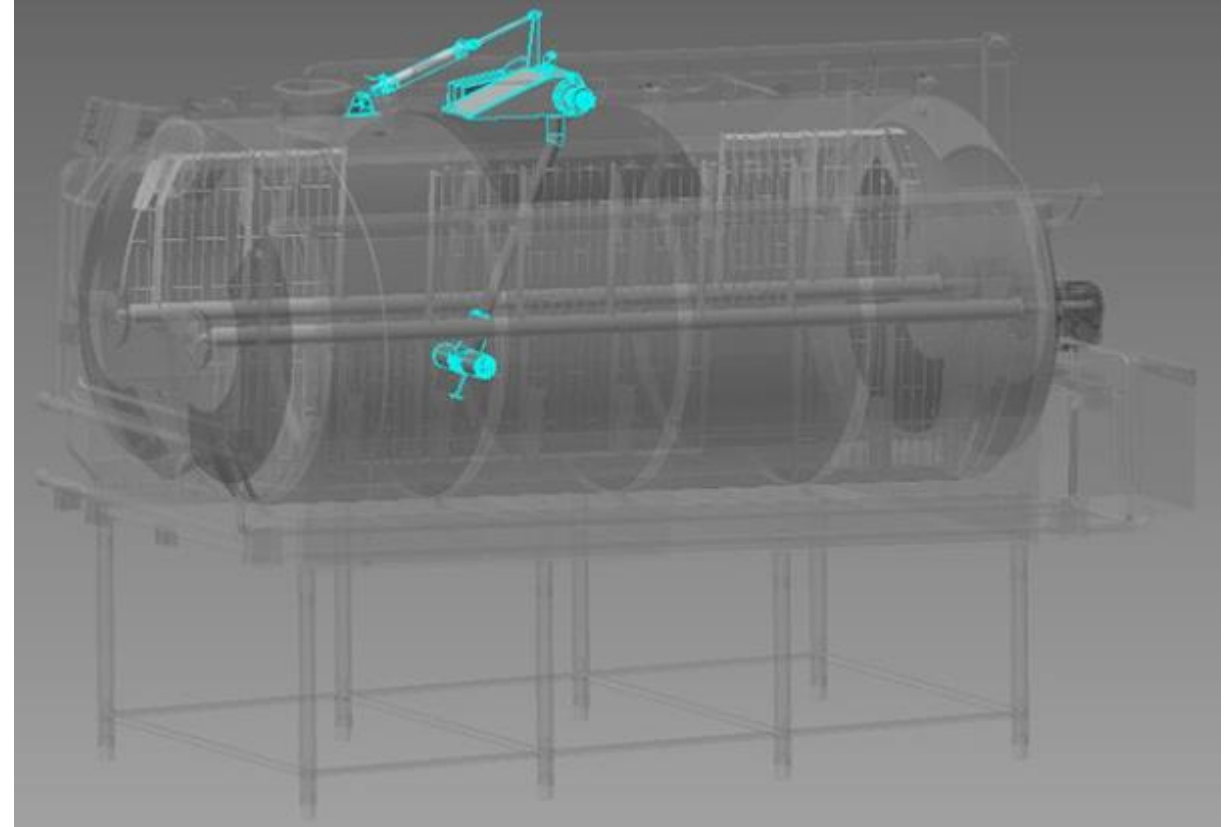




## Tetra Pak® Cheese Vat Yieldmaster 2

# Top Mounted Pre-Draw

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





Tetra Pak® Cheese Vat Yieldmaster 2

# Product Range

Cheese Vat Yieldmaster 2			
Models:	YM 2 55	YM 2 70	YM 2 85
Maximum Capacity:	55,000 lbs	70,000 lbs	85,000 lbs
	25,000 kg	32,000 kg	39,000 kg
	24,000 L	31,000 L	38,000 L





## 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**





## Tetra Pak® Cheese Vat Yieldmaster 2

# 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





Tetra Pak® Cheese Vat Yieldmaster 2

## Dual Counter-Rotating Agitators

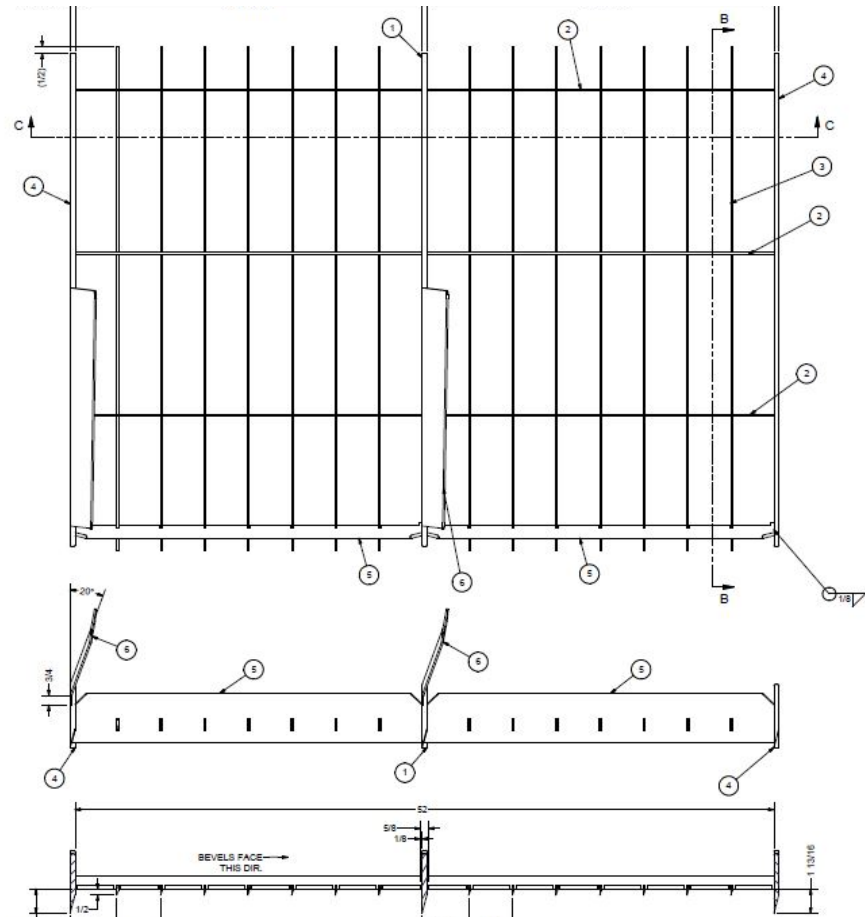
- ▶ Dual horizontal shafts that operate in a counter rotation arrangement
- ▶ Three panels per shafts
- ▶ Improved yields due to vat and blade geometry
  - 30% less blade material surface area vs. standard HCV
  - Efficient and uniform cutting/stirring at low RPM
- ▶ Maximum “lift” during cut/stir keeps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





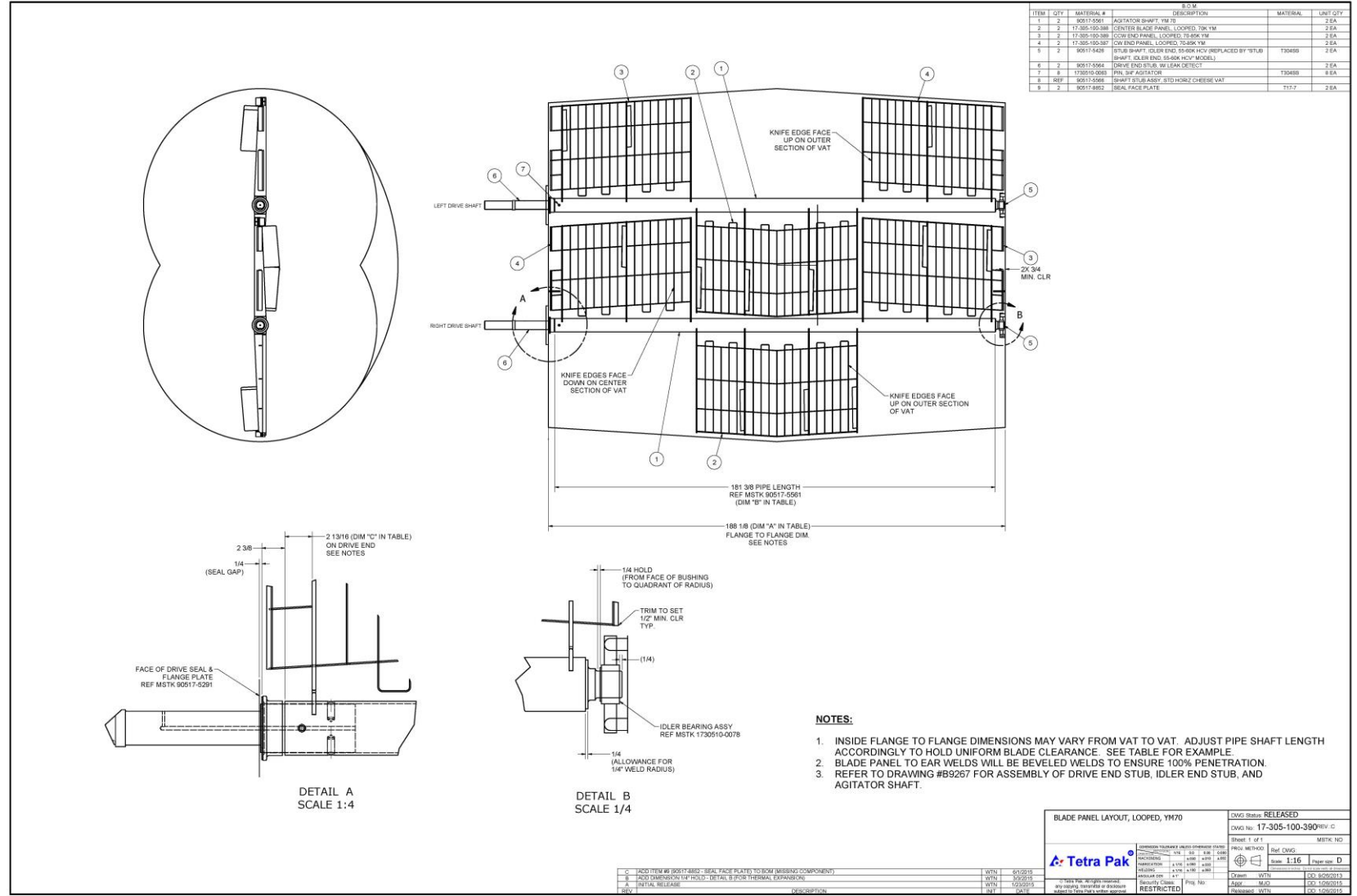
# Tetra Pak® Cheese Vat Yieldmaster 2

## Blade Panel





# Tetra Pak® Cheese Vat Yieldmaster 2 Knives







## Tetra Pak® Cheese Vat Yieldmaster 2

# Dual Shaft Drive Arrangements

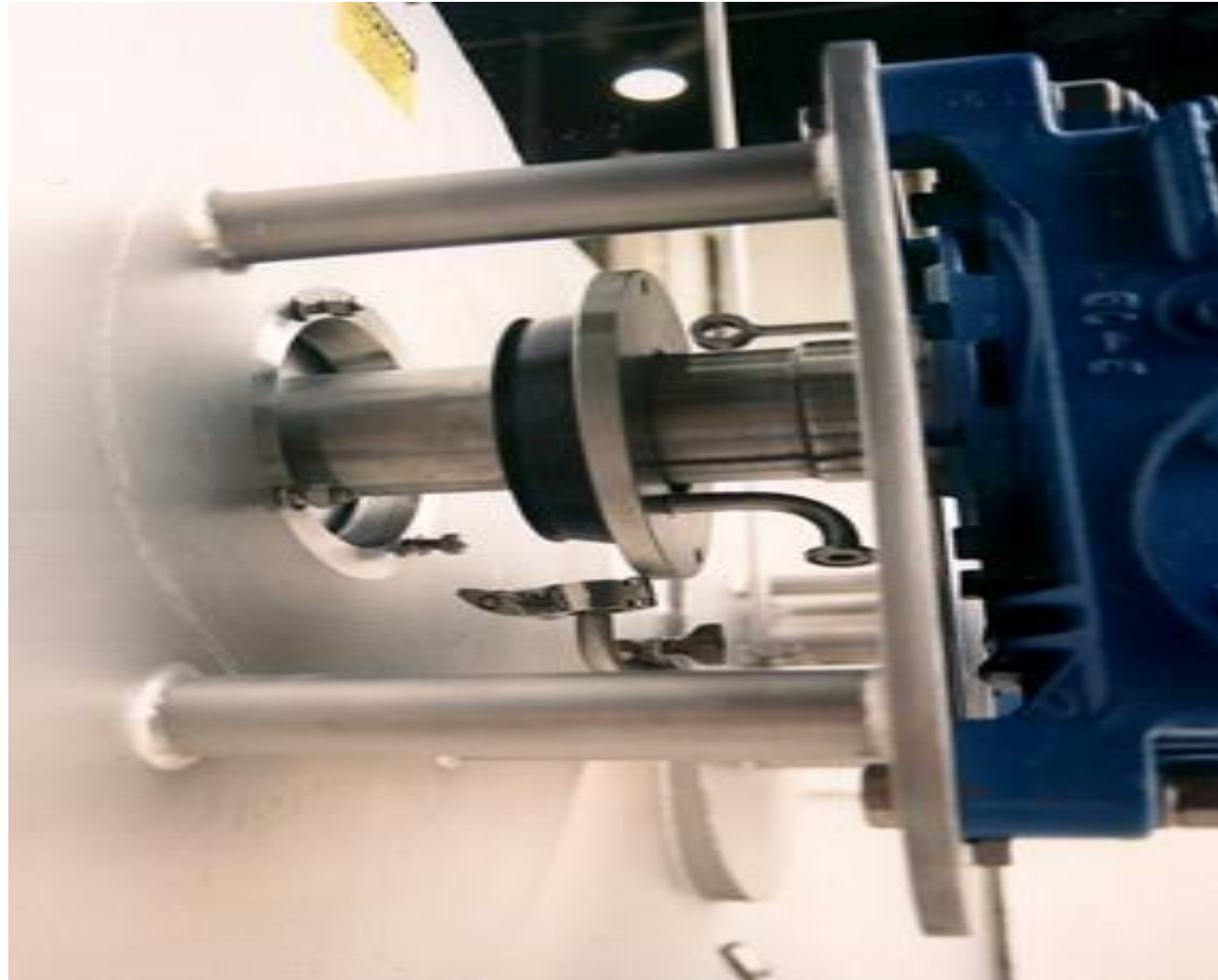
- ▶ Center drive gear motor
- ▶ Two cone drive gear reducers
- ▶ Reliable couplings
- ▶ Robust internal idler support and bearing
- ▶ Easy to maintain and CIP-able seal assembly
- ▶ Easily removable gear reducers





Tetra Pak® Cheese Vat Yieldmaster 2

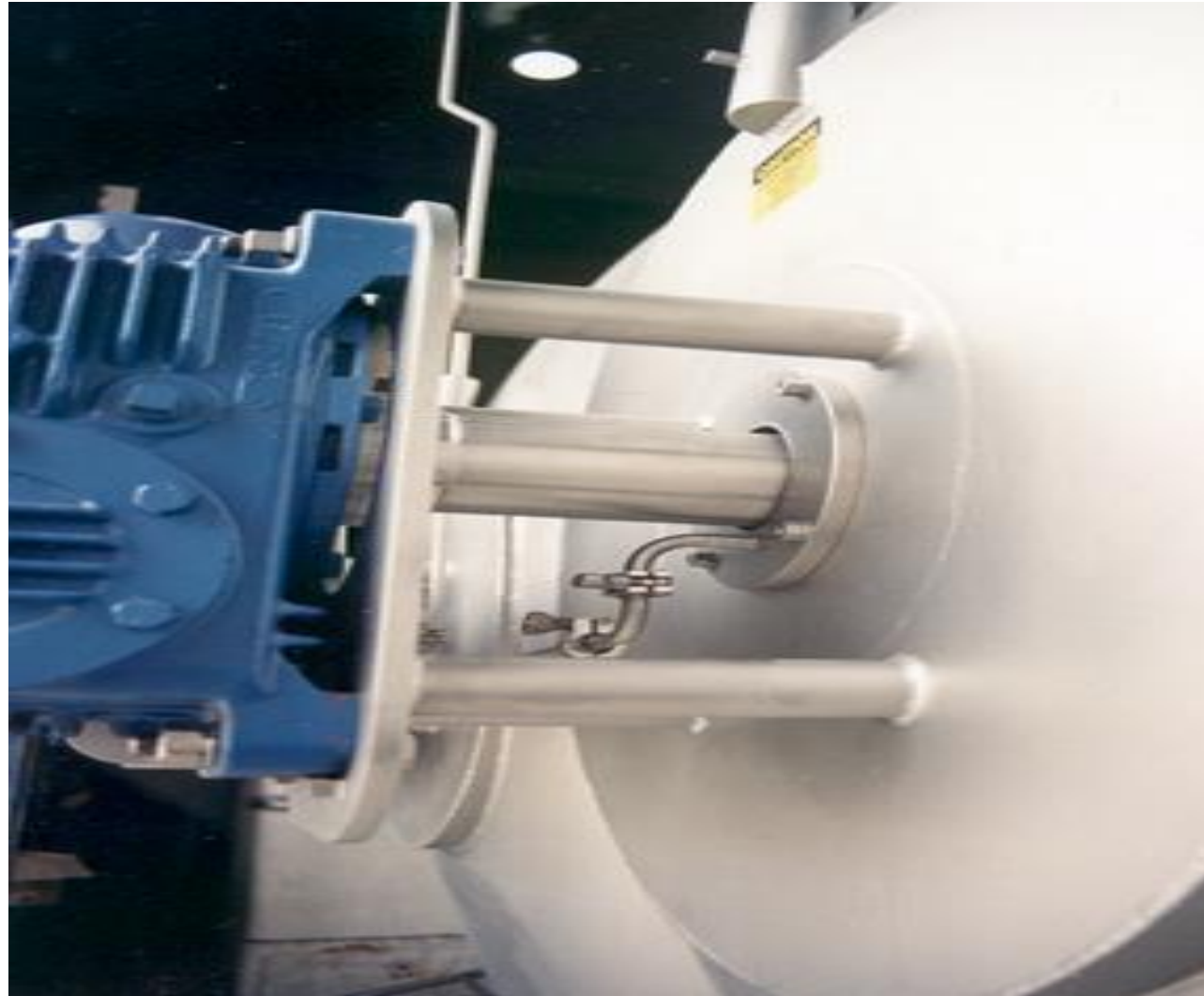
## Dual Shaft Agitator Seal Assembly/ Seal Inspection





Tetra Pak® Cheese Vat Yieldmaster 2

## Dual Shaft Agitator Seal with CIP Attached

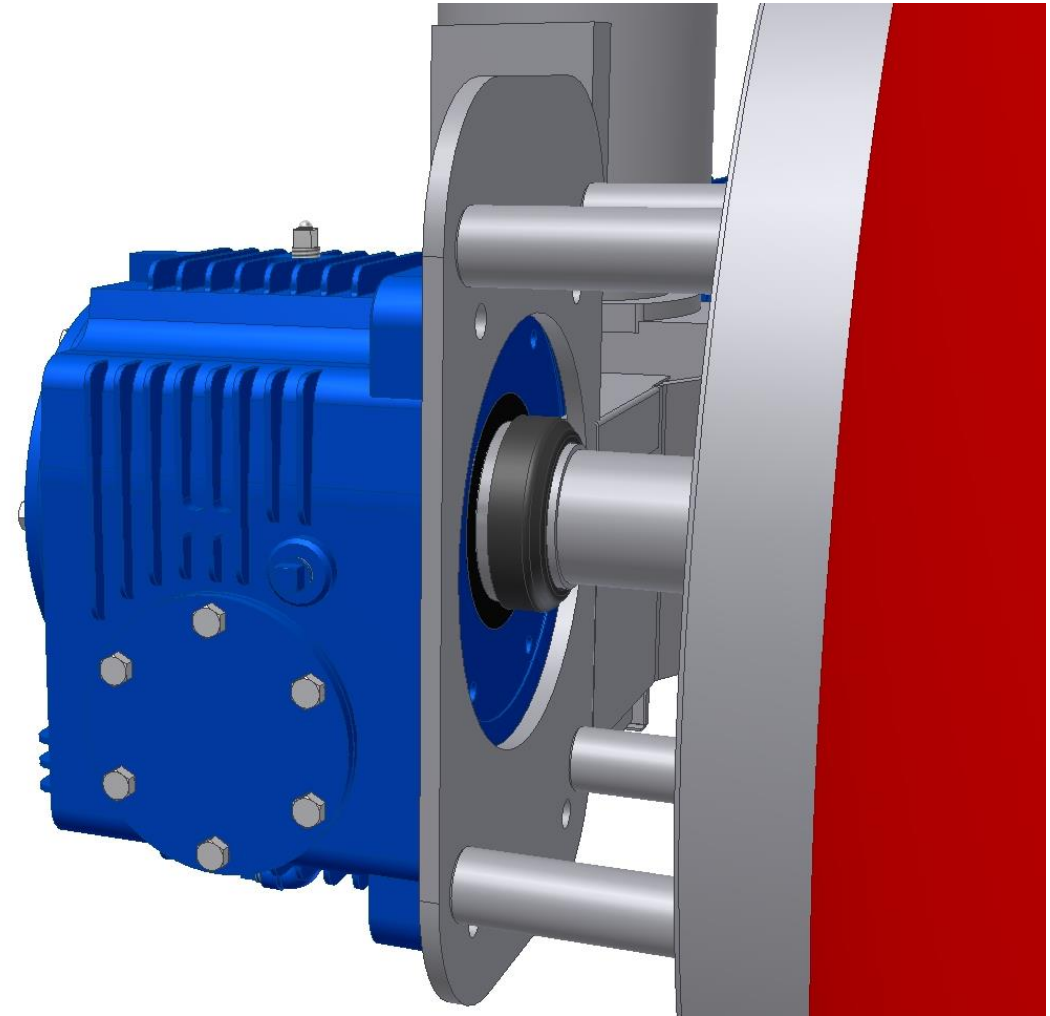




Tetra Pak® Cheese Vat Yieldmaster 2

## 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





Tetra Pak® Cheese Vat HCV

# Coagulation Sensor Insight

## Explanation

- ▶ 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.



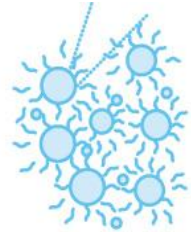


# Light reflectance changes as coagulation progresses

Agglomeration of casein micelles and increase of light reflectance



Casein micelles



Hydrolysis of bonds on casein micelles



Unfolding of the casein proteins



Cross-linking (agglomeration)



Gel-firming reactions (aggregation)



The measured reflectance pattern is related to agglomeration reactions

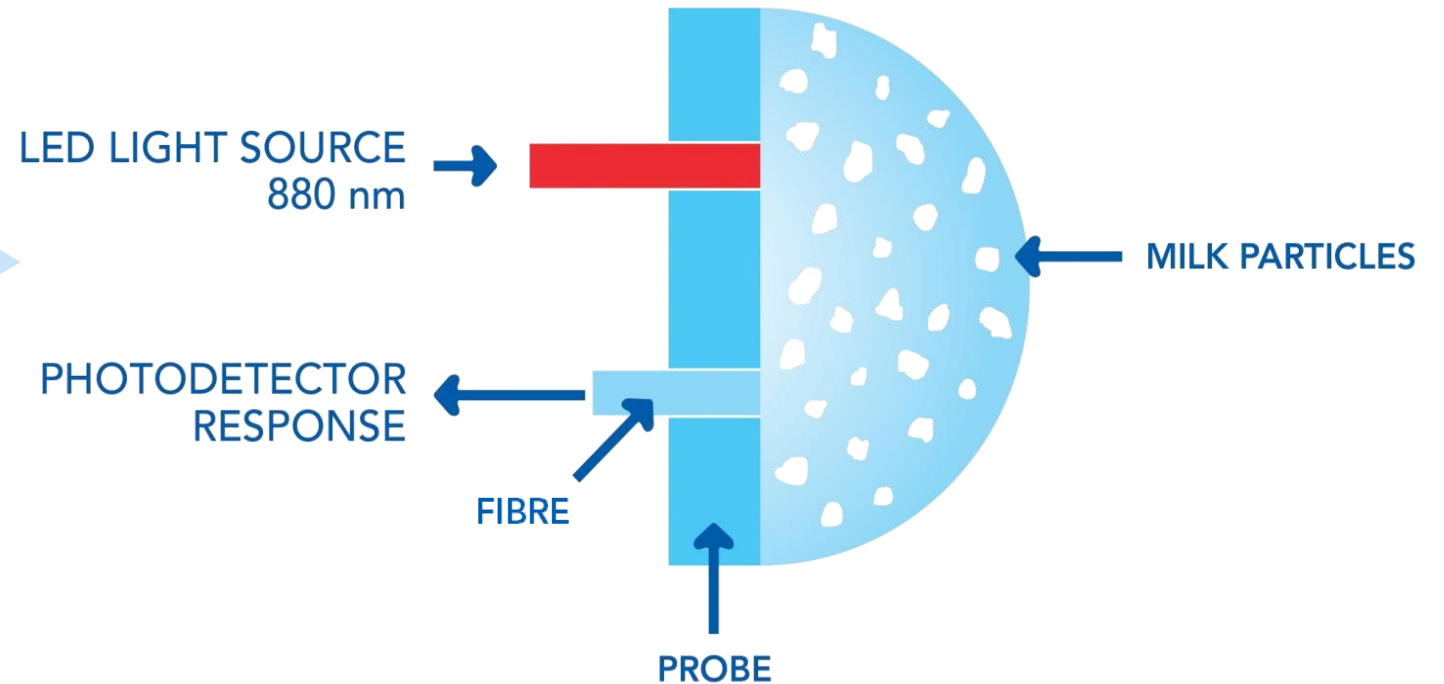




# A scientific method for measuring coagulation

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