WAFP 2017

Pasteurizer Operator

Milk Microbiology

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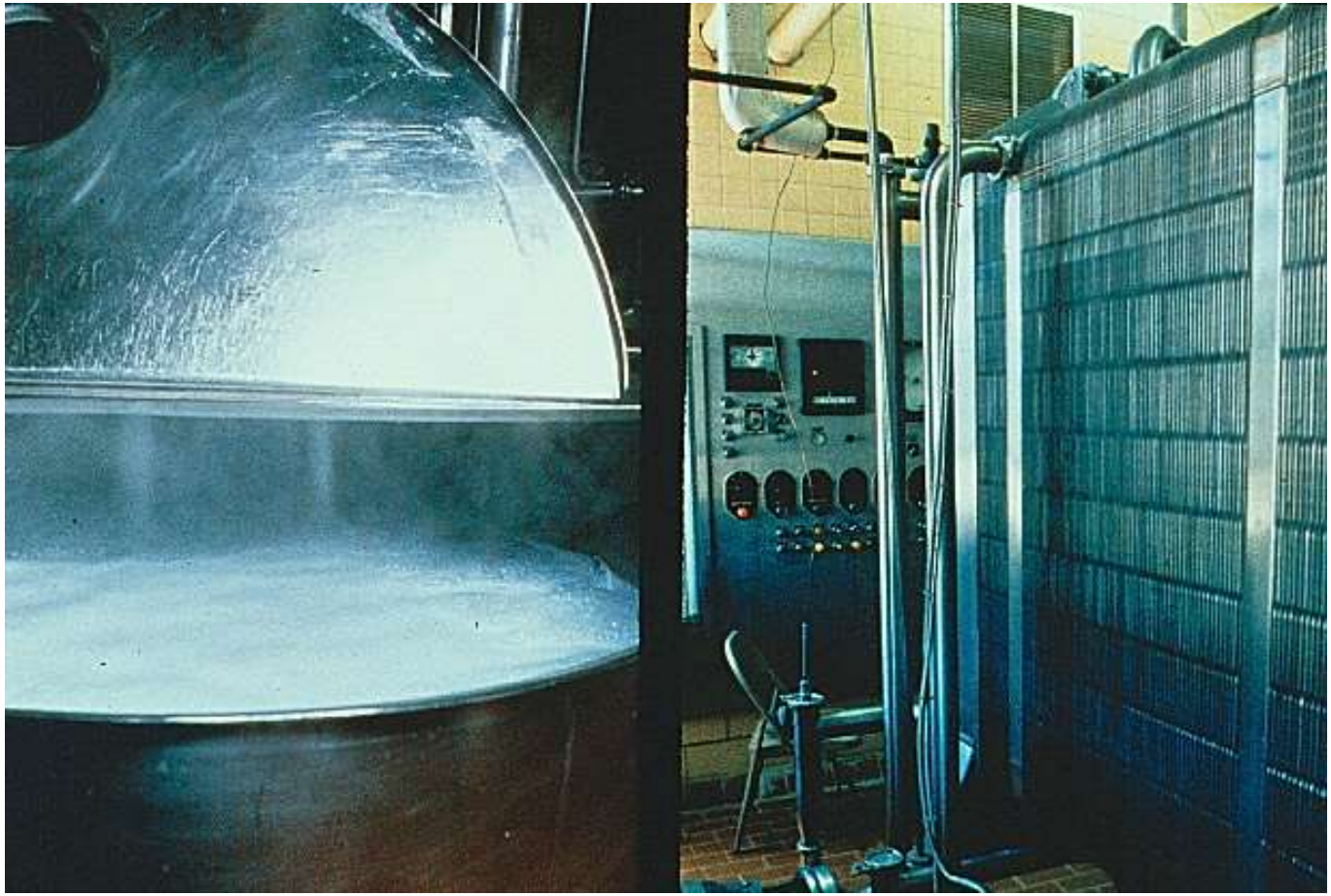
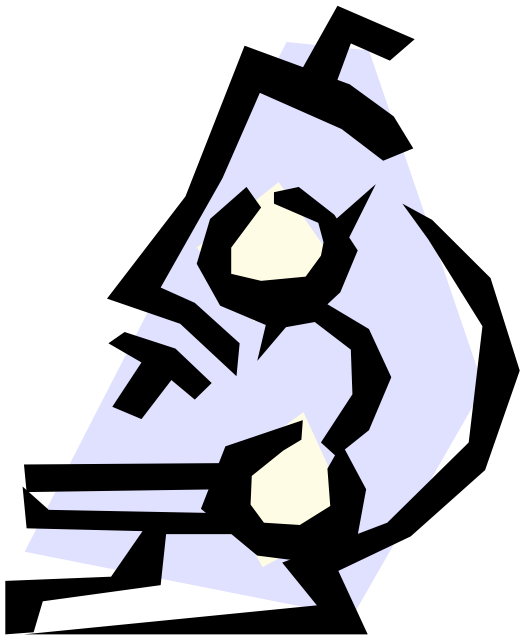
There are a few Critical Control Points in a dairy – pasteurization is one – why?



Pasteurization

- The process of heating every particle of milk product to legal pasteurization temperature and holding it continuously at or above that temperature for at least the specified legal holding time in equipment that is properly designed and properly operated.

Types of Microorganisms

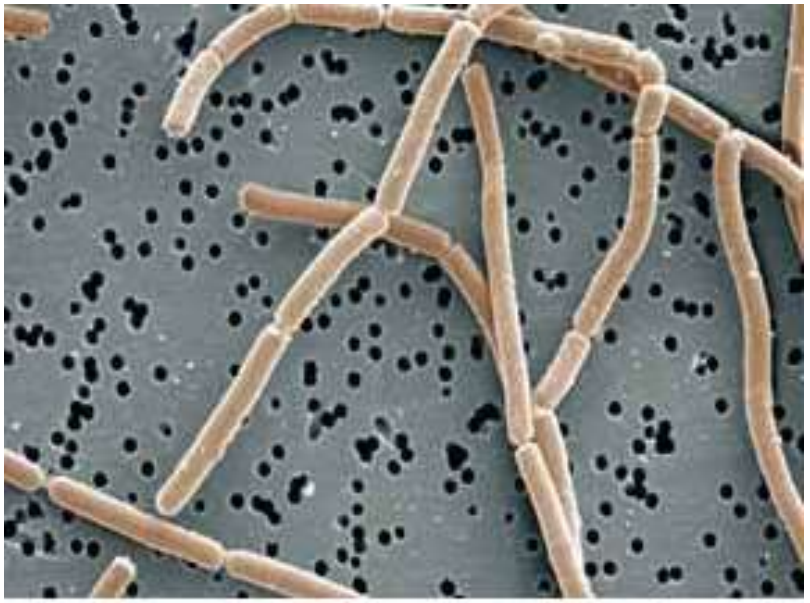


- Bacteria
- Rickettsiae
- Molds
- Yeasts
- Viruses

What bacteria look like

- Cocci (round)

- Bacilli (Rod)



D. McMahon, Utah State University

Good to know names

- Thermophiles 122-140˚F
- Mesophiles 86-98˚F
- Psychrotrophs 50-86˚F

- Thermoduric - survive or endure pasteurization
- SPC – Standard Plate Count (all aerobic bacteria)
- Coliform – indicators of sanitation (virtually eliminated in pasteurization, so if you find in finished product…what happened?)
- Pathogens – cause illness (virtually eliminated in pasteurization, so if you find in finished product…what happened?)

Pathogens – Cause Disease

- *Salmonella*
- *Escherichia coli O157:H7*
- *Listeria monocytogenes*
- *Campylobacter jejuni*
- *Etc.*

Pathogens in Raw Milk (VT)

Pathogen	% of samples (+)
Listeria	6.0
E. coli 0157:H7	4.6
Yersinia	0
Salmonella	2.0

Pathogens in Raw Milk (MN/SD)

Pathogen	*% of samples (+)*
Salmonella	6.1
E. coli	3.8
L. monocytogenes	4.6
Campylobacter	9.2
Yersinia	6.1
S. aureus	8.4

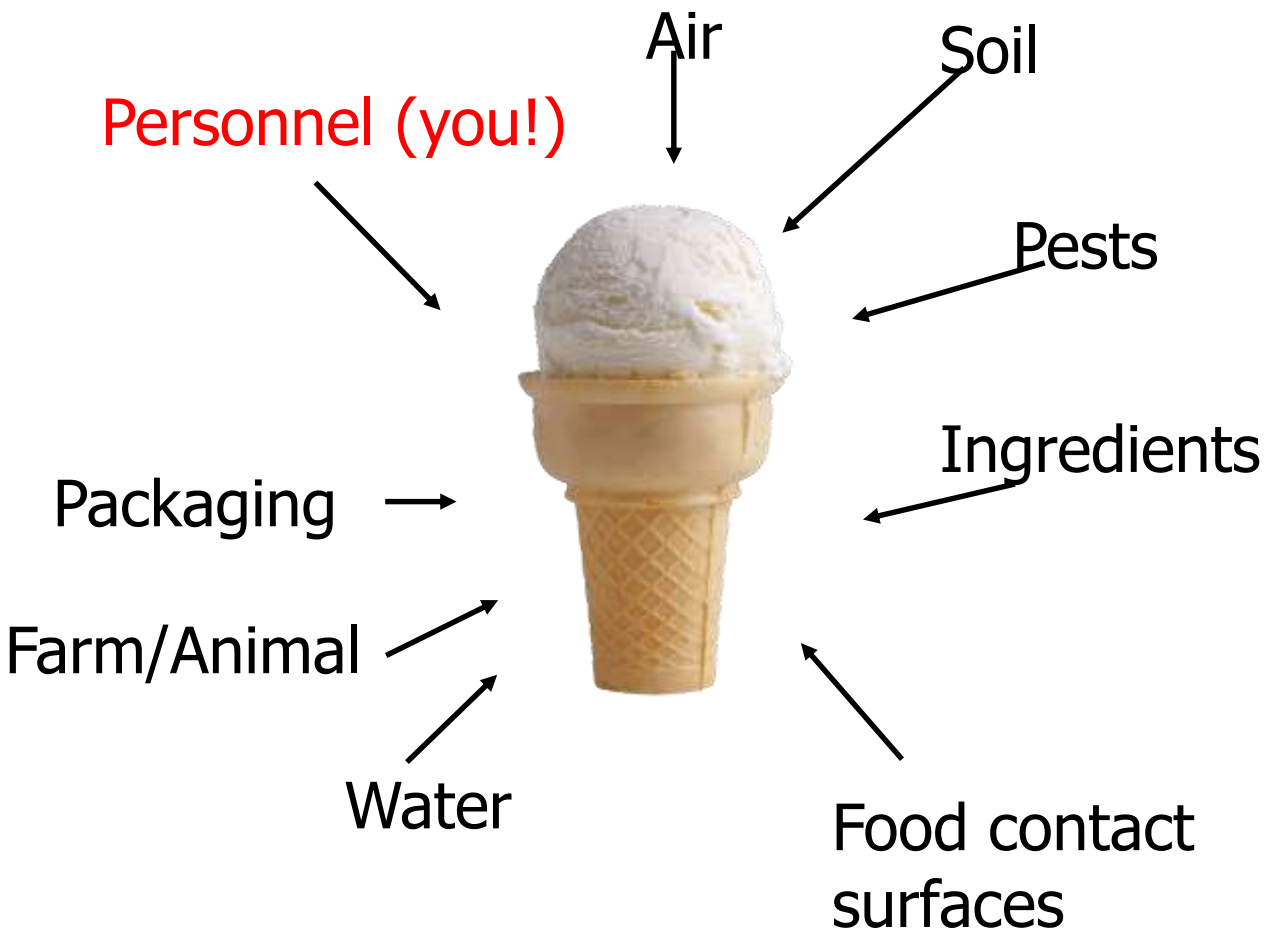
Raw Milk at the Farm (MN/SD)

- 32% of samples were + for 1 or more pathogens
- 60% of producers drink raw milk
- 34% of producers had pathogens present in milk they drank

Pathogens in Dairy Plant Areas

Area	*Listeria (+)*	*Yersinia (+)*
Process floors	17.0	12.0
Cooler floors	27.0	20.9
Entry floors	17.2	27.7
Footbaths	12.0	4.0
Other floors	26.3	15.8
Non-contact	8.1	5.4

Where do microbes come from?



Many bacteria *thrive* in milk – raw or pasteurized

Micro Tests for Raw Milk

- Standard Plate Count (SPC)
  - measure of total aerobic bacteria
- Coliforms
  - cleanliness of cows
- Lab Pasteurized Count (LPC)
  - measure of thermoduric bacteria
- Preliminary Incubation Count (PIC)
  - poor sanitation or refrigeration
- Rapid Psychrotrophic Count (RPC)
  - index of cleaning & sanitation
- Heat Resistant Sporeforming Psychrotroph (HRSP)
  - E.g. Bacillus spores
- Etc

Grade A Raw Milk Standards

- SPC not exceeding 100,000/ml
- SPC <300,000/ml prior to pasteurization

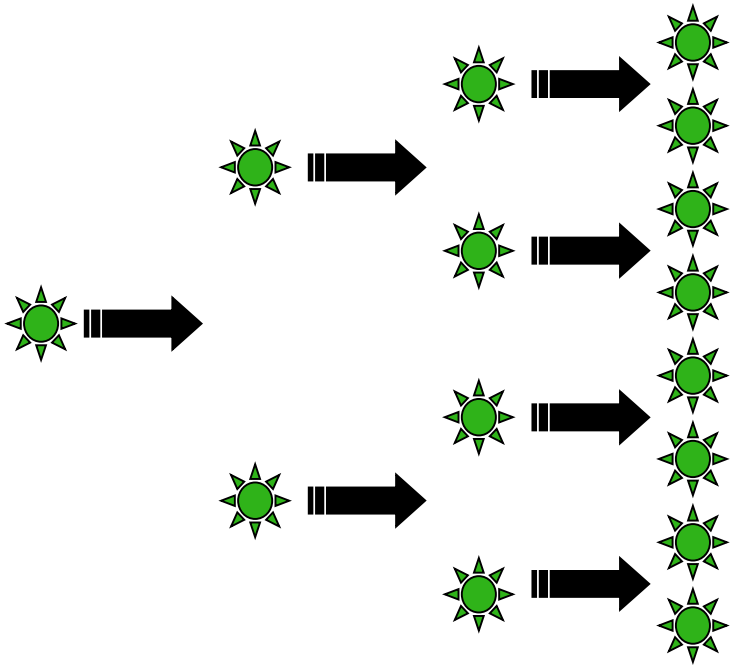
Grade B Raw Milk Standards

- SPC not exceeding 300,000/ml
- SPC <750,000/ml prior to pasteurization

How bacteria grow

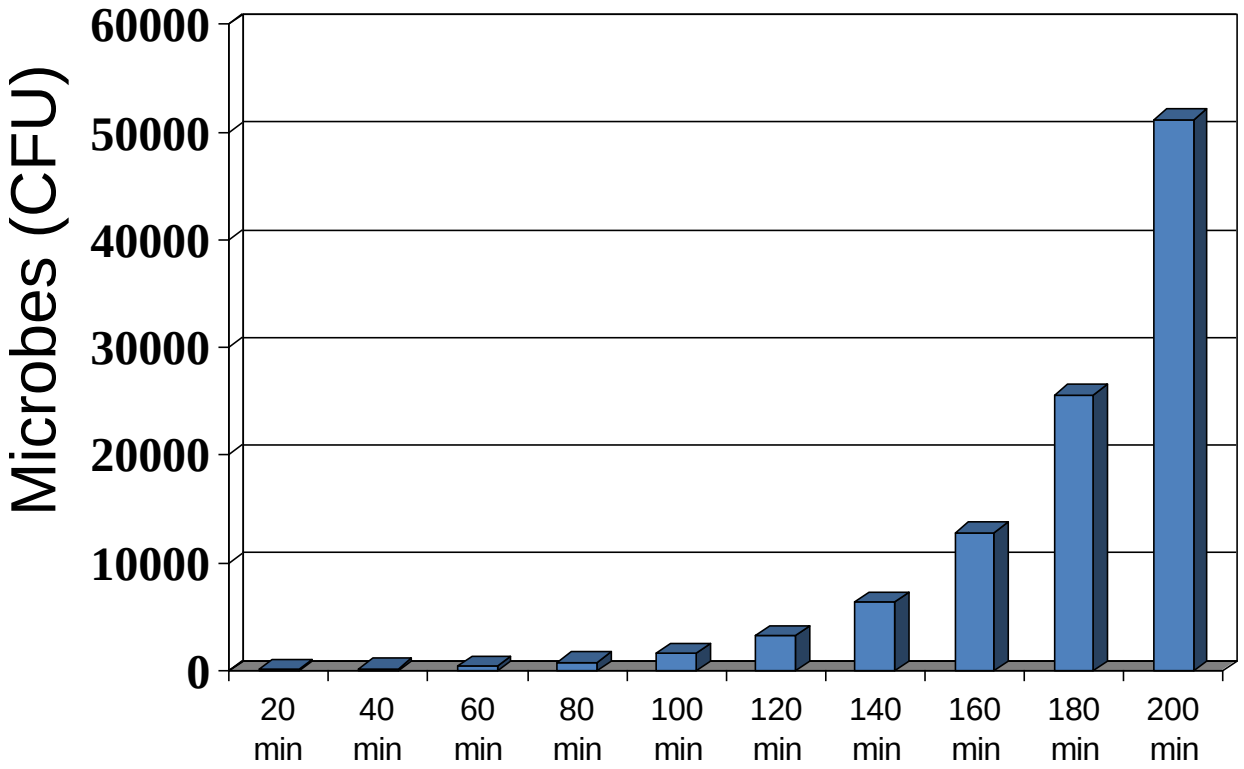
- Reproduce via binary fission (2^n)

  (n = #generations)

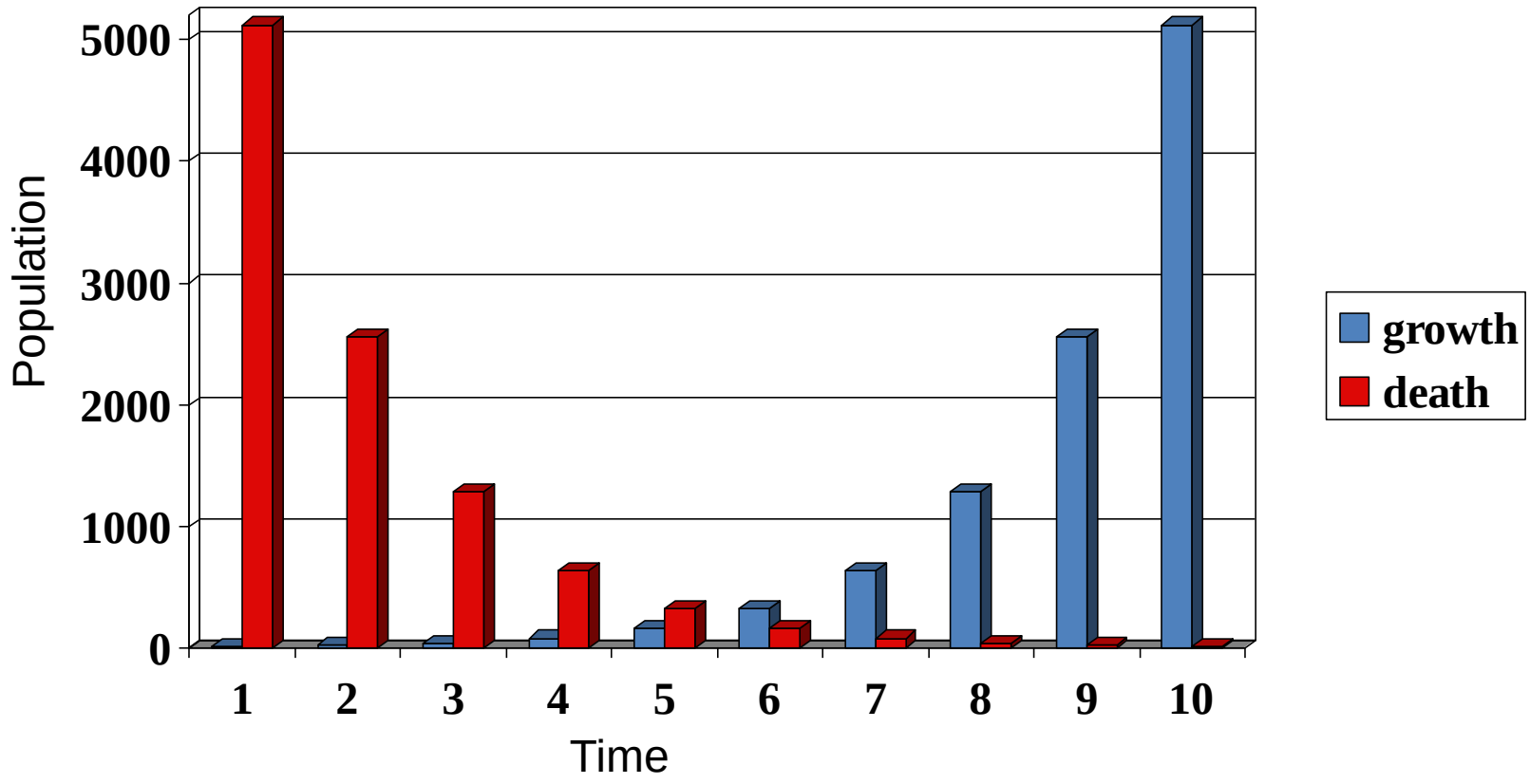


generation time

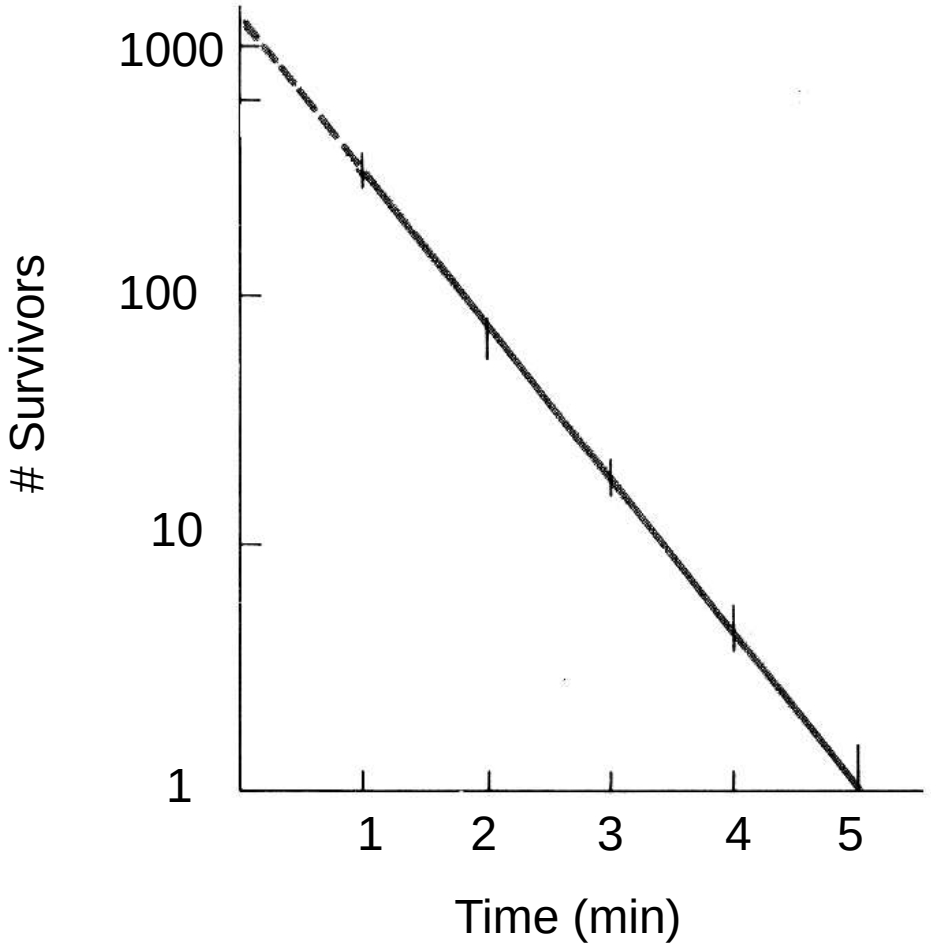
Plotting microbial growth (2^n)



How bacteria die

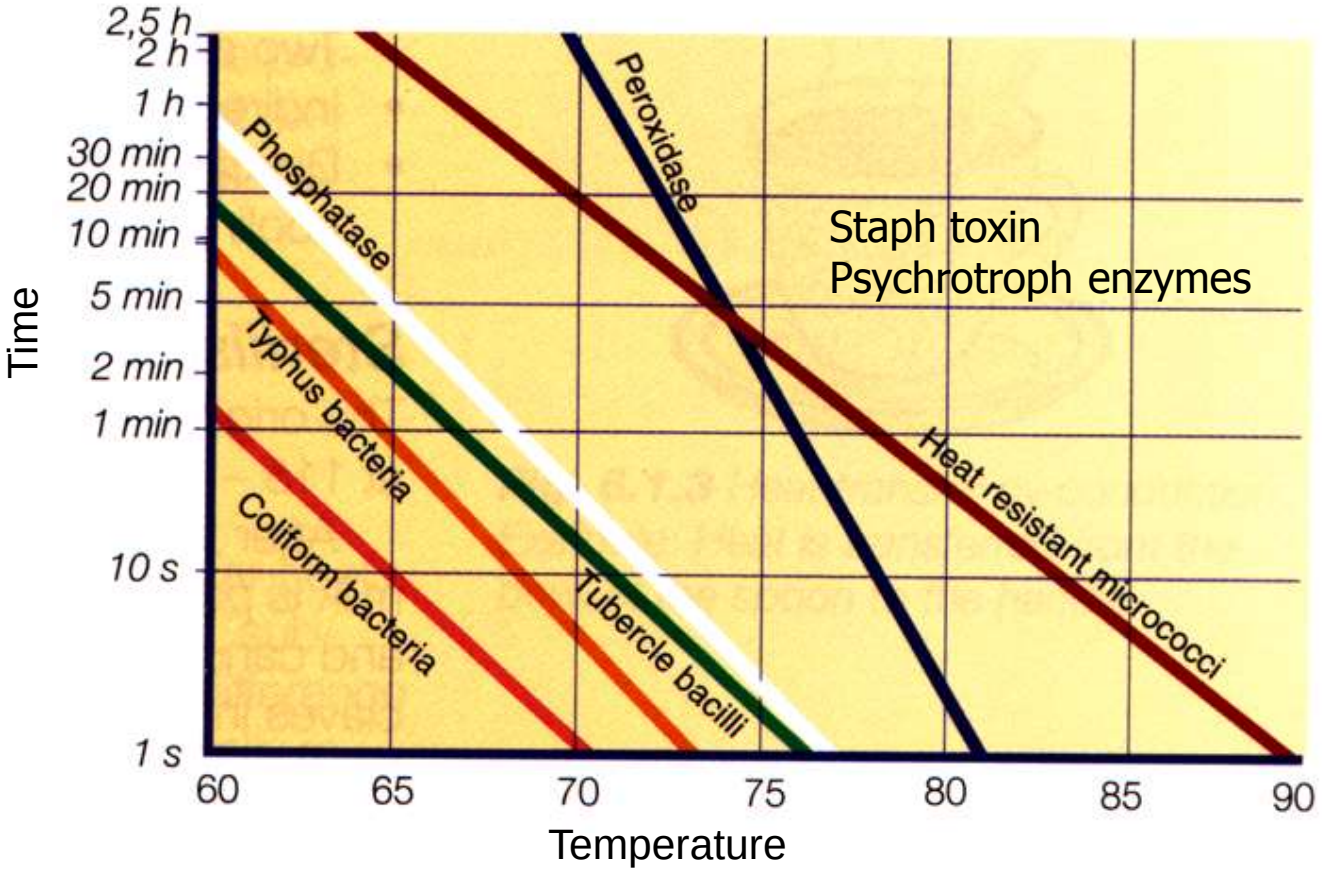


Microbial death at >140° F



Leaves Hands Feeling
Soft & Refreshed
with Moisturizers
& Vitamin E
Purell
INSTANT HAND SANITIZER
KILLS 99.99%
of GERMS
2 FL OZ (59 mL)

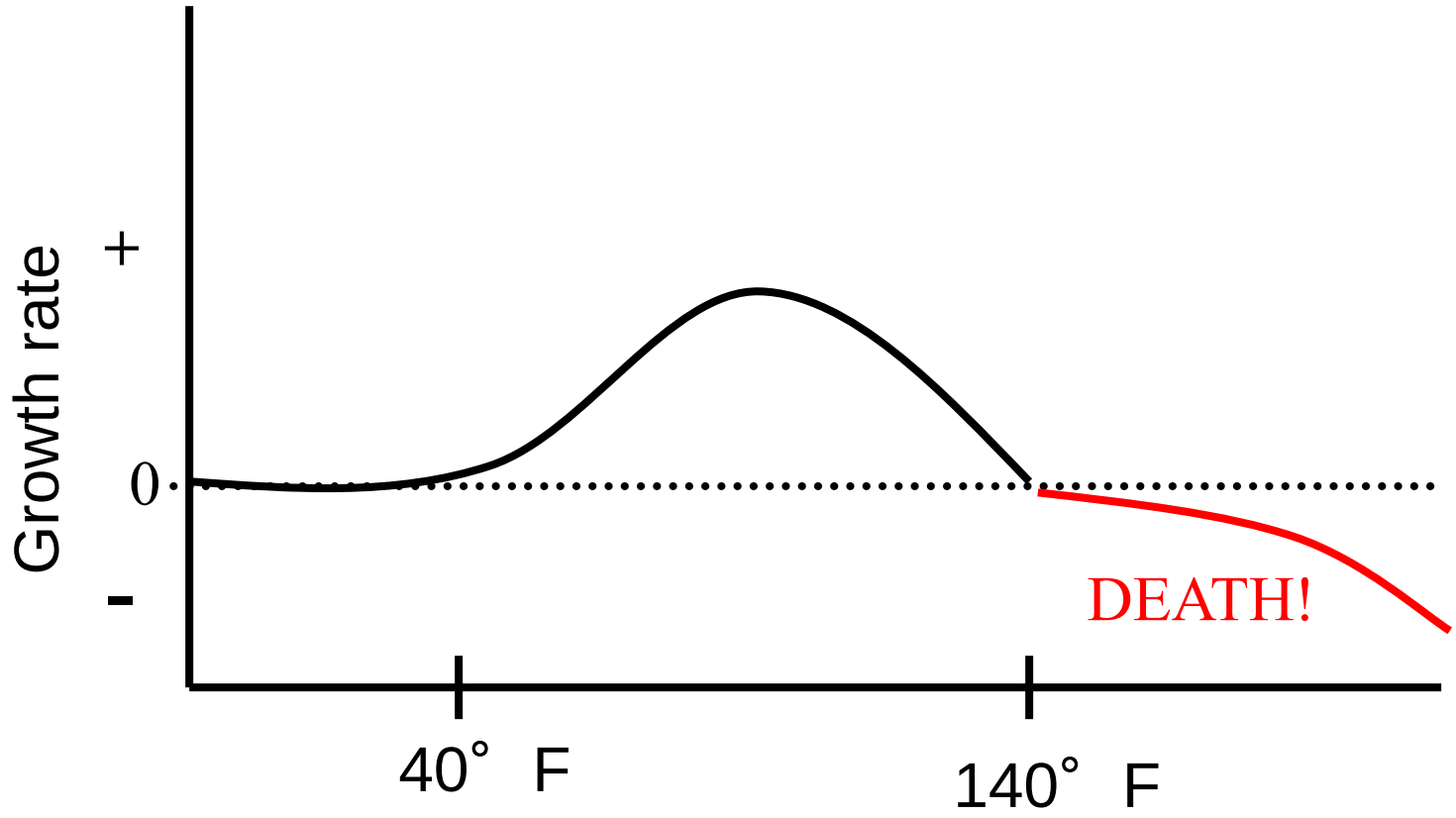
Heat resistance



Why pasteurization?

- Main purpose: *eliminate bacterial pathogens*
- Other effects:
  - Reduction of spoilage microflora/some enzymes (increase shelf life)
  - Allows defined bacteria to grow, reduces competition
- Not a remedy for poor quality milk
- *Some bacterial toxins are not inactivated with heat (reason for raw milk storage CCP)*

40 -140 rule



Pasteurization…

- Virtually eliminates bacterial pathogens
- Virtually eliminates many spoilage bacterial, *but not all*

- Does *not* render milk sterile, i.e. many bacteria survive pasteurization

MMWR

Morbidity and Mortality Weekly Report (*MMWR*)

Notes from the Field: Outbreak of *Escherichia coli* O157:H7 Infections Associated with Dairy Education Event Attendance — Whatcom County, Washington, 2015

Weekly
October 30, 2015 / 64(42);1202-3

Kathryn Curran, PhD[1,2]; Katherine E. Heiman, MPH[2]; Tushar Singh, PhD[1,3]; Zachary Doobovsky[4]; Joni Hensley[4]; Beth Melius, MPH[5]; Laura Burnworth, MPH[2]; Ian Williams, PhD[2]; Megin Nichols, DVM[2]

On April 27, 2015, the Whatcom County Health Department (WCHD) in Bellingham, Washington, was notified by a local laboratory regarding three children with presumptive *Escherichia coli* O157 infection. WCHD interviewed the parents, who indicated that all three children had attended a dairy education event held in a barn April 20–24, 2015, during a school field trip. WCHD, the Washington State Department of Health, and CDC investigated to determine the magnitude of the outbreak, identify risk factors and potential environmental sources of infection, and develop recommendations. A total of 60 cases (25 confirmed and 35 probable) were identified, and 11 patients were hospitalized.

Shiga-toxin producing *E. coli* infection is a notifiable condition in Washington. WCHD issued a health alert and notified local laboratories, school nurses, parents, and event organizers of the outbreak. WCHD and the state health department interviewed patients with confirmed *E. coli* infection and others who reported diarrheal illness about their attendance at the dairy education event. PulseNet, the national molecular subtyping laboratory network for foodborne disease surveillance, used pulsed-field gel electrophoresis (PFGE) to identify outbreak strains. A confirmed case of *E. coli* O157:H7 infection was defined as laboratory confirmation of infection with the outbreak strains or physician-diagnosed hemolytic uremic syndrome in a person with diarrheal illness onset during April 20–June 1, who had attended the dairy event or had close contact with someone who had attended the event. A probable case was defined as diarrheal illness in a person with onset during April 20–June 1, who had attended the event or had close contact with someone who attended the event. Confirmed and probable cases were classified as primary (patient attended the event) or secondary (patient was a contact of someone who attended the event). Environmental testing of the barn was conducted; bacterial isolates were compared with patient isolates using PFGE.

Stay in contact: DATCP, UW, Industry, etc.

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Vat Pasteurization

Tyson Villarreal
Dairy Technical Specialist
WDATCP

Vat Pasteurizer Components

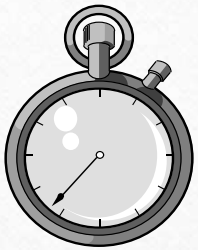
- Vat construction
- Outlet valves / Leak detect valves
- Product and air space indicating thermometers
- Recording thermometer
- Air space heating
- Agitation

Considerations
Vat versus HTST

PROS	CONS
Low investment	Not energy efficient
Low maintenance	High operator demand
Fewer moving parts	Low volume production
Simple design	Low automation
Can process small volumes	

Time and Temperature Relationships

Product	Vat Time Temp	HTST Time Temp
Milk, skim milk, or buttermilk	30 min 145°	15 sec 161°
Cream and fluid dairy products w/ > 10% milkfat	30 min 150°	15 sec 166°
Condensed dairy products & High total solids products (>18%)	30 min 150°	15 sec 166°



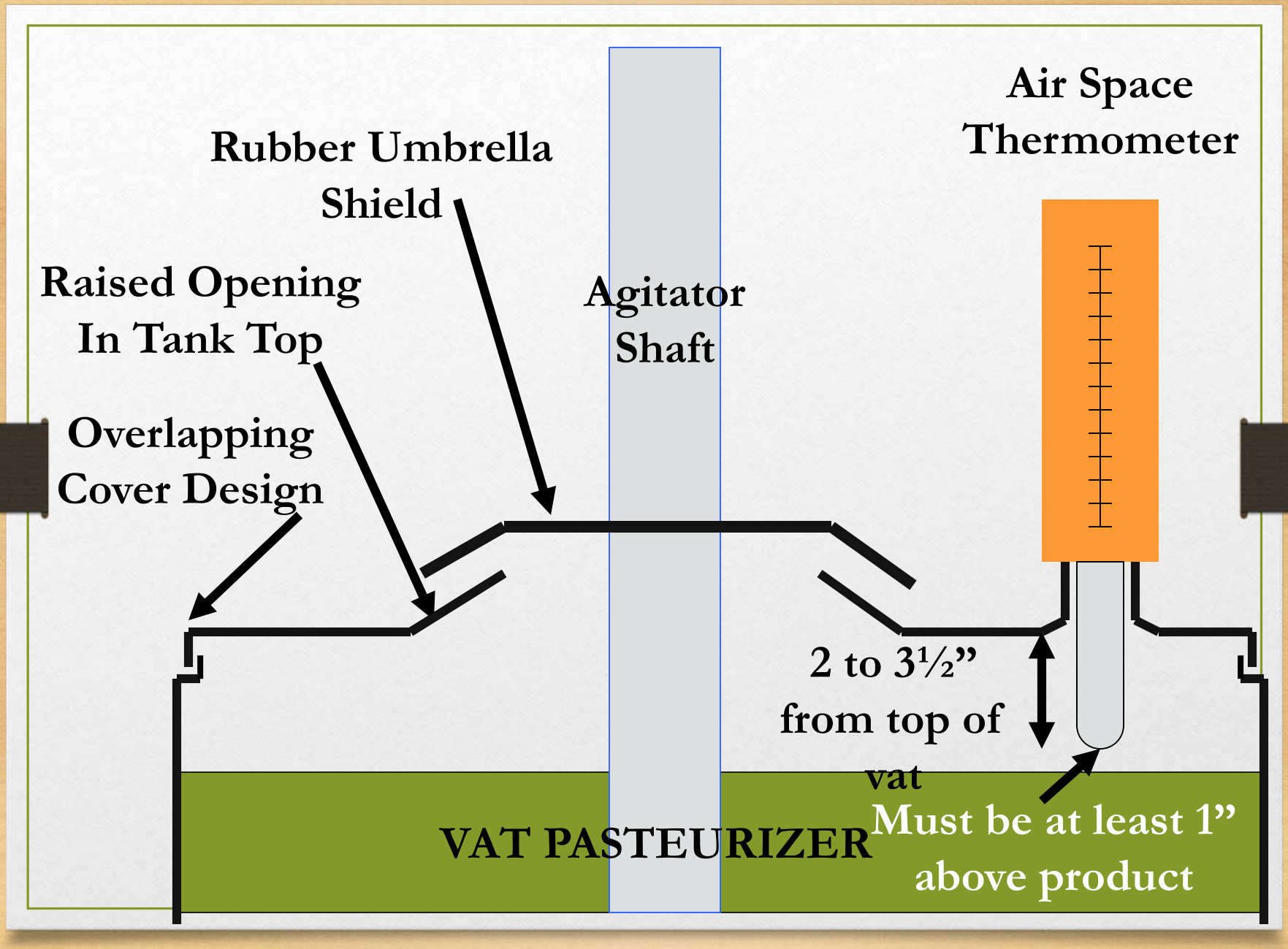
Time and Temperature Relationships

Product	Vat		HTST	
	Time	Temp	Time	Temp
Cream for butter	30 min	165°	15 sec	185°
Frozen dessert mixes & Egg Nog	30 min	155°	15 sec 25 sec	180° 175°
Process Cheese*	30 sec	150°		

Vat Construction

- Comply with 3-A Sanitary Standard 24-03 Non-Coil Type Batch Pasteurizers
- Stainless Steel
- Smooth
- Self Draining
- Overlapping covers
- Raised Edges on Openings
- Overlapping drip-deflectors on inserted implements

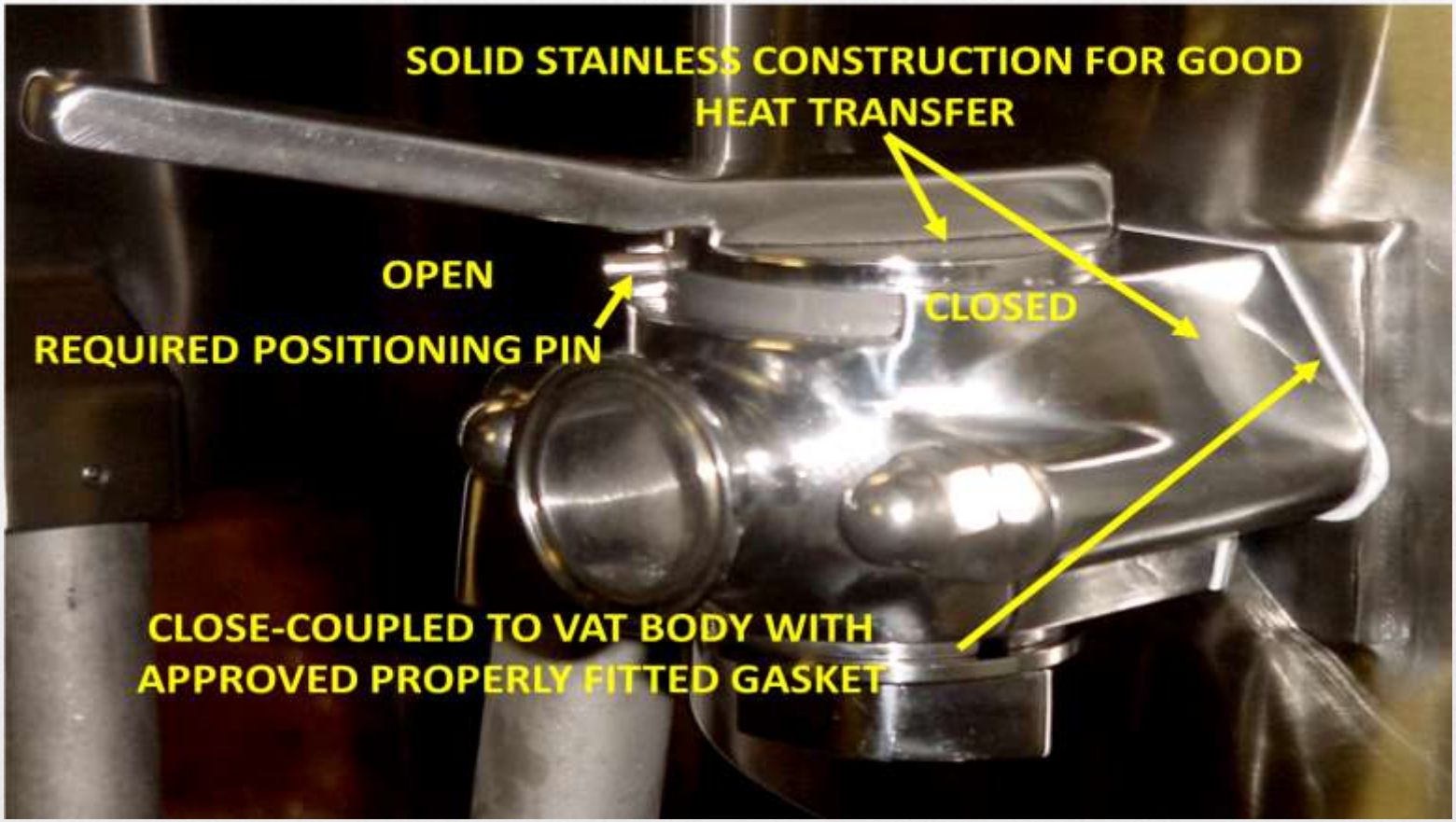
Overlapping cover and raised lip for all openings

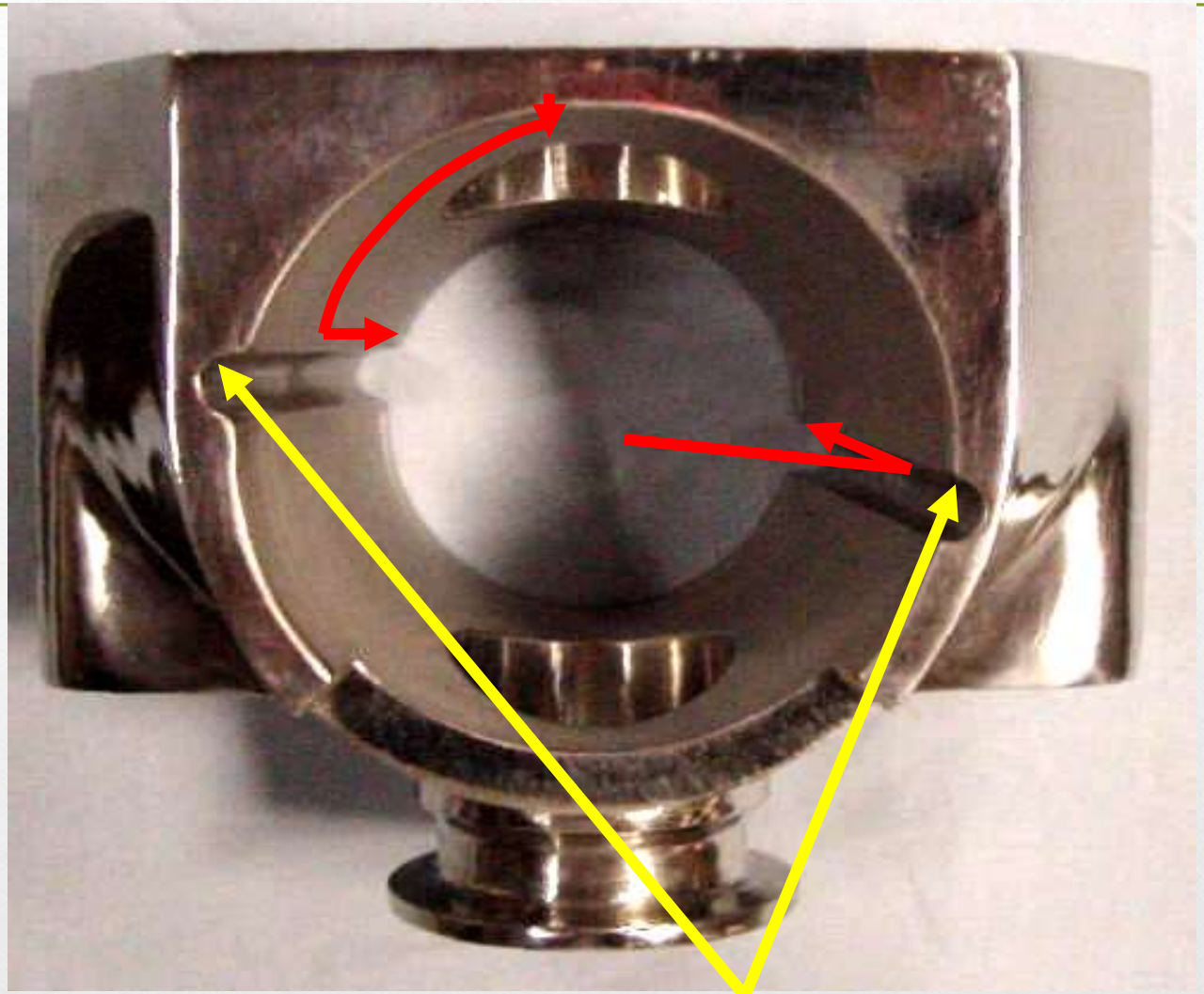

Air Space Thermometer
Rubber Umbrella Shield
Raised Opening In Tank Top
Agitator Shaft
Overlapping Cover Design
2 to 3½" from top of vat
VAT PASTEURIZER
Must be at least 1" above product

Outlet Valve

- Stainless Steel
- Close Coupled (1 diameter)
- Good Repair
- Leak Protector Style with Detect Grooves
- Designed to prevent leakage to pasteurized side
- Fitted with Stops
- Manual Only

LEAK DETECT VALVE



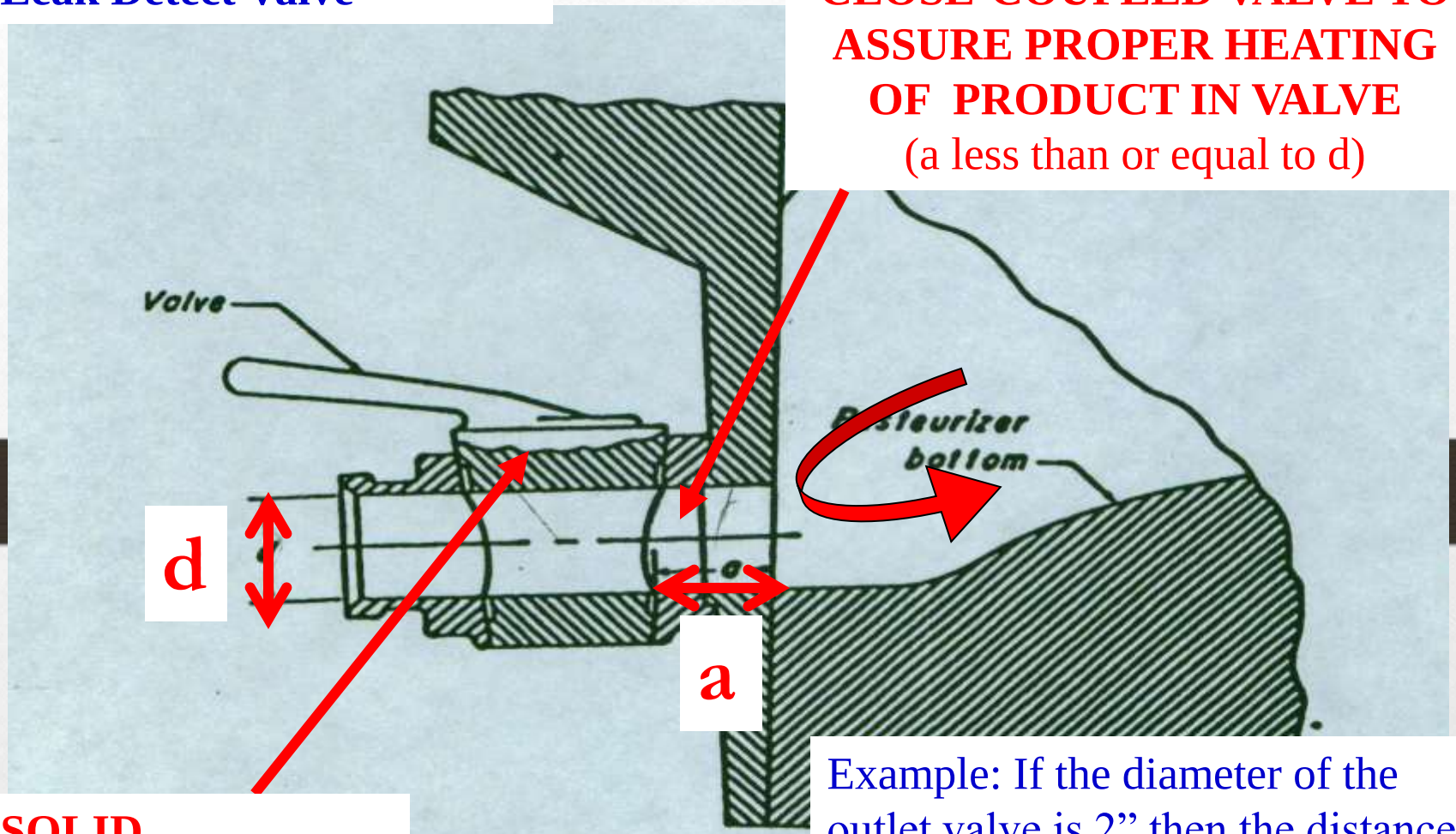


LEAK DETECT GROOVES MUST NOT BE BLOCKED WITH LUBRICANTS

- **To detect leakage past the closed valve seat.**
- **To drain out the valve cavity so all product is fully pasteurized.**

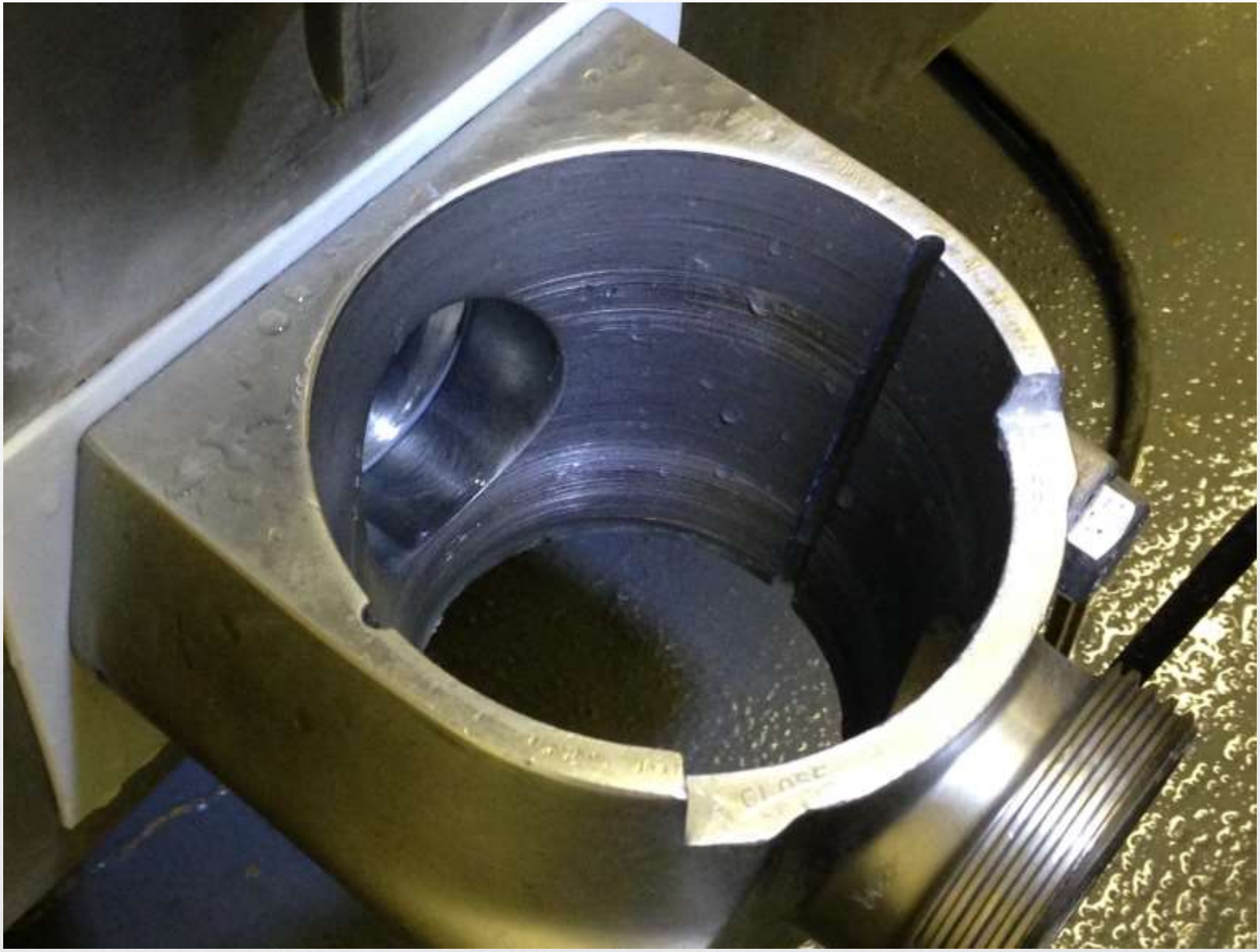
Leak Detect Valve

CLOSE-COUPLED VALVE TO ASSURE PROPER HEATING OF PRODUCT IN VALVE
(a less than or equal to d)



SOLID STAINLESS STEEL VALVE TO CONDUCT HEAT

Example: If the diameter of the outlet valve is 2” then the distance from the inside wall of the vat to the valve closure must be no more than 2”.



Indicating Thermometer Mercury in Glass (MIG)

- Sensor, adequately submerged in product to reflect accurate temperature
- Easy to read – no split in column

Digital Reference Thermometer (DRT) and resistance thermal device (RTD)

- Sensor adequately submerged in product to reflect accurate product temperature

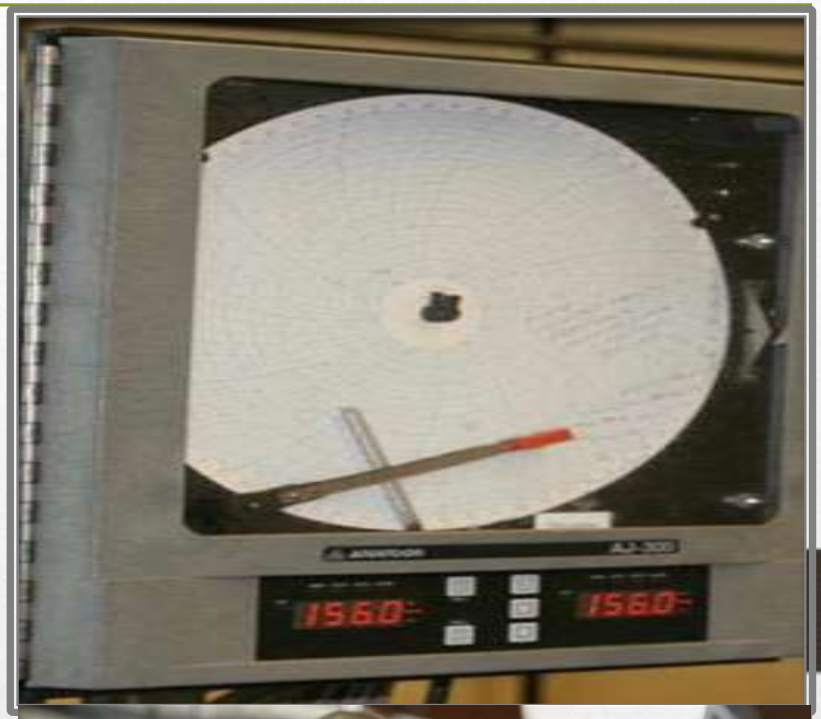
Airspace Indicating Thermometers

- Mercury in glass or resistance thermal device (RTD)
- Bottom of sensor 2 to 3½ inches below underside of top cover and at least 1 inch above product level
- Easy to read – no split in column

Thermometers Inside the Vat

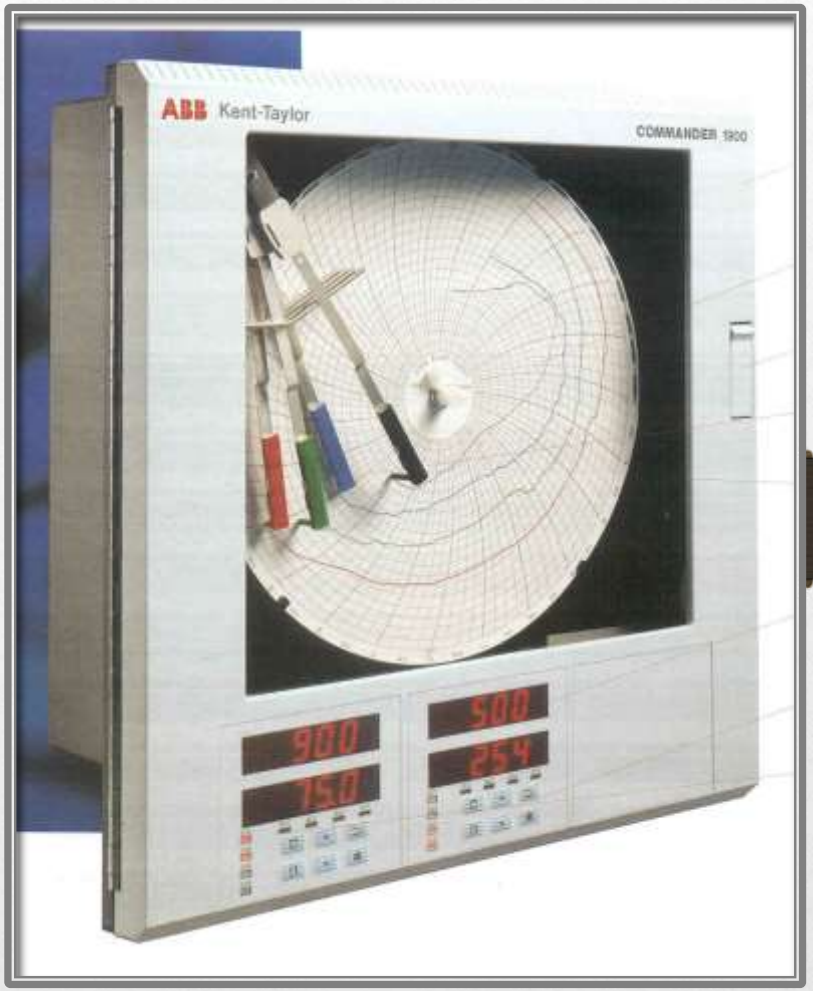
Anderson Vat Package

- Recorder displays and records:
  - Airspace temp
  - Product temp
- Airspace and product probes have digital displays
  - Serves as indicating thermometers



Vat Recording Thermometer

- Install charts at proper time
- Sensor adequately submerged in product
- ≥ to indicating thermometer



Recorder Charts

- Indicator check (start of hold time)
- Airspace check (start and end of hold time)
- Name of Product
- Amount of Product
- Unusual Occurrences

Recorder Charts

- Name of plant
- Date
- Operator ID
- Vat ID
- Holding Time

Airspace Heating Requirements

- 5°F above minimum legal pasteurization.
- May be accomplished with/without an airspace heater.

Product & Air Space Pasteurization

Product	Minimum Product Temperature	Minimum Air Space Temperature
Milk, skim milk, or buttermilk	145°F	150°F
Cream & fluid dairy products with >10% milkfat	150°F	155°F
Condensed dairy products & High total solids products (>18%)	150°F	155°F
Cream for butter	165°F	170°F
Frozen dessert mixes & Egg Nog	155°F	160°F

Product Agitation

30 minute holding time

- All raw milk fill lines are disconnected.
- All product components have been added to the batch.
- Ports, covers, and openings are closed or protected.
- Pasteurized product line is disconnected.
- Outlet valve is fully closed.

30 minute holding time

- Does not start until product temperature is at or above legal minimum pasteurization.
- Airspace temperature is at least 5°F above legal minimum pasteurization.
- Both temps shall be maintained for 30 consecutive min.
- If either drops below minimum required temperature or if the vat cover is opened at any time, then the 30 minute holding time must start over.

Operating Standards

- No overlapping of charts
- Any interruption.....START OVER!!!!
- Nothing may be added to vat after start of holding time

Questions?

HTST Pasteurization

Video

Introduction to HTST Pasteurization Equipment

Or "Go with the Flow"

Presenter: Anne Frank, Dairy Technical Specialist DATCP

Purpose of this Presentation:

- Basis for understanding following presentations
- Prepare for pasteurizer equipment portion of exam

What is an HTST Pasteurizer?

Pasteurization means:

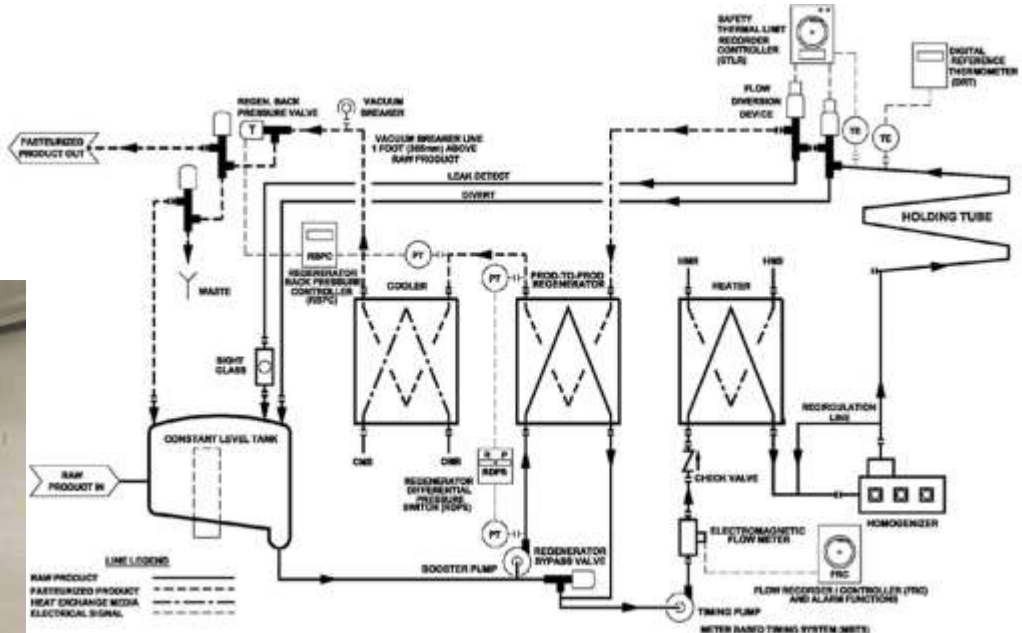
- Heating to a specific *temperature and*
- Holding for specific length of *time*
  - In properly designed equipment
- That is properly operated

- High-Temperature Short-Time
- Continuous flow pasteurization
  - Unlike vat pasteurizers

HTST Pasteurizers

- HTSTs may not have all the equipment discussed here,
- May have equipment not covered here,
- Or they may have multiples!

FORWARD
H. T. 168.9 DEG
RAW -0.0 PSI
PAST. 23.9 PSI
DIF. 24.0 PSI
BOOSTER


SAFETY THERMAL LIMIT RECORDER CONTROLLER (STLR)
DIGITAL REFERENCE THERMOMETER (DRT)
FLOW DIVERSION DEVICE
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REGEN. BACK PRESSURE VALVE
VACUUM BREAKER
PASTEURIZED PRODUCT OUT
VACUUM BREAKER LINE 1 FOOT (305mm) ABOVE RAW PRODUCT
LEAK DETECT
DIVERT
HOLDING TUBE
RBPC
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PT
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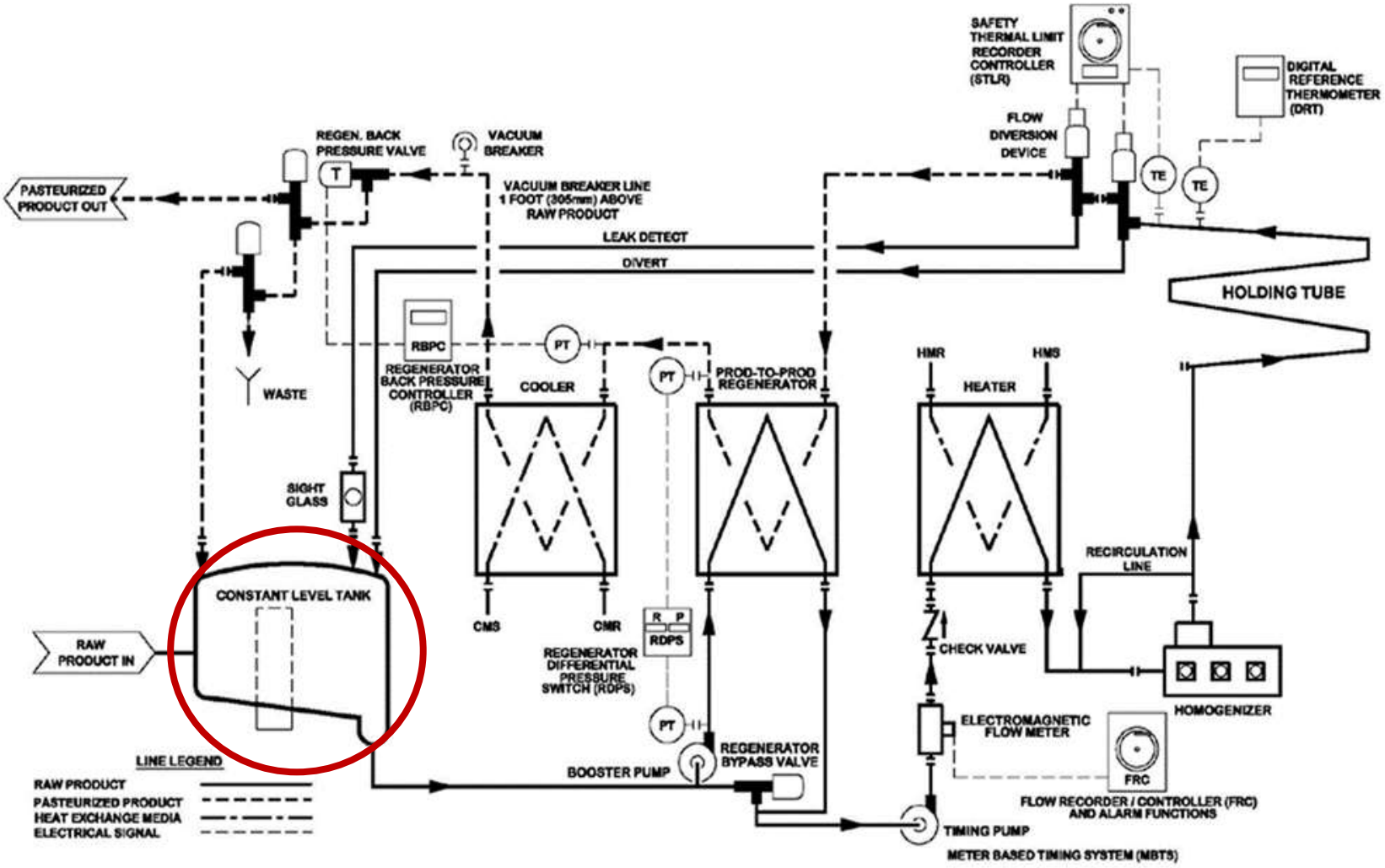
COOLER
PROD.TO-PROD REGENERATOR
HEATER
HWR
HWS
SIGHT GLASS
CONSTANT LEVEL TANK
CWS
CWR
RECIRCULATION LINE
CHECK VALVE
RAW PRODUCT IN
RDPS
REGENERATOR DIFFERENTIAL PRESSURE SWITCH (RDPS)
HOMOGENIZER
ELECTROMAGNETIC FLOW METER
FRC
REGENERATOR BYPASS VALVE
BOOSTER PUMP
FLOW RECORDER / CONTROLLER (FRC) AND ALARM FUNCTIONS
TIMING PUMP
METER BASED TIMING SYSTEM (MBTS)
LINE CODING
RAW PRODUCT
PASTEURIZED PRODUCT
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL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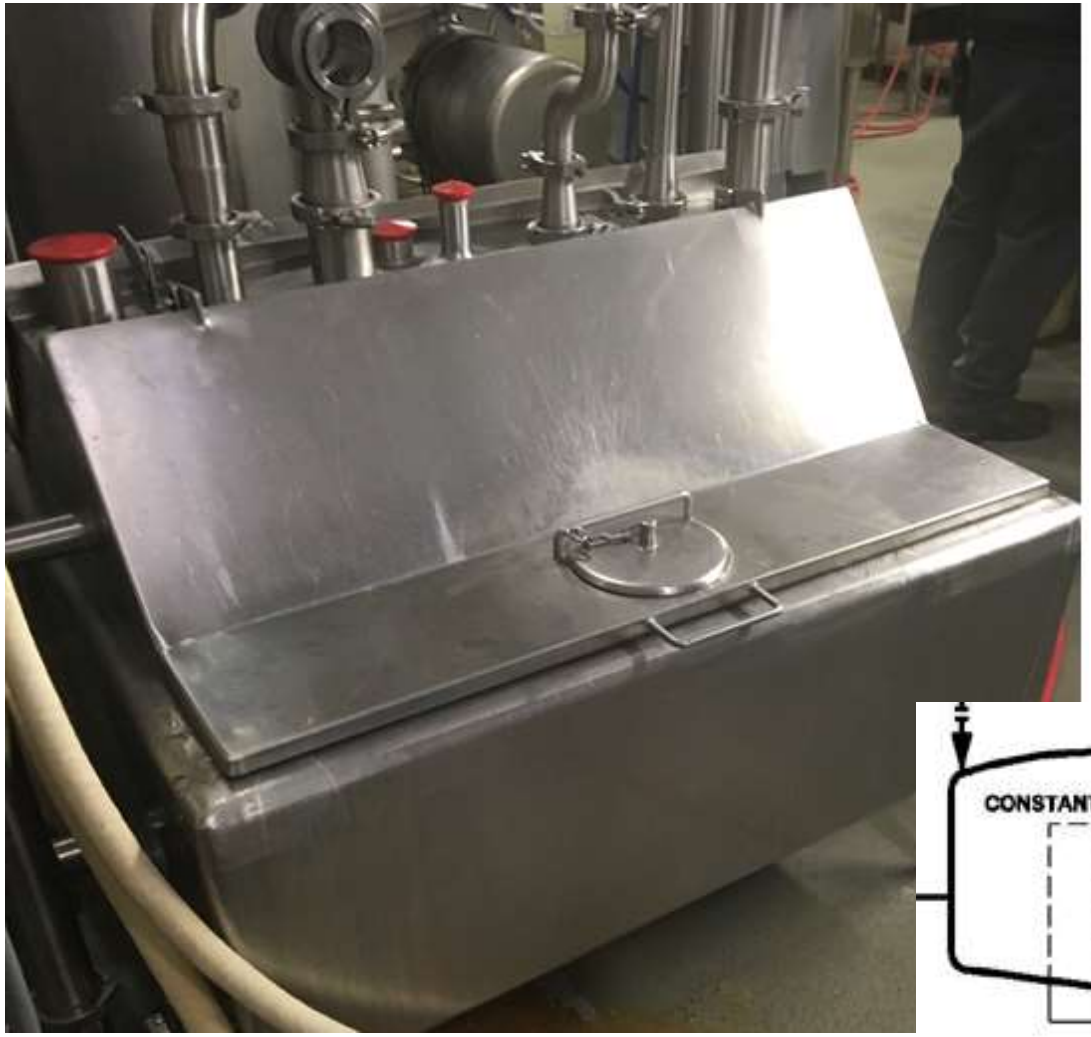
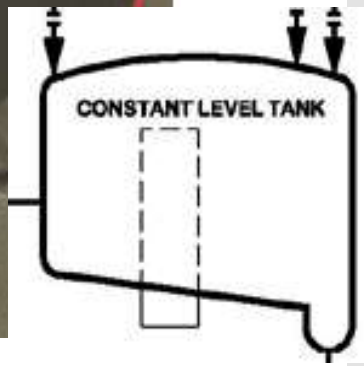
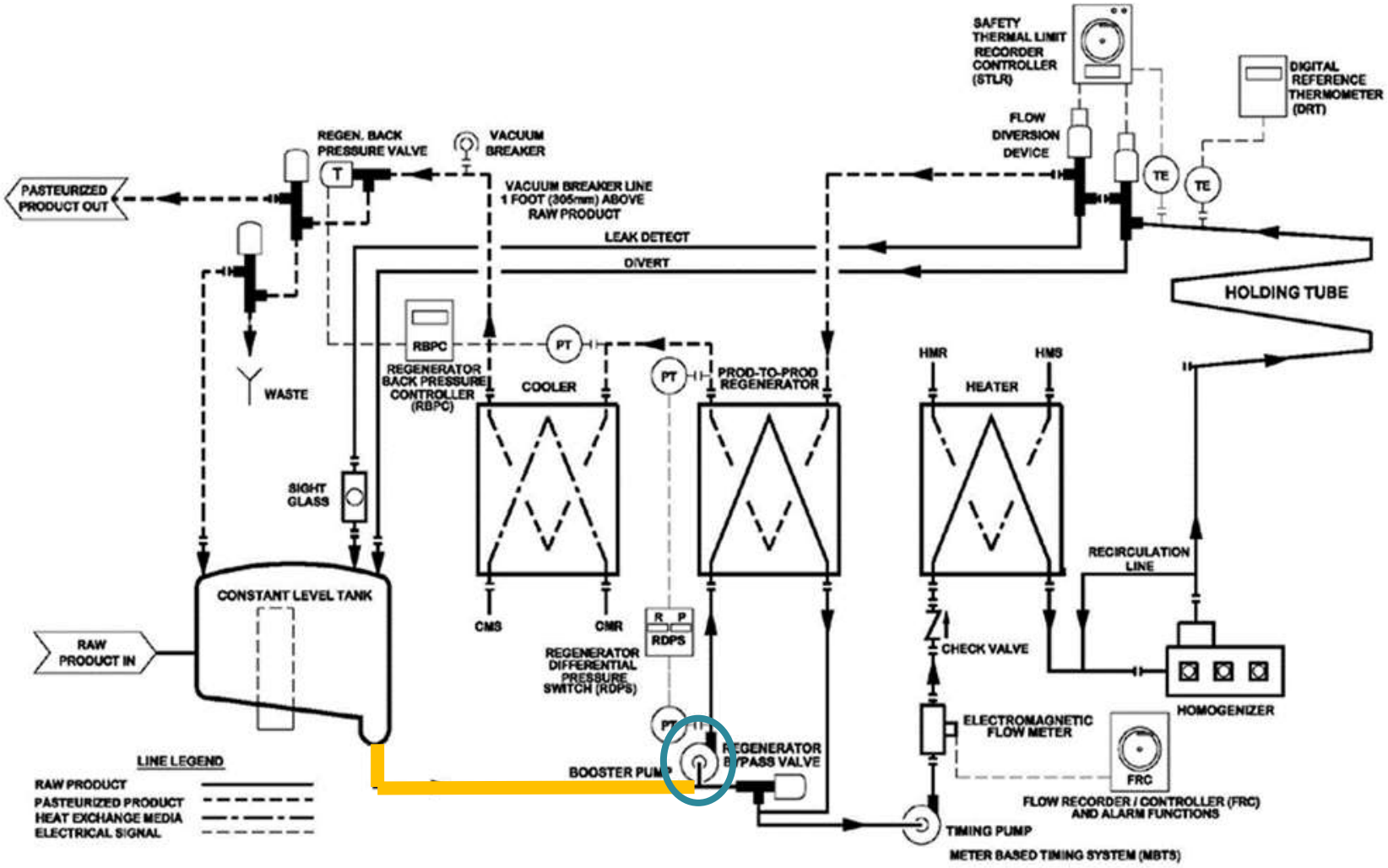
Balance Tank -or- Constant Level Tank



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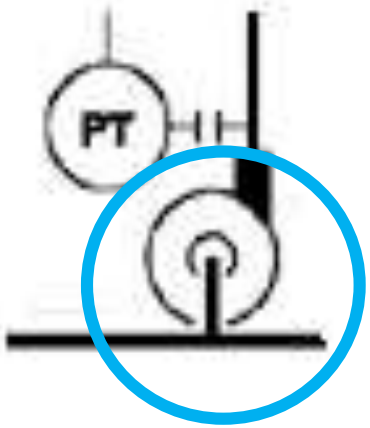
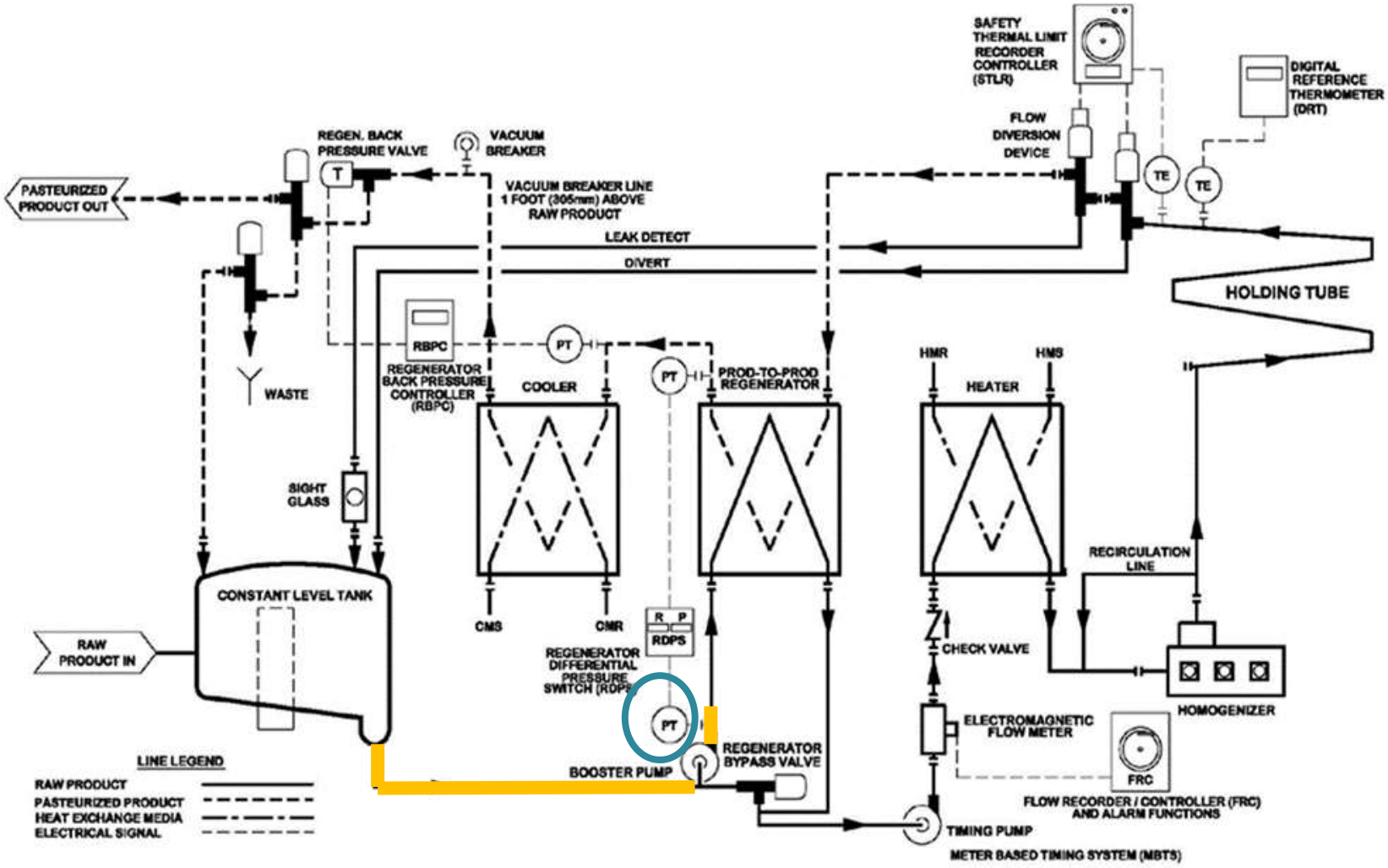
Booster Pump

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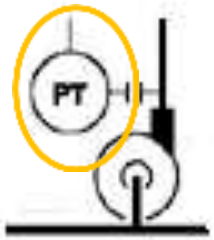
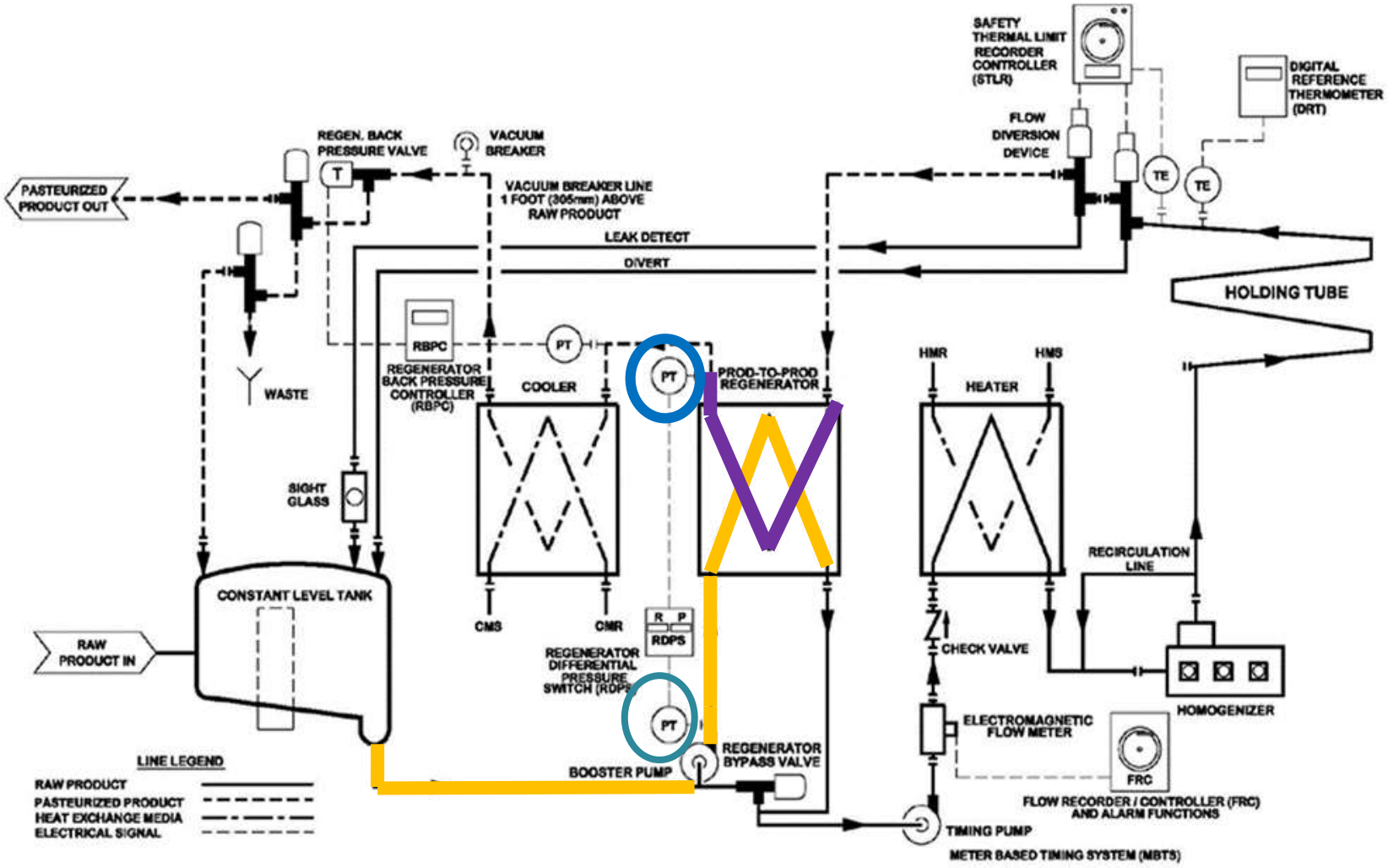
CMR
R P
RDPS
REGENERATOR DIFFERENTIAL PRESSURE SWITCH (RDPS)
CHECK VALVE
RAW PRODUCT IN
HOMOGENIZER
ELECTROMAGNETIC FLOW METER
FRC
PT
BOOSTER PUMP
REGENERATOR BYPASS VALVE
FLOW RECORDER / CONTROLLER (FRC) AND ALARM FUNCTIONS
TIMING PUMP
METER BASED TIMING SYSTEM (MBTS)
LINE LEGEND
RAW PRODUCT
PASTEURIZED PRODUCT
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL

Raw Pressure Sensor

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DIGITAL REFERENCE THERMOMETER (DRT)
FLOW DIVERSION DEVICE
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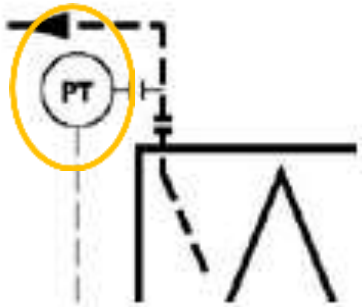
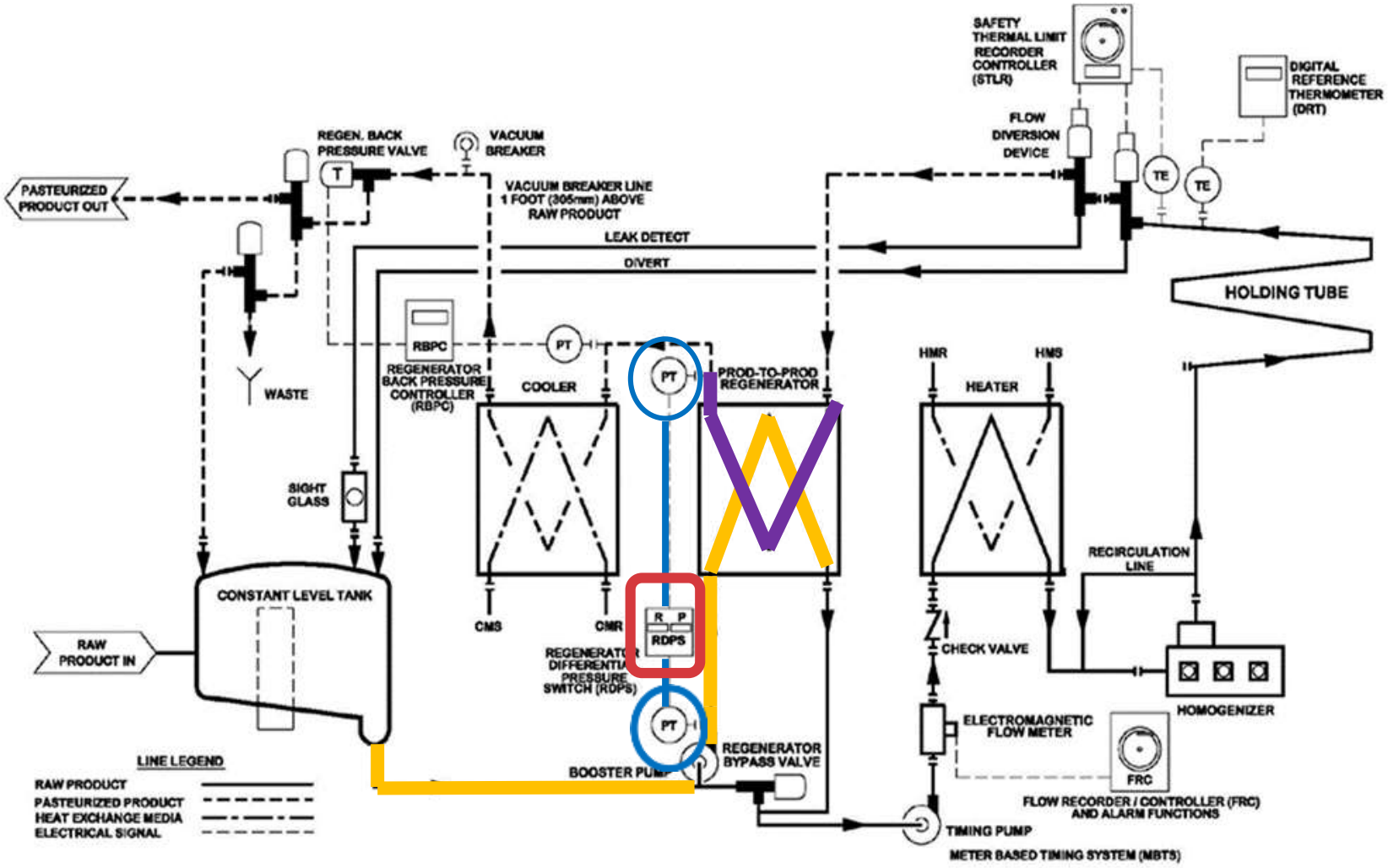
REGEN. BACK PRESSURE VALVE
VACUUM BREAKER
PASTEURIZED PRODUCT OUT
VACUUM BREAKER LINE 1 FOOT (305mm) ABOVE RAW PRODUCT
LEAK DETECT
DIVERT
HOLDING TUBE
RBPC
REGENERATOR BACK PRESSURE CONTROLLER (RBPC)
PT
PT
PROD-TO-PROD REGENERATOR
COOLER
HEATER
HMR
HMS
WASTE
SIGHT GLASS
CONSTANT LEVEL TANK
RAW PRODUCT IN
CMS
CMR
R P
RDPS
REGENERATOR DIFFERENTIAL PRESSURE SWITCH (RDPS)
RECIRCULATION LINE
CHECK VALVE
HOMOGENIZER
ELECTROMAGNETIC FLOW METER
FRC
FLOW RECORDER / CONTROLLER (FRC) AND ALARM FUNCTIONS
PT
BOOSTER PUMP
REGENERATOR BYPASS VALVE
TIMING PUMP
METER BASED TIMING SYSTEM (MBTS)
LINE LEGEND
RAW PRODUCT
PASTEURIZED PRODUCT
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL

Pasteurized Pressure Sensor

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FRC
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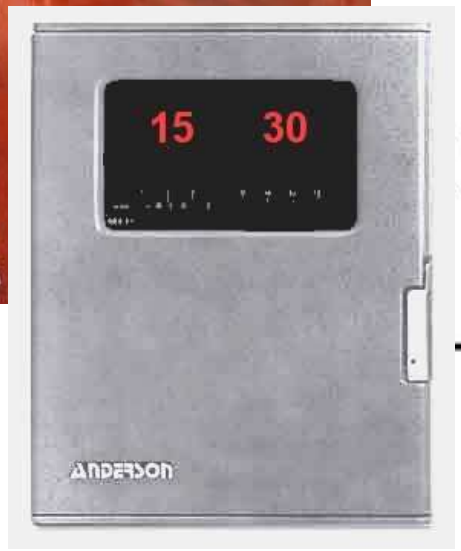
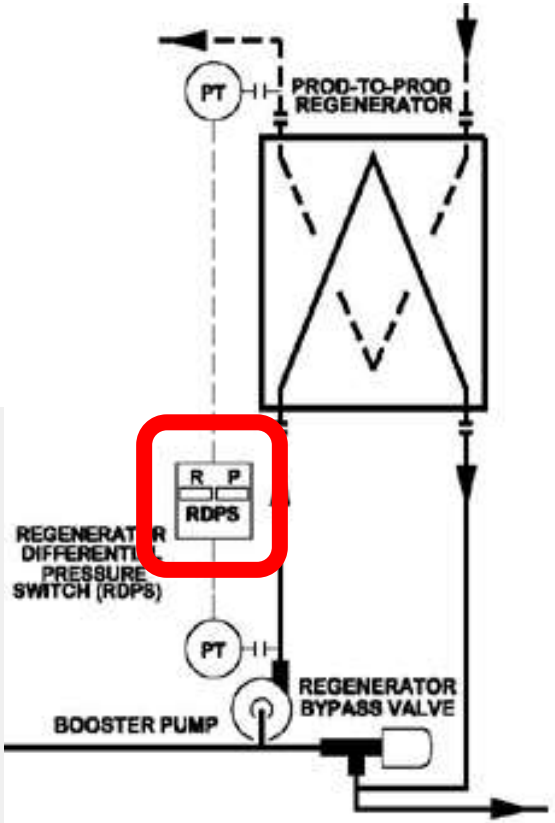
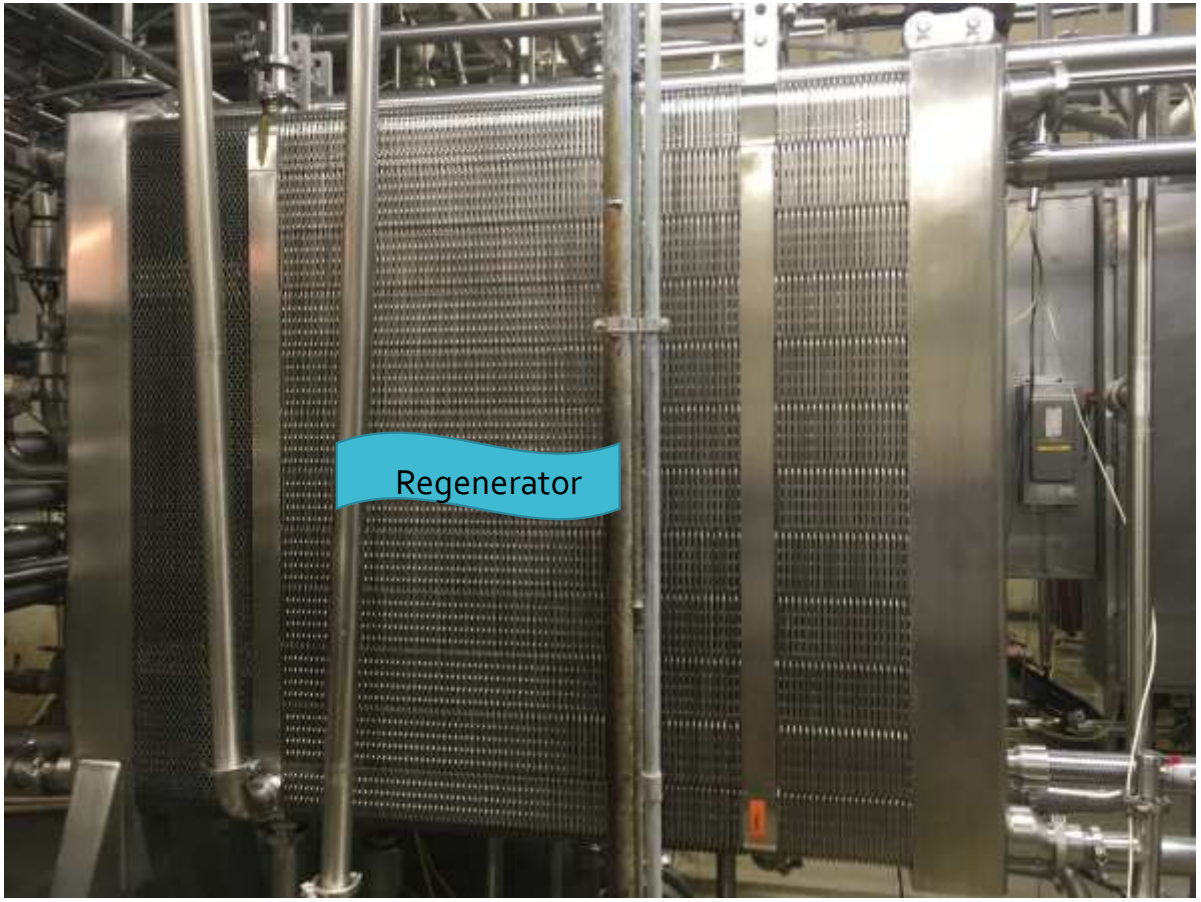
BOOSTER PUMP
FLOW RECORDER / CONTROLLER (FRC) AND ALARM FUNCTIONS
TIMING PUMP
METER BASED TIMING SYSTEM (MBTS)
LINE LEGEND
RAW PRODUCT
PASTEURIZED PRODUCT
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL

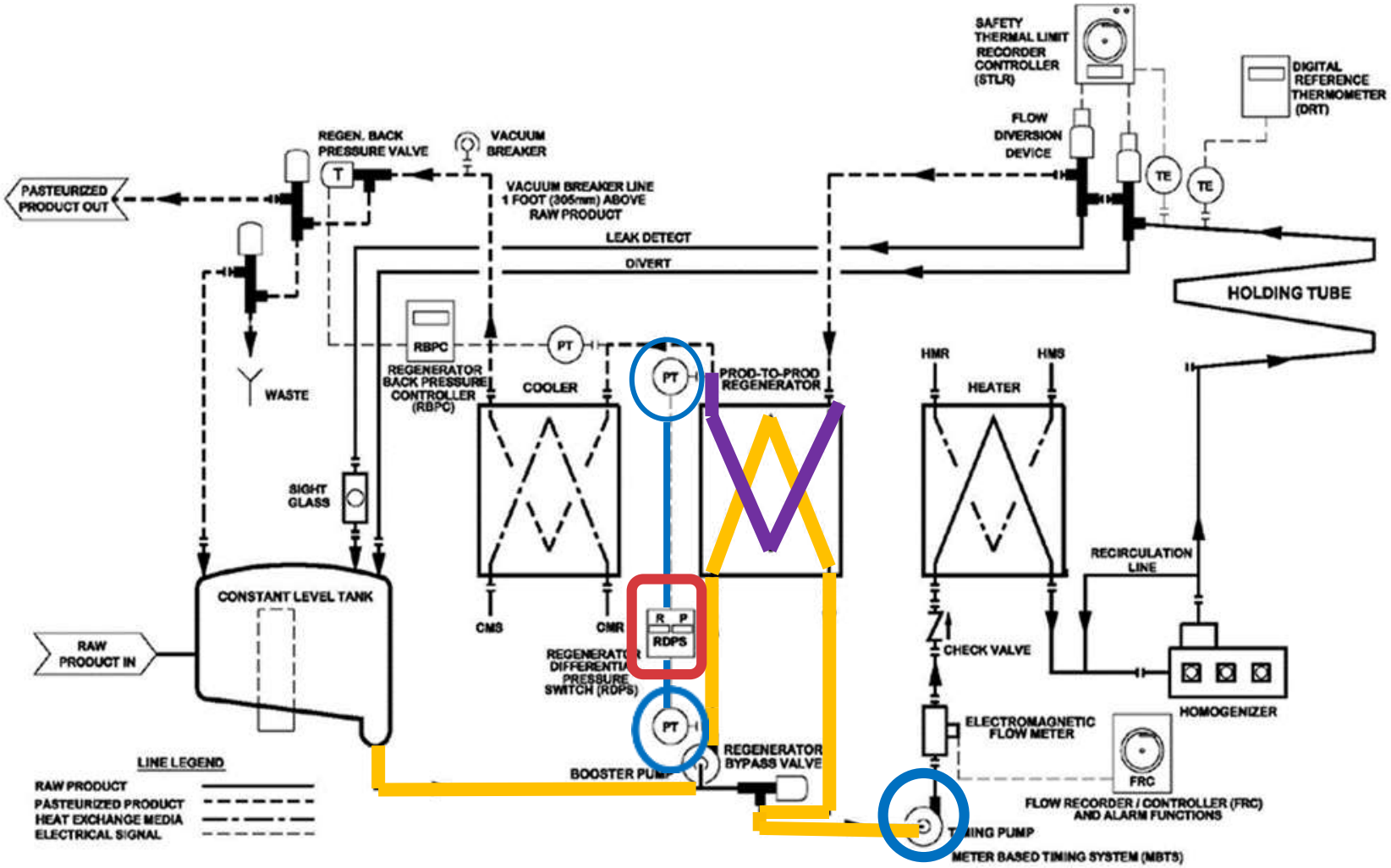
Differential Pressure Switch (DPS)





Regenerator Section

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VACUUM BREAKER
PASTEURIZED PRODUCT OUT
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FRC
PT
BOOSTER PUMP
REGENERATOR BYPASS VALVE
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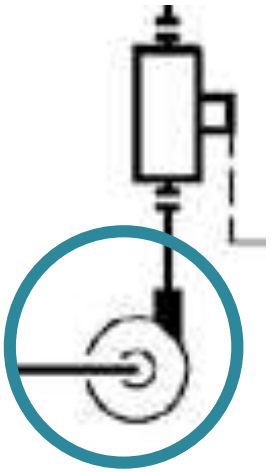
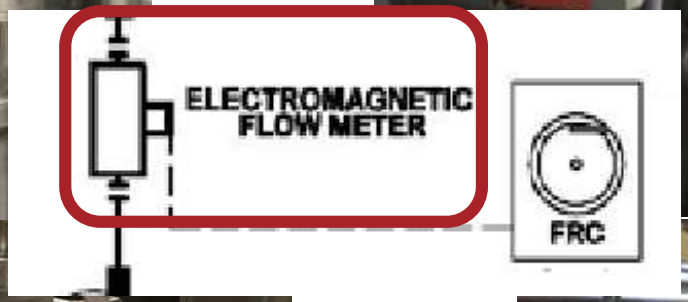
METER BASED TIMING SYSTEM (MBTS)
LINE LEGEND
RAW PRODUCT
PASTEURIZED PRODUCT
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL

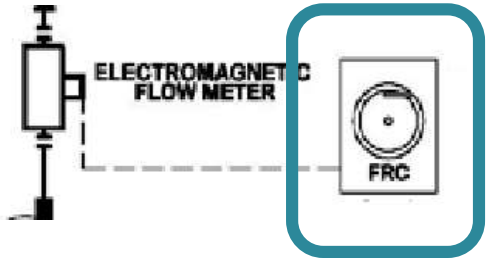
Timing Pump

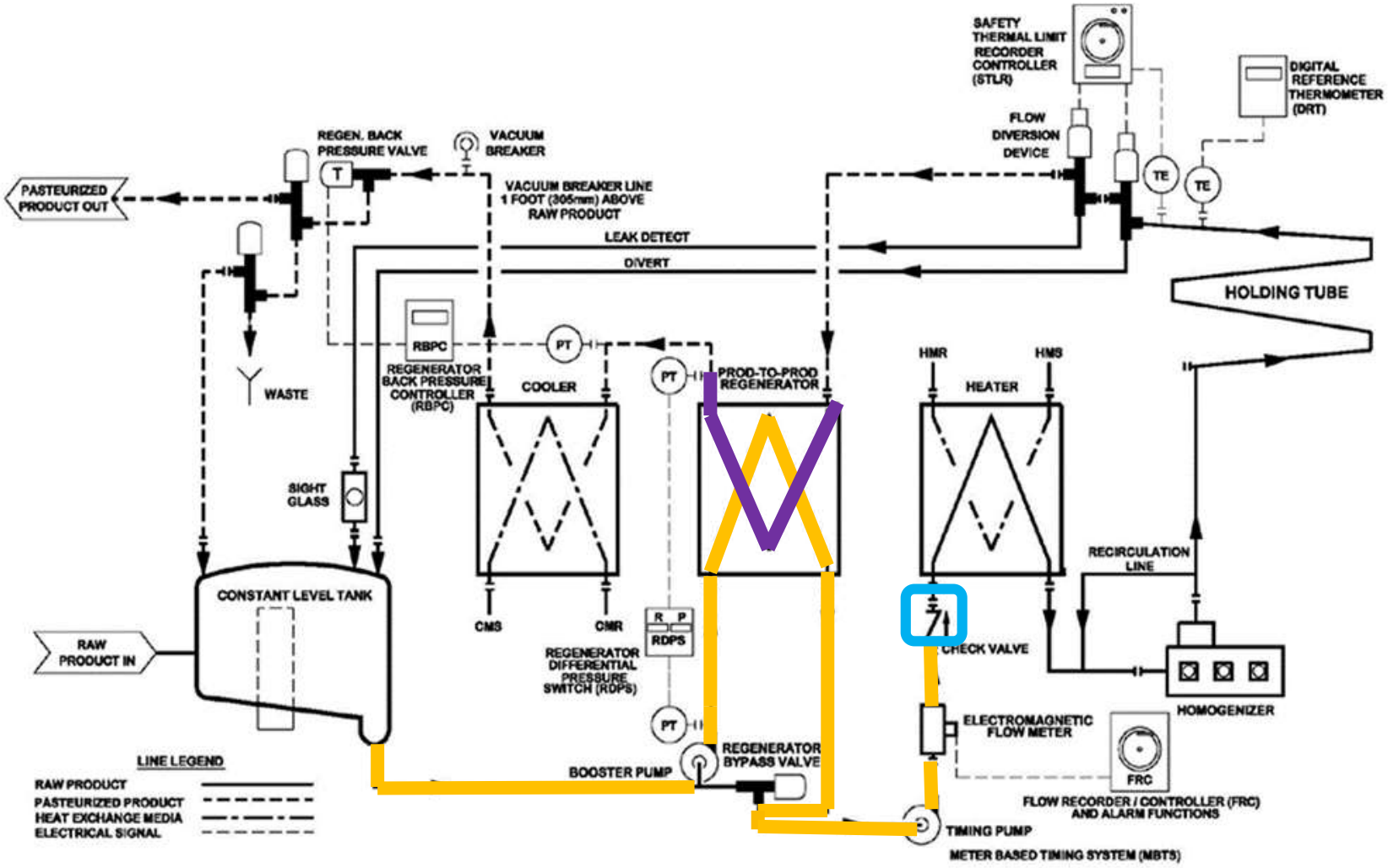


Flow Meter



Safety Flow Limit Recorder SFLR




SAFETY THERMAL LIMIT RECORDER CONTROLLER (STLR)
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HOMOGENIZER
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FLOW RECORDER / CONTROLLER (FRC) AND ALARM FUNCTIONS
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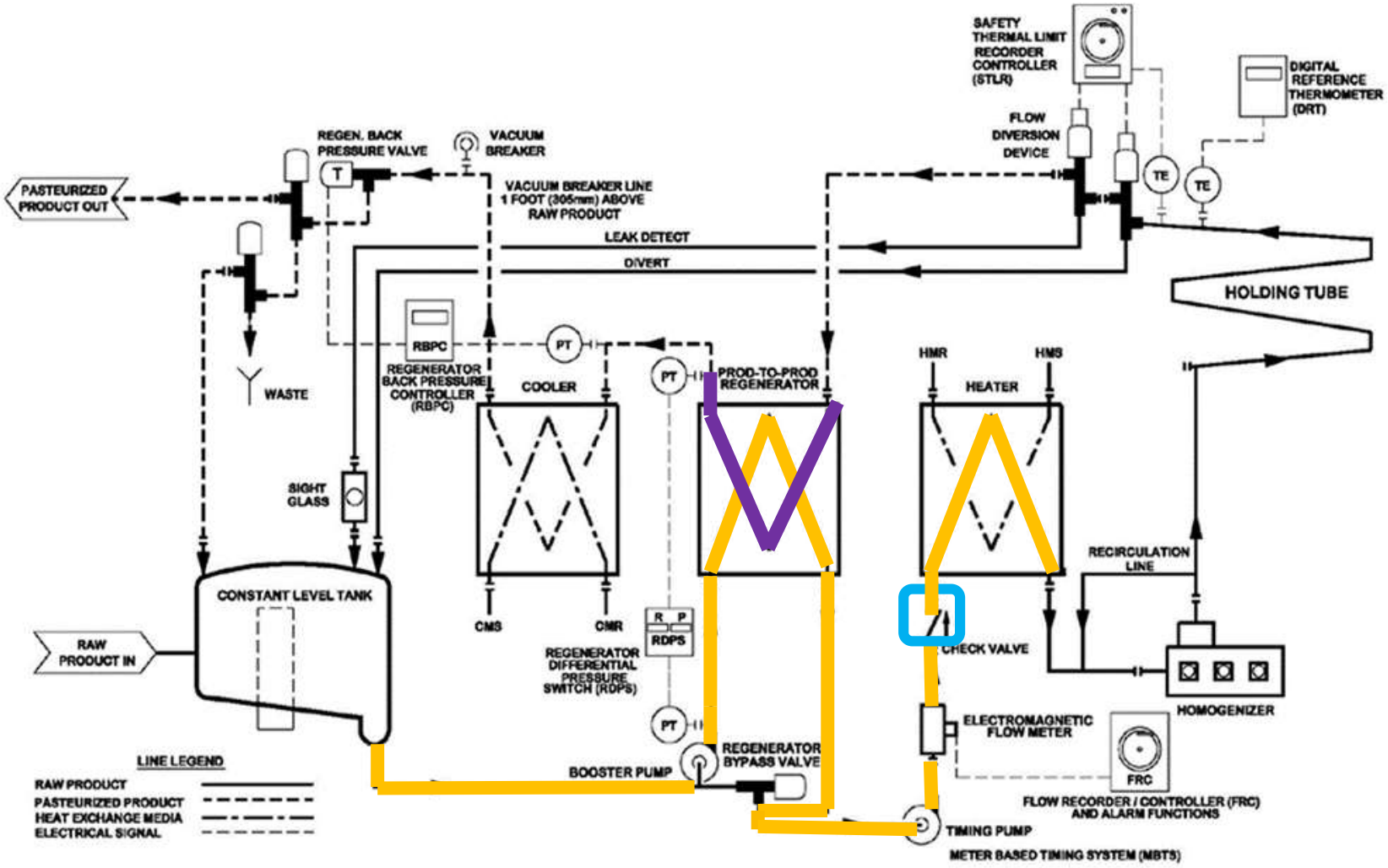
METER BASED TIMING SYSTEM (MBTS)
LINE LEGEND
RAW PRODUCT
PASTEURIZED PRODUCT
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL

Check Valve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LINE LEGEND
RAW PRODUCT
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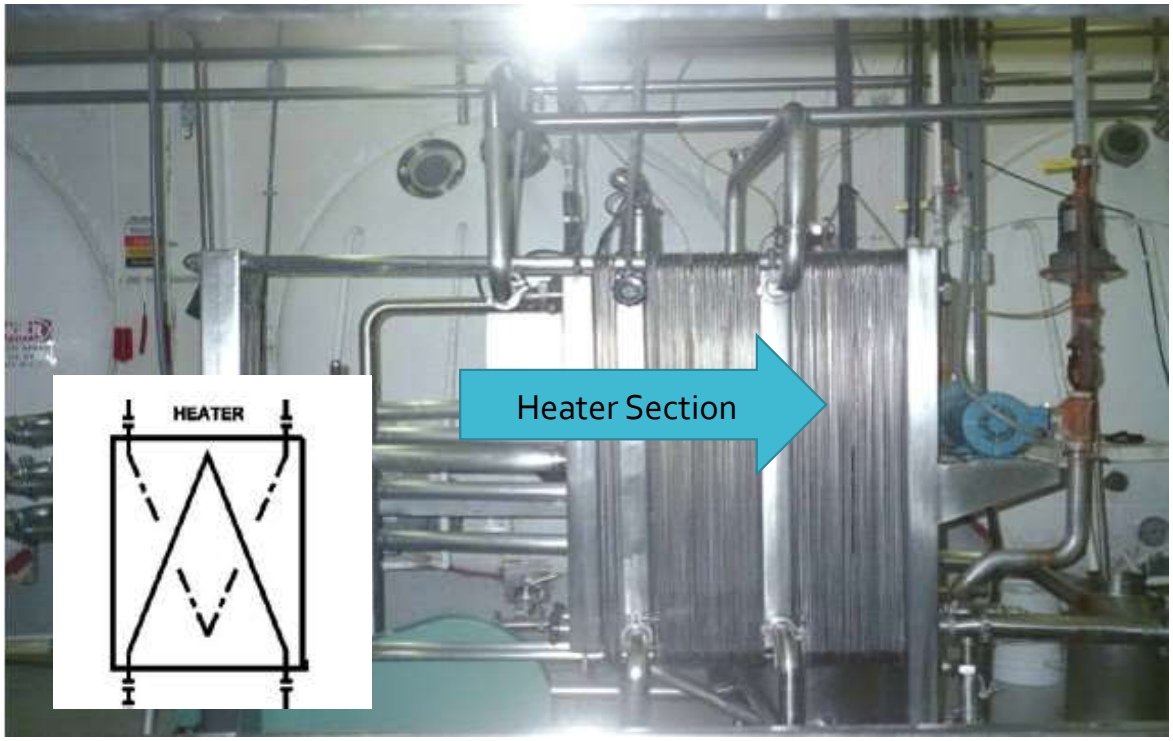
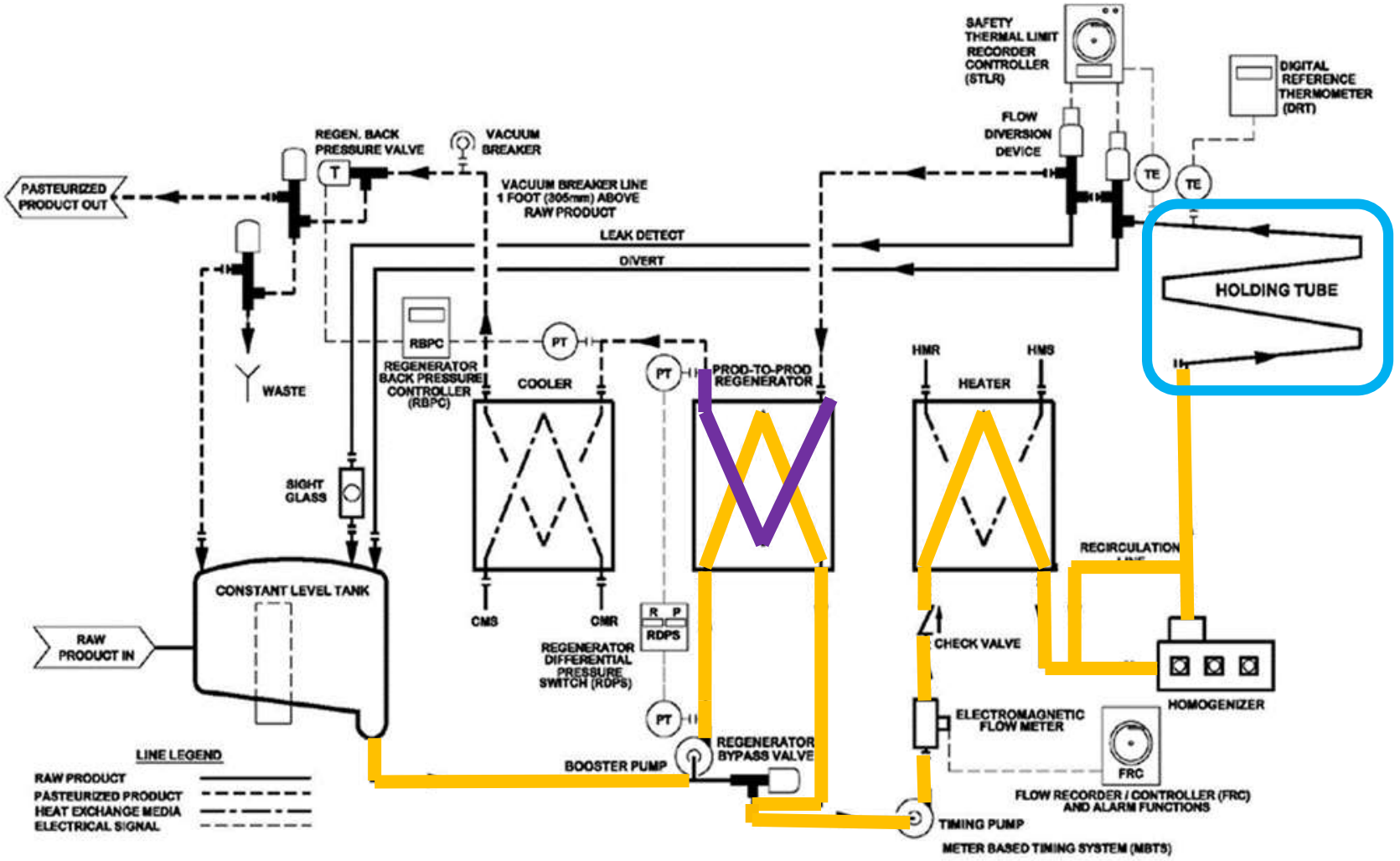
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL

HTST Road Trip:

Heater Section

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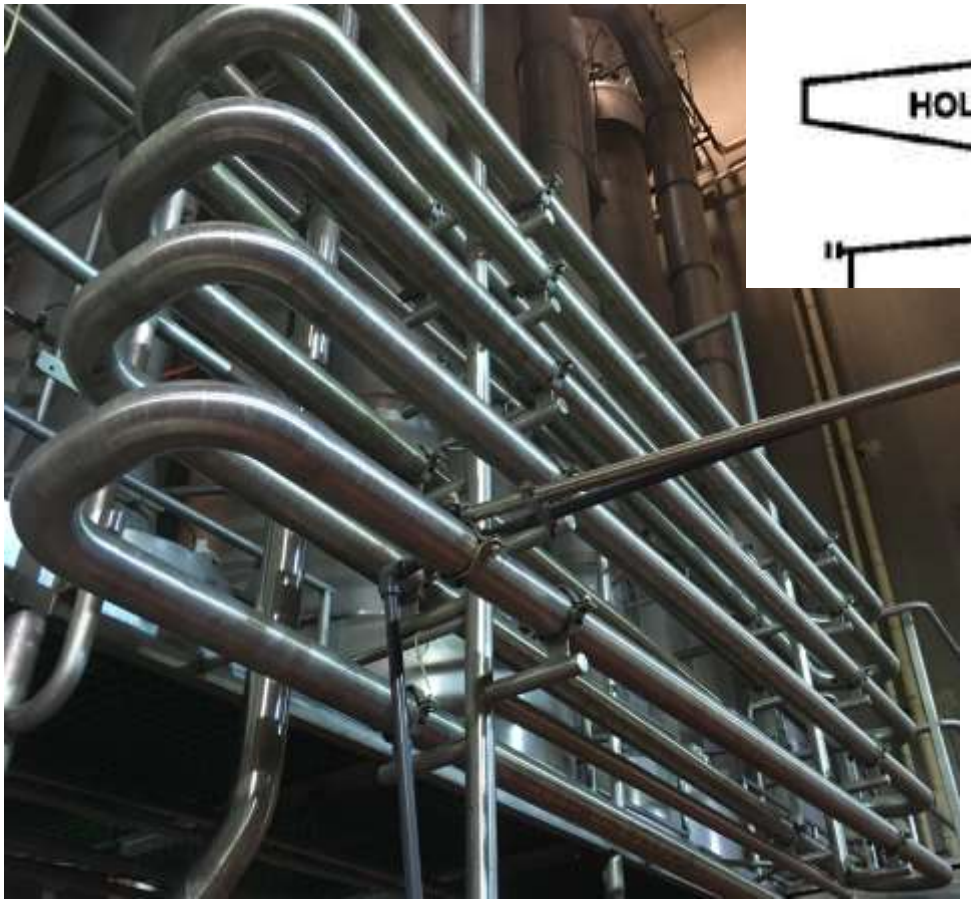
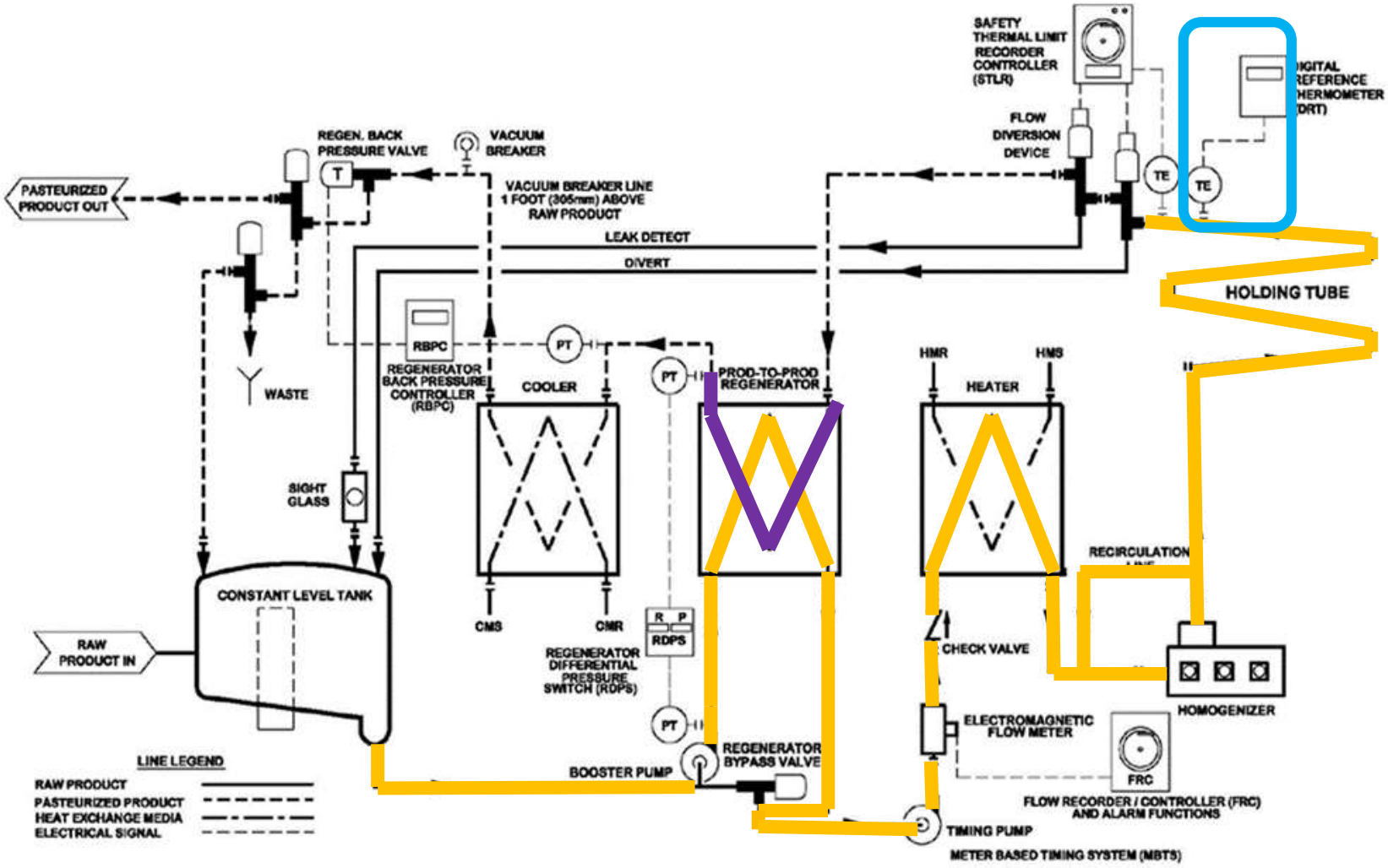
HTST Road Trip:

Holding Tube

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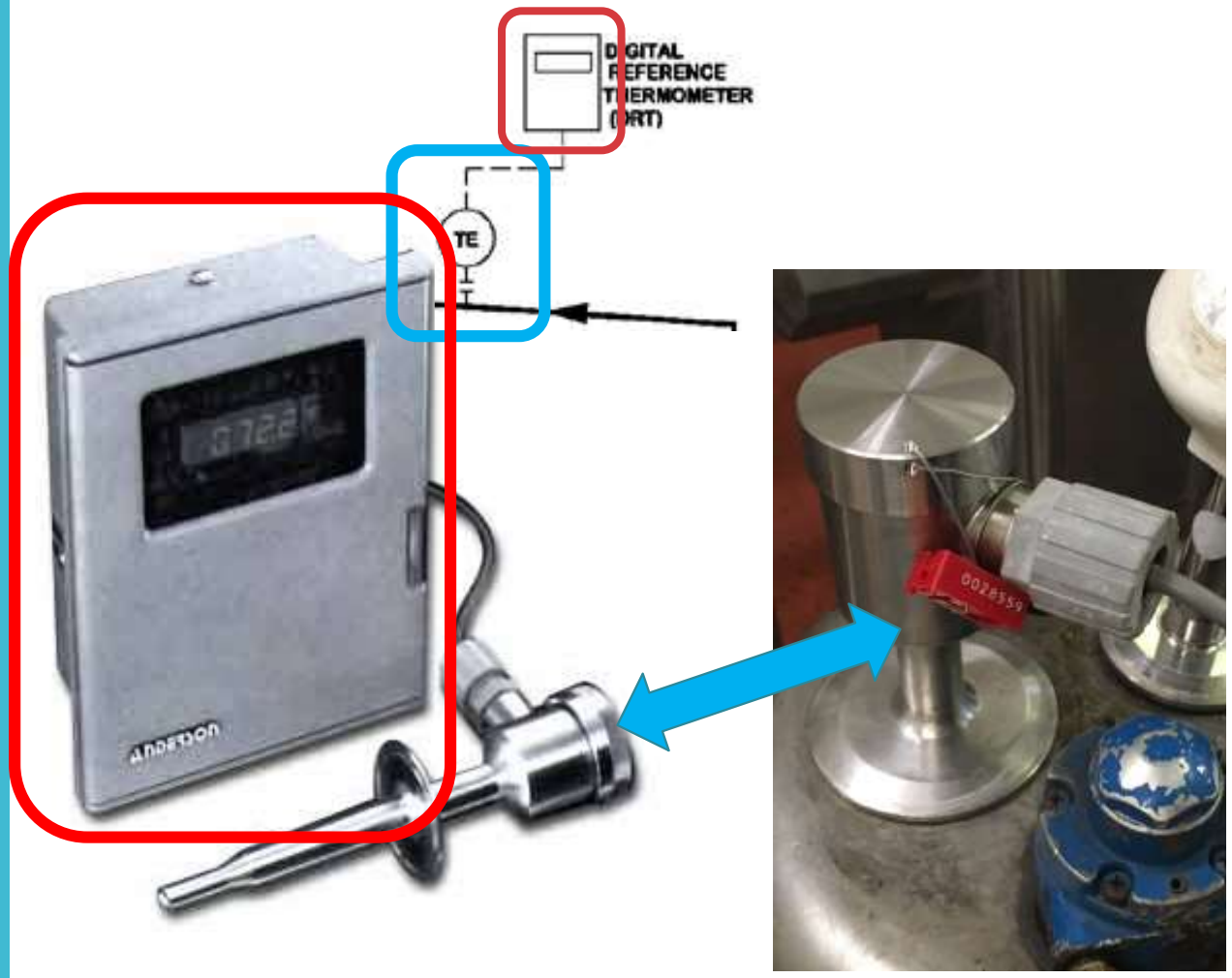
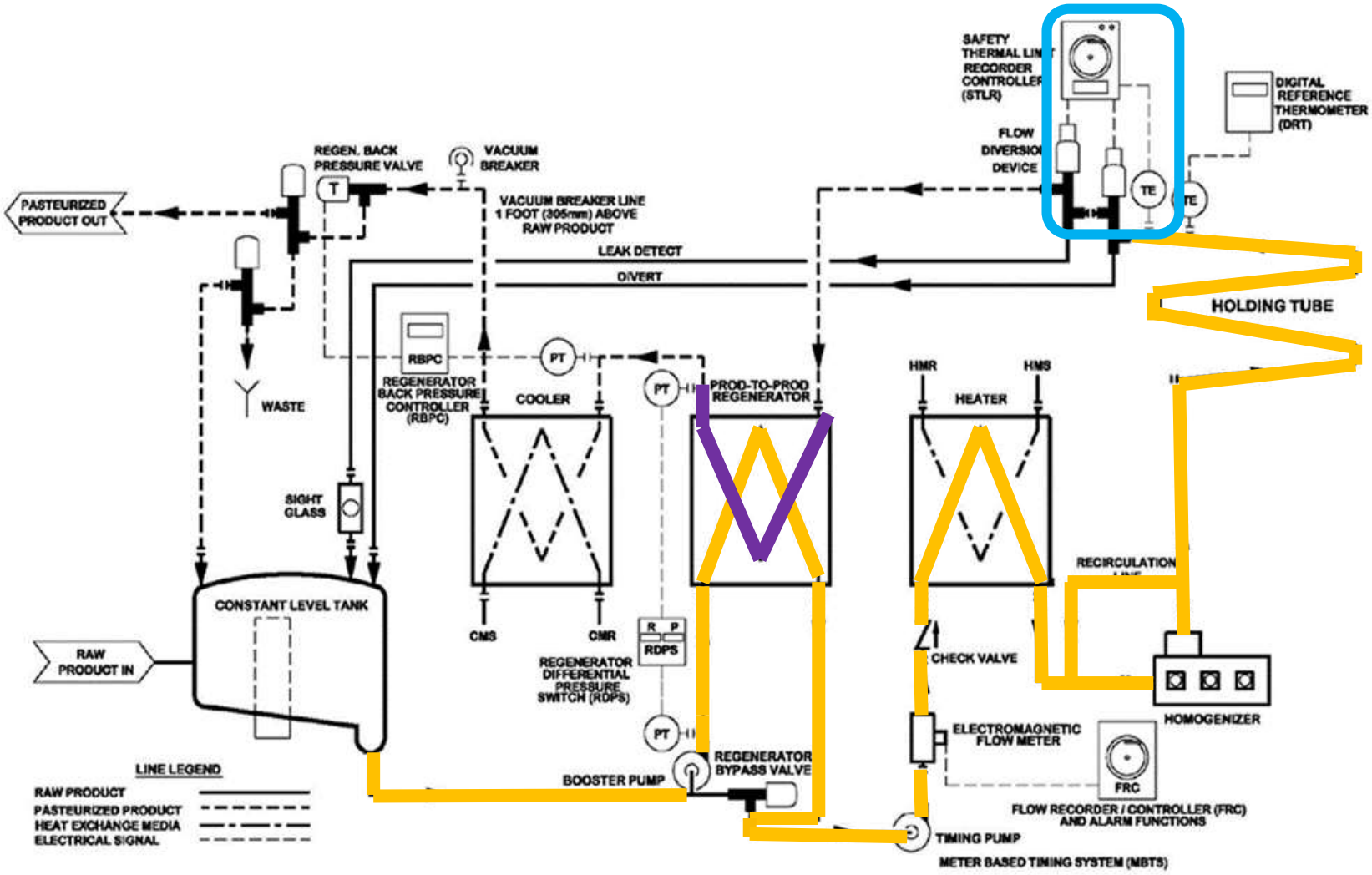
ELECTRICAL SIGNAL

DRT
&
DRT-RTD

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PASTEURIZED PRODUCT
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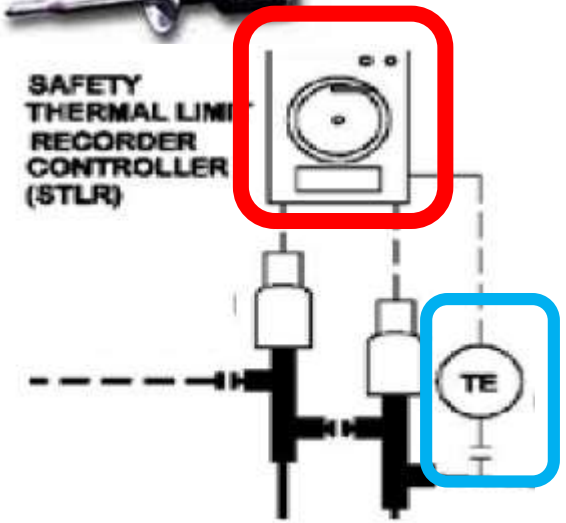
ELECTRICAL SIGNAL

STLR
&
STLR-RTD



STLR-RTD
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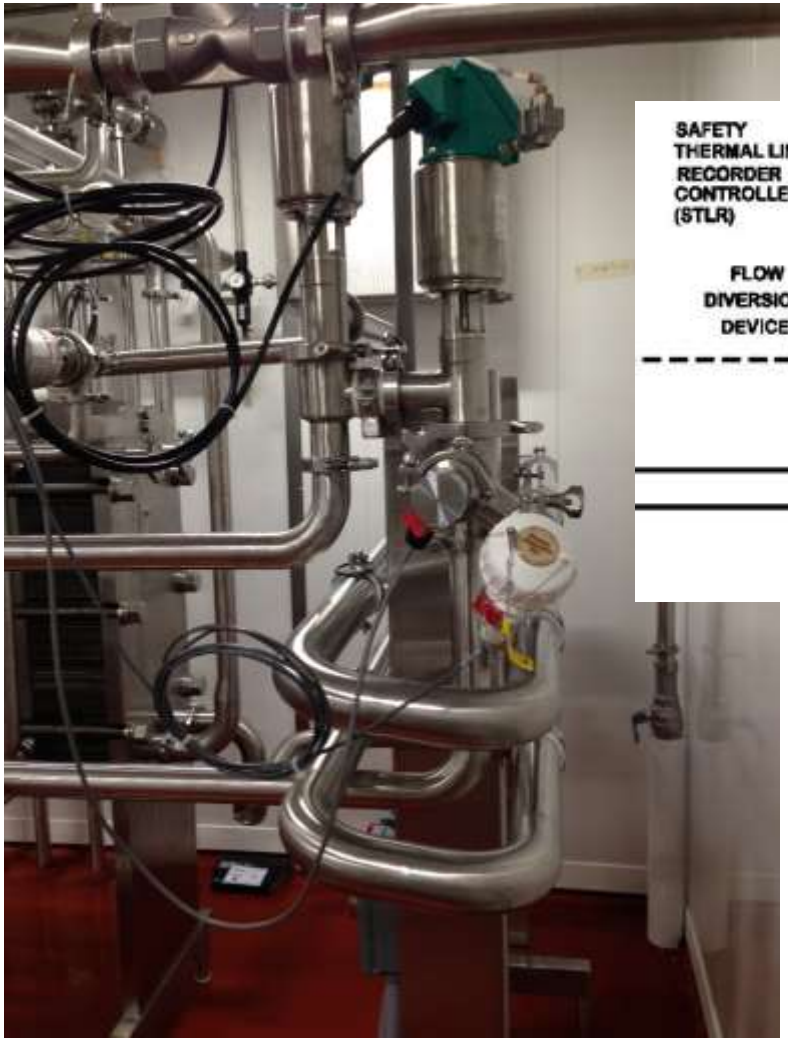
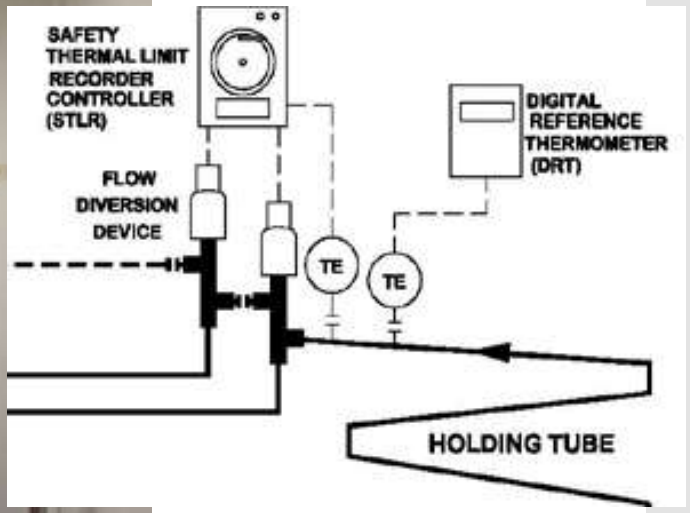
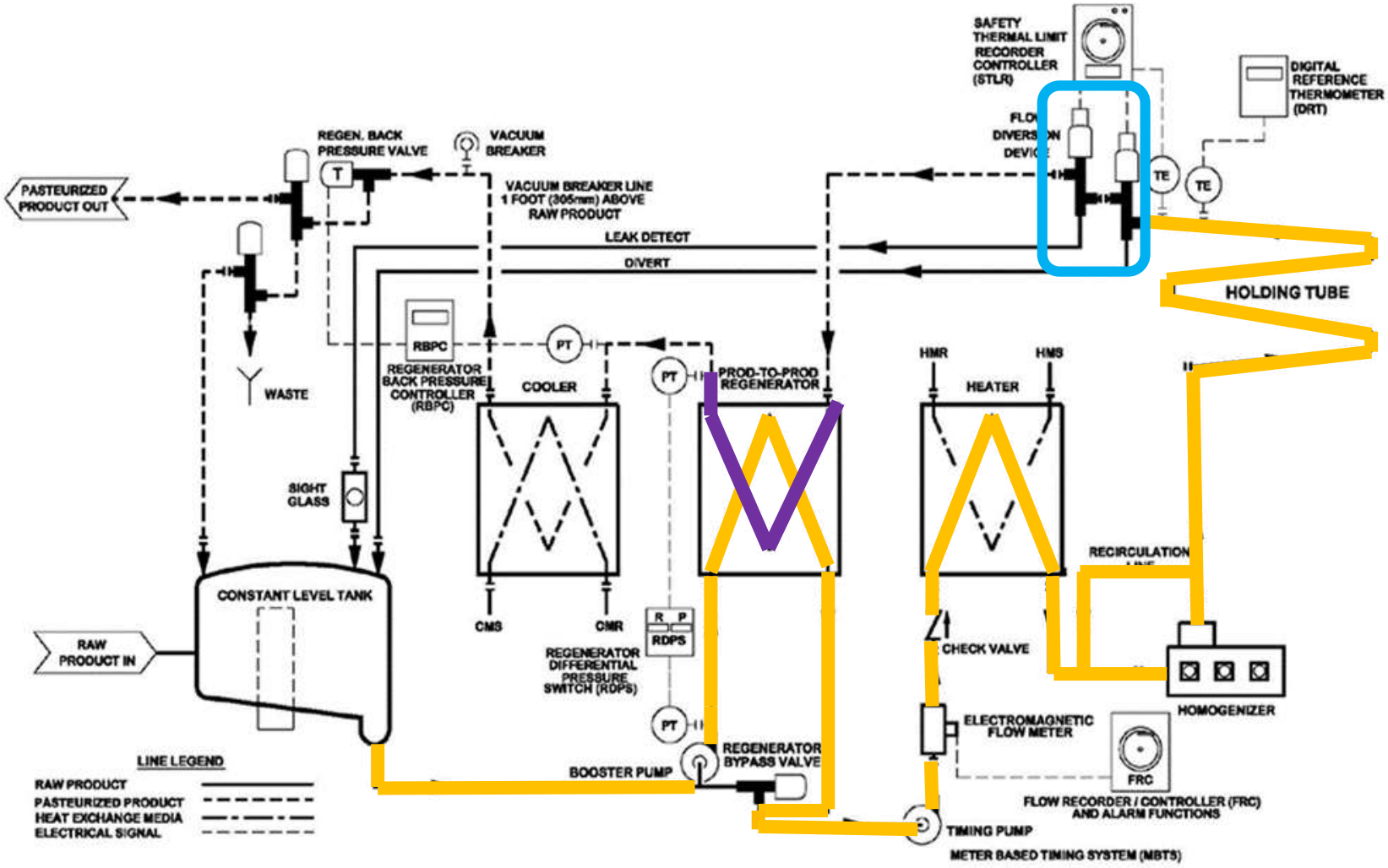
DRT-RTD






SAFETY THERMAL LIMIT RECORDER CONTROLLER (STLR)
DIGITAL REFERENCE THERMOMETER (DRT)
REGEN. BACK PRESSURE VALVE
VACUUM BREAKER
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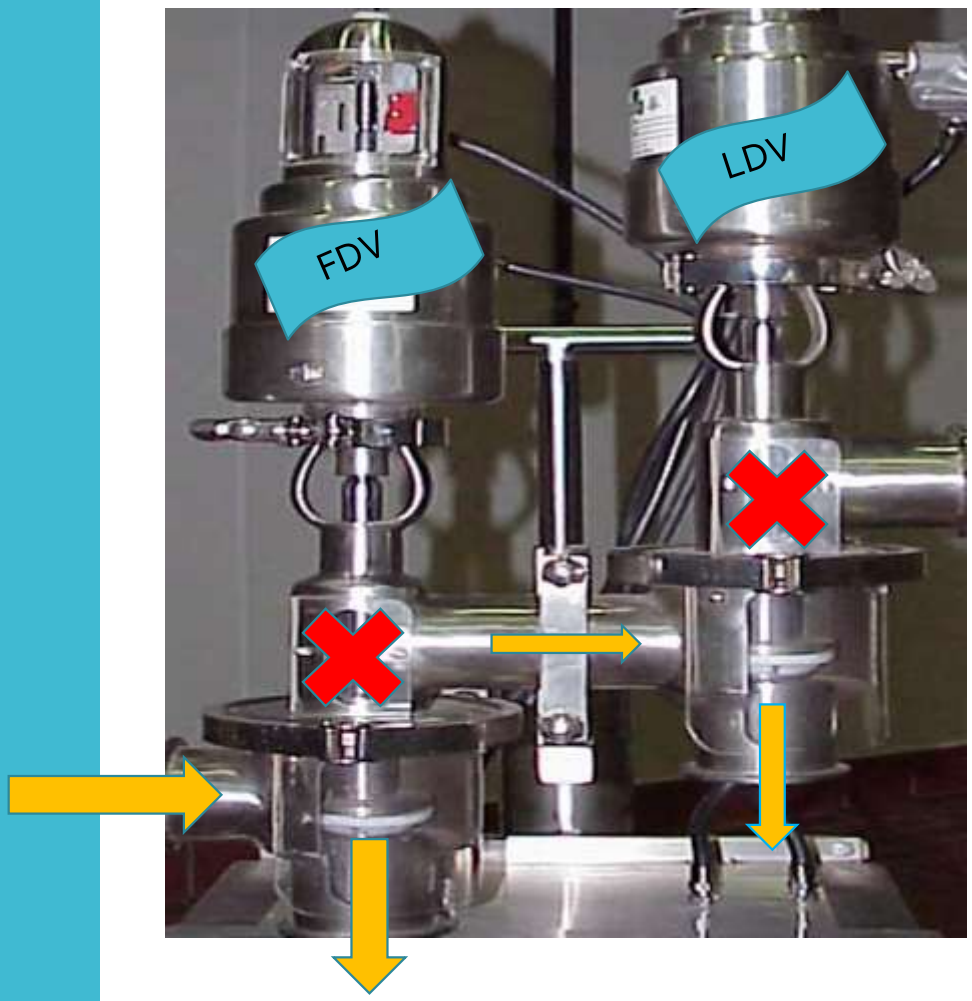
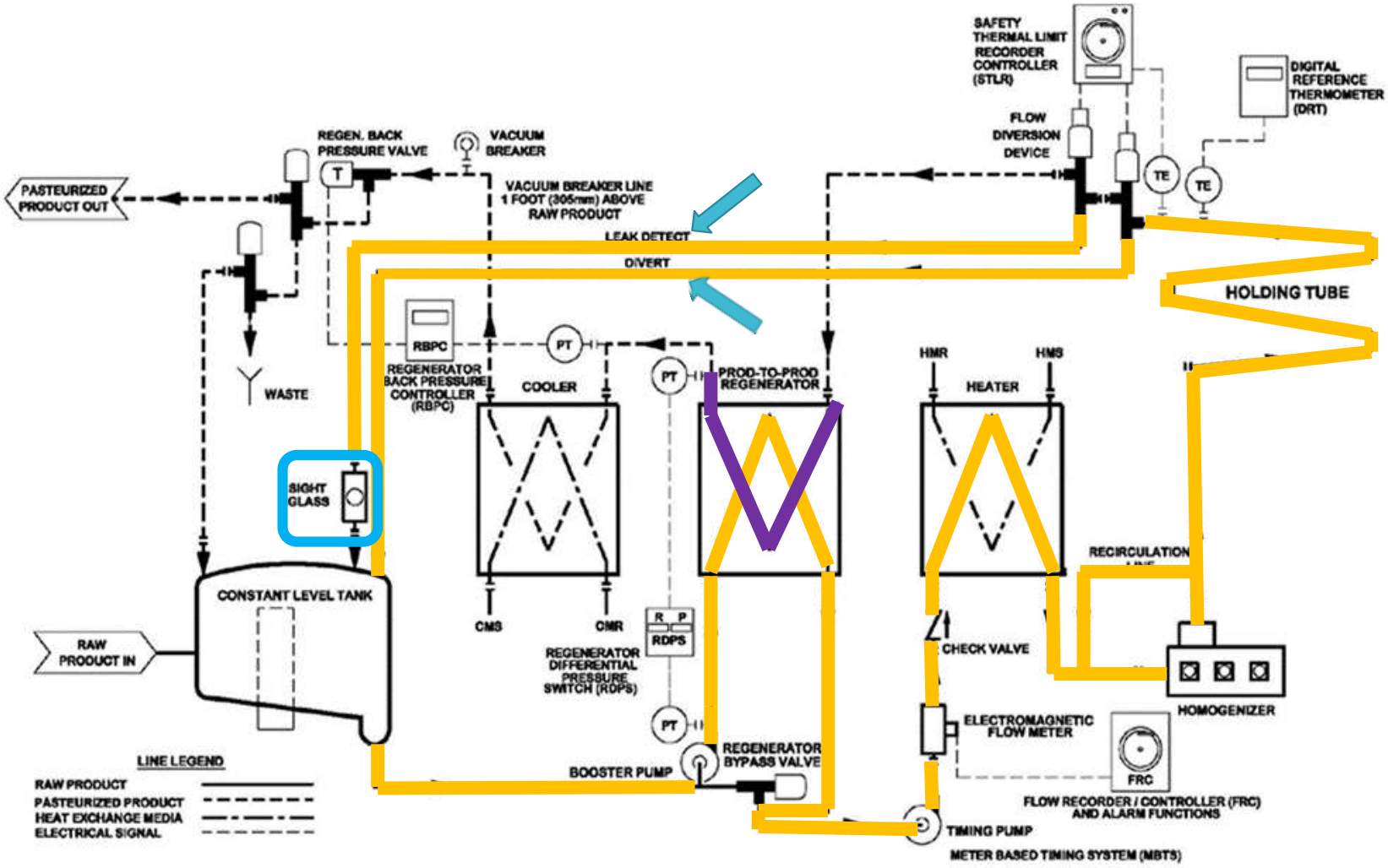
ELECTRICAL SIGNAL

Flow Divert Valve & Leak Detect Valve



- Divert Flow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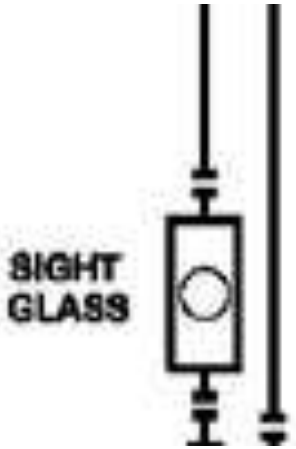
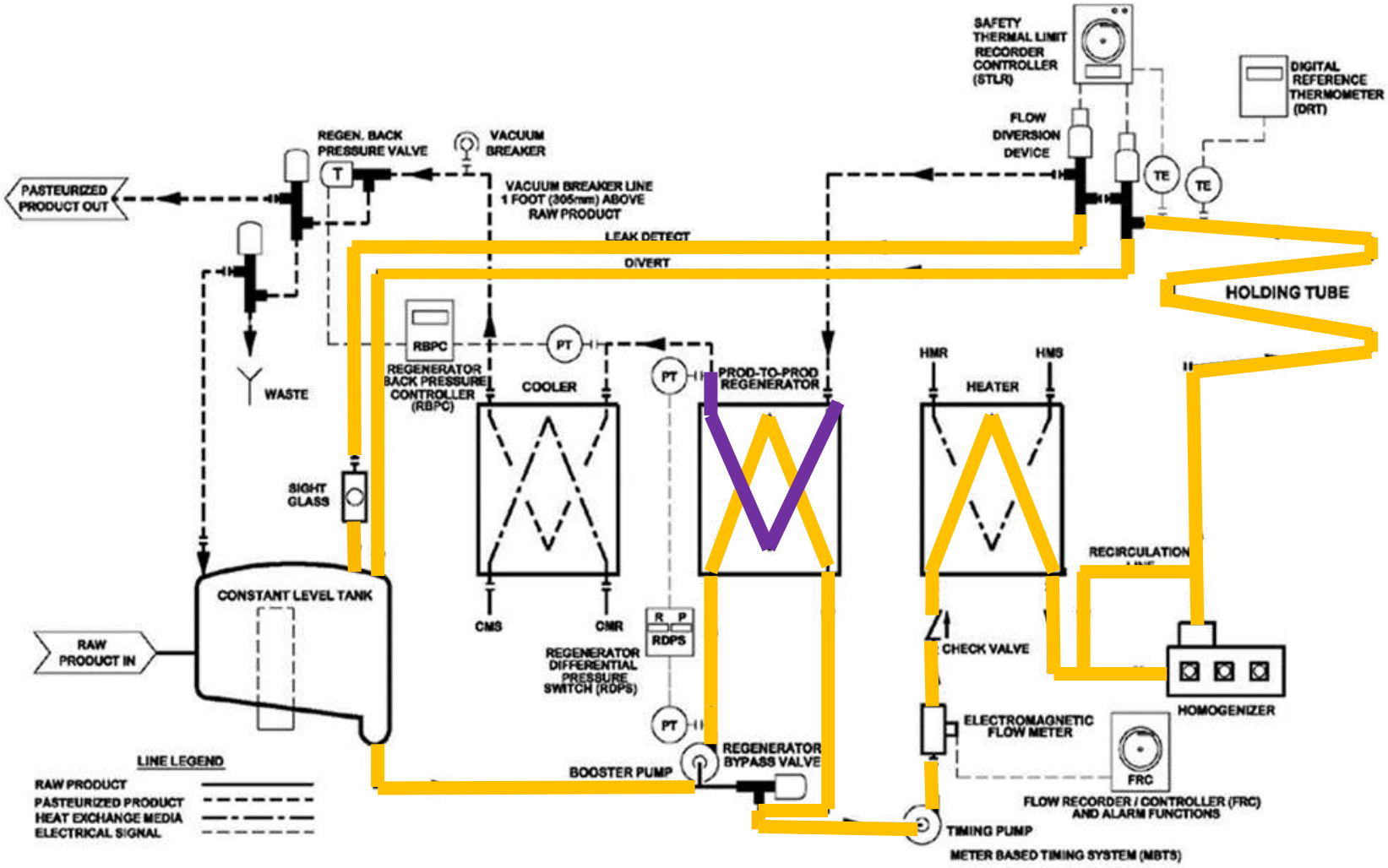
HTST Road Trip:

Sight Glass on Leak Detect Line

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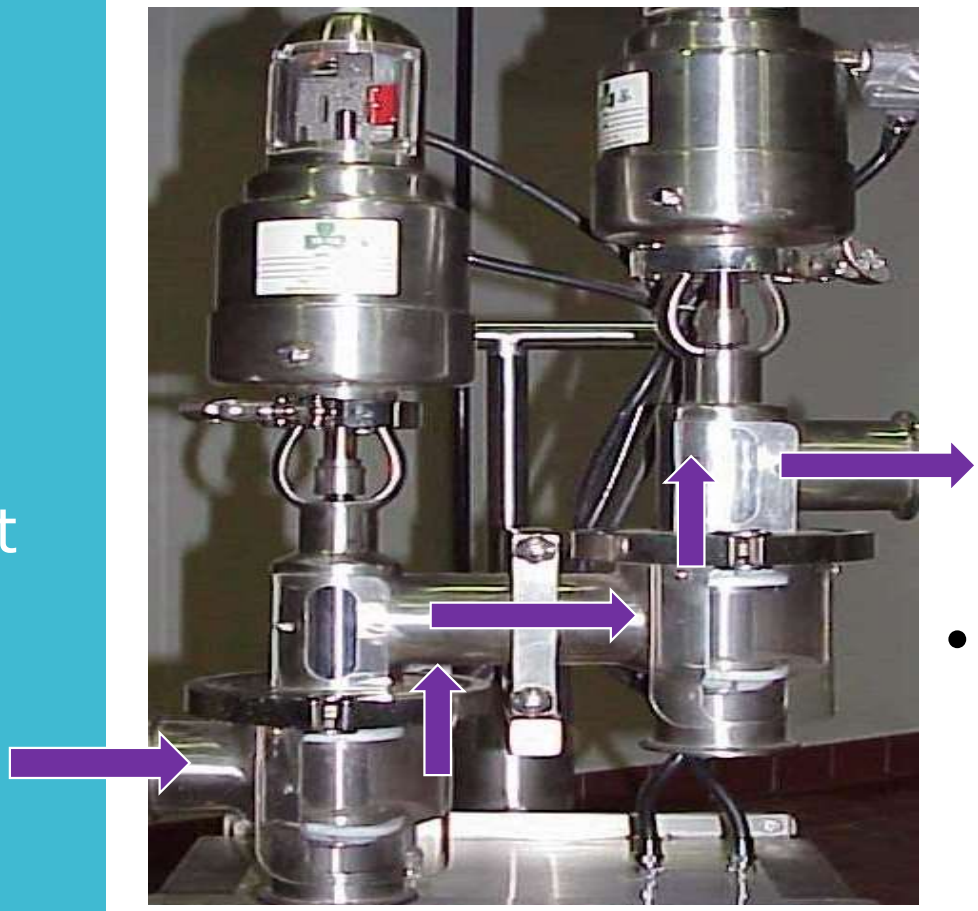
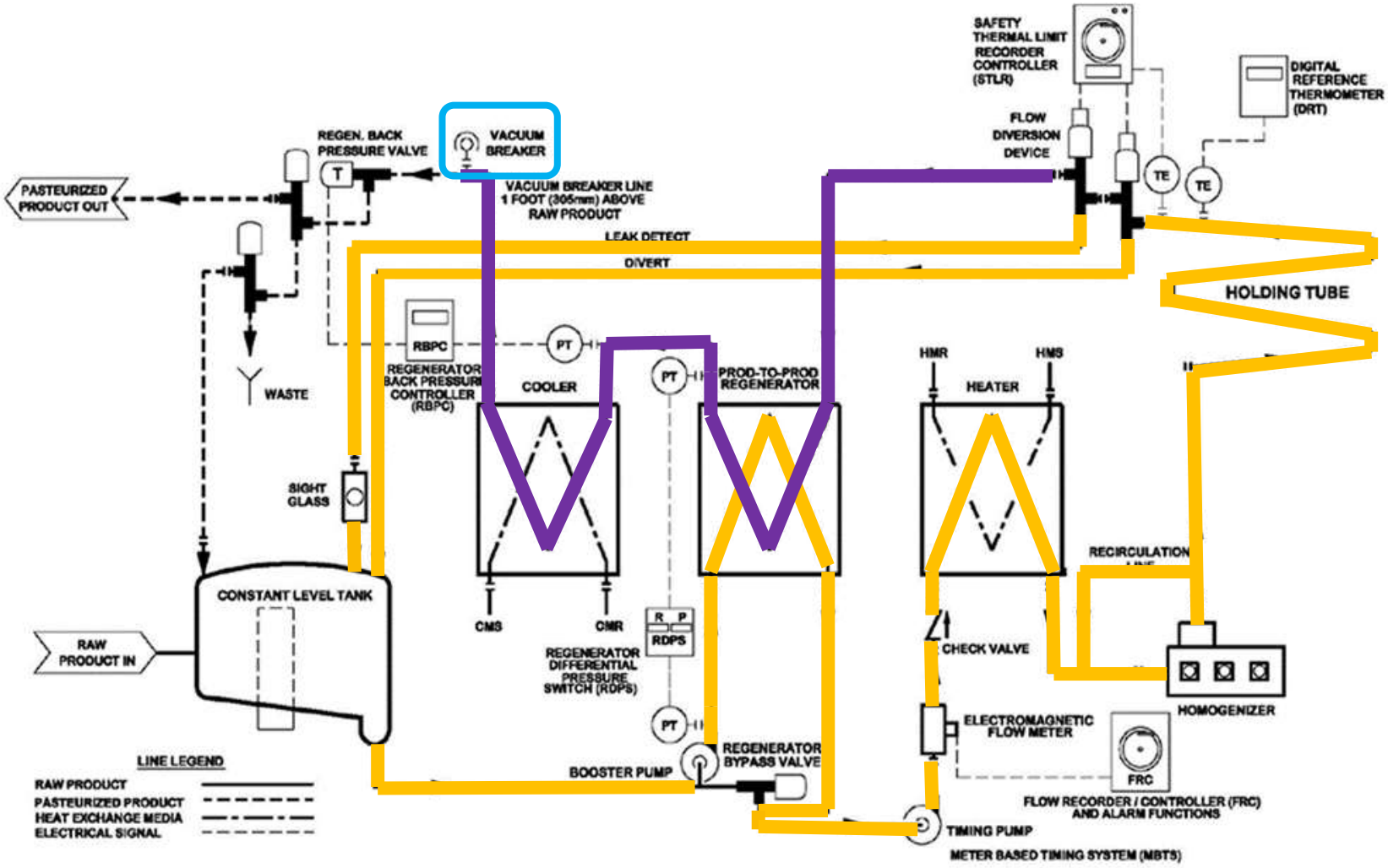
ELECTRICAL SIGNAL

Flow Divert Valve & Leak Detect Valve



- Forward Flow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DIGITAL REFERENCE THERMOMETER (DRT)
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HOLDING TUBE
RBPC
REGENERATOR BACK PRESSURE CONTROLLER (RBPC)
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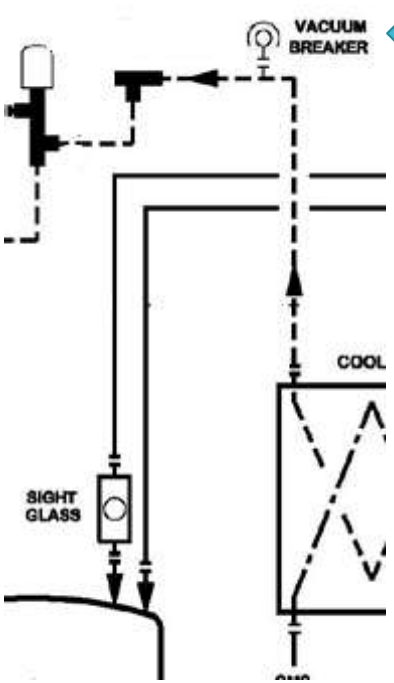
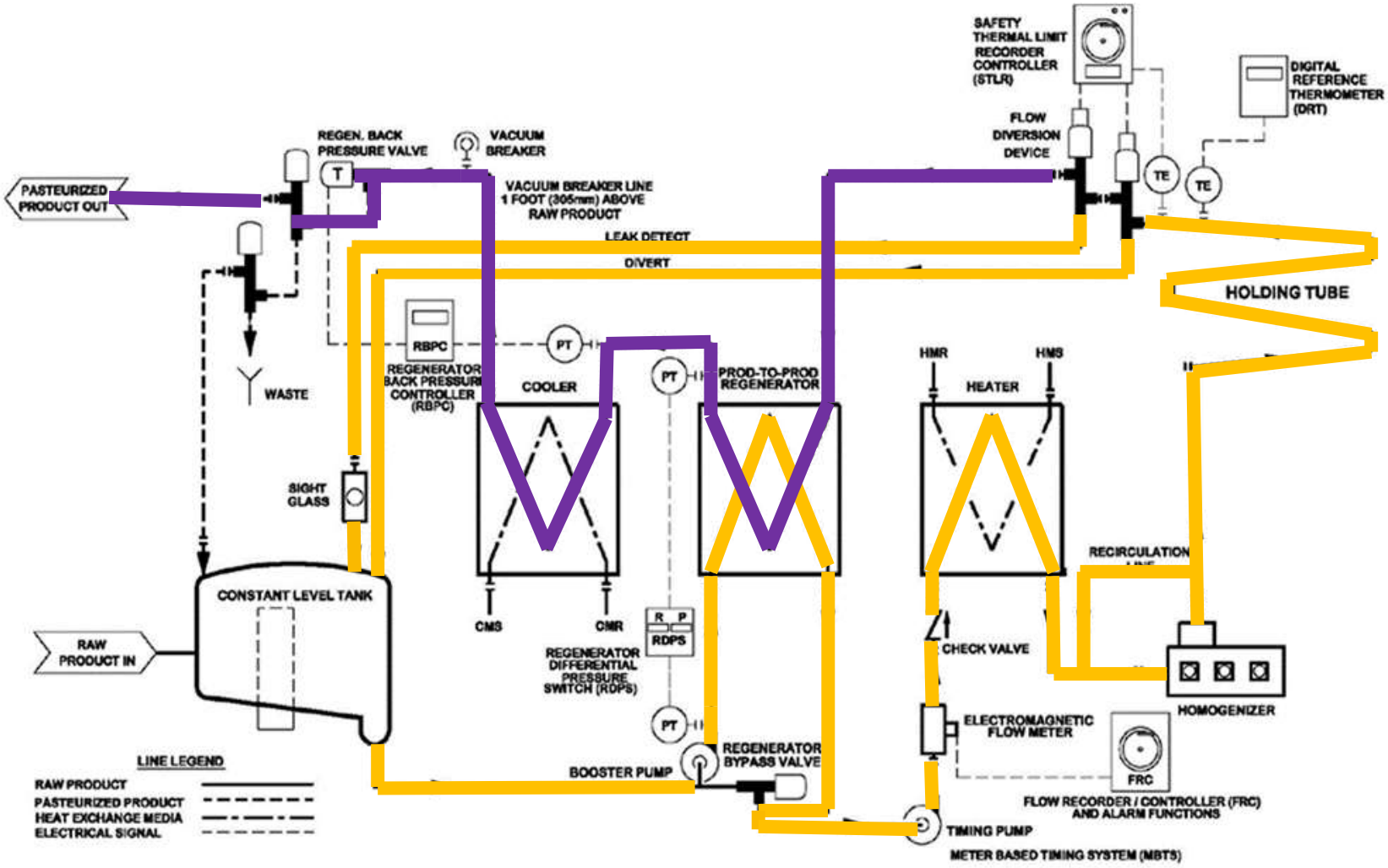
TIMING PUMP
METER BASED TIMING SYSTEM (MBTS)
LINE LEGEND
RAW PRODUCT
PASTEURIZED PRODUCT
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL

Vacuum Breaker

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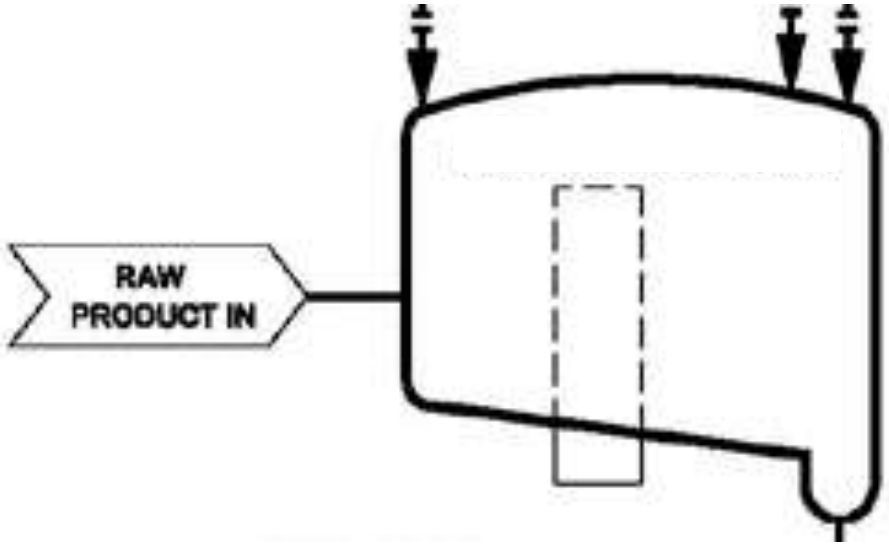
Who am I?



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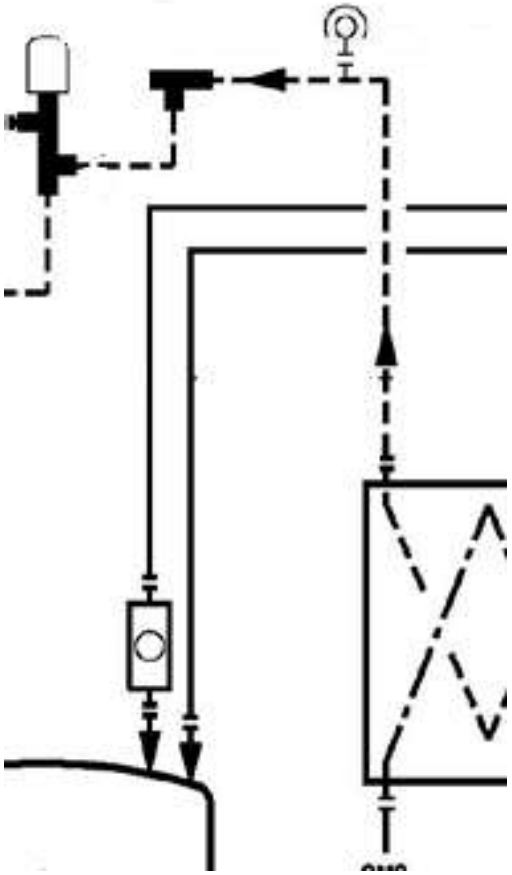

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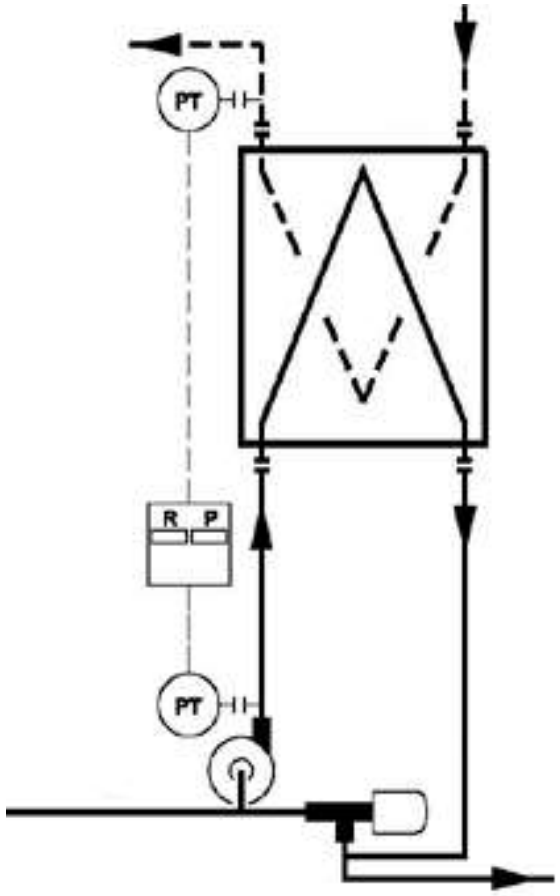

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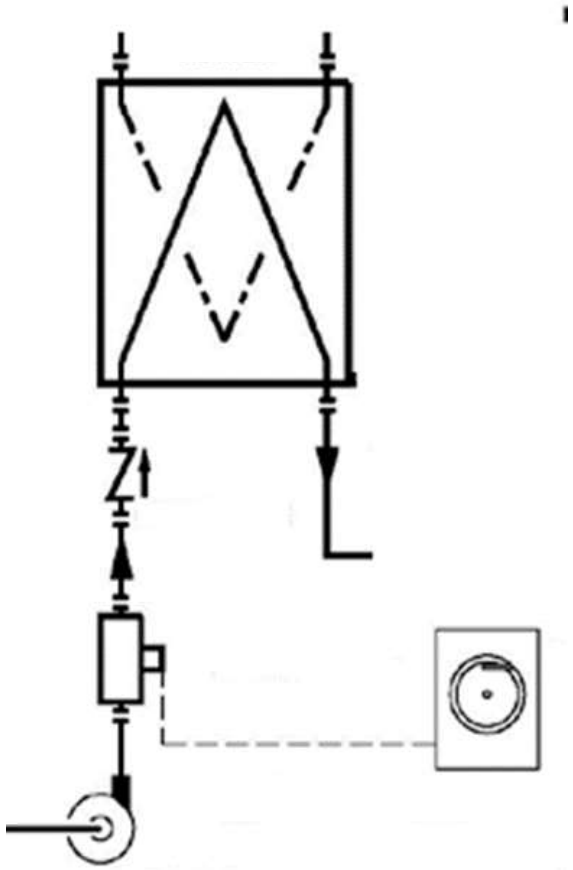

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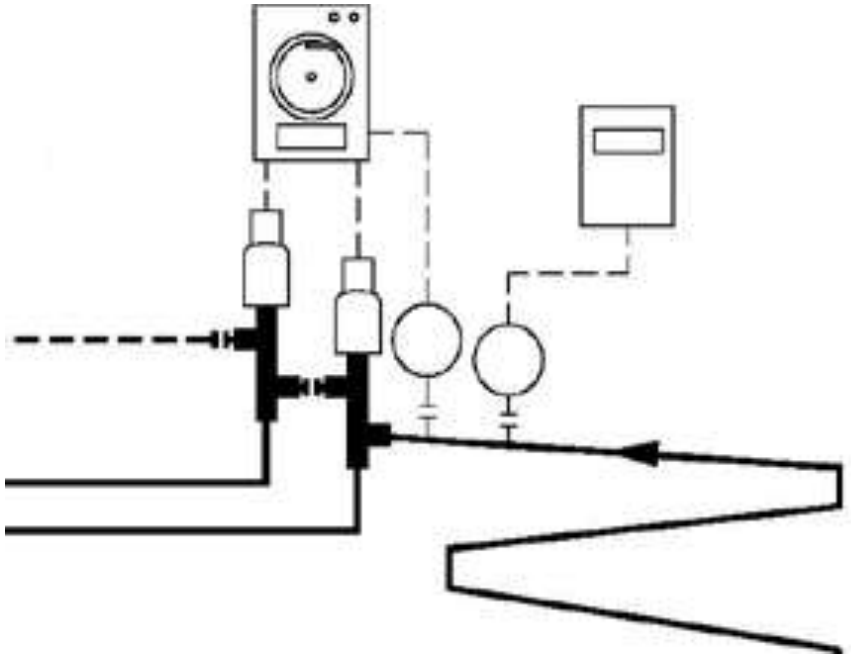

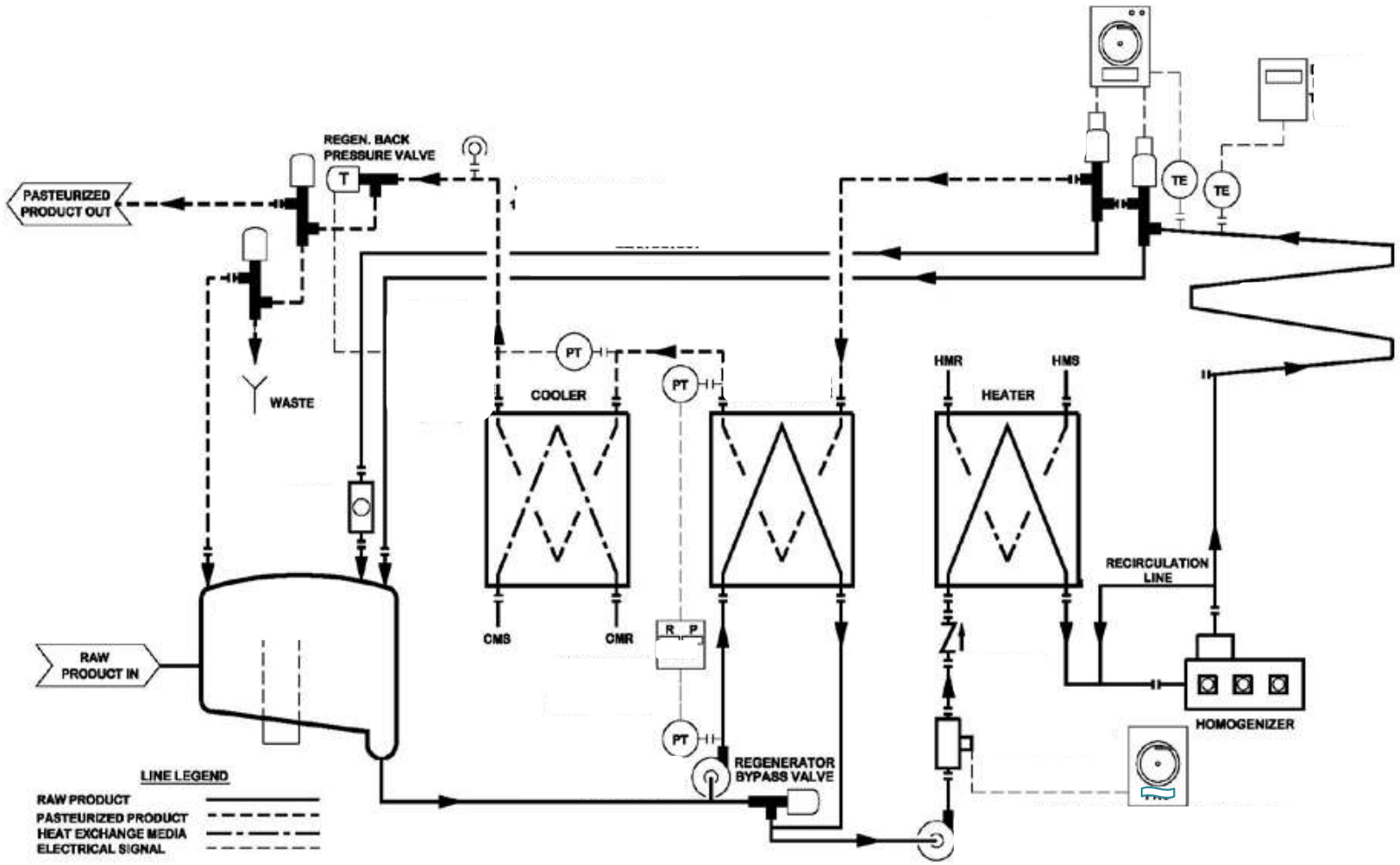
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HOMOGENIZER
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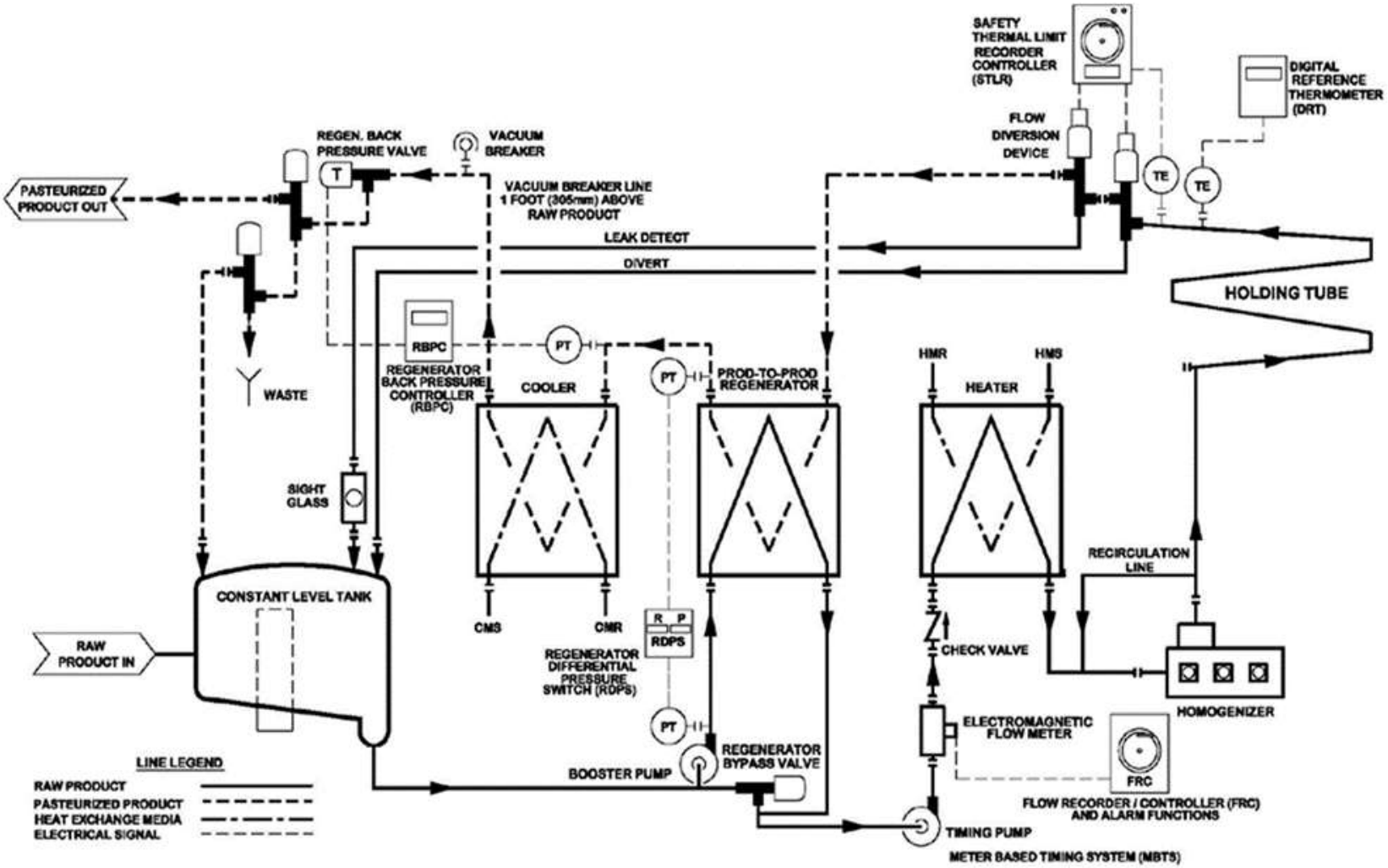
LINE LEGEND
RAW PRODUCT
PASTEURIZED PRODUCT
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL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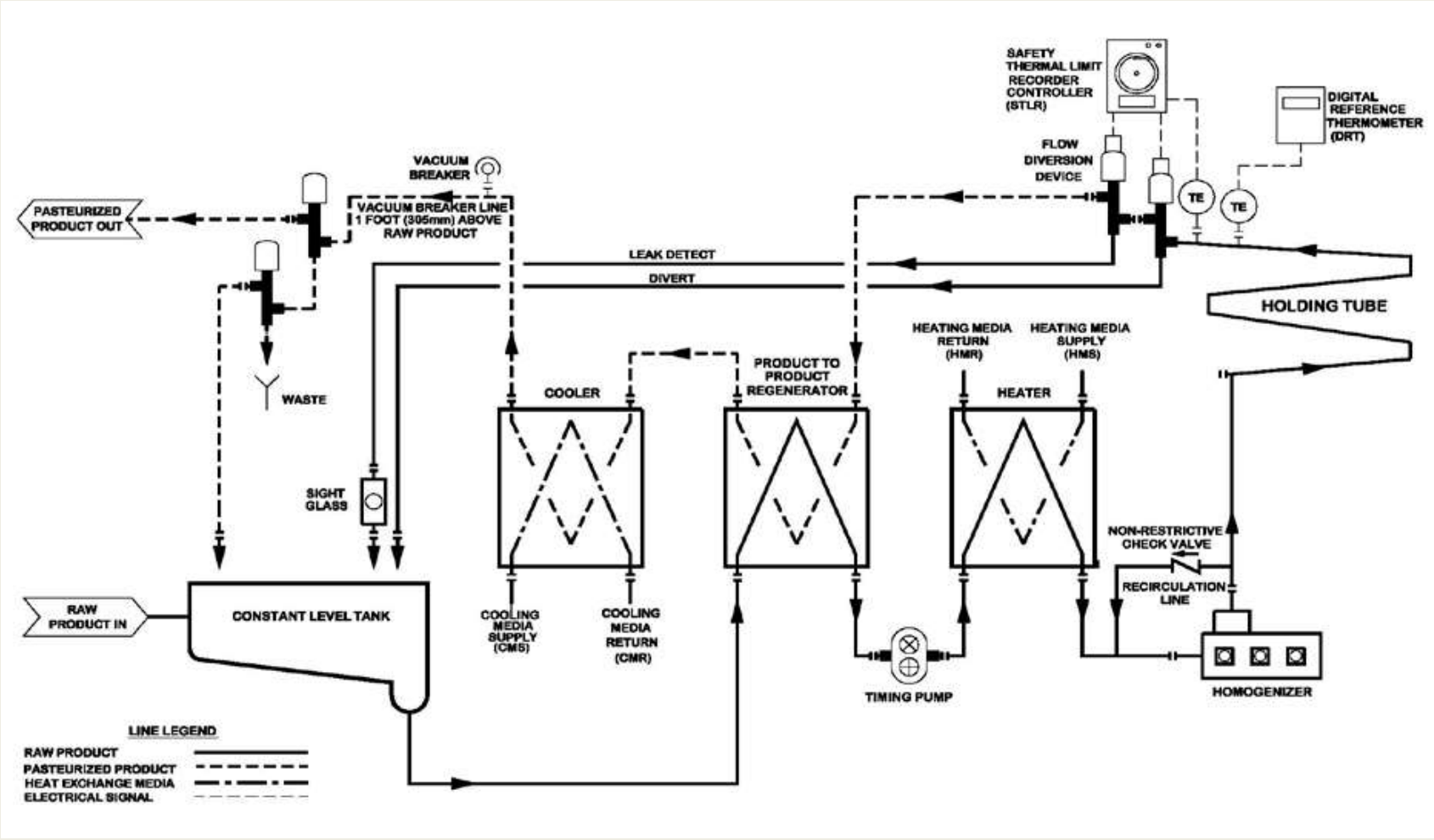
Any Questions?

FLOW, TIME, AND TEMP

Tyson Villarreal
Dairy Technical Specialist
WDATCP

Timing Pump or Timing System

- Product flow through the holding tube shall be controlled by means of a timing pump (non MBTS) or a meter based timing system (MBTS).
- Single or variable speed
- “Heart” of the HTST system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HEATING MEDIA SUPPLY (HMS)
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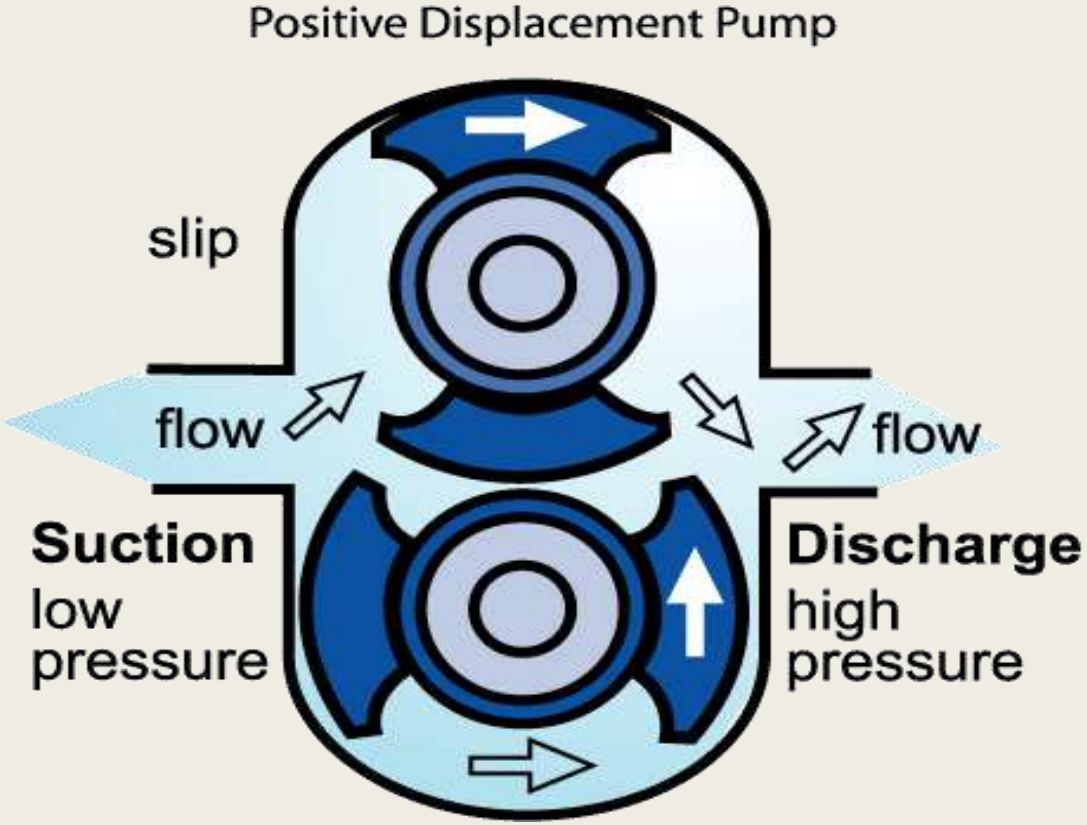
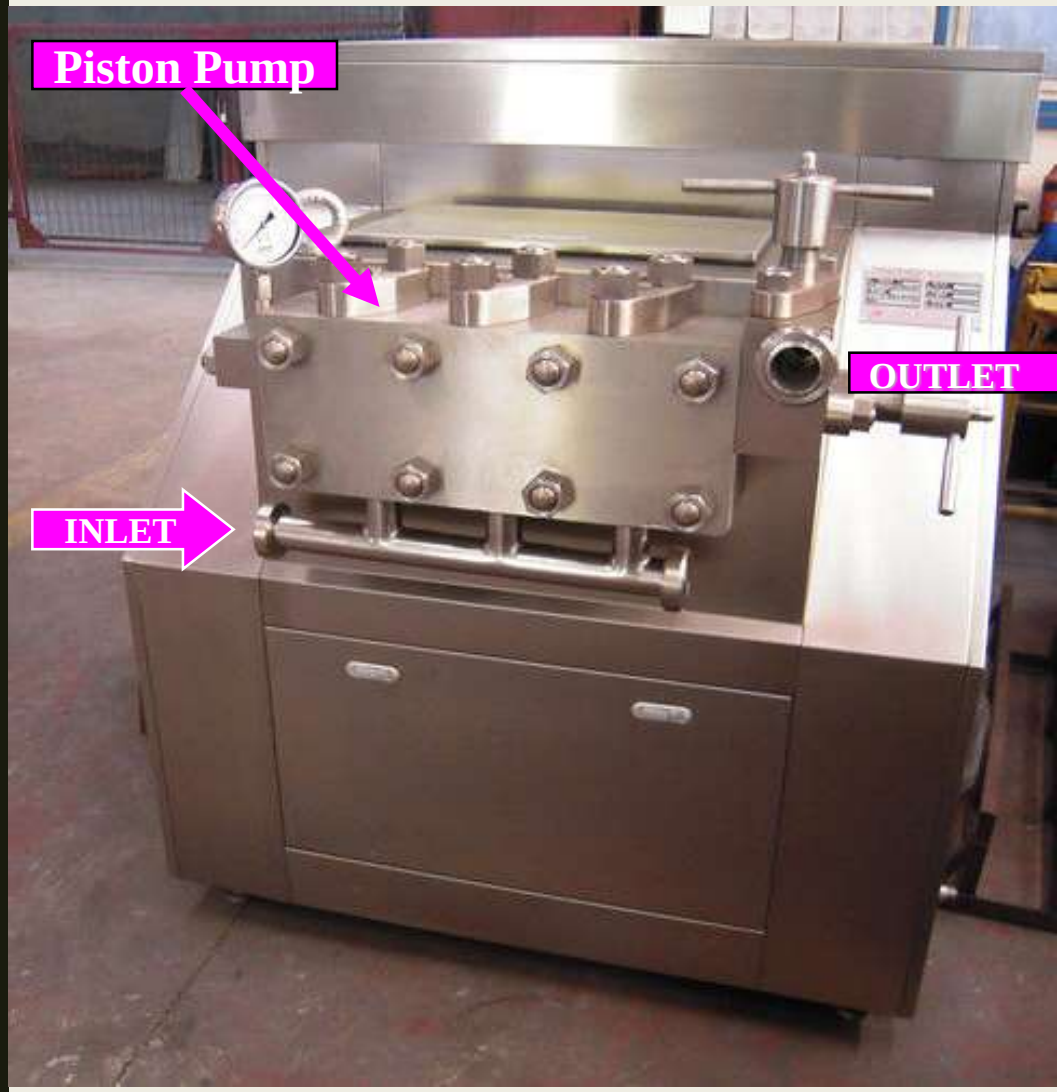
Non MBTS

- TP shall be a positive displacement pump
- PD pump, rotary (lobe) pump
- Single speed – gear or belt driven
- Variable speed – belt or VFD


Positive Displacement Pump
slip
flow
flow
Suction
low
pressure
Discharge
high
pressure

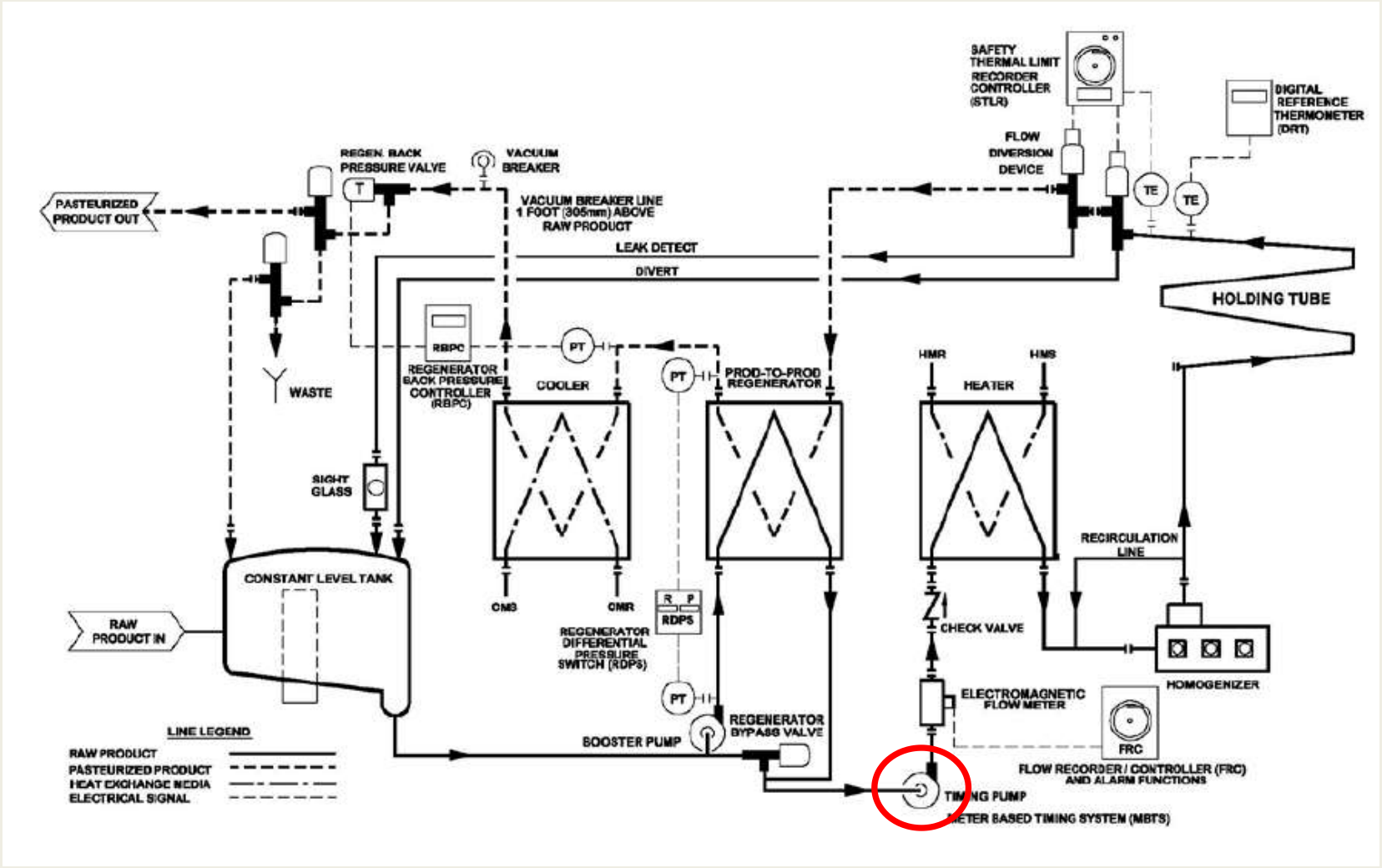
Homogenizer

Piston driven positive displacement pump



Homogenizer

- Can be a timing pump
- If not used as a timing pump it must not:
  - *Promote flow in the system*
  - *Apply negative pressure to FDD*
  - *Decrease the holding time*
- When a stuffing pump is used it shall only run when the Homogenizer is running in process mode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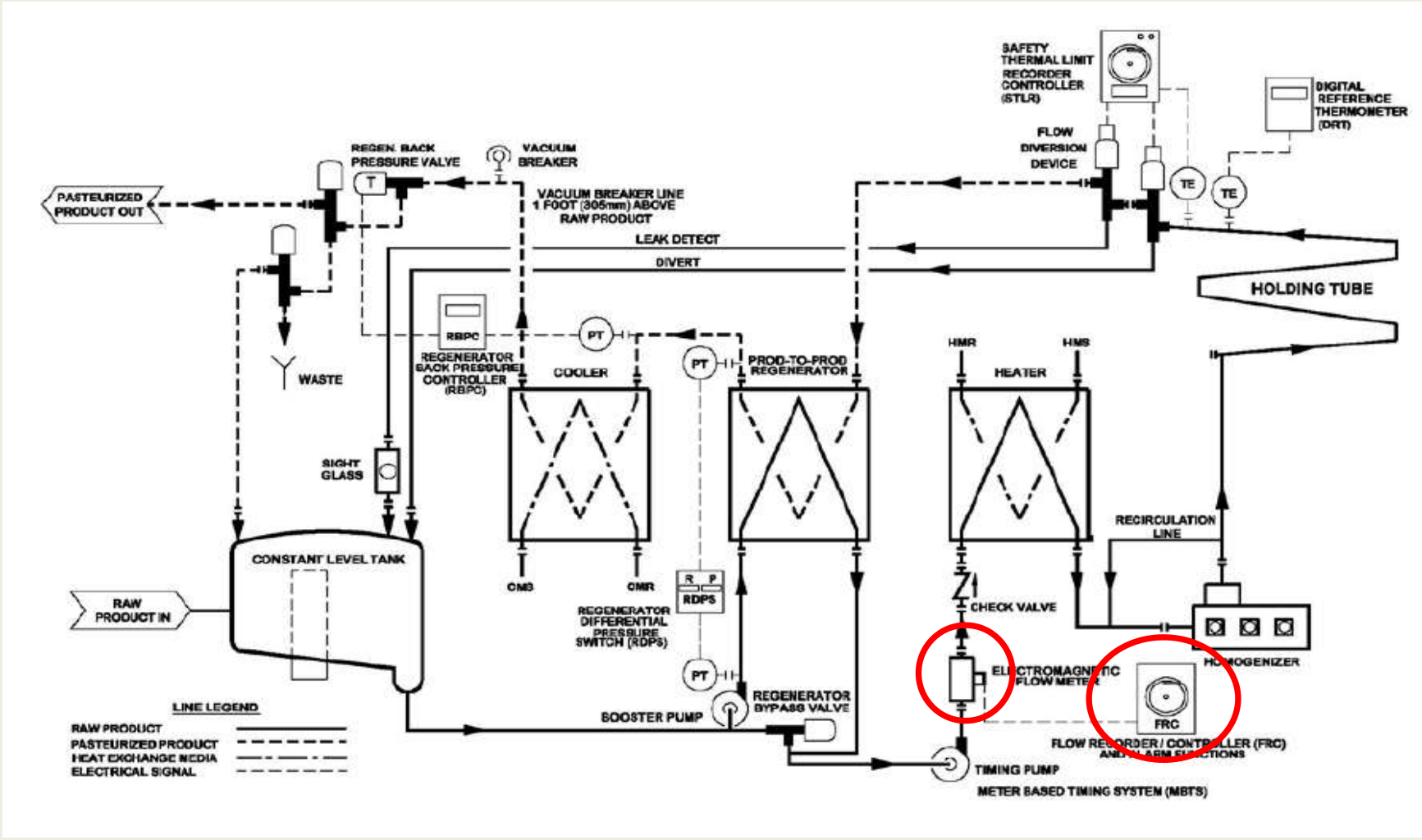
Timing System, Meter Based Timing System (MBTS)

- Single speed
  - *Centrifugal pump*
  - *Magnetic flow meter / Transmitter*
  - *Flow control valve*
  - *Flow recorder / Controller w/ alarms*
  - *Time Delay Relay*

Timing System, Meter based timing system (MBTS)

- Variable speed
  - *Centrifugal pump*
  - *Variable Frequency Drive*
  - *Magnetic flow meter / Transmitter*
  - *Sanitary check valve*
  - *Flow recorder / controller w/ alarms*
  - *Time Delay Relay*

Centrifugal Timing Pump with Magnetic Flow Meter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Flow Meter

ROSEMOUNT

Flow Meter / Transmitter

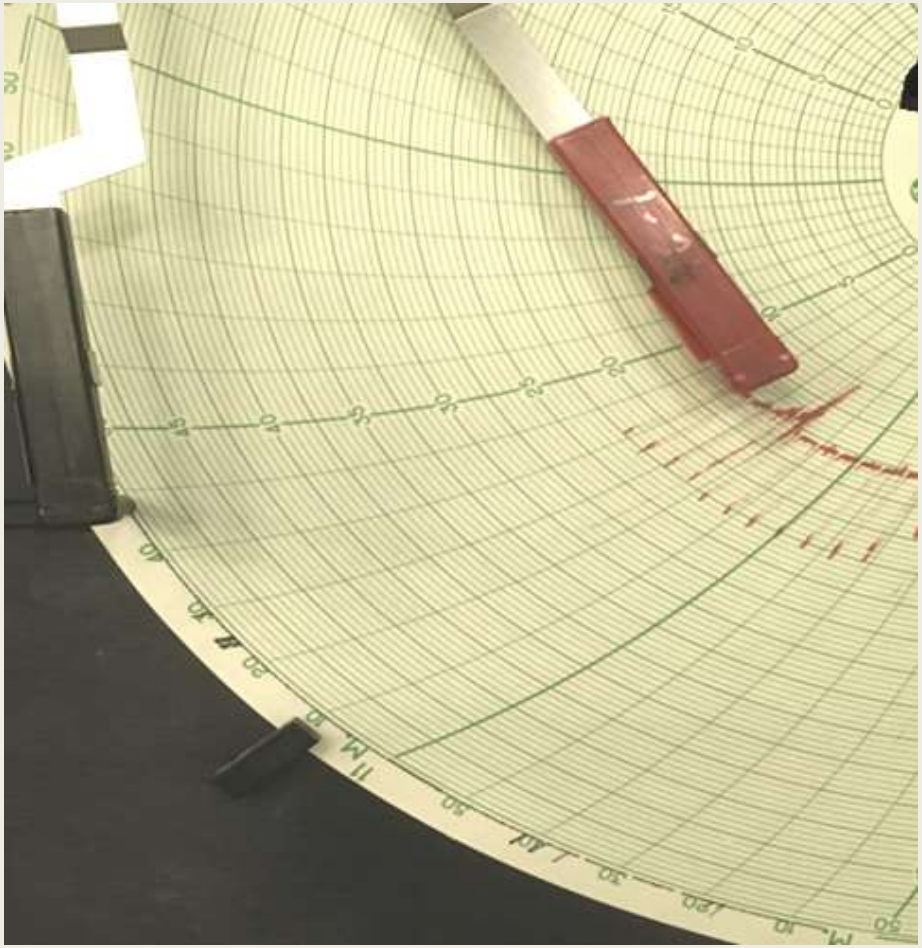
- Senses product flow rate
- Meter only measures flow, it does not control it.
- Transmitter sends a signal from the flow meter to the recorder/controller and the flow alarm.

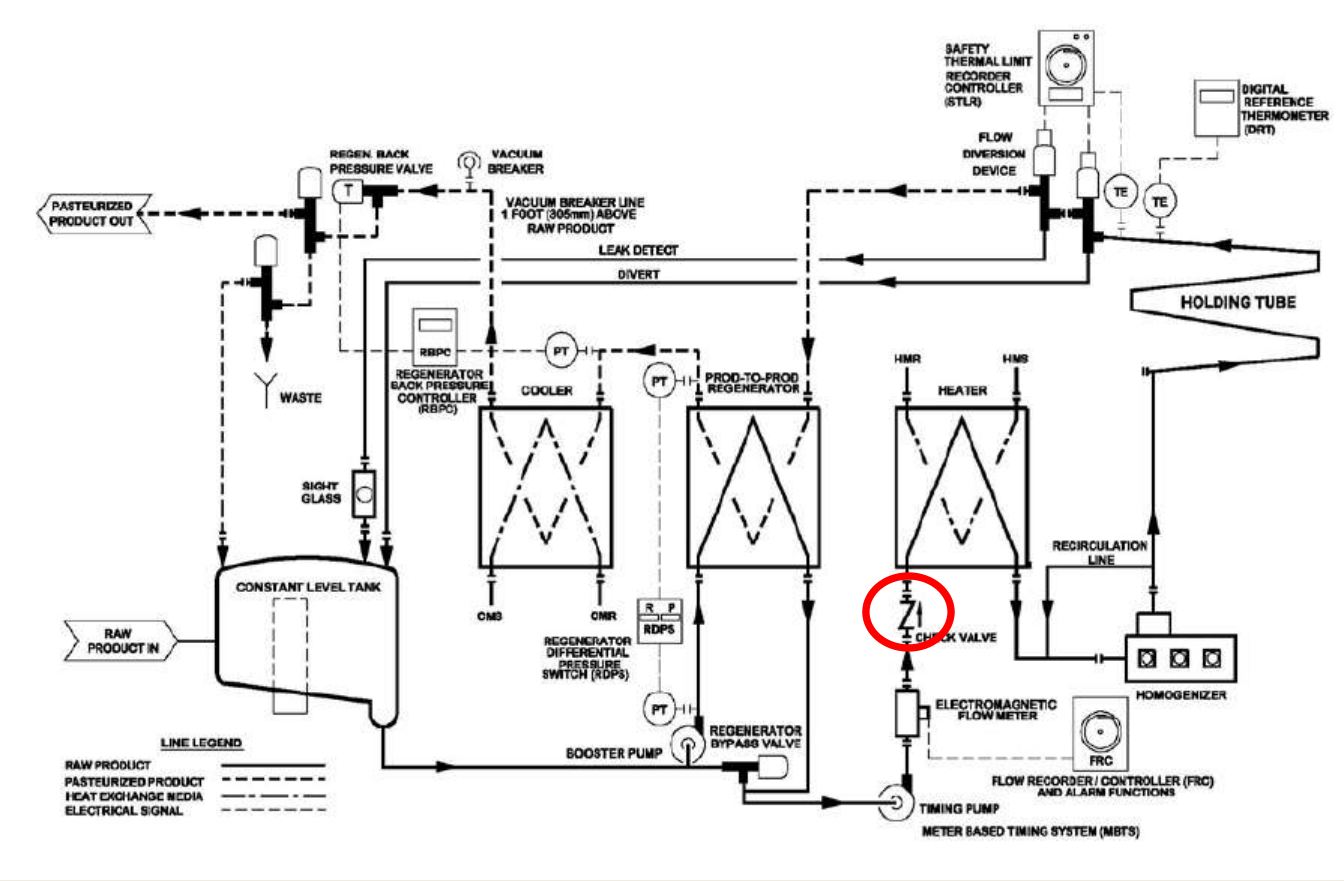
Safety Flow Limit Recorder (SFLR)

- Records flow
- Can have alarm set point

SFLR

- Flow alarm:
  - max rate
  - loss of signal
- Event pen records status of flow alarm

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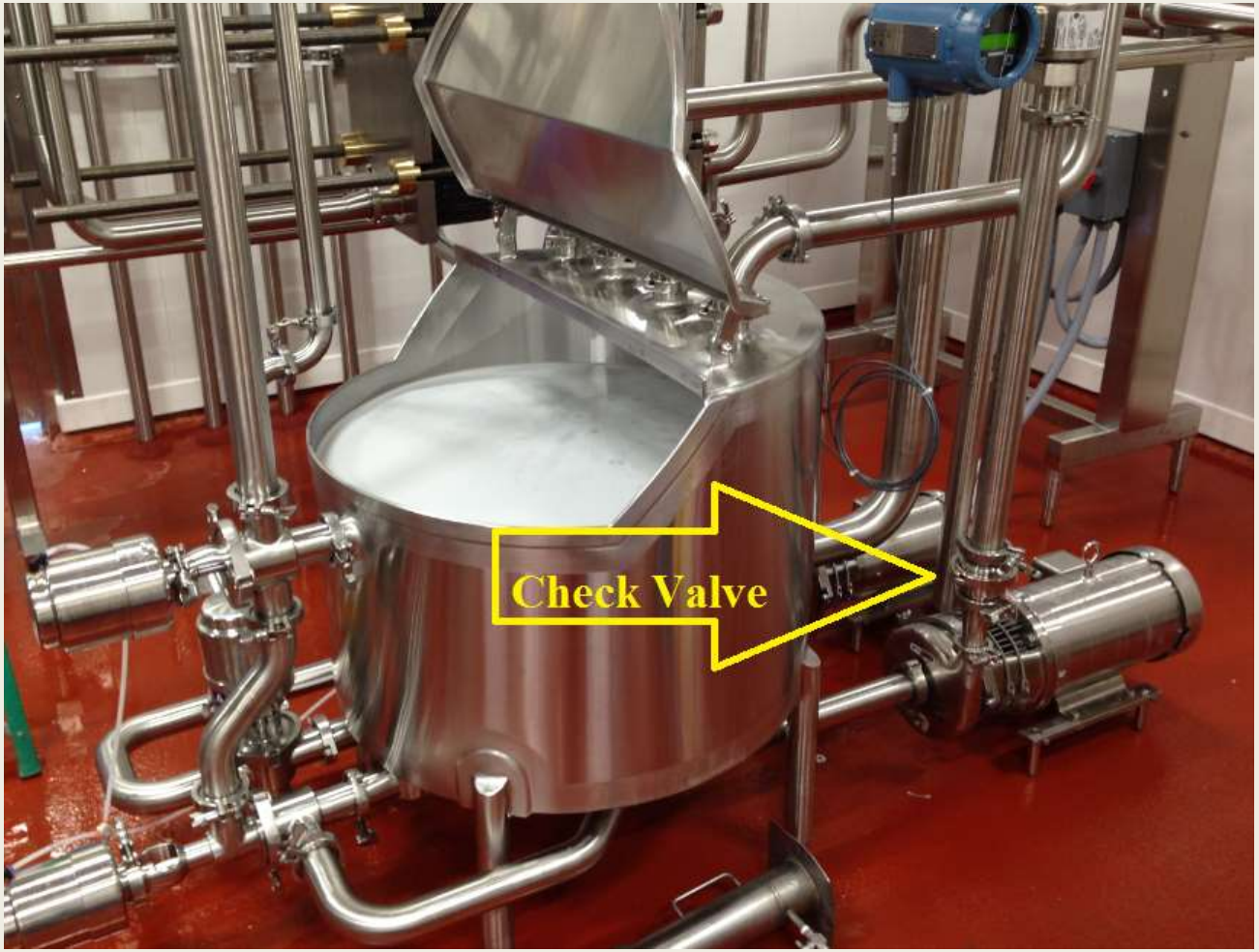
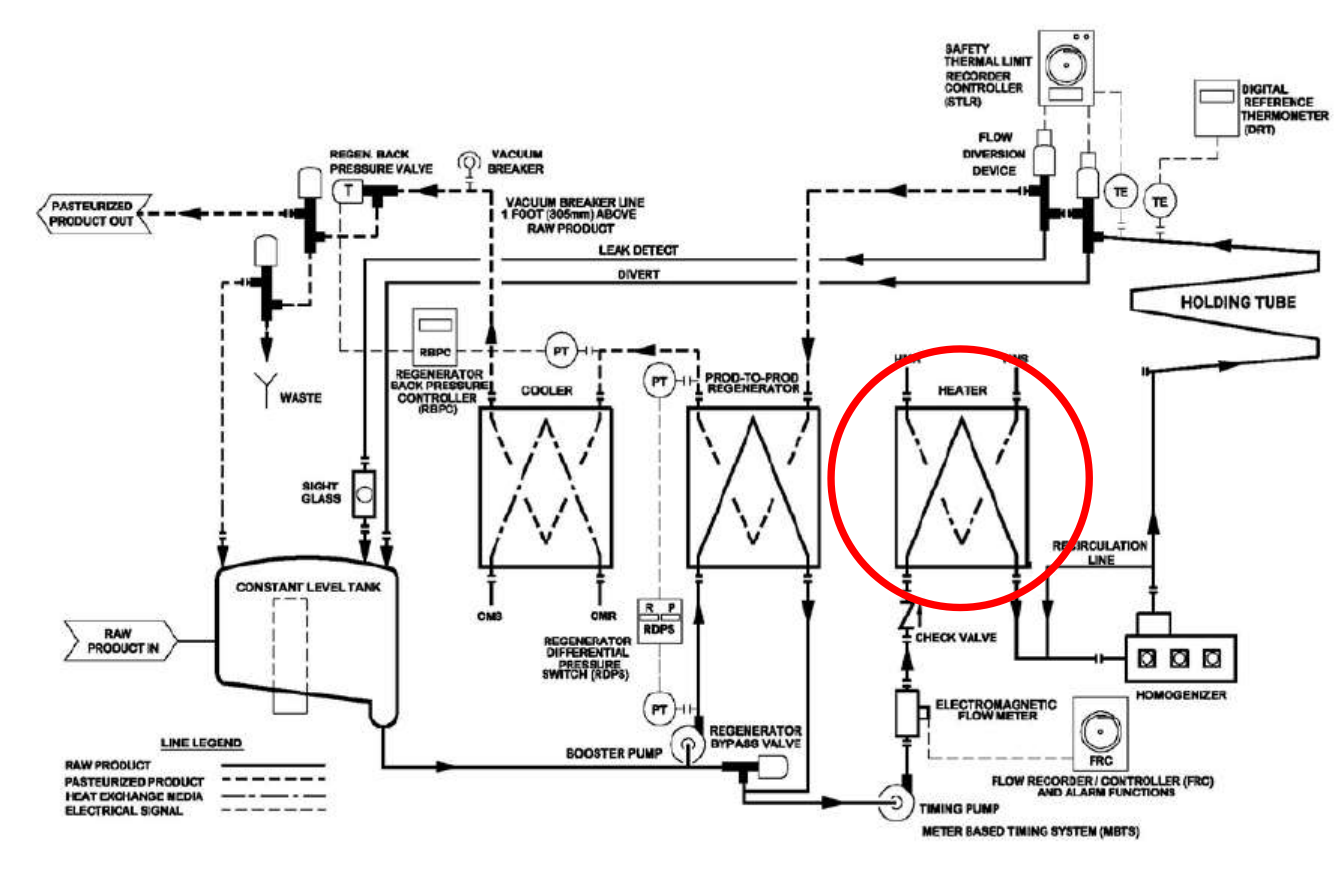

Check Valve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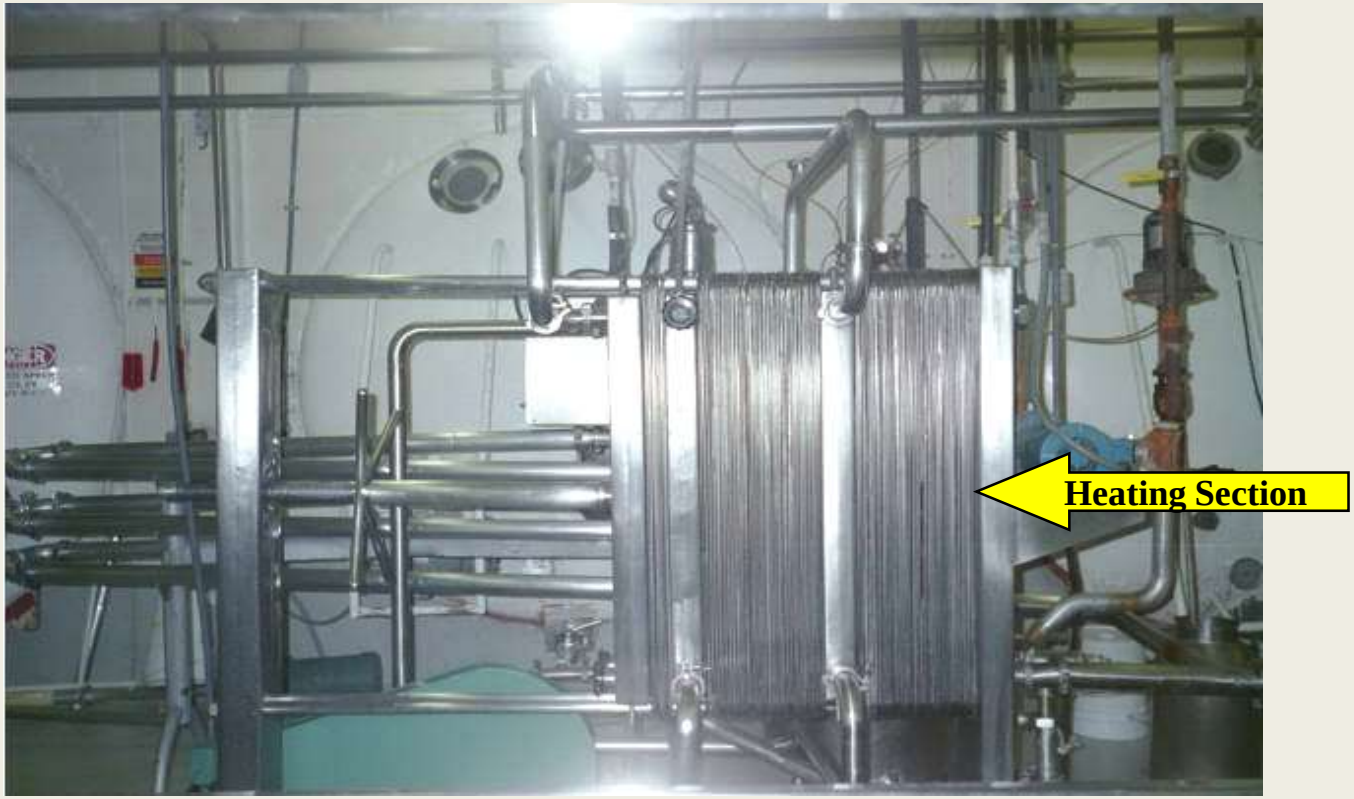
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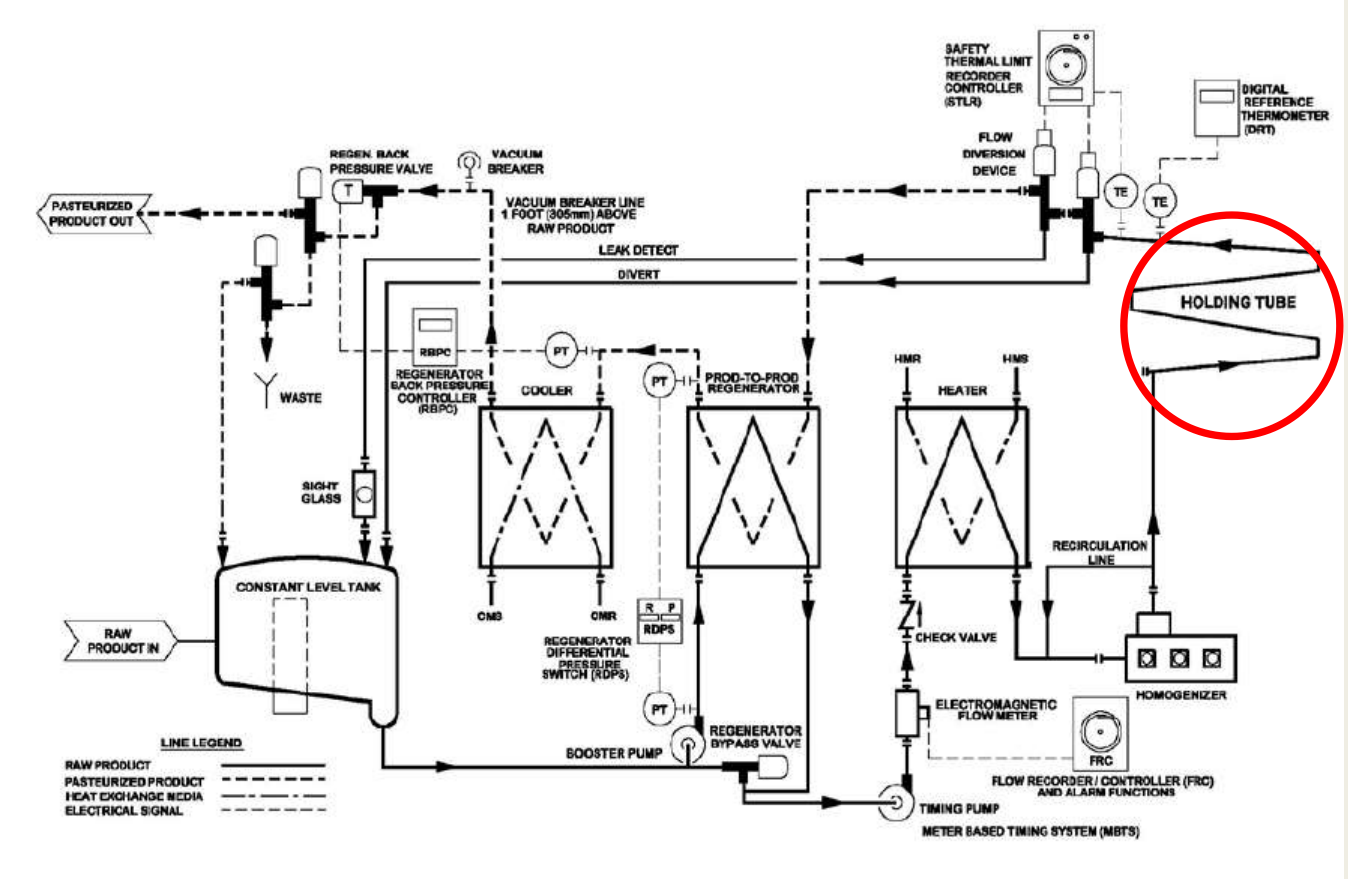
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Holding Tube

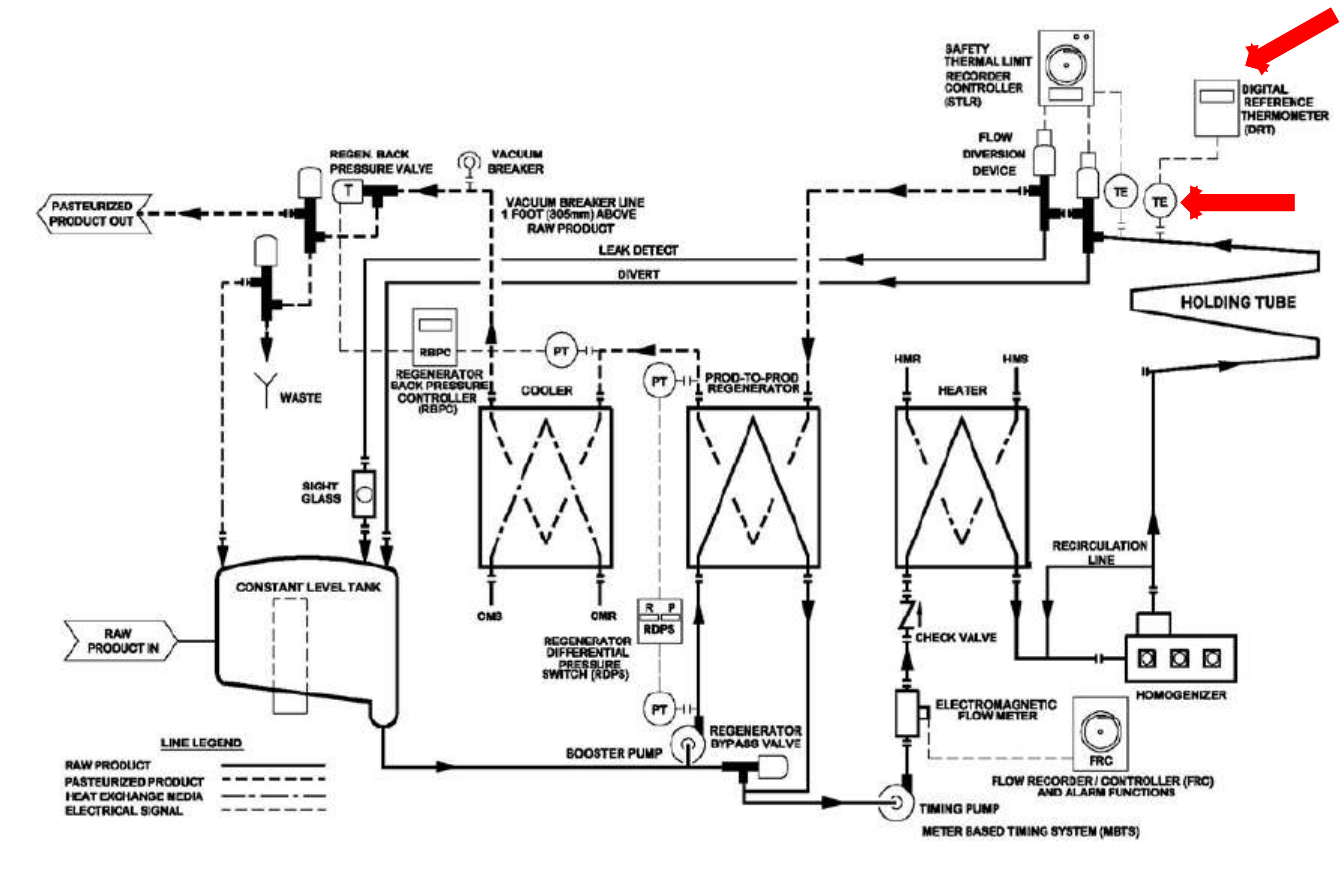
- Purpose, to hold heated product for the required length of time (hold time)
- Sanitary piping
- Permanently supported, ¼” per foot of upward slope
- Upward slope from salt injection port to FDD
- Length must be sufficient to hold product for the legal time at the flow rate determined by the timing pump.
- Non-alterable
- No more than 1°F variation in temperature

Hold Time

- Definition: minimum legal length of time product is to be held in the hold tube at a minimum legal temperature with constant flow to assure proper pasteurization.
- Determined by flow rate, length, and size of tube
- Hold time in inversely related to the flow rate.
  - *Increased flow = decreased hold time*
  - *Decreased flow = increased hold time*
- Balance tank drawdown

Table 2
Pasteurization Requirements for Selected Dairy Products

	Product Group	Batch Pasteurization	HTST Pasteurization
(a)	Milk, skim milk, or buttermilk	145°F. (63° C.) for 30 minutes	161°F. (72°C.) for 15 seconds
(b)	Cream, fluid dairy products, or blends of those products	150°F. (66° C.) for 30 minutes	166°F. (75°C.) for 15 seconds
(c)	Cream for butter	165°F. (74°C.) for 30 minutes	185°F. (85° C.) for 15 seconds
(d)	High total solids products (>18%)	150°F. (66° C.) for 30 minutes	166° F. (75° C.) for 15 seconds
(e)	Frozen–dessert mixes	155° F. (69°C.) for 30 minutes	175°F. (80°C.) for 25 seconds or 180° F. (83°C.) for 15 seconds
(f)	Egg nog	155° F. (69°C.) for 30 minutes	175° F. (80° C.) for 25 seconds or 180° F. (83°C.) for 15 seconds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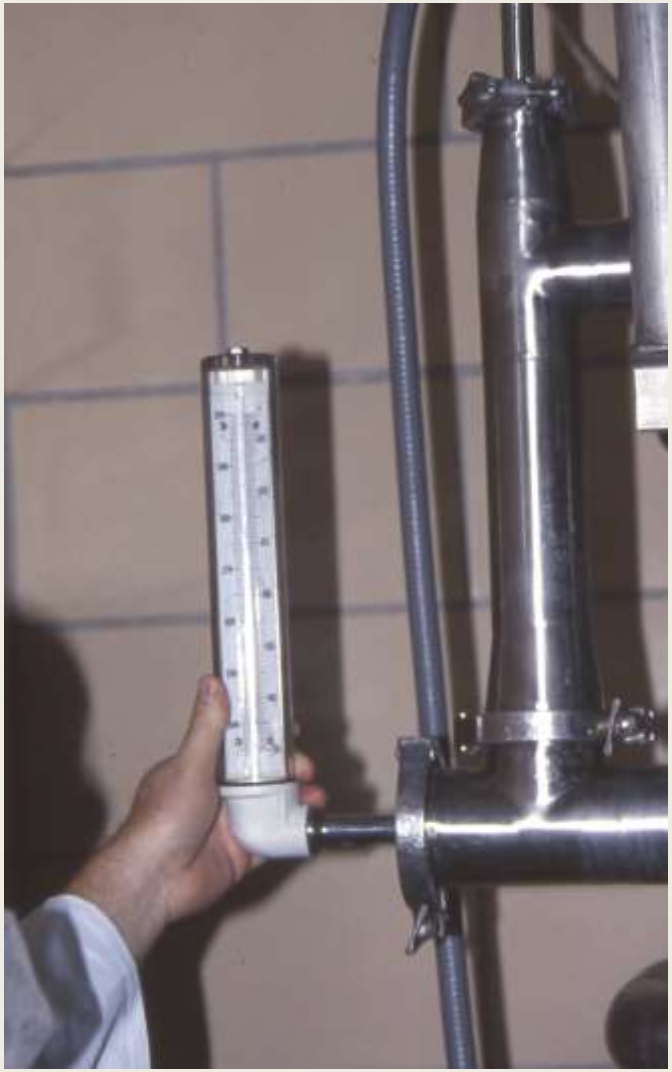
Indicating Thermometer

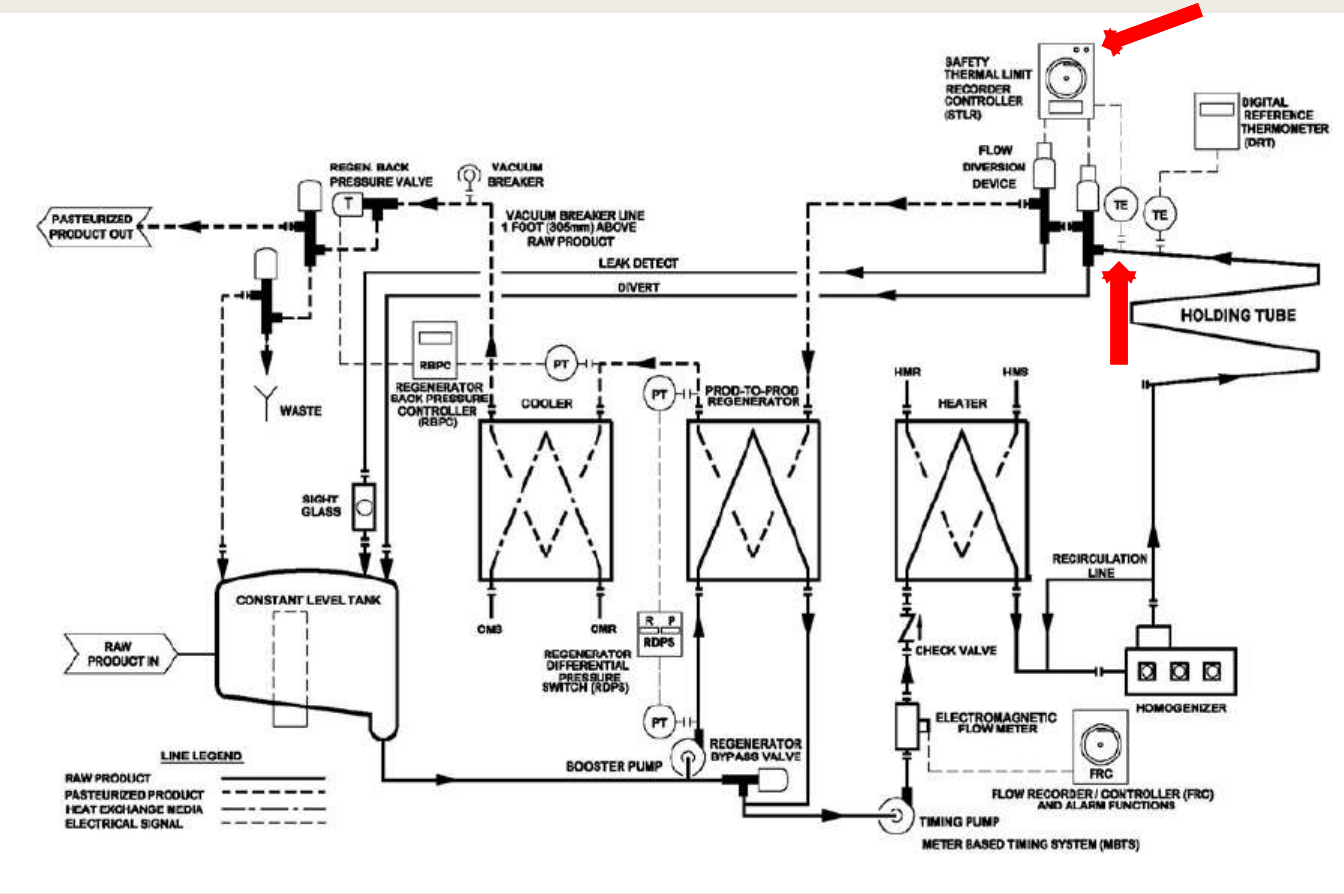
- Mercury in Glass (MIG)
- Digital (DRT)



Digital Reference Thermometer (DRT)

Indicating Thermometer

- AKA: reference thermometer
- Provides an accurate product temperature in the holding tube
- “Legal” thermometer
- Provides a means to check accuracy of recording thermometer (beginning of production run and chart change).
- Located as close as possible to the STLR-RTD


SAFETY THERMAL LIMIT RECORDER CONTROLLER (STLR)
DIGITAL REFERENCE THERMOMETER (DRT)
FLOW DIVERSION DEVICE
TE
TE
REGEN. BACK PRESSURE VALVE
VACUUM BREAKER
PASTEURIZED PRODUCT OUT
VACUUM BREAKER LINE 1 FOOT (305mm) ABOVE RAW PRODUCT
LEAK DETECT
DIVERT
HOLDING TUBE
RBPC
REGENERATOR BACK PRESSURE CONTROLLER (RBPC)
PT
PT
WASTE
COOLER
PROD-TO-PROD REGENERATOR
HMR
HMS
HEATER
SIGHT GLASS
RECIRCULATION LINE
CONSTANT LEVEL TANK
CMS
CMR
R P
RDPS
REGENERATOR DIFFERENTIAL PRESSURE SWITCH (RDPS)
CHECK VALVE
RAW PRODUCT IN
HOMOGENIZER
PT
ELECTROMAGNETIC FLOW METER
REGENERATOR BYPASS VALVE
BOOSTER PUMP
FRC
FLOW RECORDER / CONTROLLER (FRC) AND ALARM FUNCTIONS
TIMING PUMP
METER BASED TIMING SYSTEM (MBTS)
LINE LEGEND
RAW PRODUCT
PASTEURIZED PRODUCT
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL

Safety Thermal Limit Recorder (STLR)

Chart Scale

- 1° Temperature Divisions
- 12 Hour Chart – not more than 15 Minute Divisions

STLR-RTD

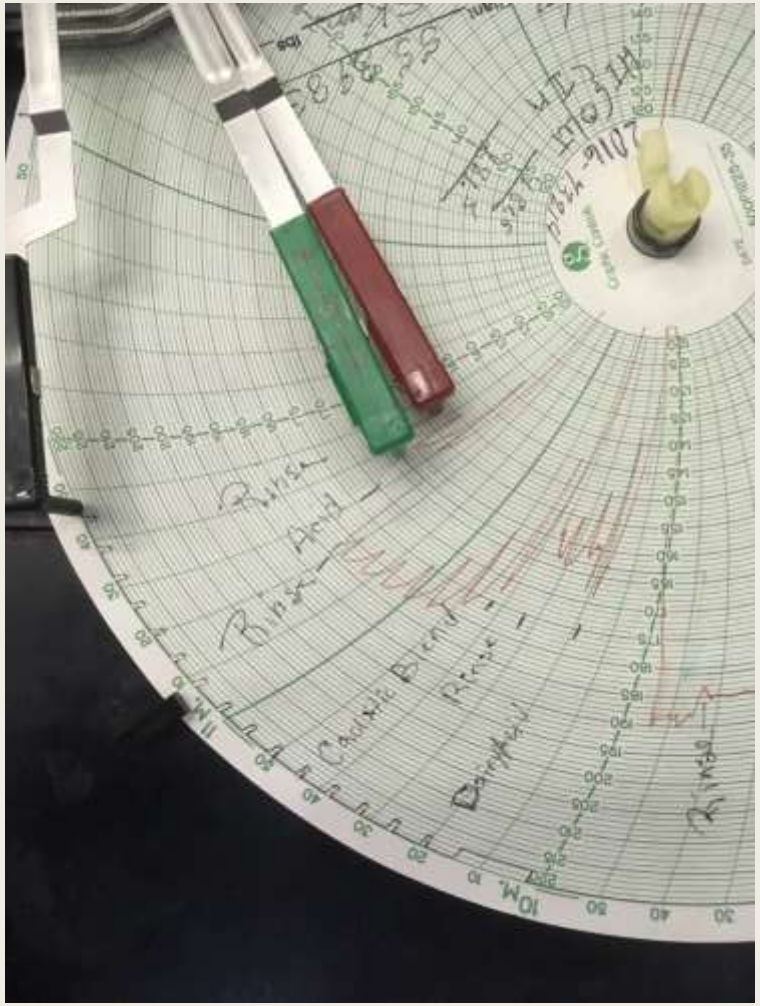
- Located within 18” upstream of FDD
- Sends signal to recorder/controller

STLR Functions

- Records temperature of product
- Creates legal document (correct time placement)
- Required in all systems

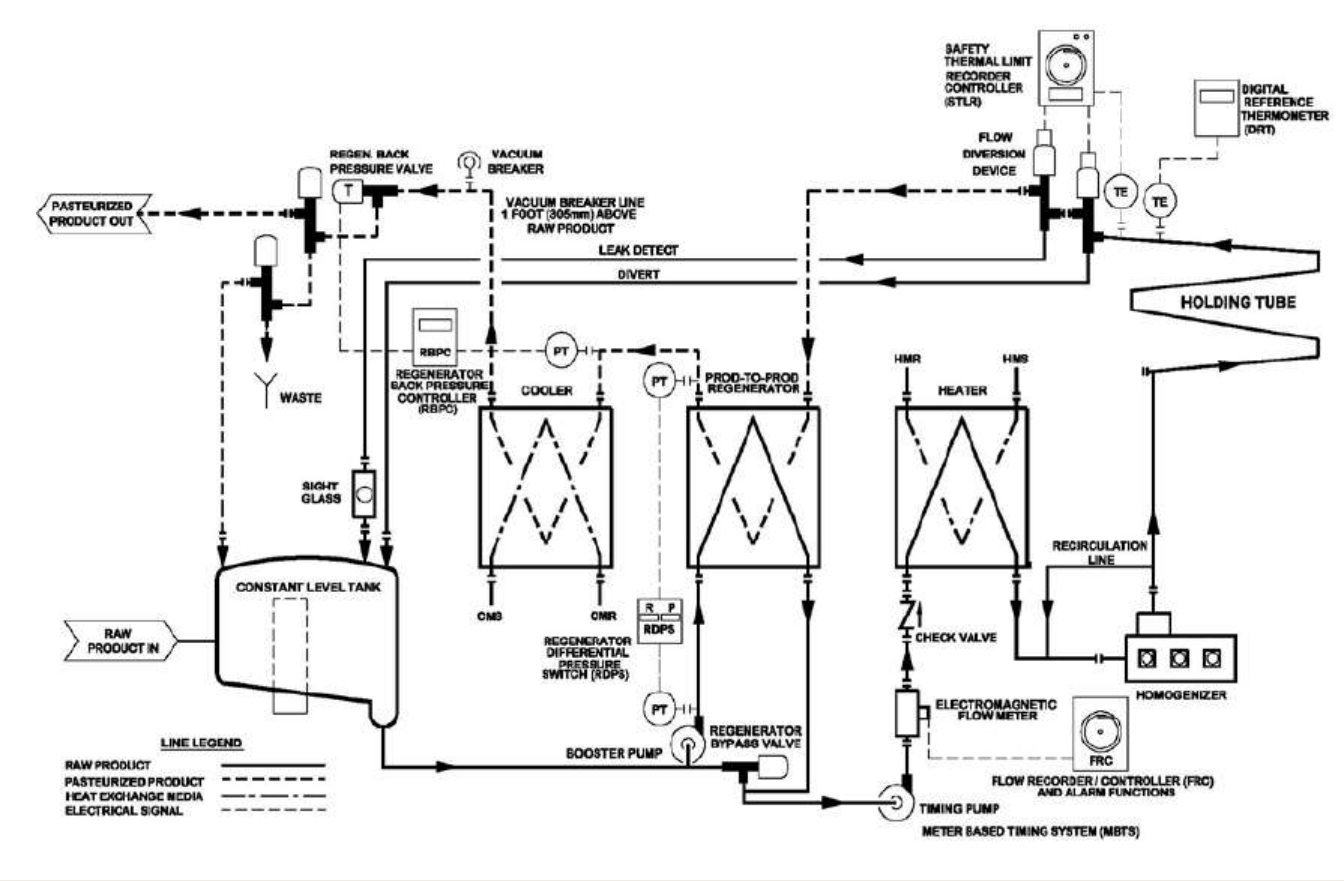
STLR Functions

- Controls and records position of FDD based on temp
- Event pen: records position of FDD
- Pens: move freely and record
- No record = no pasteurization



STLR Chart

- Plant name
- Date
- ID
- Operator initial
- Cut in and Cut out
- Name and quantity of product
- Unusual circumstance
- IT check beginning and chart change
- Shall be ≤ to indicator


SAFETY THERMAL LIMIT RECORDER CONTROLLER (STLR)
DIGITAL REFERENCE THERMOMETER (DRT)
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FLOW RECORDER / CONTROLLER (FRC) AND ALARM FUNCTIONS
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BOOSTER PUMP
TIMING PUMP
METER BASED TIMING SYSTEM (MBTS)
LINE LEGEND
RAW PRODUCT
PASTEURIZED PRODUCT
HEAT EXCHANGE MEDIA
ELECTRICAL SIGNAL

Questions?

Pressure

Dale Osuldsen
Dairy Technical Specialist
Northcentral Wisconsin

Pressure

Maintaining safe pressure relationships within the HTST system that incorporates a Raw Product to Pasteurized Product heat transfer section is critical for proper pasteurization.

The Focus is on the Product to Product Regeneration

A Critical failure happens when Raw Milk passes into Pasteurized Milk.

The installation and operating parameters are found in the *3-A® Accepted Practices for the Sanitary Construction, Installation, Testing and Operation of High-Temperature Short-Time and Higher-Heat Shorter-Time Pasteurizer Systems, Number 603-07*

Copyright© 3-A Sanitary Standards, Inc., McLean, VA

3-A® Accepted Practices for the Sanitary Construction, Installation, Testing and Operation of High-Temperature Short-Time and Higher-Heat Shorter-Time Pasteurizer Systems, Number 603-07

Standard Developer
3-A Sanitary Standards, Inc. (3-A SSI)
In Collaboration With
United States Public Health Service (USPHS)/
United States Food and Drug Administration (USFDA)
United States Department of Agriculture – Dairy Programs (USDA)
European Hygienic Engineering & Design Group (EHEDG)

Effective: November 21, 2005

Pressure

An important distinction to remember is, there are components that effect pressure and there are components that control pressure.

Components that effect Pressure

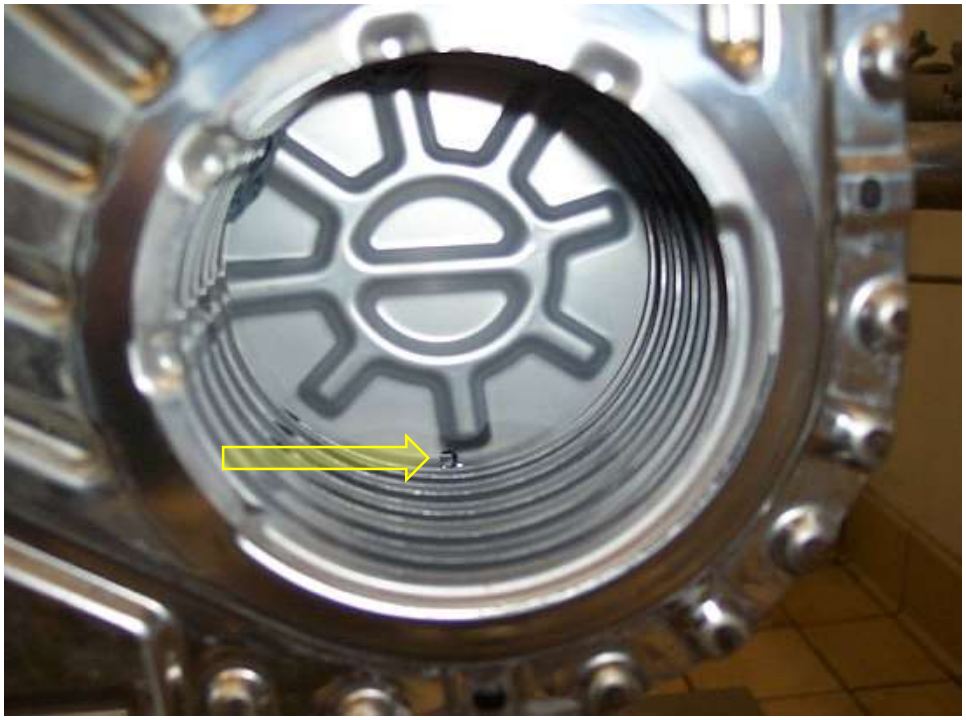
- Constant Level tank
- Booster Pump
- Heat Exchanger = Regenerator
- Holding Tube
- Vacuum Breaker
- Vacuum Chamber/ Separator
- Stuffer Pumps
- Back Pressure Valve

Components that Control Pressure in an Active System

- Booster Pump
- Check Valve or PD Pump
- Vacuum Breaker
- Differential Pressure Switch
  - Raw Pressure Transducer
  - Pasteurized Pressure Transducer

Components that Control Pressure within the system when idle

- Check Valve or PD Pump
- Vacuum Breaker
- Drilled Plate



Critical: Raw Milk to Pasteurized Milk Regeneration

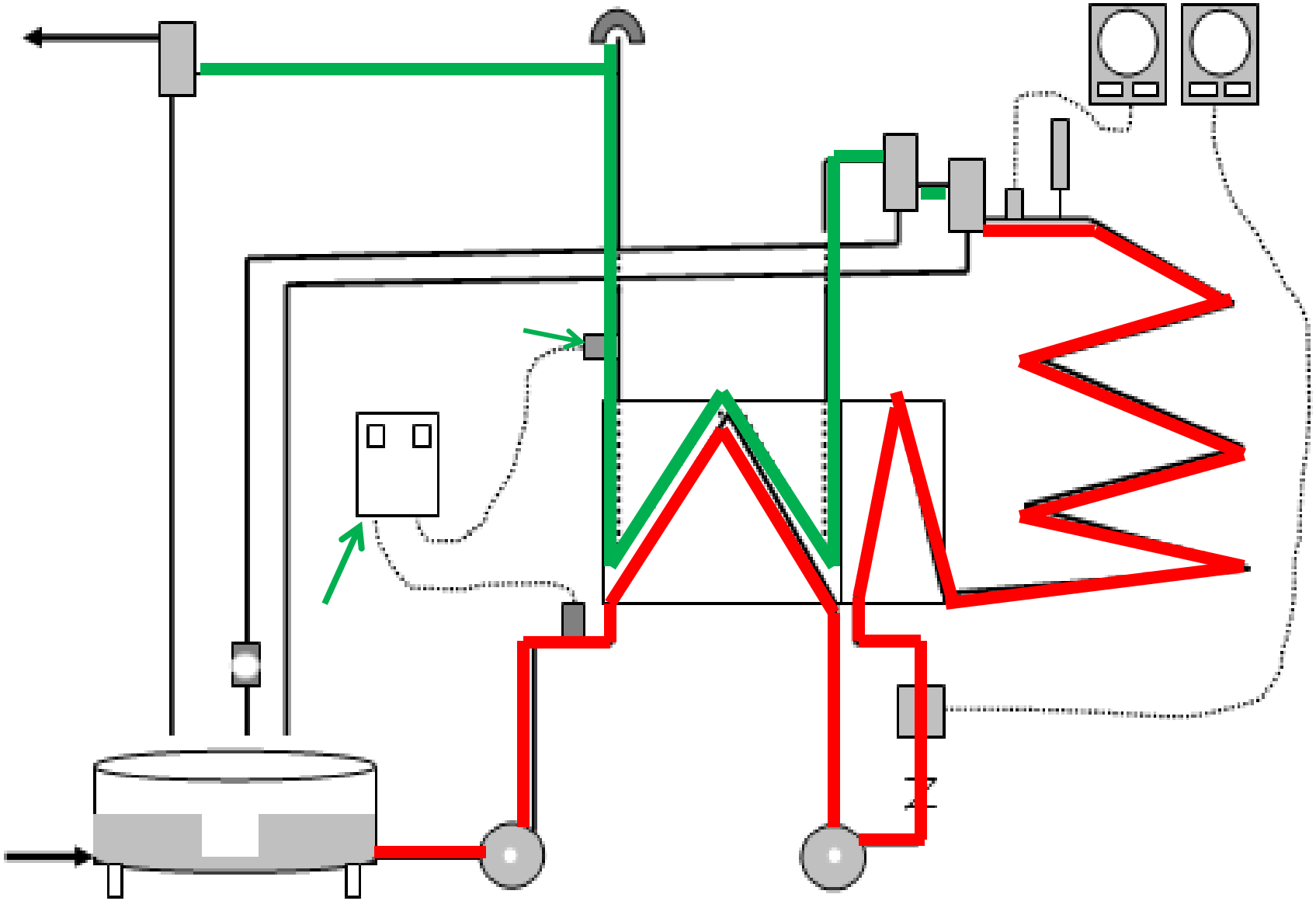
- Condition of plates and gaskets
  - Visible defects & signs of wear:
    - Scratches
    - Cracks
    - Rub marks
  - Invisible defects
    - Pin Holes
    - Stress fractures
- Tests use to find plate defects
  - Dies/stains = visual test
  - Gas/air = sniffers & visual
  - Ultrasound = instrumentation

In Summary

The Pasteurized Product Side Pressure of the Regenerator Must Always be at least 2 PSI higher Than the Raw Product Side Pressure within the Regenerator.

Questions?

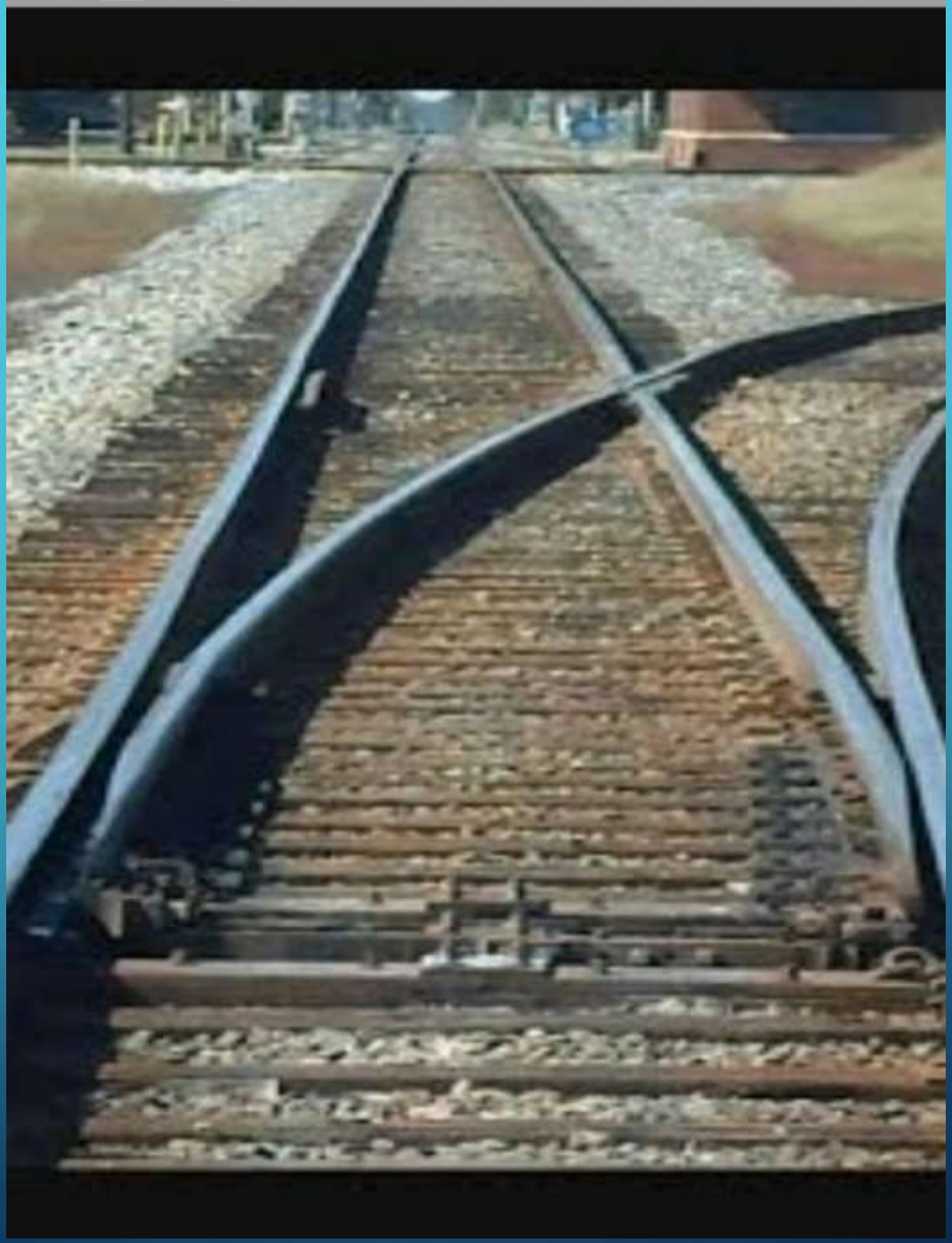
FLOW DIVERSION DEVICES (FDD)



METER BASED HTST PASTEURIZER

Purpose of FDD

- To provide an automatic fail-safe method of control to prevent sub-legal (raw) milk from entering the pasteurized side of the HTST system



FLOW DIVERSION DEVICES-ALL

- Controls Direction of Flow
  - Divert or Forward Flow
- Position is Controlled by:
  - STLR (legal temperature)
  - SFLR (legal flow in meter based systems)
- Two Valve Seats
- Visible Leak Detect System Between Valve Seats
- Failsafe
  - Spring to Close
  - Microswitch

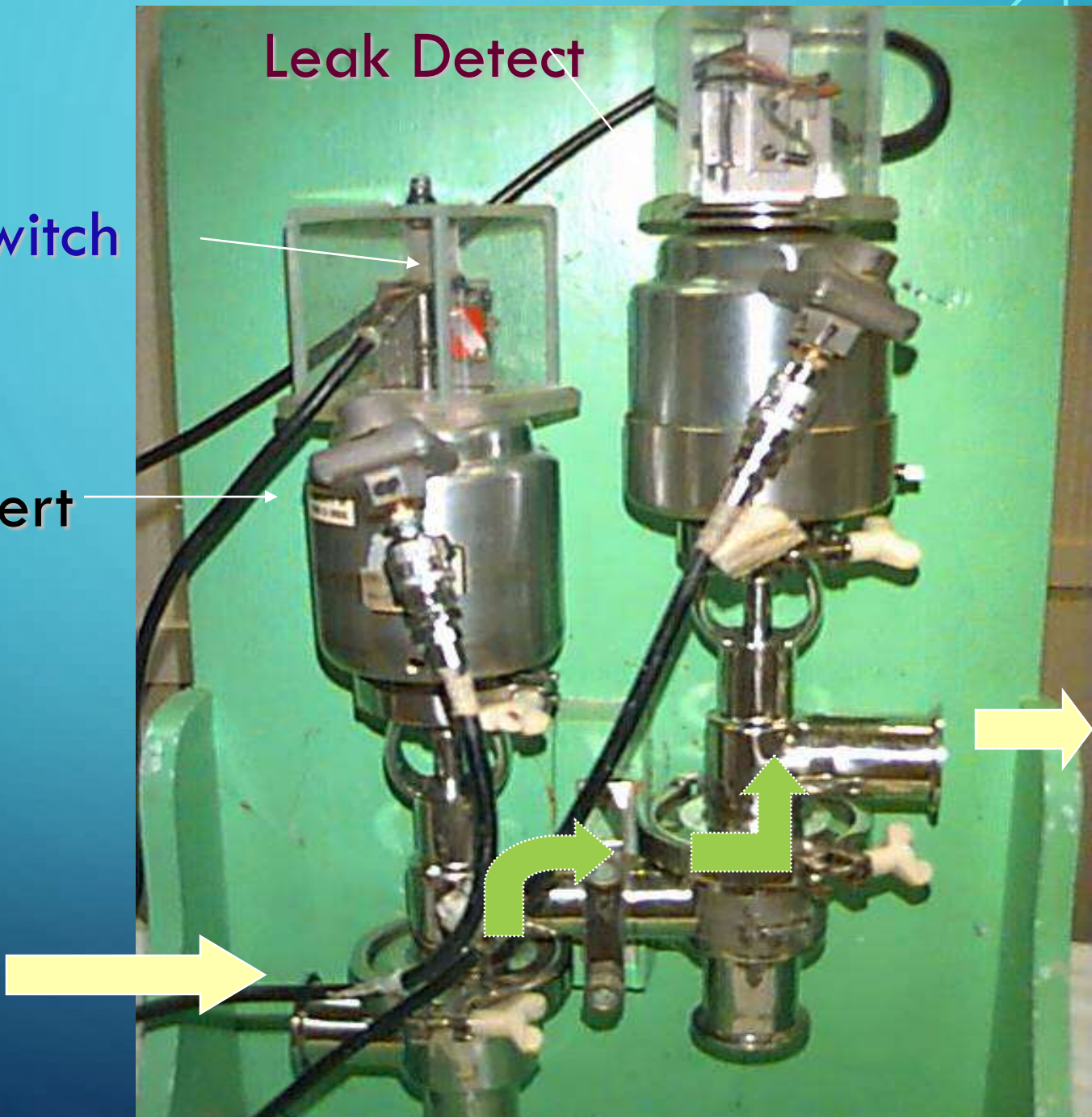
FDD- FAILSAFE FEATURES

- Spring to Close
  - FDD will Divert upon loss of air pressure or electrical power
- Micro-switch will Not allow the Timing Pump to run if the valve is,
  - Not Assembled Properly at sub legal temperatures
  - Not Fully Diverted

DUAL STEM FDD

- Two 3-way Valves
  - Divert Valve
  - Leak Detect Valve
    - Sight Glass located in line to balance tank. Purpose is to be able to see FDV seat failure.
- This Type of Valve Is Designed for CIP Cleaning

The Tri Clover Dual Stem Flow Diversion Device.

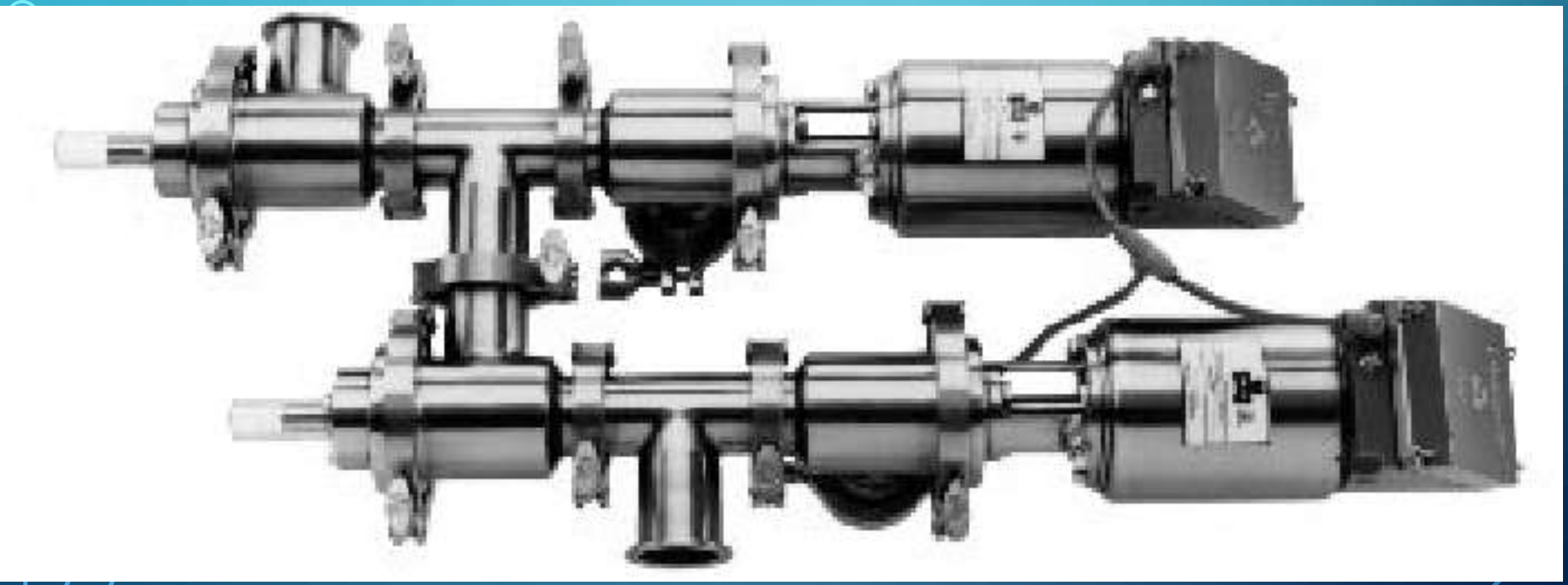


DUAL STEM FDD-MODES

- Product
  - Normal Processing Mode, valves are controlled by STLR & SFLR
- Inspect
  - No Flow Through System Allowed
- CIP
  - If Timing Pump Runs in CIP- A Ten Minute Delay Is Required

CONTROL BOX
PRODUCT
INSPECT
CLEAN
MANUAL
DIVERSION

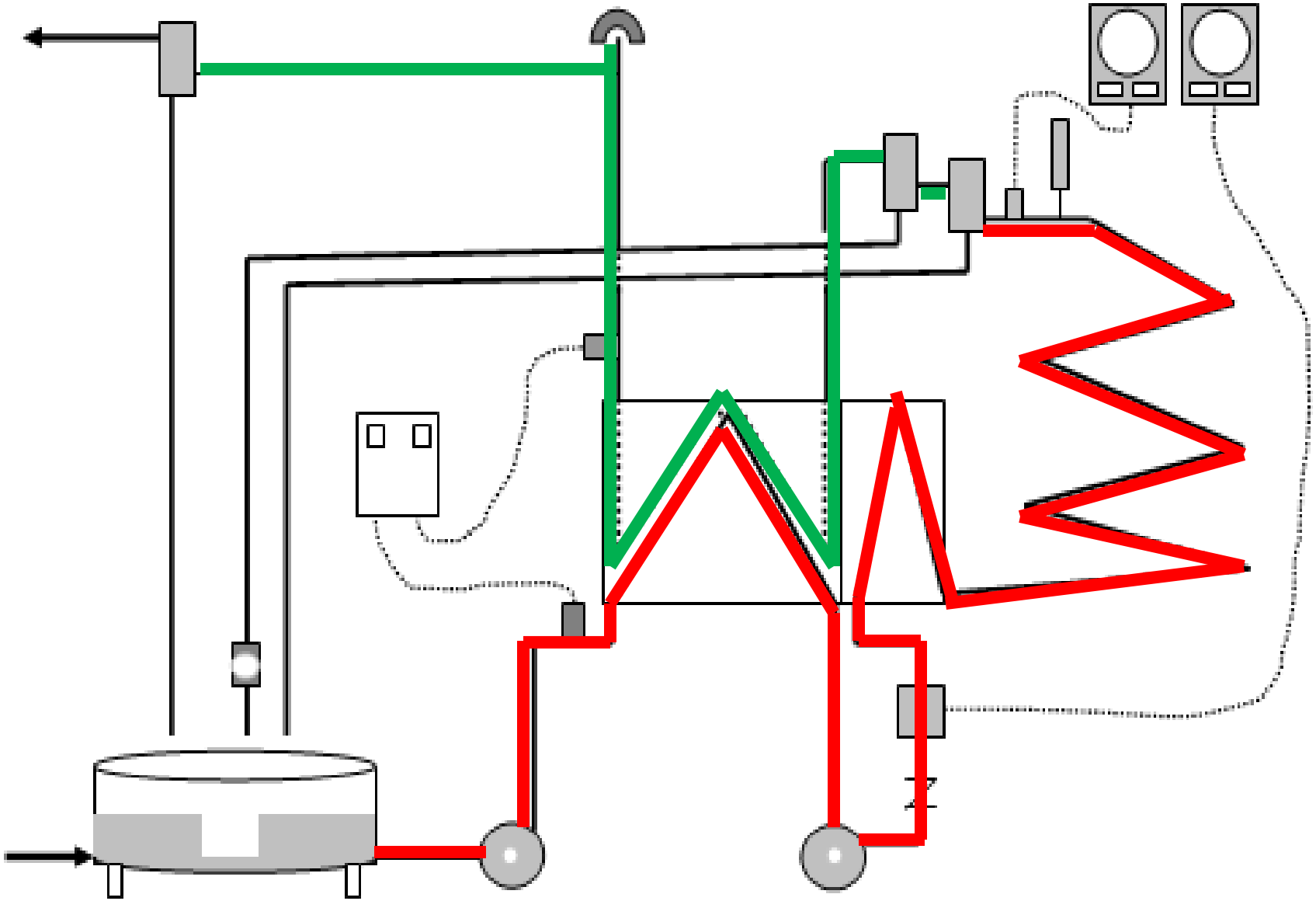
REVERSE ACTING FDD



Divert and Leak Detect Valve Lines

- Both must slope to drain
- Divert line maybe restricted
- Leak Detect line:
  - Free discharge, no restriction
  - Line discharging to constant level tank must have visible means of leak detection

LADISH



METER BASED HTST PASTEURIZER

Vacuum Breakers

Manual Cleaned

CIP Cleaned

Vacuum Breakers Purpose

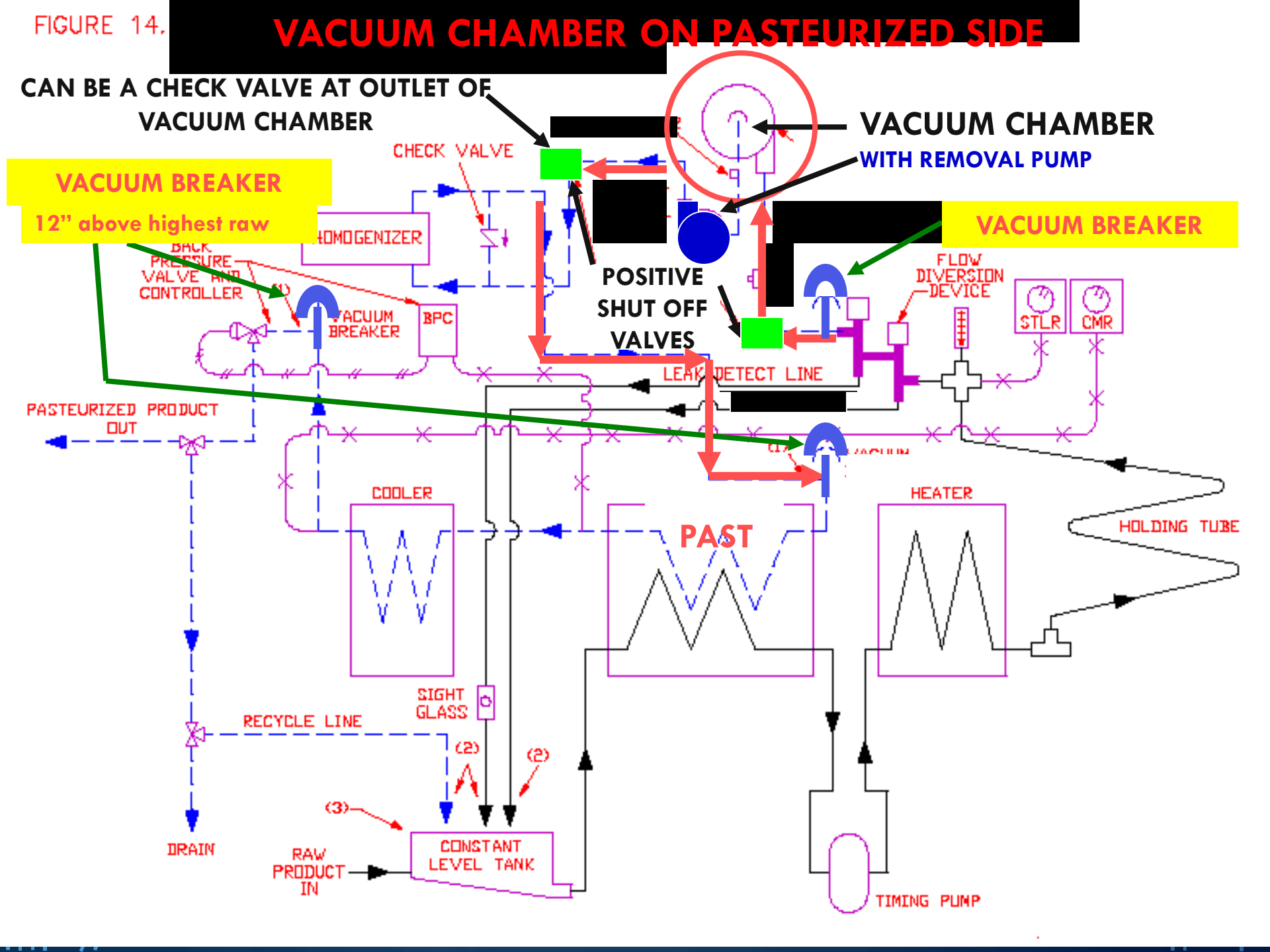
To help maintain proper pressure relationships in milk-to-milk regenerator sections or to prevent a negative pressure between the FDD and any downstream flow promoting device.

Vacuum Breaker Installation

- Installed after the Pasteurized Milk Regenerator
- Pasteurized milk shall rise to a vertical elevation of 12 inches above the highest raw milk level

FIGURE 14.

VACUUM CHAMBER ON PASTEURIZED SIDE



The purpose of a vacuum breaker between the pasteurized regenerator and the vacuum chamber is to prevent the lowering of the pressure in the pasteurized side of the regenerator.

REVIEW OF DETAILS

The sequence for forward flow of milk through the valves: Forward Divert Valve, Leak Detect Valve with the booster pump starting.

The event pen on the STLR records the position of VALVES.

Power outage will cause the valves to DIVERT by spring pressure.

A flow of milk noted in the sight glass indicates a leak in the forward divert valve.

The FDD must move from Forward to fully Divert in at least a ONE second or less.

A sight glass is required on a Leak Detect Valve line.

Pasteurize side shall be higher than the raw side on the DPC when pasteurizing using the regen.

If the stem is broken or disconnected or misaligned the timing pump will not run.

Pasteurizer Records

Presenter:

Michelle Steinmetz – Dairy Technical Specialist

Record Keeping

- Dairy plants must keep a record of all products pasteurized
- Records are reviewed as a part of routine inspections and whenever a regulatory seal is broken
- Very important to keep accurate records.

Documentation is proof!

Vat Recording Chart Information

- Vat Pasteurization
  - Date
  - Name of plant/Number 55-
  - Identification of pasteurizer or location (if more than one)
  - Name and quantity of product
  - Signature or initials of operator (helpful if legible)
  - Record of any unusual occurrences

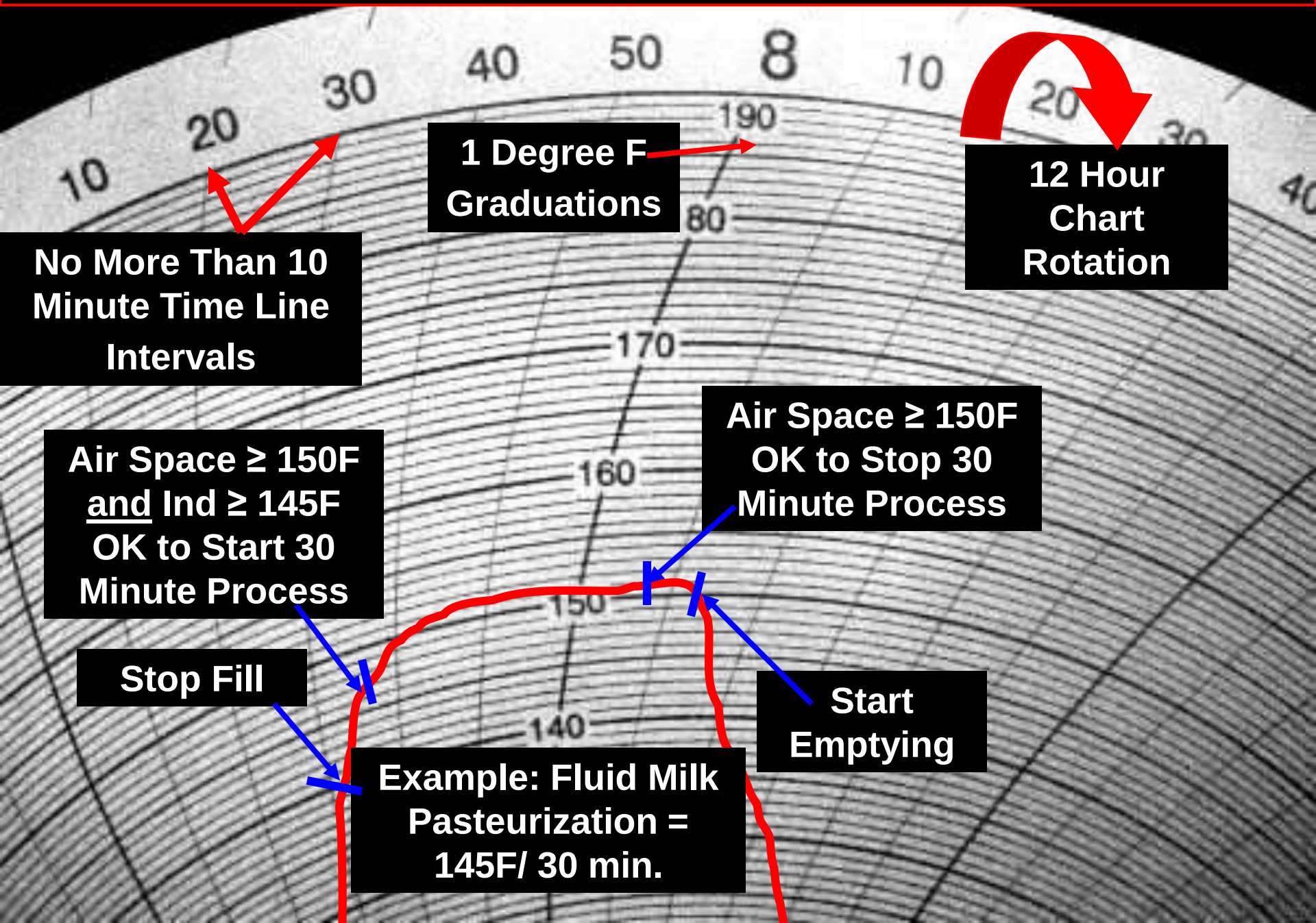
Vat Recording Chart Information continued…

- Continuous temperature recording (NO OVERLAPPING)
- Pasteurization holding time of each product
- Temperature reading of the airspace thermometer at the start and end of the holding period.
- Temperature reading of the Indicating thermometer at the start of the holding period.

Vat Recording Chart Information

- Must Clearly Show Minimum 30 Minutes Uninterrupted Process (Start 30 Min Process All Over)
- Be at Minimum Legal Temperature for Product Being Pasteurized (Example: Milk ≥145 F)
- Airspace must be at least 5 F Above Min Legal (Example: Milk Process Air Space ≥ 150 F)
- 30 Min. Process Time Does Not Start Until Recording, Indicating & Air Space Requirements Are Met

For Vat Process Temperatures of Less Than 160F

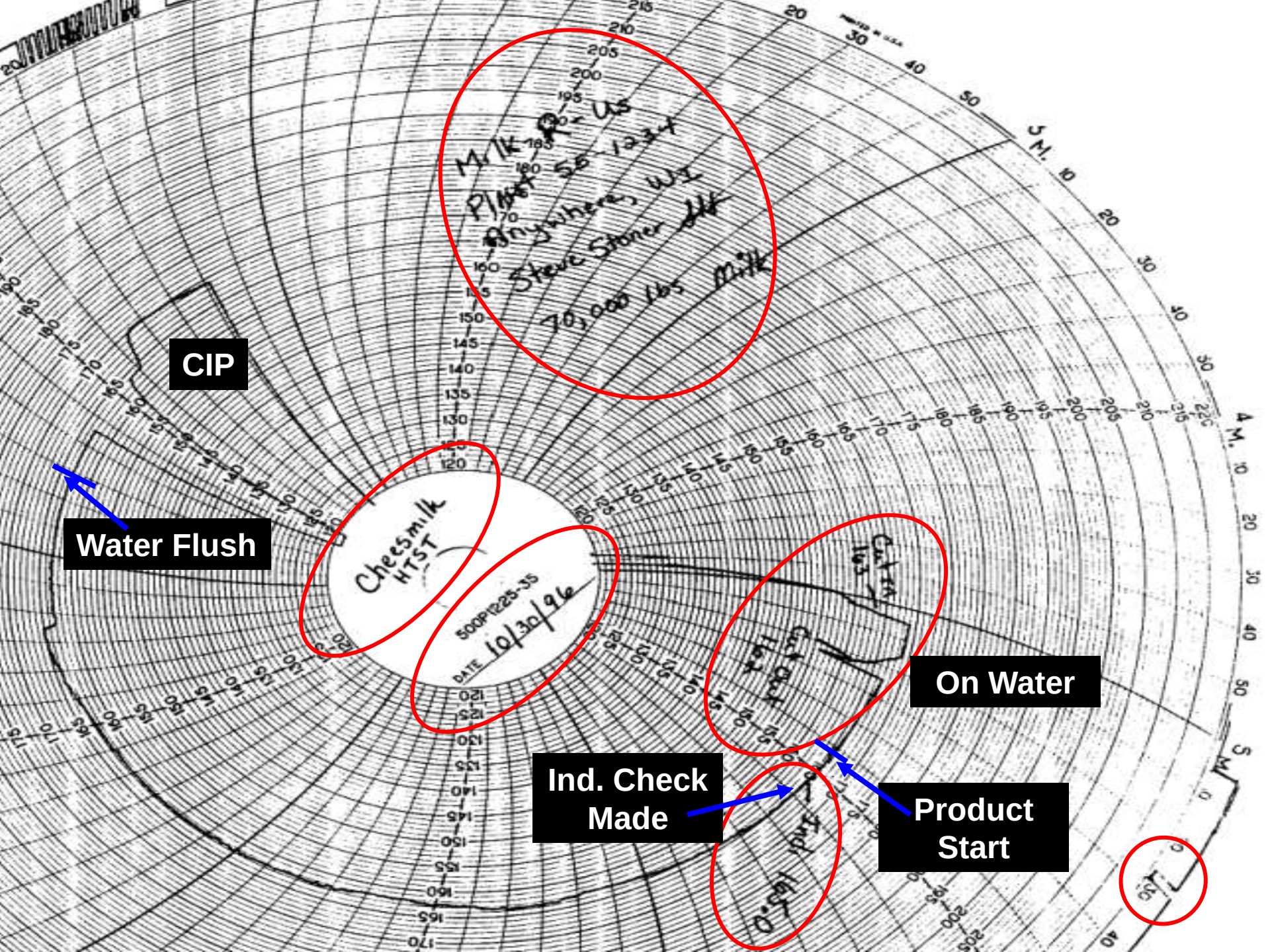


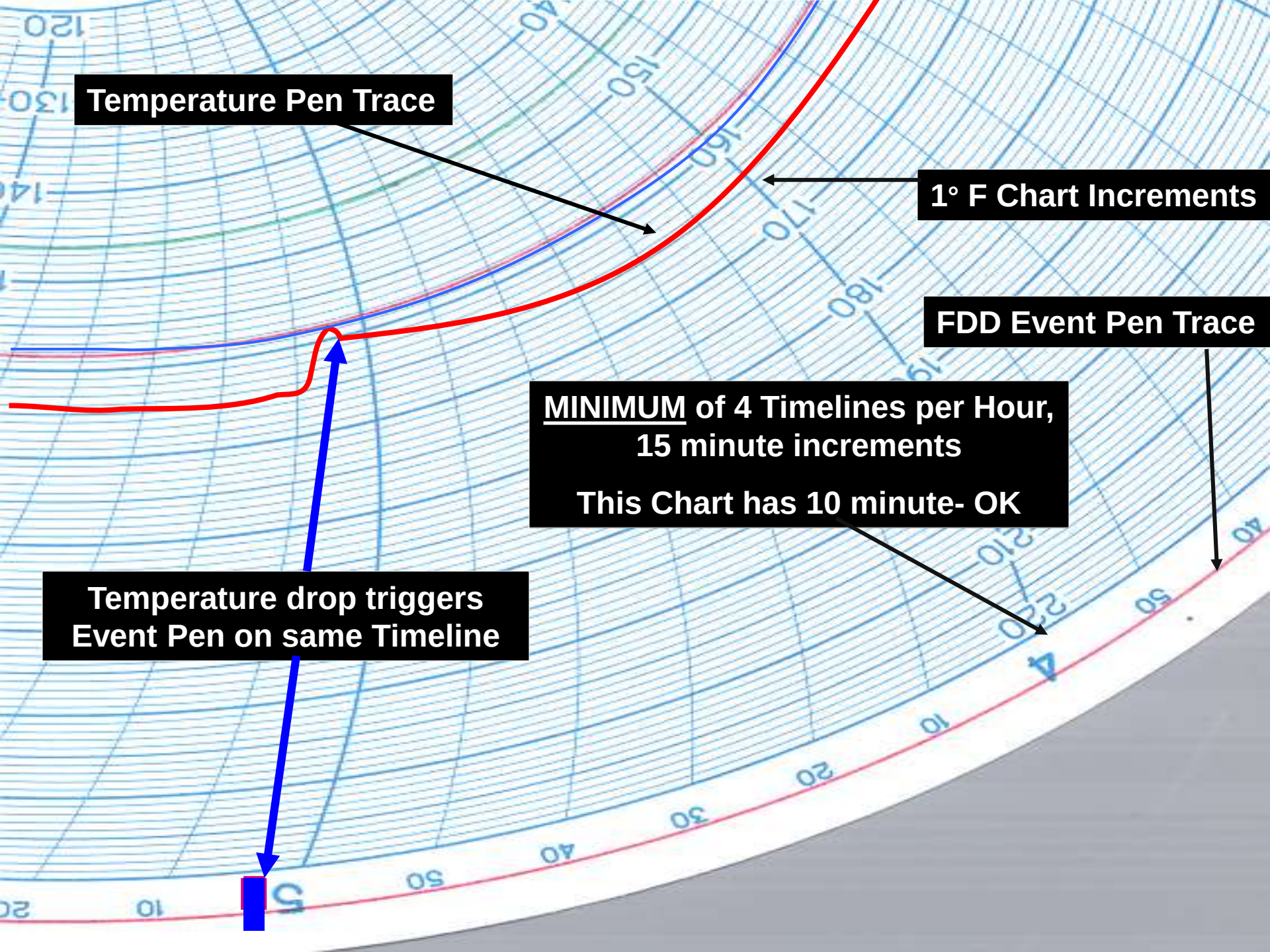
HTST Recording Chart Information – ATCP 65.66(3)

- STLR Recording Chart
  - Date
  - Name of plant/Number 55-
  - Identification of pasteurizer or location (if more than one)
  - Name and quantity of product
  - Signature or initials of operator (helpful if legible)
  - Record of any unusual occurrences

HTST Recording Chart Information continued

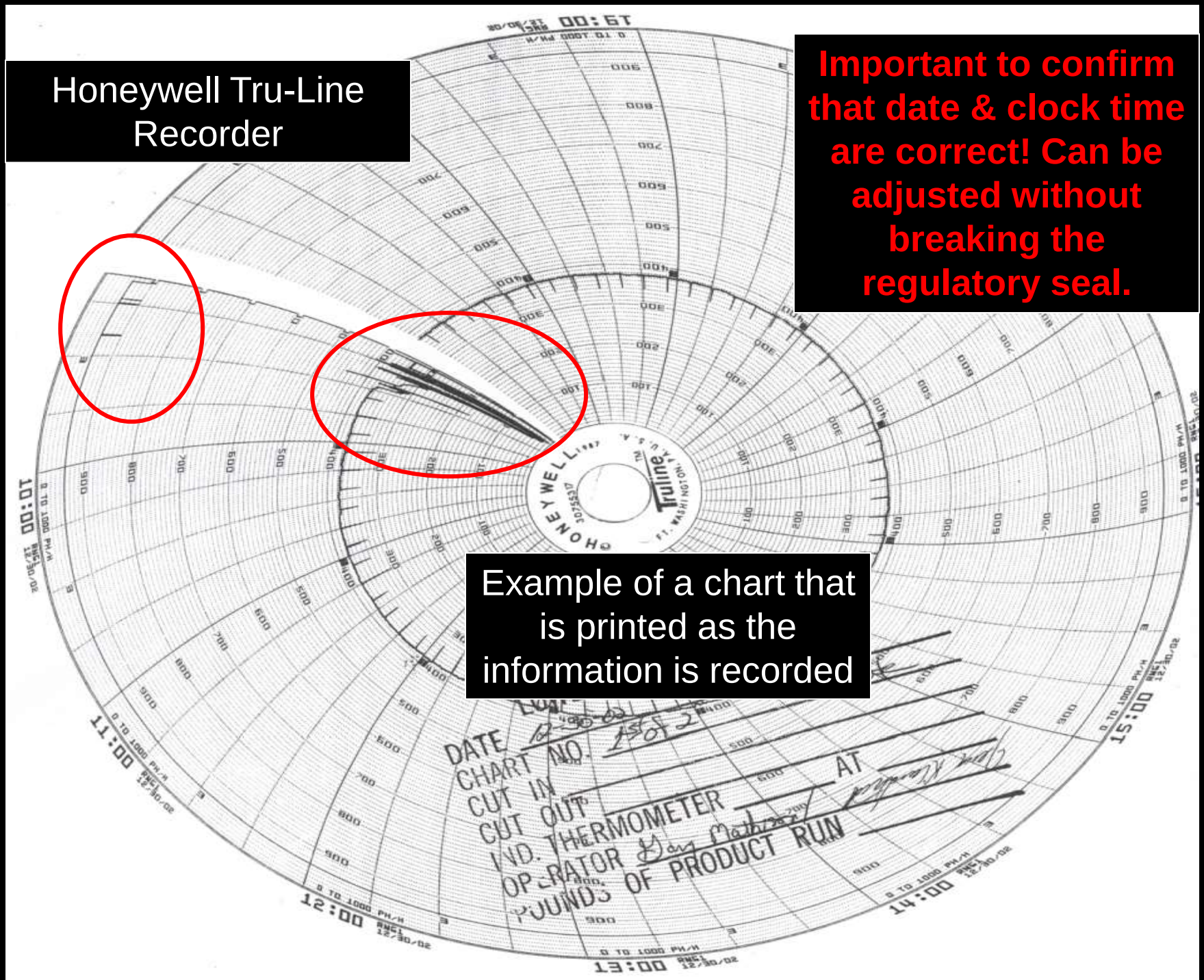
- STLR recording chart
  - A continuous record of temperature (NO OVERLAPPING)
  - Indicating thermometer temperature
  - Cut-in temperature
  - Cut-out temperature
  - Documentation of forward flow / divert flow


CIP
Water Flush
On Water
Ind. Check Made
Product Start


Temperature Pen Trace
1° F Chart Increments
FDD Event Pen Trace
MINIMUM of 4 Timelines per Hour,
15 minute increments
This Chart has 10 minute- OK
Temperature drop triggers
Event Pen on same Timeline

Flow Recording Chart Information
Meter based timing

- SFLR
  - Date
  - Pasteurizer Identification
  - The Type and Amount of Product Processed
  - Any Unusual Occurrences
  - Plant Name and Location
  - A continuous record of the flow rate
  - A continuous record of the flow alarm status. (Flow Event Pen)


Honeywell Tru-Line Recorder
Important to confirm that date & clock time are correct! Can be adjusted without breaking the regulatory seal.
Example of a chart that is printed as the information is recorded
DATE
CHART NO.
CUT IN
CUT OUT
IND. THERMOMETER
OPERATOR
POUNDS OF PRODUCT RUN
AT

Record Keeping

- Use the Correct Chart & Pen Tips
- Recording charts cannot contain overlapping information (Replace Prior to 12 hour Time-lapse)
- Records shall be kept for a period of 6 months or until the product is no longer in commerce

OTHER RELATED PASTEURIZATION RECORDS

- Phosphatase test results to support product safety during broken seal situations.
- Recommend documentation of corrective actions taken (repairs, replacement, reprogramming), of any public health related controls on a pasteurization system at anytime, but especially when a regulatory seal has been removed.

OTHER RELATED PASTEURIZATION RECORDS

- Recommend documentation of product action taken (Segregation, QA Hold Order, Recall, Disposal, (landfill, fish bait), etc.) as a result of any loss or malfunction of any public health related pasteurization system control.
- The better the documentation the more effective it is in determining product safety, both, for Industry and Regulatory.

Remember: If you didn't document it, then it never happened.

Testing and Broken Seals

Why Test and Seal Pasteurization Equipment?

- **Required by:**
  - FDA -PMO Appendix I
  - USDA - Inspection guide item B5 (B)
  - WDATCP - ATCP 65.88(3-4)
    - Quarterly for Grade A plants
    - Annually for Grade B plants
  - Industry
    - QC, HACCP, SQF, Customer Audits

Purpose of Testing & Sealing

- ✓To help ensure safe product to the public
- ✓To determine if controls are operating according to standards
- ✓To provide evidence that settings have not been changed
  - Offers only reasonable security against accidental changes
- ✓To satisfy regulatory requirements

What is Tested & Sealed?

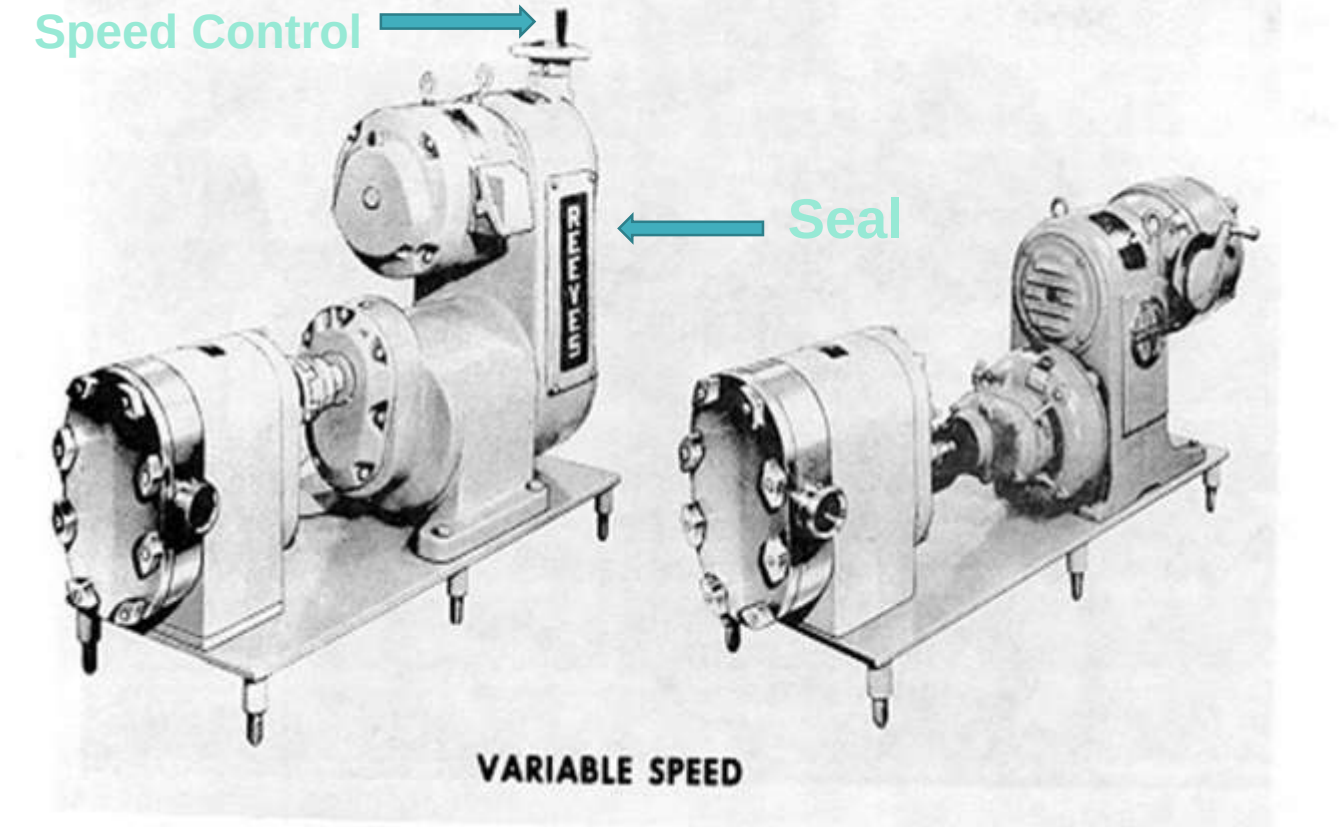
-Controls that if changed can affect public health

Time

- Flow Recorder (SFLR)
- Timing pump (positive displacement pumps)
- Variable frequency drives
- Flow meters/transmitters/alarms
- Flow diversion device (FDD) timers
- Inspect, CIP, valve flush, & timing pump off delay timers

ABB Commander 1900

Variable speed positive displacement timing pumps

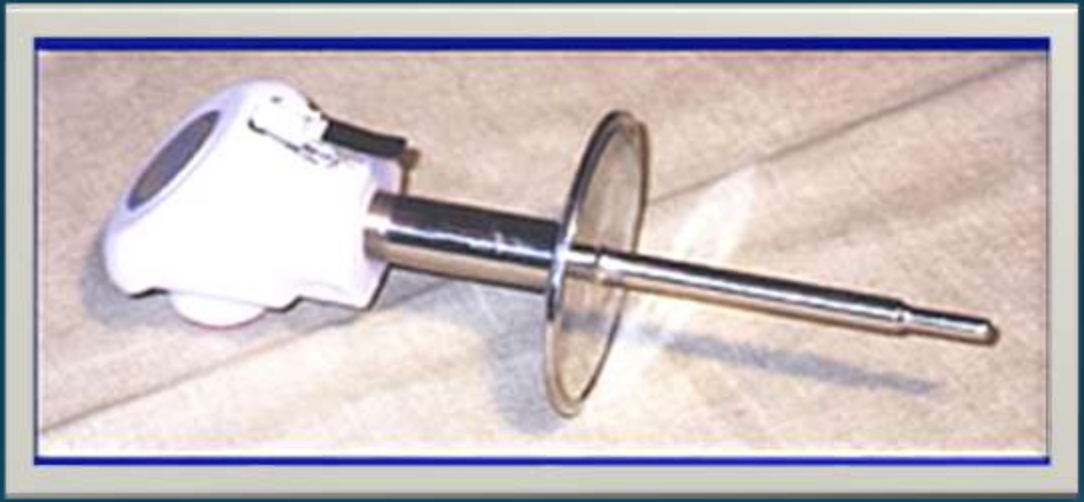


What is Tested & Sealed?

-Controls that if changed can affect public health

- **Temperature**
  - Digital reference thermometer (DRT)
  - Temperature recorder (STLR)
  - Temperature Probes
    - STLR RTD
    - DRT RTD

Anderson AV9900



Anderson

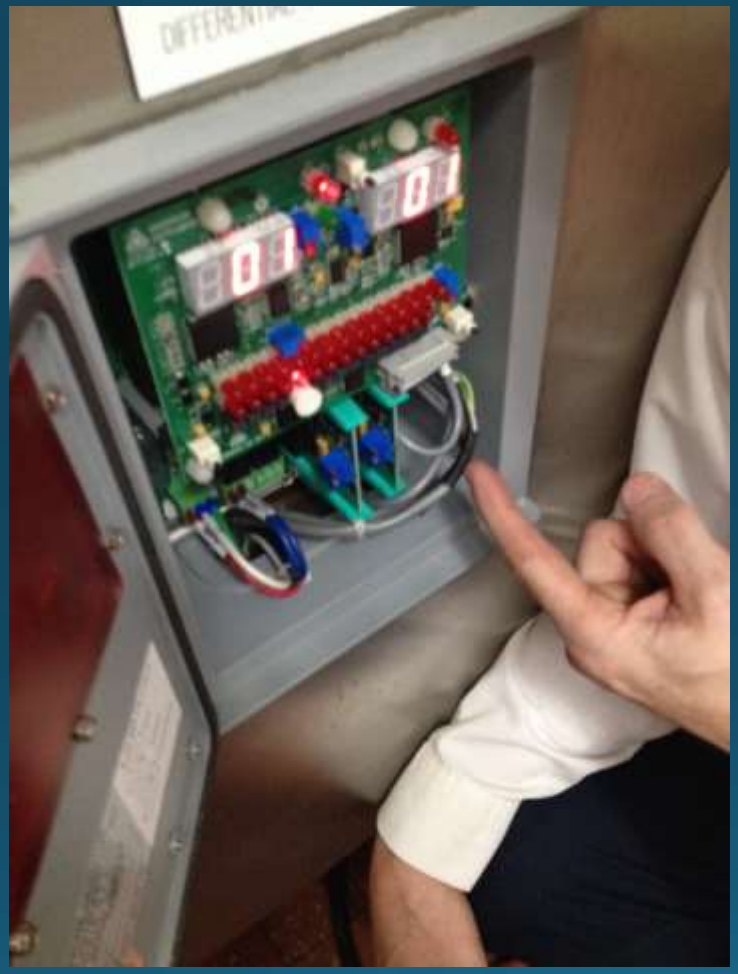
°F

What is Tested & Sealed?

-Controls that if changed can affect public health

- **Pressure**
  - ➢ Differential pressure switch
  - ➢ Raw pressure sensor
  - ➢ Pasteurized pressure sensor

15
30
ANDERSON



What is Sealed?

-Controls that if changed can affect public health

Other Public Health Controls

- Programmable Logic Controls (PLC)
- PLC & terminal strip connections
- R to I converter
- Pump control relays
- Valve solenoids (when have a manual override feature)

HTST #1
4

Seal Locations

9.2.2	● S ○ U ○ N/A	DPS Interwiring-Booster Pump	Booster pump off at ____ PSI
9.3.1	● S ○ U ○ N/A	DPS Interwiring-FDD	BP off in divert
9.3.2	● S ○ U ○ N/A	DPS Interwiring-Metering Pump	BP off with timing pump
10.1	● S ○ U ○ N/A	Cut-in and Cut-Out Temperatures	1. Cut-in: 163.4 Cut-out: 162.4
11.2a	● S ○ U ○ N/A	Holding Time (MBTS)	**Forward** sec | sec | sec | sec | sec | sec | | Average **Divert** sec | sec | sec | sec | sec | sec | | Average
11.2b	● S ○ U ○ N/A	Flow Alarm (MBTS)	Divert Flow at: STLR at: F
11.2c	● S ○ U ○ N/A	Loss of Signal Alarm (MBTS)	FDD diverts immediately at loss of signal
11.2d	● S ○ U ○ N/A	Flow Cut-in & Cut-out (MBTS)	Cut-in: Cut-out:
11.2e	● S ○ U ○ N/A	Time Delay (after divert) (MBTS)	seconds
11.2f	● S ○ U ○ N/A	High Flow Alarm Response Time	Less than 1 second
15	● S ○ U ○ N/A	Electromagnetic Interference	No adverse effect with (insert testing device information)

Seal Locations

STLR Seal #: 12345	STLR-RTD Seal #: 23456
DRT Seal #: 34567	DRT-RTD Seal #: 45678
SFLR Seal #: 45679	DPS Seal #: 45680
RPT Seal #: 45681	PPT Seal #: 45682
PLC Seal #: 45683	VFD-TP Seal #: 45684
VFD-TP Seal #: 45685	

Comments

Inspector: **Michelle Steinmetz**

SEAL LOCATIONS	1. STLR (0298)	2. STLR RTD (0279)
3. DRT (1603)	4. DRT RTD (1692)	5. DPC (0989)
6. RAW PRESSURE SENSOR (0963)	7. PAST. PRESSURE SENSOR (0914)	8. SFLR (1234)
9. FLOW TRANSMITTER (0293)	10. PLC (1683)	11. TIMING PUMP VFD (1677)
12. BOOSTER PUMP VFD (1668)	13.	14.
15.	16.	17.

ABBREVIATIONS USED:

- DRT – Digital Reference Thermometer
- DPC –Differential Pressure Controller for booster pump
- PLC – Programmable Logic Controller (computer)
- RTD – Resistance Temperature Detector (temperature sensor)
- SFLR – Safety Flow Limit Recorder (flow recorder)
- STLR – Safety Thermal Limit Recorder (temperature recorder)
- VFD – Variable Frequency Drive

Pasteurizer Malfunction

Report when a system malfunctions to the possible detriment of public health or safety

What does that mean?

Identified issues such as:

- Cut-in or cut-out temperature below legal minimum
- Holding time below legal minimum
- Improper valve function
- Seals missing after maintenance or cleaning

Pasteurizer Malfunction

Report when a system malfunctions to the possible detriment of public health or safety.

Pay attention:

- Raw pressure reading below zero
- Pasteurized pressure not maintaining ≥ 2 PSI above raw pressure when going into divert flow
- Flow alarm malfunction
- Unexplained diversions from flow alarm
- Vat or tank fill times faster than usual
- Recording pen malfunction

Broken Seal or Public Health Malfunction Detected

- First & Foremost – STOP PRODUCTION!

ATCP 65.68(6) Requires:
Notification

- Contact assigned Dairy Technical Specialist within 2 hours
  - Telephone or E-mail
- Submit broken seal report within 5 business days
  - Fax: 715-839-3867
  - Mail: 718 W Clairemont Ave, Ste 128 Eau Claire WI 54701

ATCP 65.68(6) Requires:
Repair & Verify Proper Function

- Make repairs or adjustments.
- **Verify** proper function prior to resuming production
  - ✓Page 2 of Broken Seal Report:
    - Not a list of all verifications that may be necessary,
    - But it is a useful starting point or general guide.
- HTST operation supervised by a certified operator.

Relatively

NEW

BROKEN SEAL REPORT

Wisconsin Department of Agriculture, Trade and Consumer Protection
Division of Food Safety
718 W Clairemont Ave., Ste. 128, Eau Claire WI 54701
Phone: (715) 839-3844 Fax (715) 839-3867

PASTEURIZER BROKEN SEAL REPORT

s. ATCP 80.52(6)(a), Wis. Adm. Code

PLANT INFORMATION

PLANT NAME:		TODAY'S DATE:
COUNTY:	TOWNSHIP:	
PASTEURIZER ID:	Plant 55-	LIC. -D1
DATE SEAL BROKEN:	TIME SEAL BROKEN:	SEAL LOCATION(S):
REASON FOR BROKEN SEAL(S):		

DATCP NOTIFICATION INFORMATION

NAME OF DATCP PERSONNEL CONTACTED:	DATE CONTACT MADE:	TIME CONTACT MADE:
HAS RESEAL BEEN SCHEDULED? ☐ YES ☐ NO	DATE SCHEDULED:	

After the dairy plant operator breaks a seal which has been applied by the department or after the pasteurization system malfunctions to the possible detriment of public health or safety, the dairy plant operator shall:

- Contact the appropriate Food & Dairy Specialist to schedule an appointment for resealing the pasteurization system. Specialist contact information may be obtained by calling the Eau Claire Office (phone number above).
- Notify WDATCP by phone, email, or FAX within 2 hours. (Provide the above Plant information.)
- Complete this form (F-fd-228), and mail or fax a scanned PDF to the Eau Claire Office to the contact information at the top of this form within 5 business days after the seal is broken. **Note:** This report must be submitted within 5 business days, even if the resealing appointment has not yet taken place.

DAIRY PLANT PROCEDURES FOR BROKEN SEALS & REPAIRS TO PASTEURIZATION SYSTEMS

1. Operator detects malfunction during startup or while running and immediately notifies plant management. Plant personnel evaluate the nature of the malfunction and perform repairs as appropriate. Note: A pasteurization system may only be operated following repair when all the public health controls are repaired and confirmed to be working properly.
2. Notify the Department via telephone, email or FAX within two hours of breaking a regulatory seal. Complete the Broken Seal Report Form (F-fd-228) and submit within 5 business days.
3. The Dairy Plant operator must document the proper functioning of the repaired system (time, temperature, and pressure relationships) before restarting. This is usually specific to the item that was repaired and the public health control affected. Perform the PMO test specific to the component and properly document recorder charts as appropriate. **Production records and verification documentation must be available for regulatory review. The table on page 2 of this form may be used as a guidance in performing verification procedures, however, it does not preclude other verifications that may be necessary to determine proper function of all public health controls.**
4. When a plant processes **fluid milk products** containing no additives other than vitamins in a pasteurization system with a broken seal, phosphatase testing is required at least once during every 4 hours of operation. Test verification records must be available for review by the department. Phosphatase tests for Grade A products must be conducted in an IMS or Wisconsin certified lab by a certified individual. Phosphatase tests for Grade B products may be conducted in an IMS or Wisconsin certified lab or by a person who has been trained to properly conduct phosphatase tests on dairy products manufactured in their dairy plant. Confirmatory tests for a positive result (>350 milli-units) must be conducted in an IMS or Wisconsin certified lab.

Broken Seal Report Page 2:

SAFETY THERMAL LIMIT RECORDER (STLR)		
☐ YES	☐ NO	Verified programming of electronic recorder per the FDA's M-b approval for the device
☐ YES	☐ NO	Compared temperature with indicating thermometer and adjusted as necessary, typically 0.5-1.0°F lower than the indicating thermometer
☐ YES	☐ NO	Verified cut-in and cut-out temperatures are above legal pasteurization temperatures
STLR RTD		
☐ YES	☐ NO	Ensured replacement probe is a fast response pasteurization probe
☐ YES	☐ NO	Compared temperature with indicating thermometer and adjusted as necessary, typically 0.5-1.0°F lower than the indicating thermometer
DIGITAL REFERENCE THERMOMETER		
☐ YES	☐ NO	Checked temperature against certified laboratory thermometer or pasteurizer recording thermometer, adjusted as necessary -typically 0.5-1.0°F higher than the recording thermometer
DRT RTD		
☐ YES	☐ NO	Checked temperature against certified laboratory thermometer or pasteurizer recording thermometer, adjusted as necessary -typically 0.5-1.0°F higher than the recording thermometer
PRESSURE DIFFERENTIAL SWITCH		
☐ YES	☐ NO	Removed sensors from press, adjusted as necessary so both read zero
☐ YES	☐ NO	Placed sensors on tee and increased air pressure up to 50 psi ensuring both track through scale with difference no greater than 1 psi, adjusted as necessary
☐ YES	☐ NO	Removed raw sensor from tee, capped tee and applied air pressure to pasteurized sensor to verify green light activates at differential of 2psi or higher as determined during the last time & seal testing
☐ YES	☐ NO	Verified that raw pressure is never greater than pasteurized pressure when going from forward flow to divert flow and when going from divert flow back to forward flow
PRESSURE SENSORS/TRANSDUCERS		
☐ YES	☐ NO	Removed sensors from press, adjusted as necessary so both read zero
☐ YES	☐ NO	Placed sensors on tee and increased air pressure up to 50 psi ensuring both track through scale with no difference greater than 1 psi, adjusted as necessary
FLOW RECORDER/ALARM (SFLR)		
☐ YES	☐ NO	Verified programming of recorder per the FDA's M-b approval for the device, including flow alarm set points
☐ YES	☐ NO	Verified flow alarm diverts the system at the high flow alarm set point
☐ YES	☐ NO	Verified flow rates have not changed, (compare cheese vat fill times, balance tank draw down times, volumetric checks from before and after broken seal)

Broken Seal Report Page 2 continued:

MAG-FLOW METER OR TRANSMITTER		
☐ YES	☐ NO	Verified programming matches parameters set during past timing & sealing and FDA's M-b approval for the device
☐ YES	☐ NO	Confirmed replacement meter has FDA approval (Index of Memoranda of Milk Ordinance Equipment Compliance)
☐ YES	☐ NO	Verified flow rates have not changed, (compare cheese vat fill times, balance tank draw down times, volumetric checks from before and after broken seal)
FLOW DIVERSION DEVICE CABINET -MECHANICAL TIMERS		
☐ YES	☐ NO	Verified cut-in and cut-out temperatures are above legal pasteurization temperatures
☐ YES	☐ NO	Verified valve function: tested flush time delay, manual divert, inspect, product, and CIP mode functions
PROGRAMMABLE LOGIC CONTROLLERS (PLC)		
☐ YES	☐ NO	Verified valve function: tested flush time delay, manual divert, inspect, product, and CIP mode functions
☐ YES	☐ NO	Verified cut-in and cut-out temperatures are above legal pasteurization temperatures
☐ YES	☐ NO	Verified that the WDATCP approved or original sealed program was restored and the PLC wiring (inputs & outputs) match the wiring schematic as supplied to WDATCP
FREQUENCY DRIVE FOR TIMING, BOOSTER, OR STUFFING PUMPS		
☐ YES	☐ NO	Verified programming, specifically pump start, stop and control methods are the same as prior to the broken seal
OTHER VERIFICATIONS: Clearly describe and document any other tests or verifications conducted to ensure all public health controls relating to the broken seal(s) have been restored.		

This institution is an equal opportunity provider. Personal information you provide may be used for purposes other than that for which it was originally collected – sec.15.04(1)(m), Wis. Stats.

ATCP 65.68(6) Requires:
Documentation

- Verify and **document** that the control is working properly
- Conduct Phosphatase Testing
  - Collected at least every 4 hours of production
  - Less than 350 milli-units per liter
    - Negative = Good
  - 350 milli-units per liter or greater
    - Positive = Bad!

Phosphatase Sampling & Testing

- Positive result: put product on hold and notify DATCP
- White milk products only
- Whey, flavored products, and colored products exempt
- Is only a component to verification of proper pasteurization

Dairy Technical Specialist Follow-Up

- Set date to test & reseal within **10 days**
- Verify proper function
- Review phosphatase records

System resealed and placed back in normal operation

-or-

Product put on hold and follow-up by Sanitarian

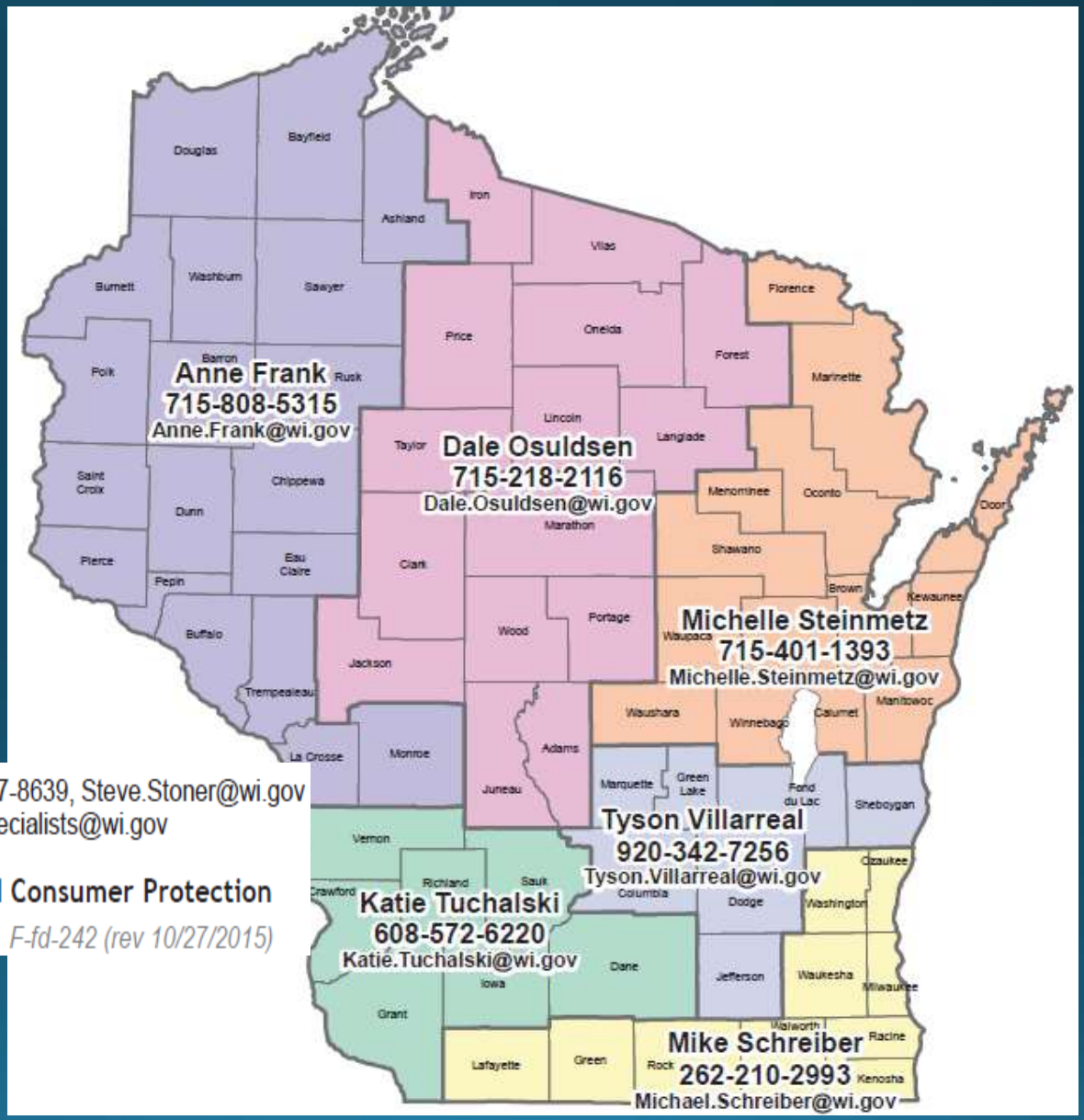
Unreported Broken Seals

Sanitarians may take action against product!

✓Know where seals are

✓Check them often!

Dairy Technical Specialist Map



Food Safety Supervisor - Technical: Steve Stoner, 715-577-8639, Steve.Stoner@wi.gov
General Technical Specialists E-mail: DATCPTechnicalSpecialists@wi.gov

Wisconsin Department of Agriculture, Trade and Consumer Protection

F-fd-242 (rev 10/27/2015)

HTST SANITATION PROCESS

Allan Ver Voort

Ecolab Food and Beverage

WHY CLEAN + SANITZE

YOUR HTST?

ECOLAB

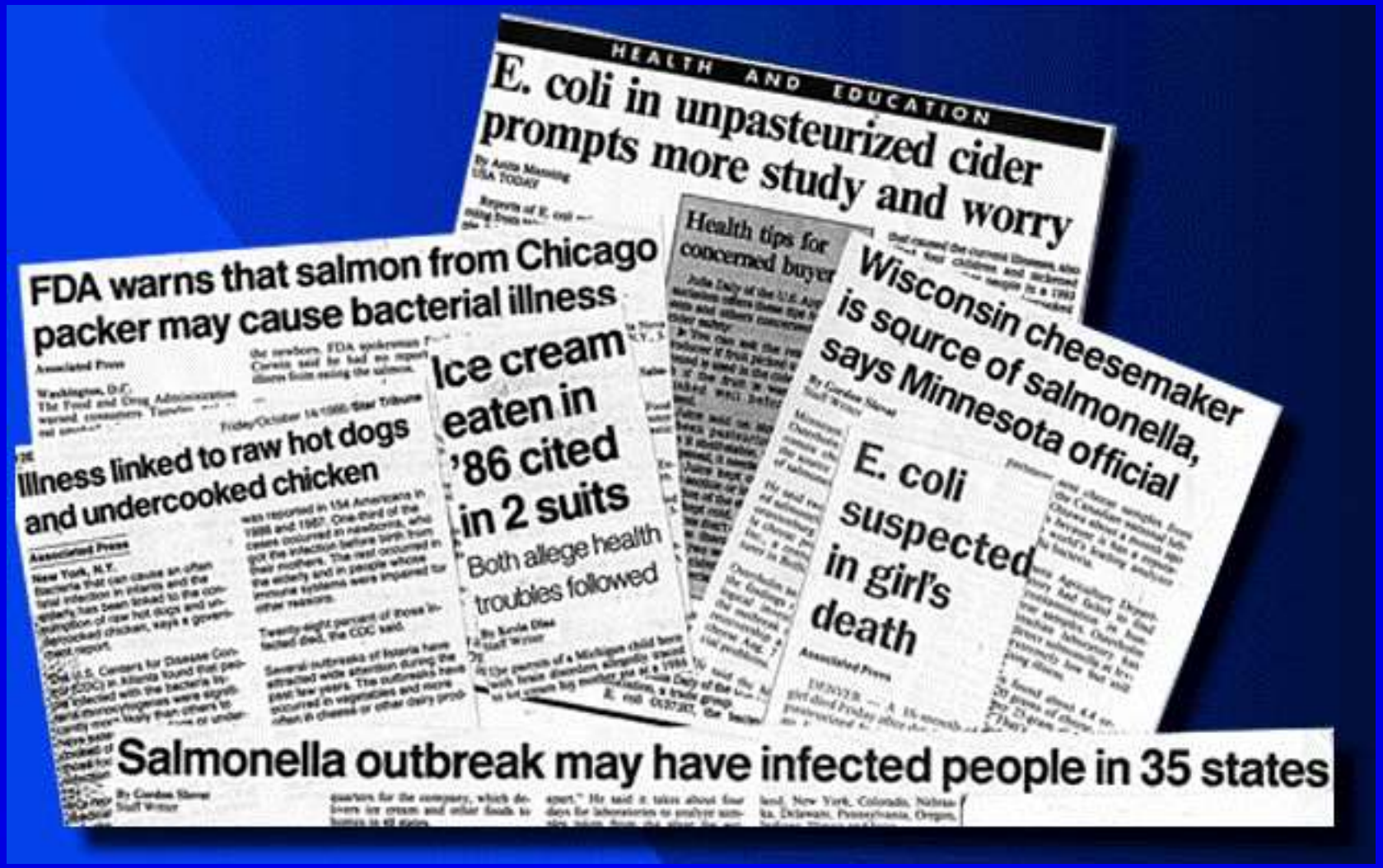
To Protect Product

Quality and Safety

The Enemies

- SPOILAGE ORGANISMS:
  - Poor Quality
  - Shelf Life
  - Customer Dissatisfaction
- PATHOGENS:
  - Food Safety
  - Illness
  - Death
- Allergens
  - Shock
  - Death

Could This Be Your Plant?



PROPER CLEANING COMPLETELY REMOVES ALL SOILS ON THE HTST

- Product Contact Surfaces
- Environmental (Exterior Surfaces)

CLEANERS

Designed to Remove

the HTST Soils

SOILS IN THE HTST

- FAT
- PROTEIN
- CARBOHYDRATES
- MINERALS

FAT

Removed by:

- Alkaline Cleaner (caustic)
  - – Concentration designed for your system
- Temperature
    - Caustic Wash ten degrees over production temperature

PROTEIN

- Removed by:

- Alkaline or Acid Cleaners
- Oxidizing Agents (Chlorine)
  - Typically not used on HTST Units

Carbohydrates

- Removed by:
  - Alkaline Cleaners
  - Acid Cleaners

Minerals

- Removed by:
  - Acid Cleaners
  - Specifically Designed Cleaners

Cleaning Procedures (SSOPs)

CLEANING PROCEDURES

SSOPs

Sanitation Standard Operating Procedures

SSOP

- Includes the CIP of the System
- Manual Cleaning of the Vacuum Breaker if it Isn’t CIPed.

SSOPs Developed Based On:

- Product
- Ingredients
- Equipment Design
- Process Time
- Process Temperature Differential
- 4X4 Process
- Other (Water, Energy, Time, etc.)

Must Follow Specific

SSOPs Developed

for Your HTST

Cleaning is a

4 X 4 Process

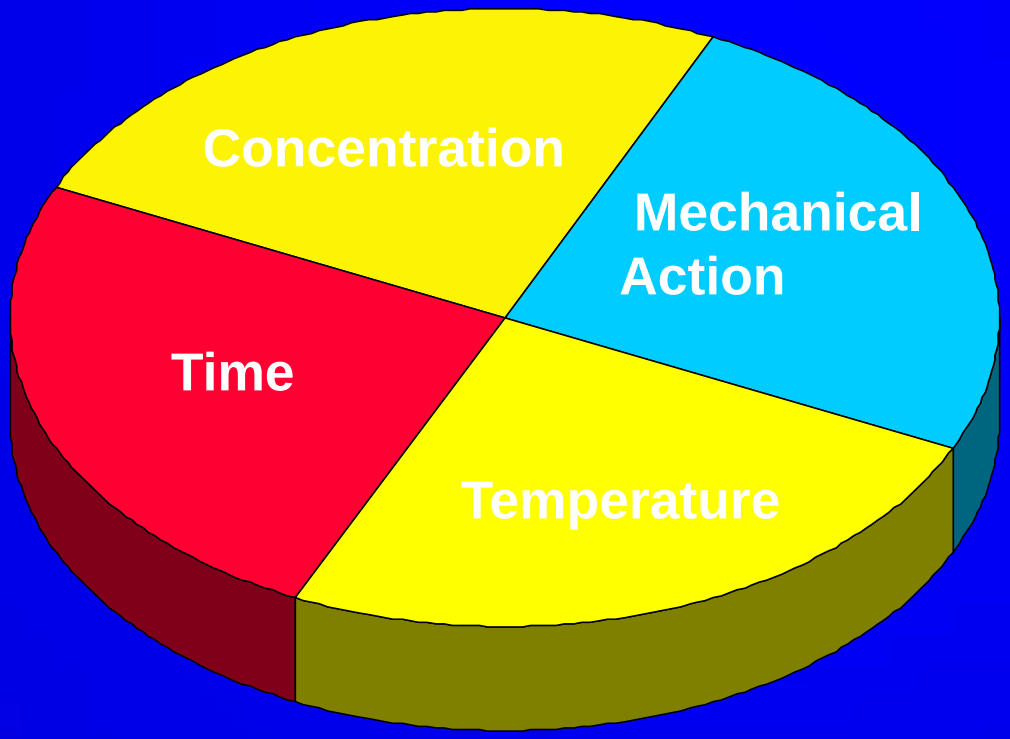
Cleaning Steps

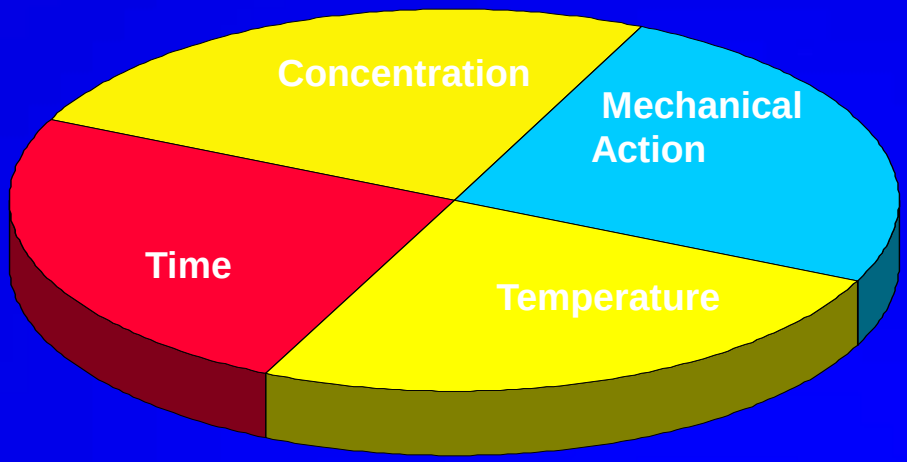
1. Pre-Rinse
2. Alkaline Wash
3. Acid Wash
4. Sanitize

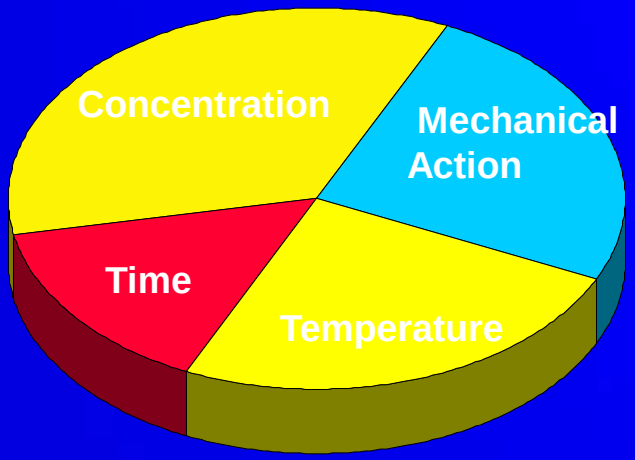
Cleaning Factors

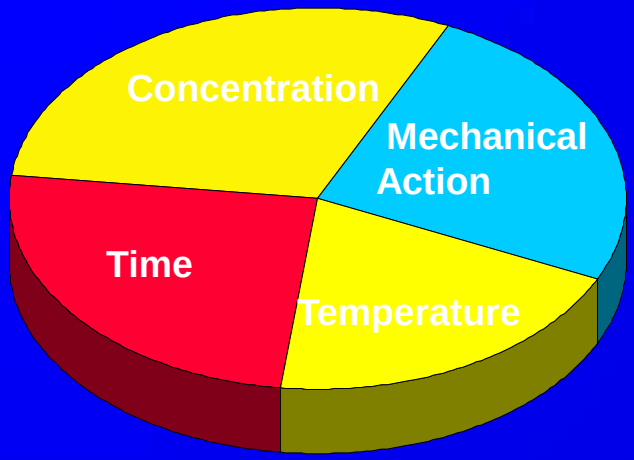
1. Time
2. Temperature
3. Mechanical Action
4. Concentration

Four Factors




Concentration
Mechanical Action
Time
Temperature


Concentration
Mechanical Action
Time
Temperature


Concentration
Mechanical Action
Time
Temperature

Time and Concentration

- Developed into SSOP
- Depends on
  - Time of Production Run
  - Production Temperature Differential
  - Type of Product Run (Soils)

Cleaner Concentrations

- The combination of 4 factors on this unit
- Build in margin for varying conditions
- Assure clean equipment
- Control Cost
- Adjust for solution loss

- Developed into SSOP

Mechanical Action - Flow

- If Using a Timing Pump Which Uses Impellers then Remove and Clean Them And Install CIP pump
- If washed with Homo -- use bypass
- Try to attain 1.5 times production flow
  - Get as high a flow as possible – may be same flow as process flow

Temperature

- Usually 10 Degrees Above Process
- Caustic Wash is More Temperature Dependant for Thorough Cleaning

PRERINSE

- Most Important Step of the Wash
- Removes 50 - 80% of the Soil
- Rinse Immediately after Production
- May do Caustic Pre-Wash

WASH

- Mid Day Flush

- Conventional
- Over- Ride
- Single Phase

Mid-Day Flush

- Rinse
- Light Caustic Flush
- Rinse

CONVENTIONAL

- Pre-Rinse
- Caustic
- Rinse
- Acid
- Post-Rinse
- Sanitize

OVER-RIDE

- Pre-Rinse
- Acid Wash
- Alkaline Wash
- Post-Rinse
- Sanitize

SINGLE-PHASE

- Pre-Rinse
- Alkaline Wash
- Post-Rinse
- Sanitize

During The Wash:

- All Valves Must Pulse to Clean the Valve Seats and Heads as Well as Divert Lines
- Maintain Minimum Concentrations, Temperatures and Flows Throughout
- Not Required But Prefer Concentrations Written on Recording Chart.

New Technologies:

- Research done on Spore and Biofilm survival in the HTST + Lines
- Affects Product Quality and Shelf Life

- Special Products and Procedures

ECOLAB

HTST SANITATION

Sanitizing the HTST

Why Sanitize?

- Product Safety
- Product Quality
  - Flavor
  - Shelf Life
- Comply with Regulatory Standards

System Must be Completely Cleaned before it can be Sanitized

Sanitizing:

Eliminates 99.999% of Organisms

But does not sterilize the equipment

Sanitizing Requires the Use of Potable Water

Sanitizing Cycle

Must Be:

- Separate from Cleaning Steps
- Done before Startup

Sanitizing Must Follow SSOP

- Concentration
- Time
- Temperature
- Contact all Surfaces

SANITIZERS

- Hot Water
  - PMO – Min. 170º for 5 minutes
  - IDF – Min. 185º for 15 minutes
- Chlorine
- Peroxyacetic Sanitizer

- Others

HTST SANITATION

Verification

Need to Assure Proper

Cleaning & Sanitizing

VERIFICATION

- Product Quality -- Too Late
- Inspection
- ATP
- Check Wash Recording Chart
- Heat Transfer – Indirect
  - Hot Water Temp vs. Product Temp

ECOLAB

HTST SANITATION

Summary

Summary:

- Important to Follow the SSOP
  - Make Sure You Get a Good Pre-rinse
  - Follow Proper Time, Flow, Conc. Time
  - Increased Concentrations are Not Always Better
    Especially on Over-Ride
  - Sanitize Before Startup With Proper Concentrations

PROPER SANITATION PROGRAM

- Helps Assure Product Safety
- Regulatory Compliance
- Helps Meet Customer Expectations
- Protects Your Reputation (Brand Name)
- Consumer Acceptance of Your Product
- Financial Protection for You and Co.
- Job Security

HTST SANITATION

Questions???

Pasteurizer Operator Course Summary

Katie Tuchalski – Dairy Technical Specialist

Free Test Answers – pay attention and participate!

What are the minimum VAT pasteurization temperatures?

Milk, Skim, buttermilk

- Product temperature minimum must be 145 degrees F
- Airspace temperature minimum must be 150 degrees F

Cream

- Product Temperature minimum must be 150 degrees F
- Airspace temperature minimum must be 155 degrees F

Air space Temperature must be 5 degrees above **minimum** pasteurization temperature

If the milk product temperature in the VAT pasteurizer is 155 degrees F, what does my airspace temperature need to be?

150

High Temperature Short Time (HTST) Pasteurization

- What is the minimum pasteurization temperature and hold time for milk, skim milk, buttermilk?

161 for 15 seconds

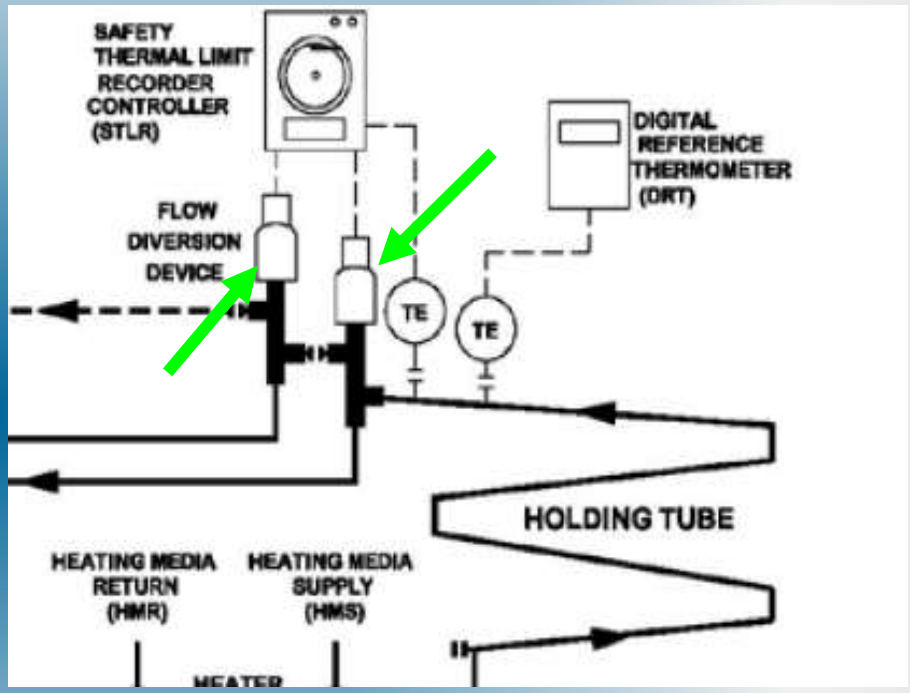
- What is the minimum pasteurization temperature and hold time for cream or products with high solids (>18%)?

166 for 15 seconds

Flow Diversion Device (FDD)

- Two valves located after the hold tube
- First valve is the?
  Flow Diversion Valve (FDV)
- Second valve is the?
  Leak Detect Valve (LDV)
- Air actuated valves

Does the air open the valve or close the valve?



Air to open, Spring to close

Flow Diversion Device

- Position detectable
- Are interwired with other components in the HTST system
- Valves must divert within 1 second if **temperature** or **flow** are not met.

What happens if the Flow Diversion Device does not divert within 1 second or if it does not fully divert?

The timing pump will not run

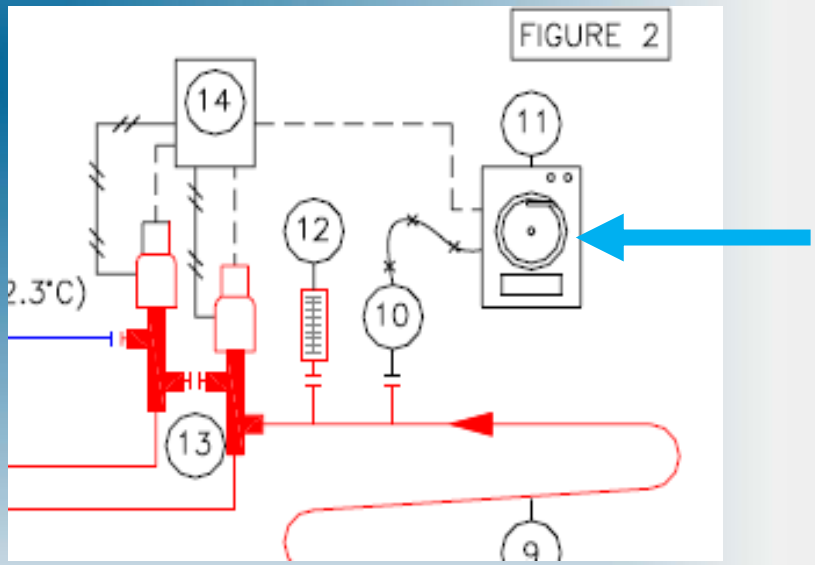
When can the FDD return to forward flow after the pasteurizer diverted because of high flow?

After the high flow alarm time delay

Why is there a delay?

Safety Thermal Limit Recorder-Controller (STLR)

Where is it?



What does it record?

- Temperature
- Status of the FDD

What temperature display do I look at when performing the cut-in and cut-out tests?

STL
R

DRT

Which display do I look at to check the accuracy of the thermometers?

STLR

DRT

What should you do if the STLR

is reading higher than the DRT?

Adjust the recording thermometer (STLR) pen to read at or below the indicating thermometer (DRT)

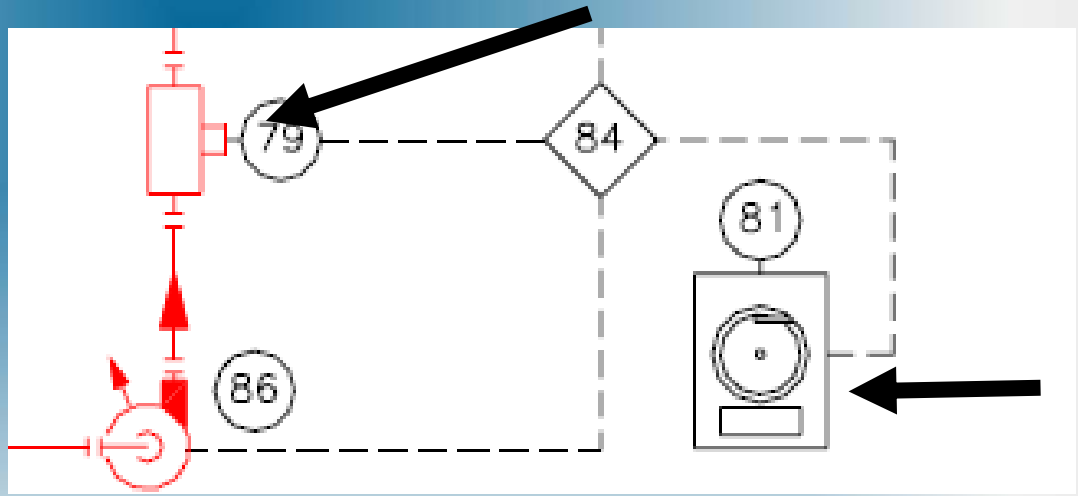
Magnetic Flow Meter

Where is it located on the HTST?

- After the timing pump

Not all systems will have a mag flow meter. Systems with mag flow meters will also have?

- Safety Flow Limit Recorder (SFLR)

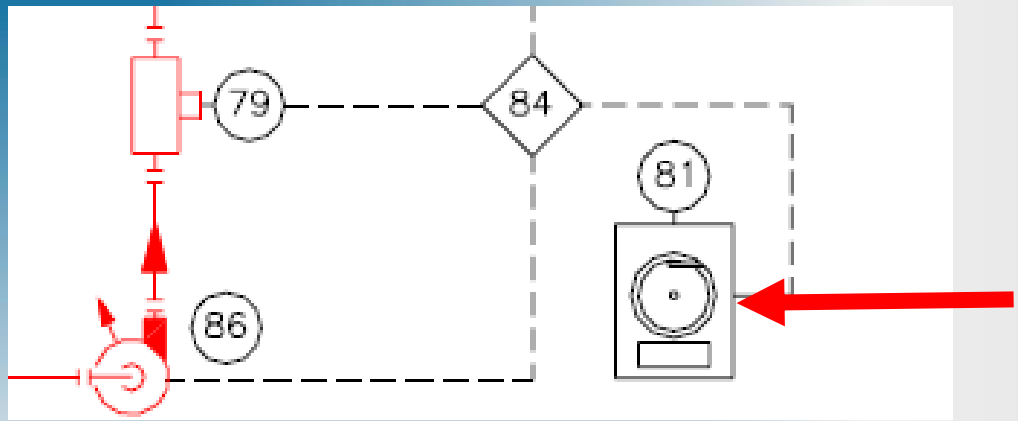


Safety Flow Limit Recorder-Controller (SFLR)

Where is it?

What does it record?

- Flow
- Status of Flow alarm (event pen)



What happens if my HTST over speeds and activates the flow alarm?

The FDD's divert

Pressure Control

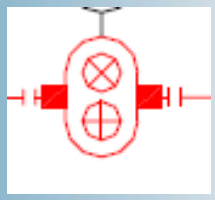
- Pasteurized Product Pressure must be minimum how many psi higher than raw?
  - 2 psi
- Does the differential pressure switch control the timing pump or booster pump?
  - Booster Pump

If the raw product pressure is higher than the pasteurized product pressure during product pasteurization I can continue to process product.

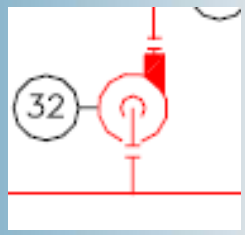
NO

Pumps

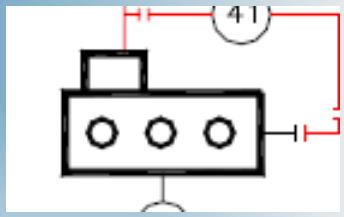
Timing Pump



Booster Pump



- When can each of these pumps run?



When can a timing pump NOT run?

When the pasteurizer is in inspect

When the valves are not fully seated in the divert position

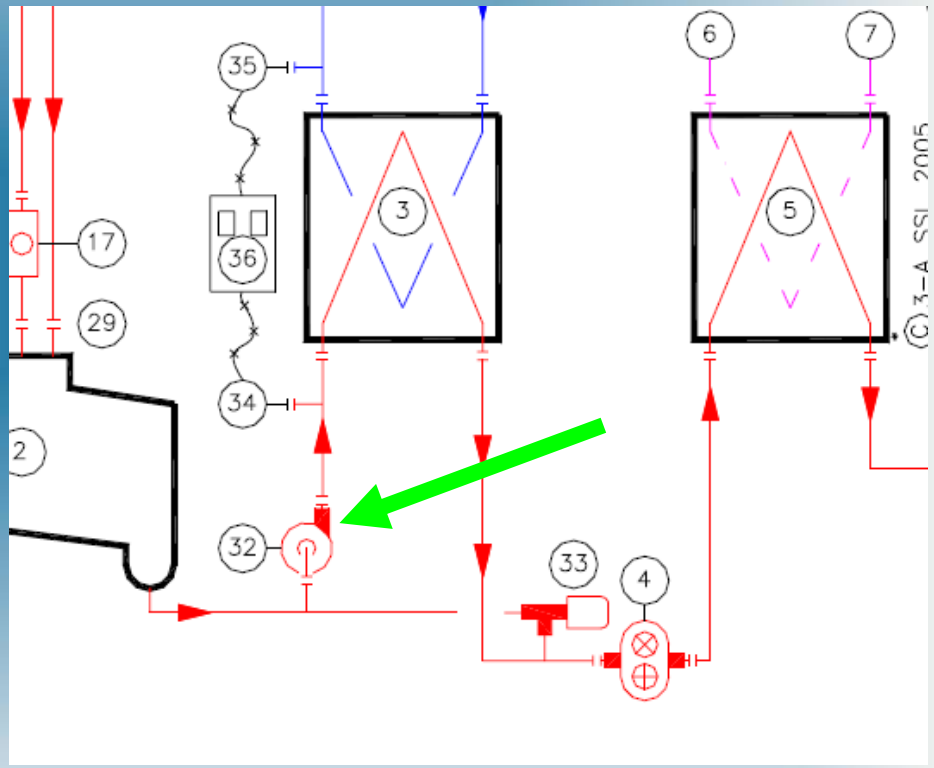
Loss of Power

When can the booster pump run?

Timing pump is running

Forward Flow

Proper pressure differential



What is Phosphatase?

- Enzyme naturally present in raw milk
- Heat sensitive
- Pasteurization inactivates the enzyme
- Indicator of proper pasteurization
- The test is used on fluid white milk products only

Can I operate my pasteurizer if the chart is not working properly but I am taking samples for phosphatase testing?

NO

Can I operate my pasteurizer if the indicating thermometer is not working but the chart recorder is and my plant takes samples for phosphatase?

NO

Can I operate my pasteurizer with a broken seal if I have fixed all public health controls, confirmed they are working properly by testing the control and I am taking samples for phosphatase every 4 hours?

YES

HTST Process mode

I am approaching the minimum required temperature for pasteurization and my flow and pressure are adequate. The pasteurizer should go into forward flow once it reaches the cut-in. What are the chain of events that follow?

Fluid Diversion Valve (FDV) Opens

Leak Detect Valve (LDV) Opens

Booster Pump starts

What happens in each Mode?

Product

- Timing pump can run
- Booster pump can run
- Valves can be forward or divert positions

Divert

- Timing pump can run
- Booster pump CANNOT run
- Valves are in diverted position

What happens in each Mode?

Inspect

- Timing pump CANNOT run
- Booster pump CANNOT run
- Valves move to Forward poistion after all flow promoting devices stop

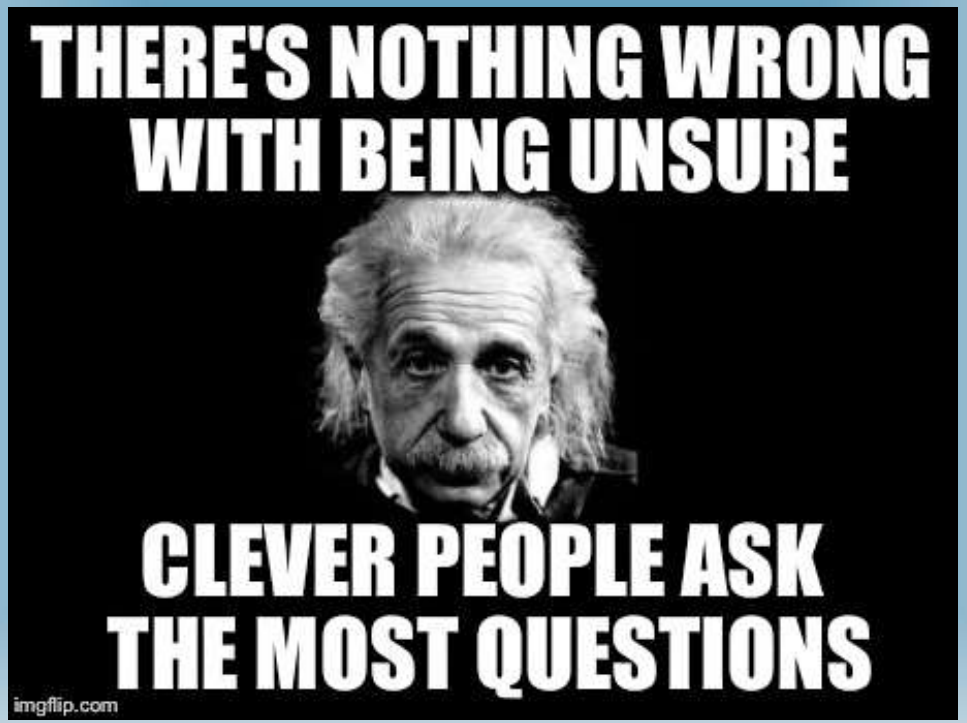
CIP

- Timing pump may run for first 10 minutes
- Booster pump CANNOT run for first 10 minutes
- Valves must stay in diverted position for first 10 minutes

Suggestions for Successful Test Taking

- Read each question slowly
- If you don't understand the question, please ask
- Rely on your instincts/gut
- Maintain a positive attitude
- Relax

Questions?


THERE'S NOTHING WRONG WITH BEING UNSURE
CLEVER PEOPLE ASK THE MOST QUESTIONS
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