

# ICE CREAM 101



# Ice Cream 101

## Basic Mix



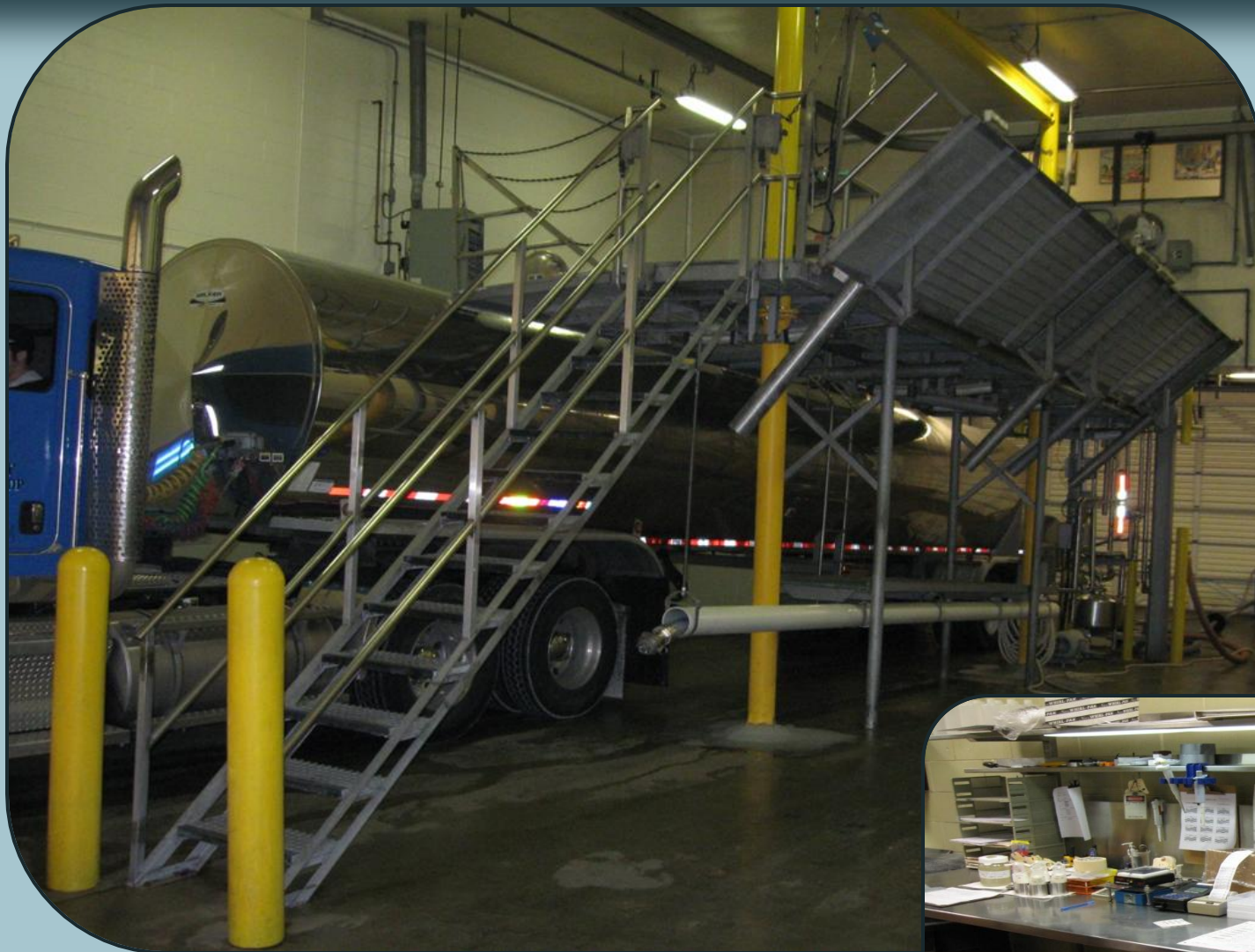
# Ice Cream 101

## Receiving Liquid Ingredients in tankers:

- Refrigerated raw milk from nearby farms
  - Refrigerated heavy cream from nearby dairies
  - Refrigerated condensed skim milk from nearby condensing plant
  - Liquid sucrose from nearby blending plant
  - Corn syrup from nearby blending plant
  - Liquid ingredients are pumped into their respective refrigerated tanks
- Capacity: 10,000 to 60,000 Gallons



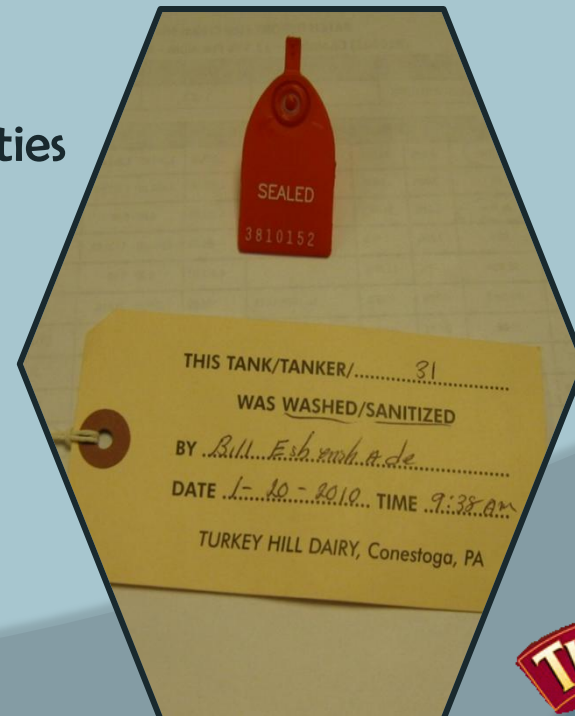
# Ice Cream 101



# Ice Cream 101

## Quality Assurance Testing Prior to Acceptance:

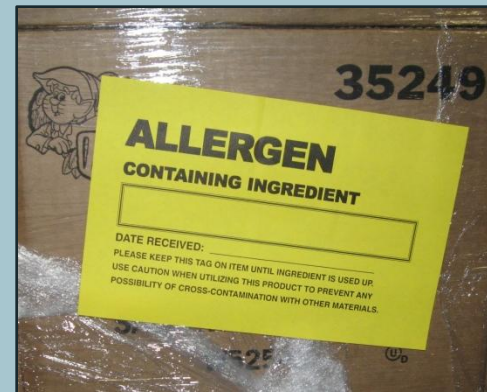
- Safety seals are properly attached, wash tags indicate cleaning
- Temperature: Below 45F for all dairy ingredients
- Ingredients meet visual and odor specifications
- Raw milk: Antibiotic free
- Assign date stamp and physical properties



# Ice Cream 101

## Receiving of Dry Ingredients:

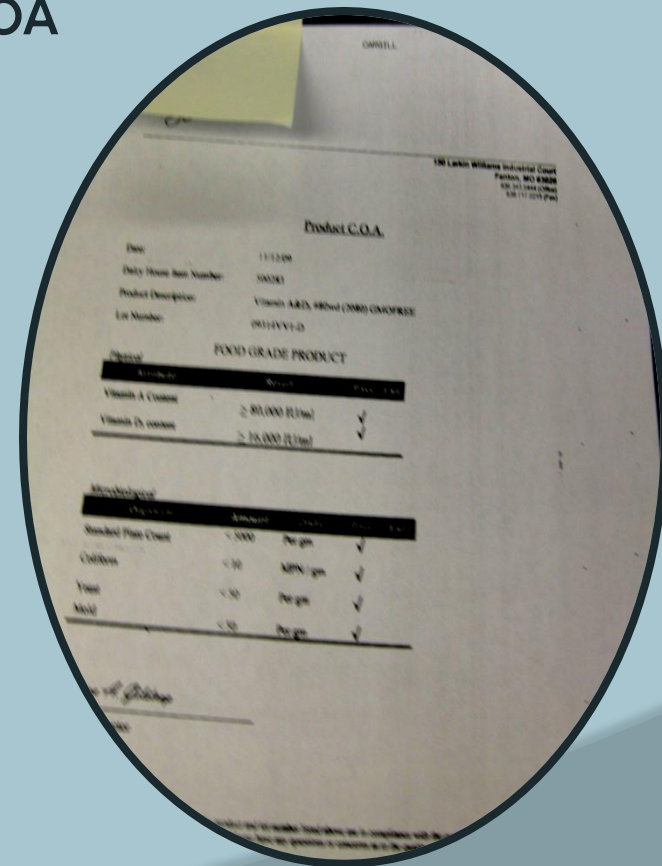
- Low heat, non fat dry milk from nearby drying plant
- Sweet whey powder
- Stabilizer blending powder
- Identify and tag all allergen ingredients
- Assign unique tracking number
- Place products on pallets in the racking system



# Ice Cream 101

## Quality Assurance Testing Prior to Acceptance:

- Certificate of analysis for each lot, COA
- Random testing



# Ice Cream 101

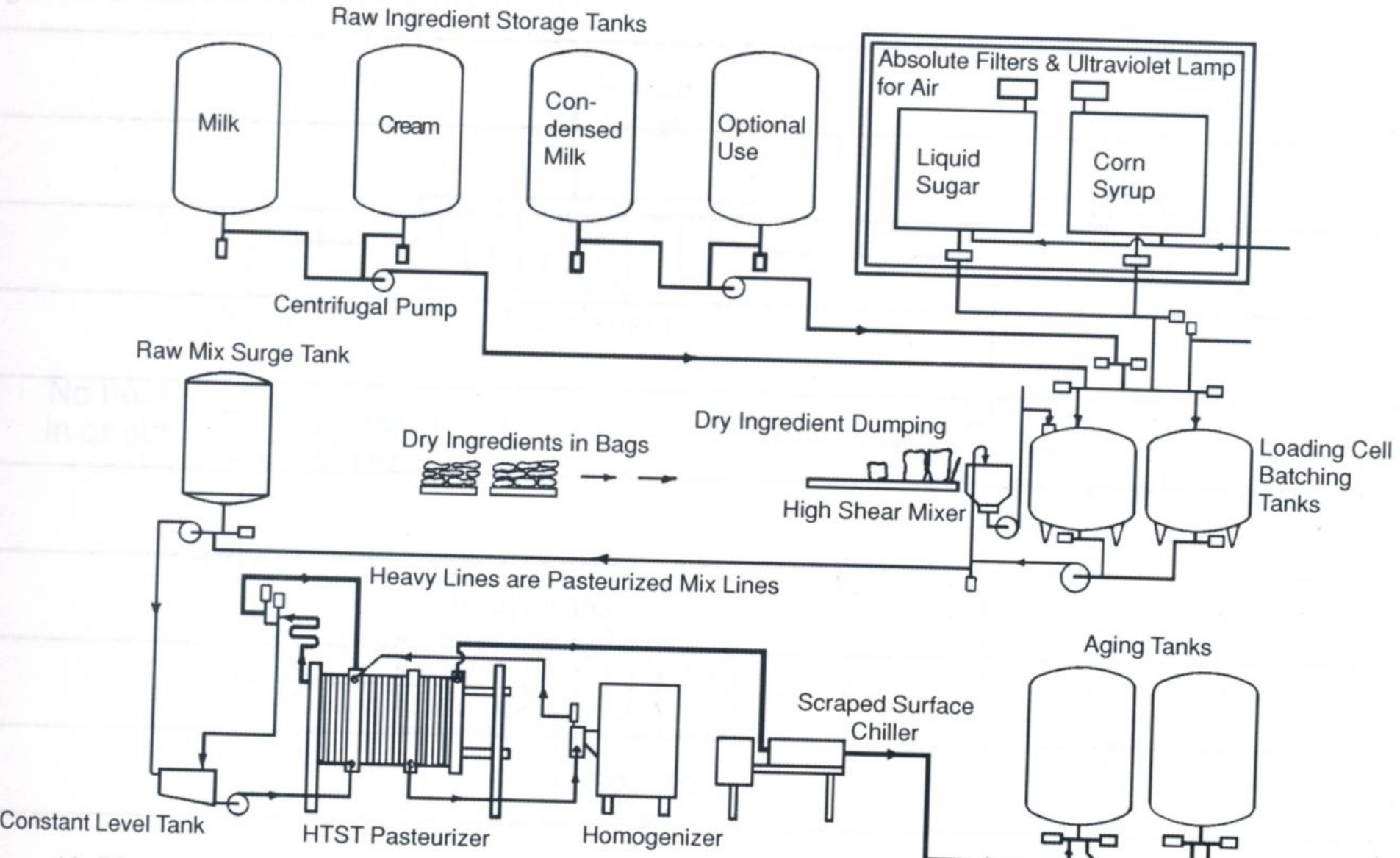
**Batching,  
Pasteurization and  
Homogenizing of  
Basic Mix**





# Ice Cream 101

Figure 1. Creaming



# Ice Cream 101

## Batching:

- Load recipe into batching computer
- Computer calculates quantity of ingredients needed



# Ice Cream 101

## Batching:

- System will start pumping milk and sugars into weighed tank
- Pumping will stop when quantity required is reached
- Dry ingredients will then be pumped into weighed tank
- Cream is then added to weighed tank and blended



# Ice Cream 101

## Quality Assurance Testing

- Samples of each batch tank are tested for proper physical properties including butterfat, viscosity and total solids



# Ice Cream 101

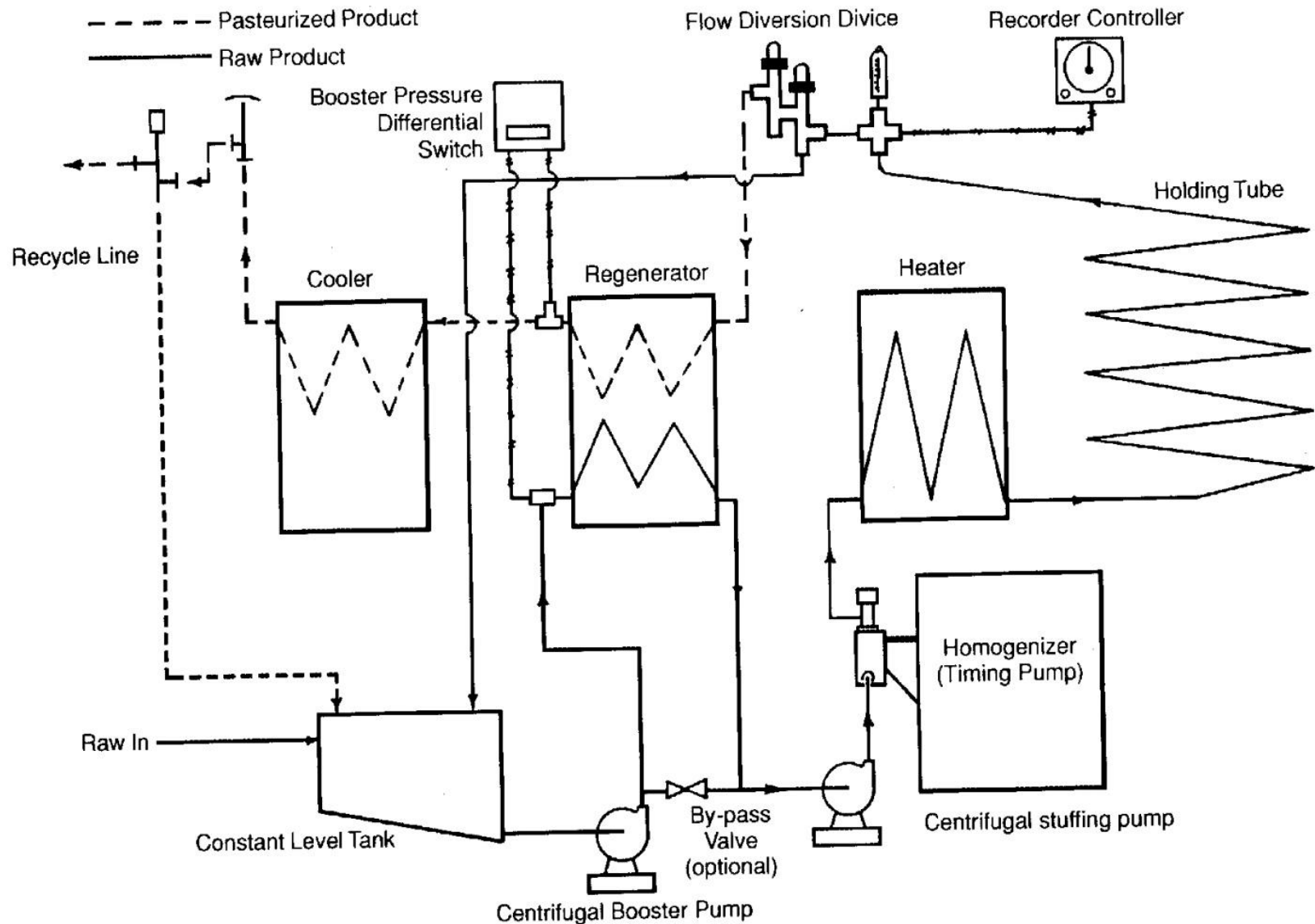
## Pasteurization

### High Temperature Short Time (H.T.S.T.)

- Pasteurization: The heating of the liquid mix and holding the mix at a specified temperature for a specified time to destroy all pathogenic organisms
- HTST: The continuous pumping of the mix through a heat exchanger(series of parallel plates with grooved or waffled surfaces, where warmer liquid on one side passes cooler liquids on the other side in opposite flow direction), at temperature above 175F for at least 25 seconds, followed by cooling to 40F or lower. This process runs continuously at 4,000 GPH



# Ice Cream 101



# Ice Cream 101



## Phase One: Regeneration Section

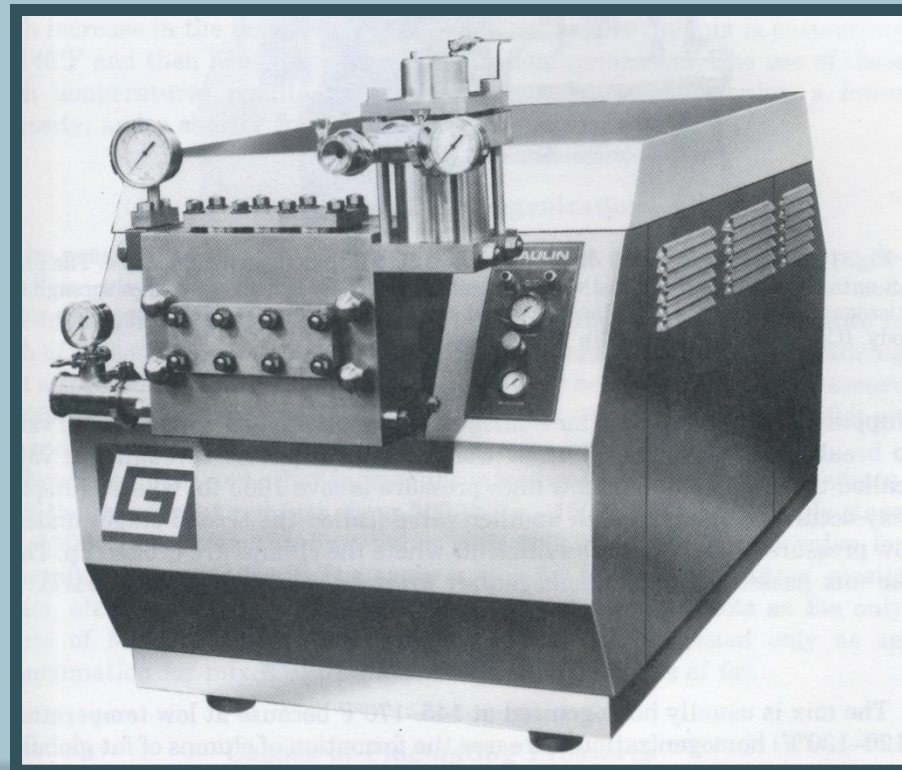
The completed batch which is cold, is pumped into this section, flowing on one side of the plates, while hot mix which has been pasteurized, flows on the other side of the plate. The result is the cooling down of the hot mix and the warming up of the cold mix, thereby saving energy.



# Ice Cream 101

## Homogenization:

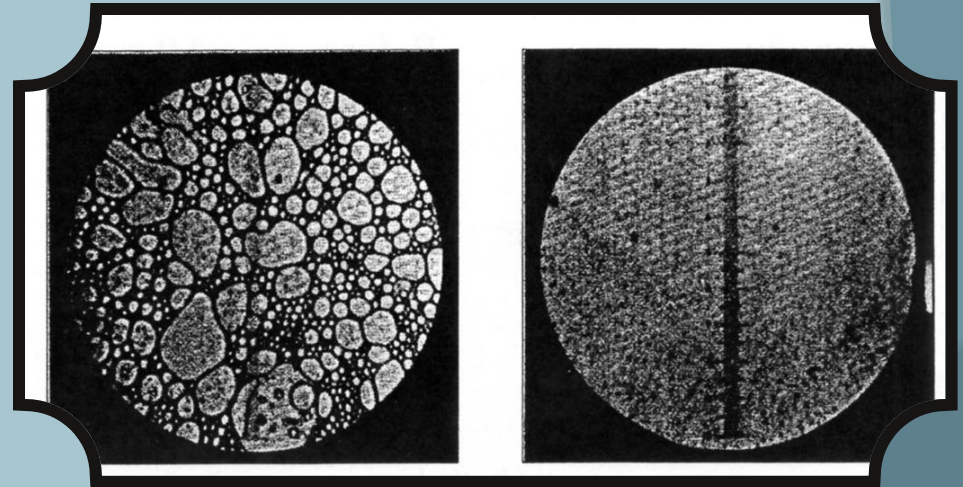
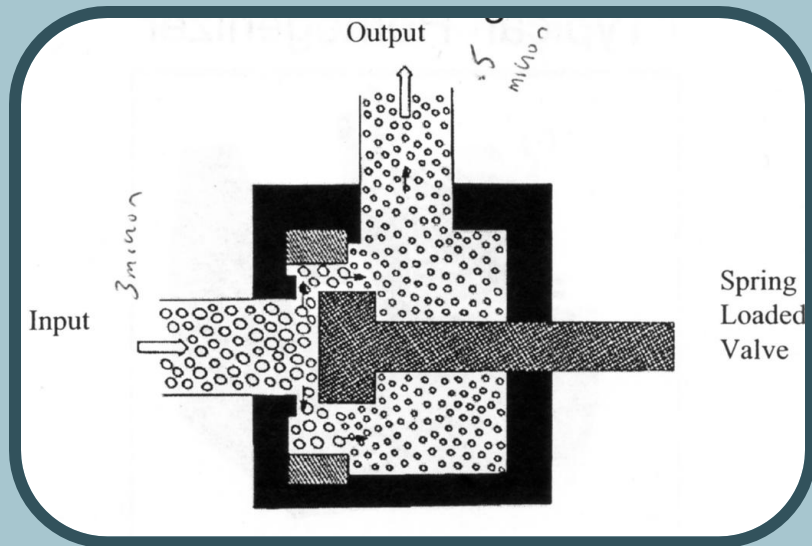
- The homogenization process reduces particle size for all liquid mix components. It promotes complete mixing of all ingredients – no separation of cream and a smoother ice cream.





# Ice Cream 101

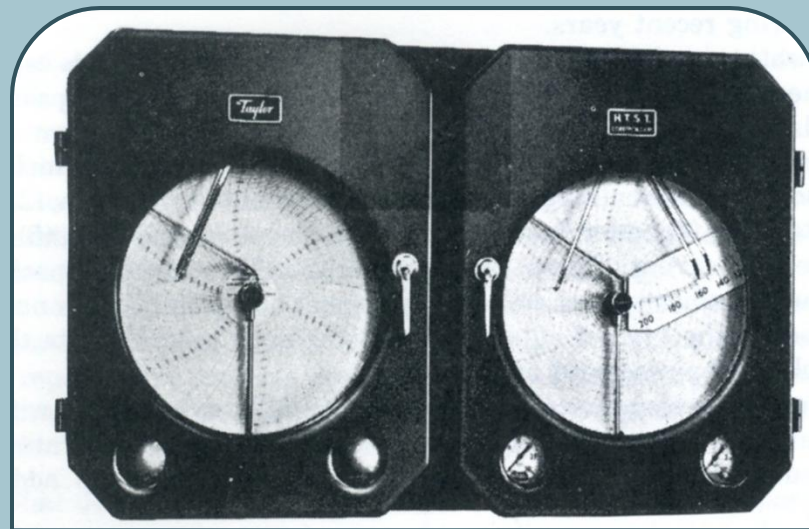
- The homogenizer is a piston pump – reduces particle size by pushing mix through an extremely narrow opening at high velocities and high pressures.



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## Phase Two: Heating Section

- Warmed mix moves into this section flowing on another section of plates in one direction while hot water flows on the other side.
- Result: The warmed mix is brought up to pasteurization temperature. It continues through a flow diversion valve, measuring exact temperature and diverts to start the process over if the pasteurization temperature is not met.



# Ice Cream 101

## Phase Three: Holding Tube

- The hot mix continues into the holding tube where it flows for the specified time to destroy all pathogenic organisms.



## Phase Four: Regeneration Section

- Repeat of phase one – hot mix flows through on the other side of the plates.



# Ice Cream 101

## Phase Five: Cooling Section

- The hot mix, which has now been reduced to a warm mix, continues through this section, flowing on one side of the plates while a refrigerant (chilled glycol) flows on the other side in the opposite direction – resulting in a temperature reduction to 36F. The pasteurization process is now complete and the mix is pumped into a large vertical tank – held at this temperature until tested by the quality assurance.



# Ice Cream 101

## Quality Assurance Testing:

- The completed mix is tested to ensure that the physical and micro standards are met.



# Ice Cream 101

Flavoring,  
Freezing,  
Inclusions, and  
Packaging



# Ice Cream 101

## Flavoring of Mix:

- Completed Mix, **White or Chocolate**, is metered in small quantities (500 gal or less) into a Flavor Tank.
- Flavoring/Color is added while mix is under constant agitation, resulting in a thoroughly blended mix at 40F or less.
- Basic mix has now taken identity of a Flavored mix – ready for freezing process



# Ice Cream 101

## Quality Assurance Testing:

- Prior to freezing step, the flavored mix is tested to ensure that the physical properties, including flavor and micro standards, are met.





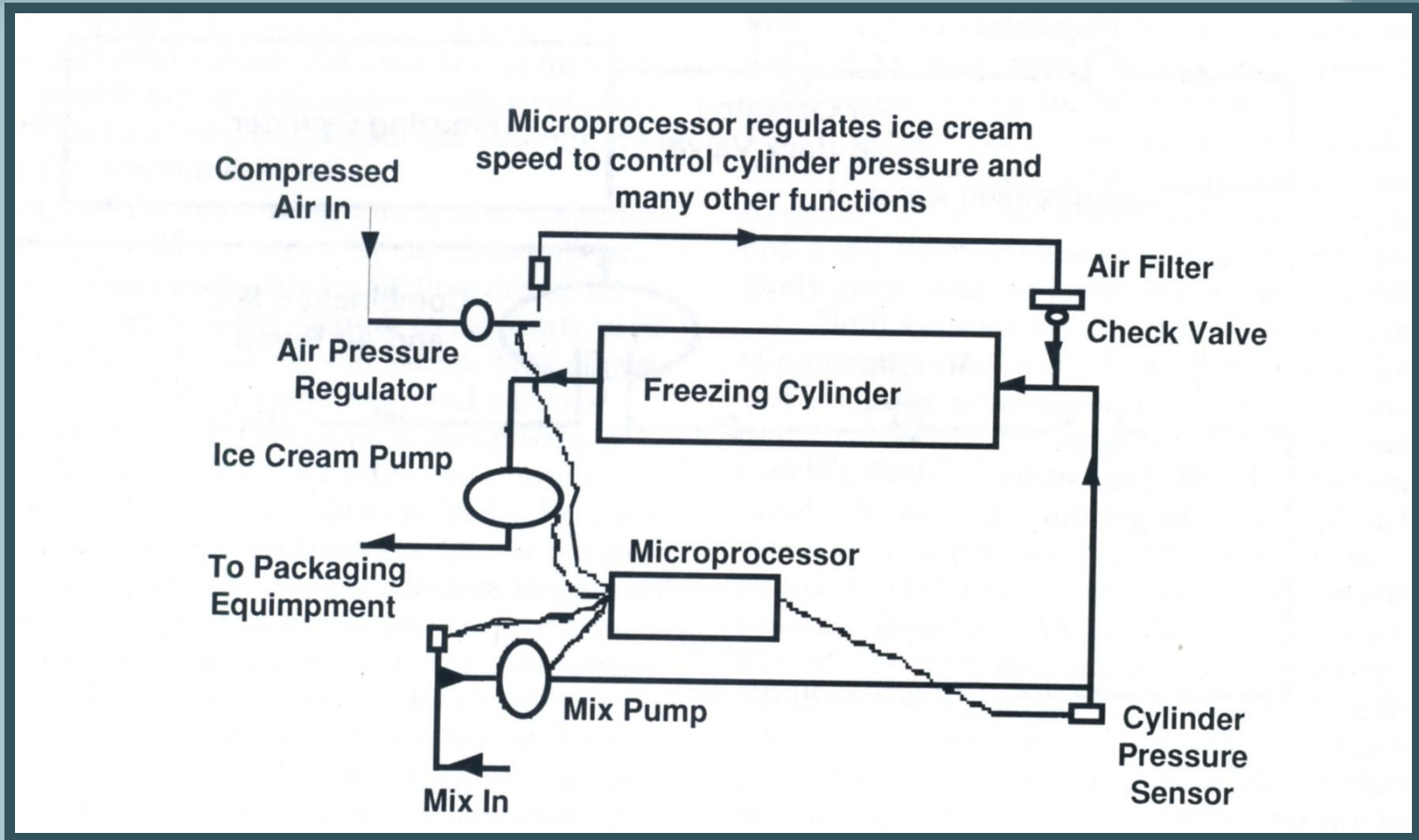
# Ice Cream 101

## Freezing of Flavored Mix:

- Freezing of mix is one of the most important operations in making ice cream – quality, palatability, and yield of finished product depend on this step.
- Mix is frozen quickly while being agitated to incorporate air and to limit size of ice crystals formed.
- Freezing barrels at TH produce up to 400 gallons of ice cream per hour.



# Ice Cream 101



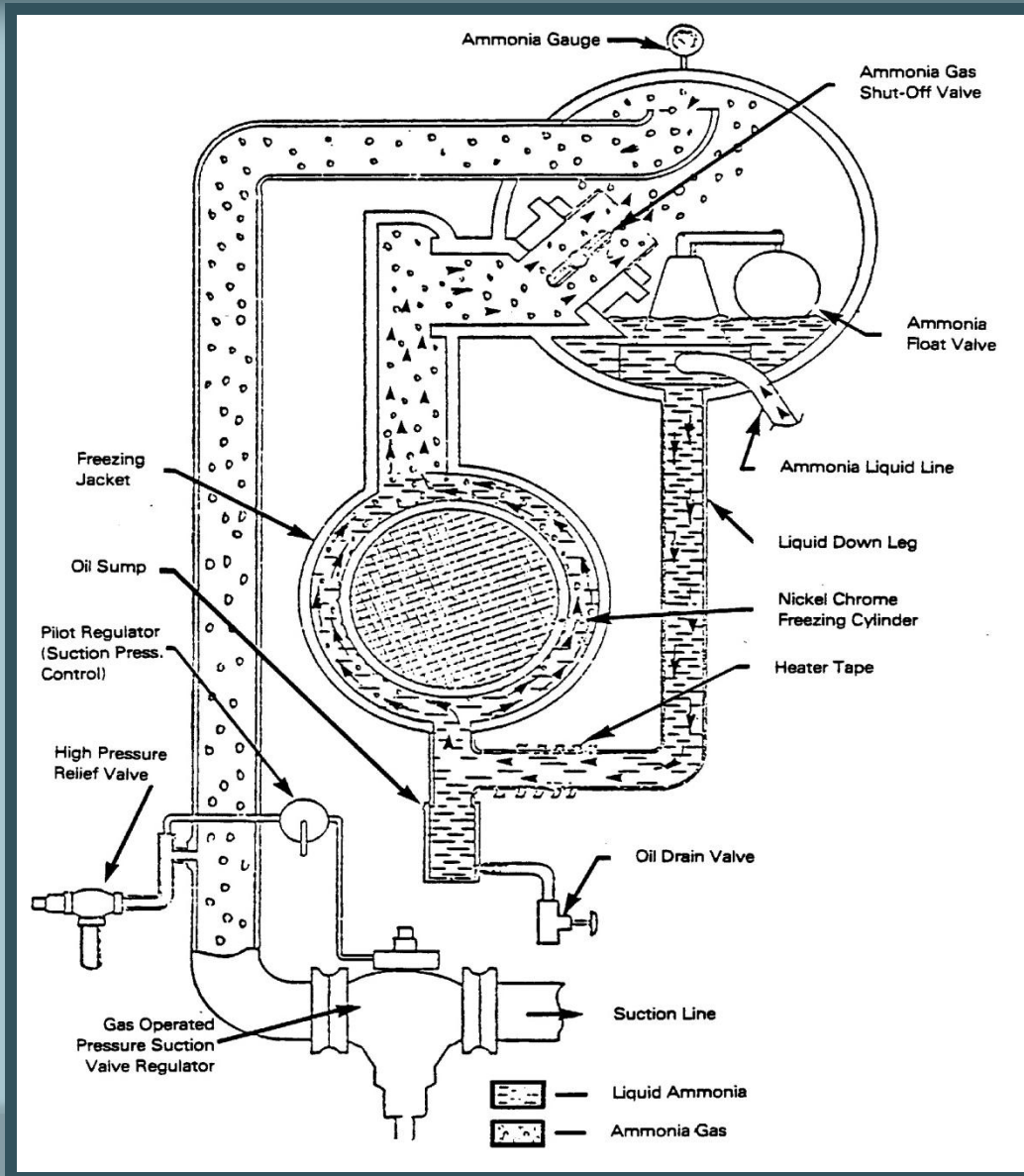
# Ice Cream 101

## Freezing of Flavored Mix (con't):

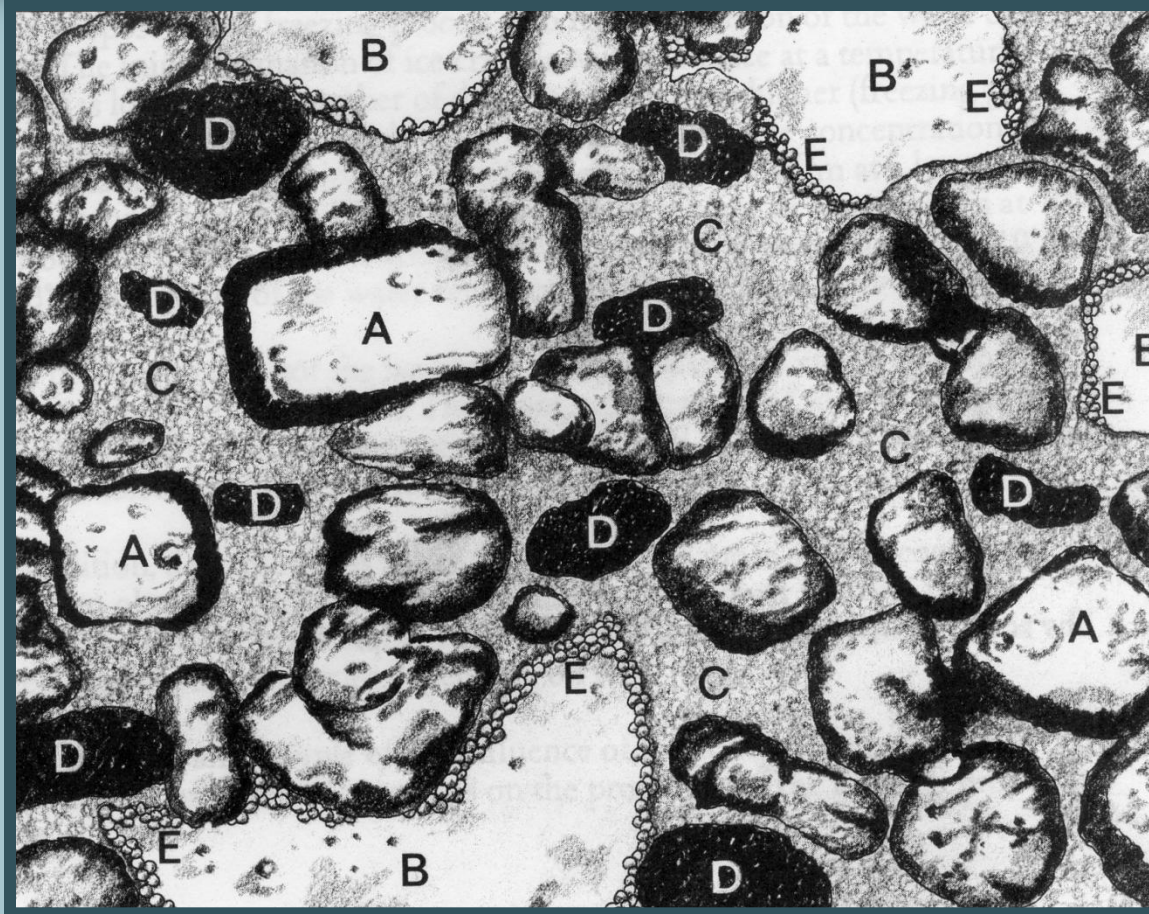
- Cold flavored mix, along with air, is pumped into inner barrel of continuous freezer – inner barrel chilled generally with ammonia refrigerant.
- Flavored mix is whipped with a dasher – attached to dasher are sharp scraper blades that scrape ice crystals that are forming on the cylinder wall – by removing these immediately, ensures product will have smooth texture.
- As it exits the chamber, the flavored mix is a stiff, flowing cream at a temperature of 21F – 50% frozen – rapidly growing to twice its volume.  
Product can now be called Ice Cream.



# Ice Cream 101



# Ice Cream 101



- a: Air cells (110-185  $\mu\text{m}$ )
- b: Ice crystals (44-55  $\mu\text{m}$ )
- c: Unfrozen material
- d: Cocoa particles (5-50  $\mu\text{m}$ )
- e: Fat globules



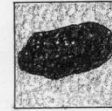
a



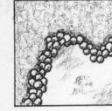
b



c



d



e



# Ice Cream 101



## Adding Inclusions: Tin Roof Sundae:

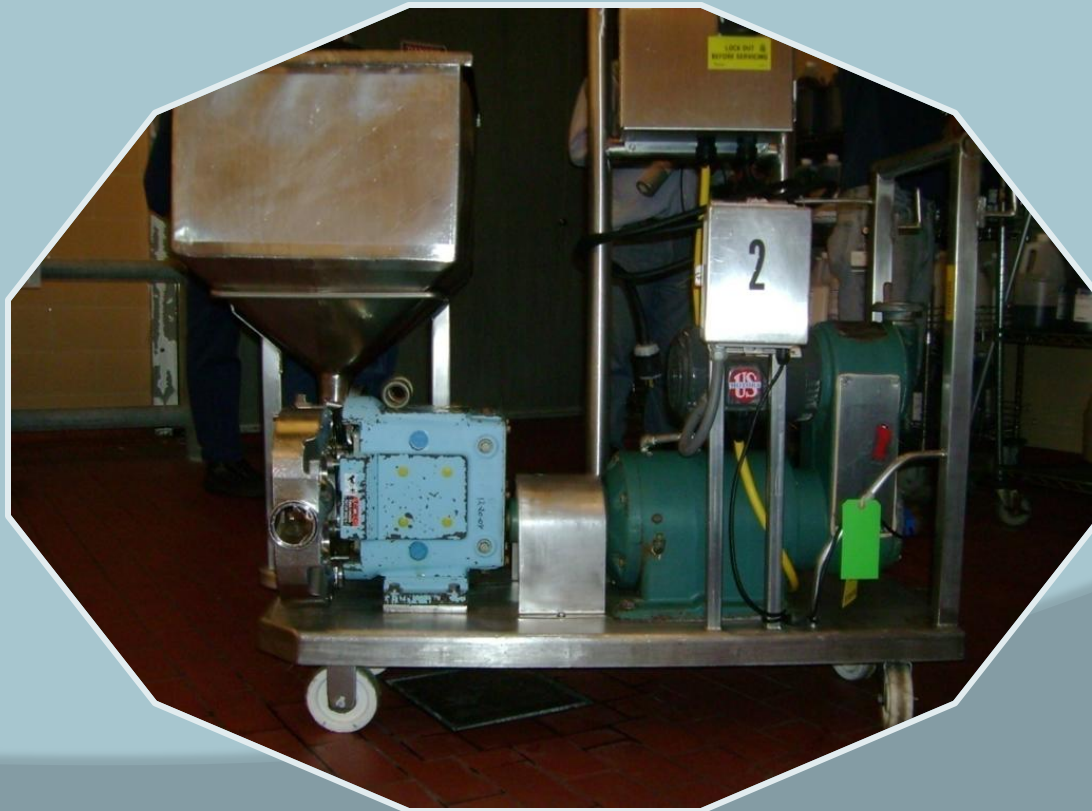
- Inclusions (candies, cookies, fruits, fancy nut meats, etc.), in this case, chocolate covered peanuts, are added to the ice cream after it has exited the freezer – using an ingredient feeder.



# Ice Cream 101

## Adding Variegates: Tin Roof Sundae

➤ Example are peanut butter, whipped marshmallow, brownie fudge, strawberry weave. Chocolate fudge, in this example, are added after the chocolate covered peanuts – a positive pump with a nozzle attached is used for this process.



# Ice Cream 101

Vanilla ice cream passes along through a pipe where an ingredient feeder drops the chocolate covered peanuts in a wheel which folds the peanuts into the ice cream. While still in the pipe, the ice cream enters a larger cylinder containing a spinning blender which distributes the peanuts evenly.

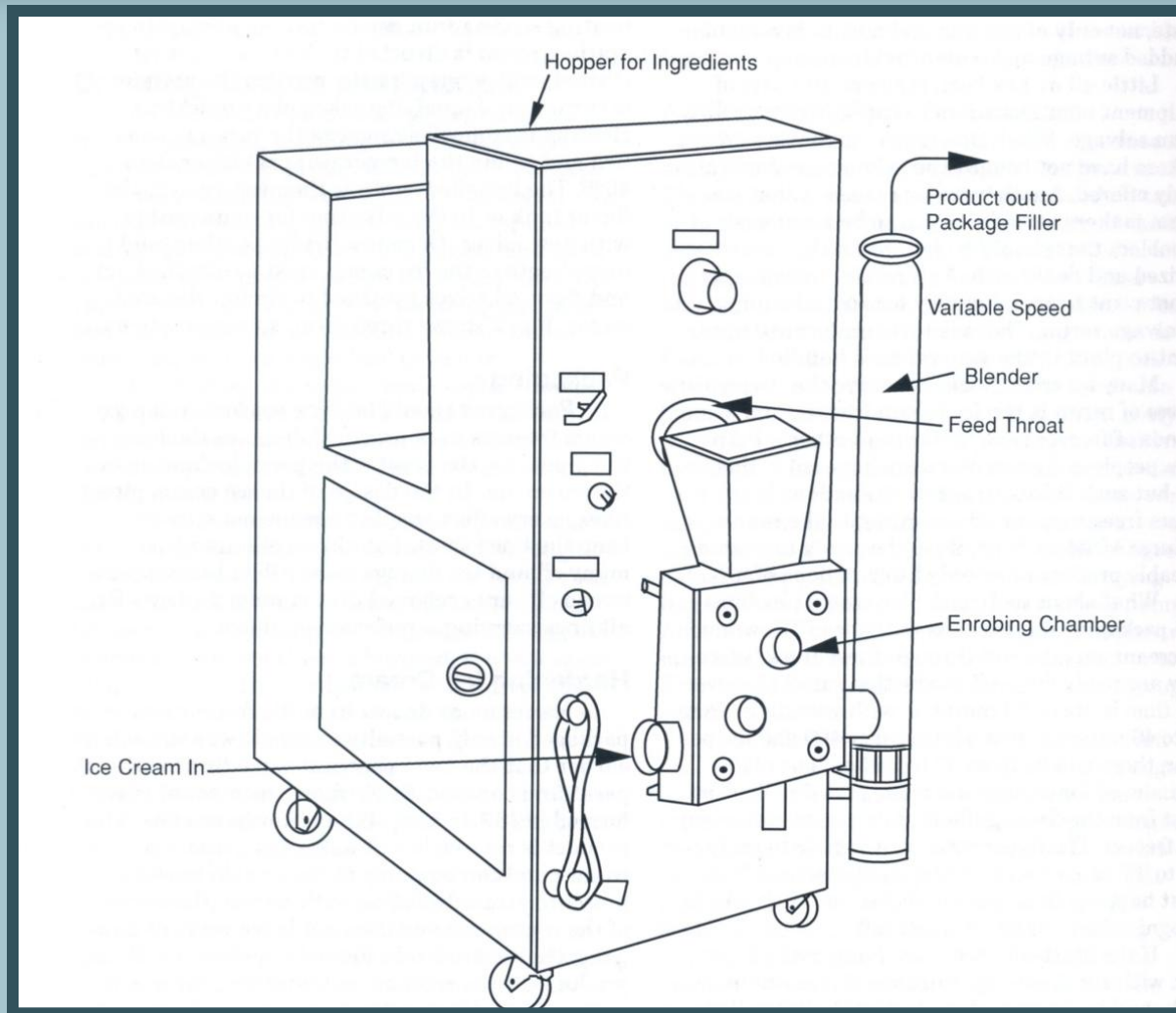
## Pack Counts:

The number of six packs of finished ice cream made needs to have a specific amount of ingredients in it.



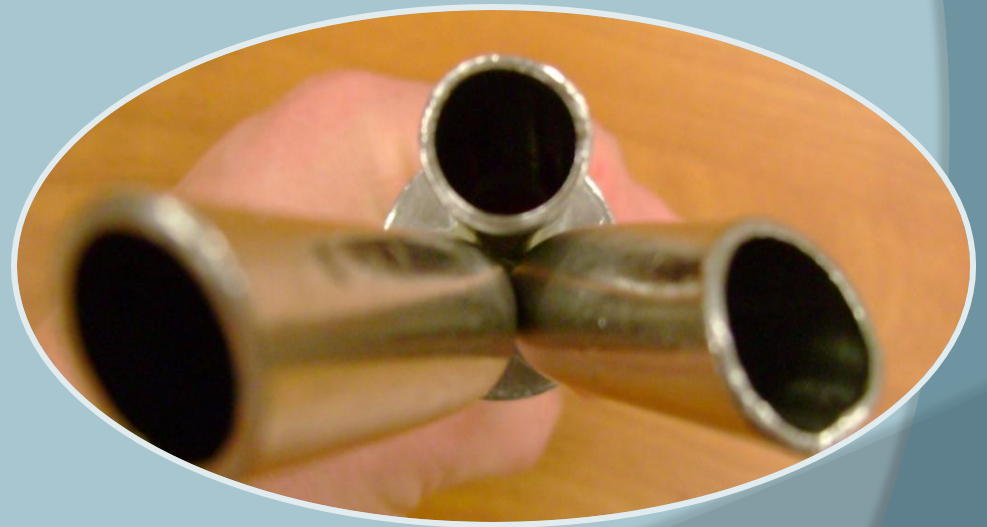


# Ice Cream 101



# Ice Cream 101

The mixture continues to flow through the pipe where it encounters the rippling nozzle dispensing the rich, creamy fudge evenly through out this mixture – now known as Tin Roof Sundae Ice Cream.



# Ice Cream 101



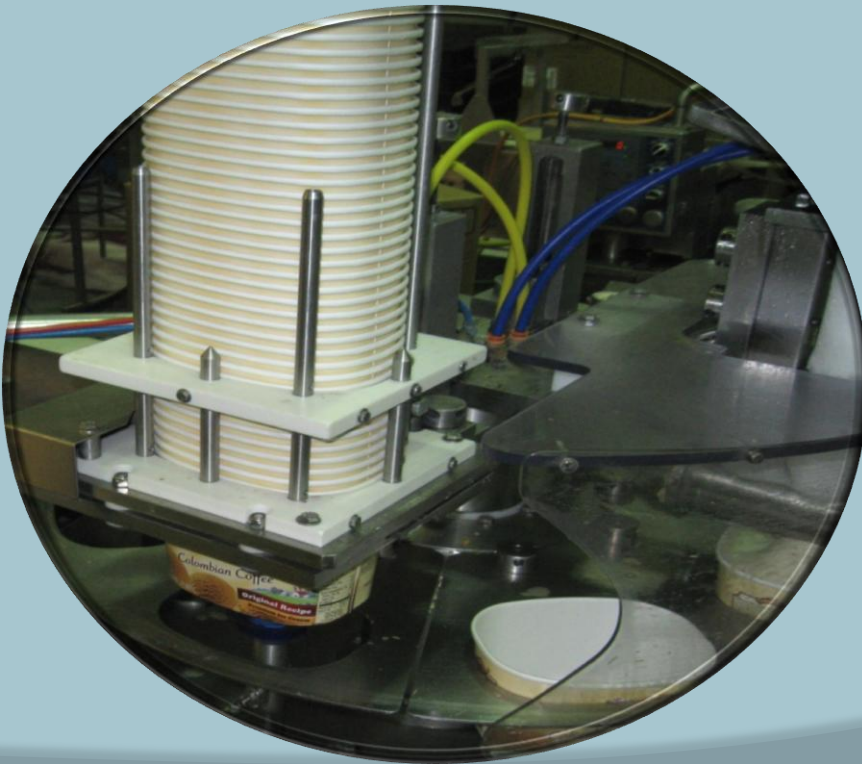
# Ice Cream 101

Filling,  
Lidding,  
Coding and  
Bundling



# Ice Cream 101

Tin Roof Sundae continues flowing through the pipe and enters the fill valve of the rotary cup filling machine – fill valve deposits correct volume of ice cream into the cup – encounters a lid.



# Ice Cream 101

Lid is placed on to the filled cup and is firmly sealed using pressure.



# Ice Cream 101



Filled cup and lid are deposited onto a conveyer belt where application of best if used by code, time of day, and signature letter code of operator occurs.



# Ice Cream 101

The next step is the tipping over of every other package along the conveyor belt – to be overwrapped in plastic (six packages to a bundle). The bundle then passes through a heat tunnel where the plastic is shrink wrapped around the cartons.





# Ice Cream 101

## Quality Assurance Testing:

Samples of the Tin Roof Sundae Ice Cream are taken to be tested to ensure that the physical properties including flavor, inclusions, proper filling, legible coding and micro standards are met.



# Ice Cream 101



**TIN ROOF SUNDAE**



# Ice Cream 101

Hardening,  
Palletizing,  
Warehousing,  
and Shipping

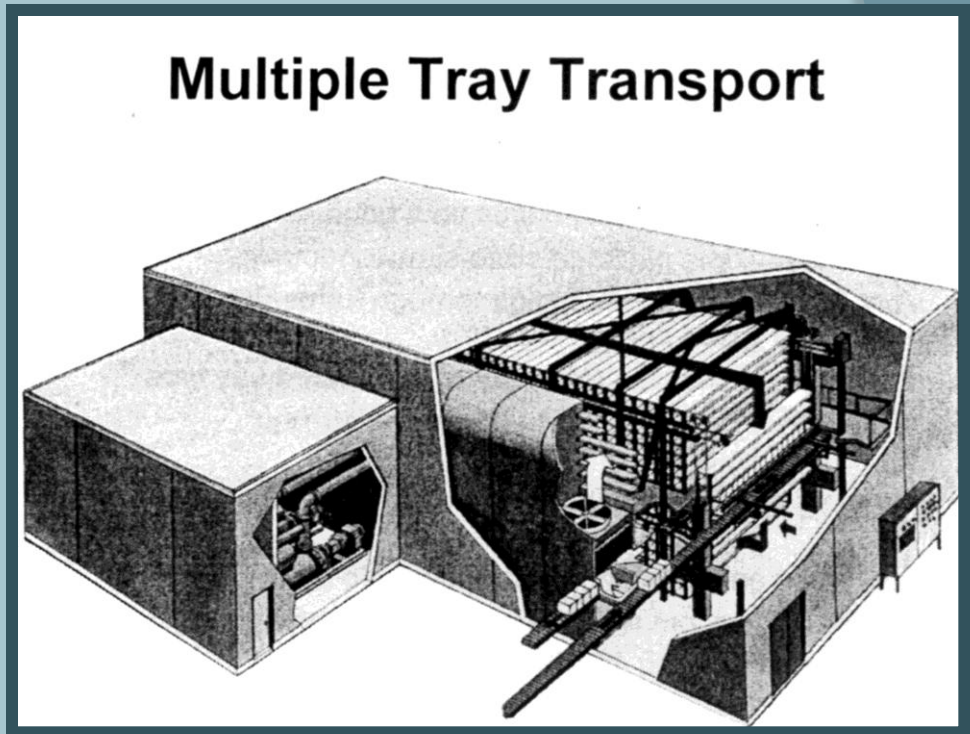


# Ice Cream 101

In order to ensure that the smooth velvety texture is maintained, the ice cream needs to be completely frozen in as short a time period as possible to a core temperature of minus 20F. This allows packages to be stacked on pallets without damaging their shape. This is called the hardening phase of the process.



## Multiple Tray Transport



# Ice Cream 101

The bundled packages continue along the conveyor where they are assembled in an orderly row to be pushed into the quick hardener – holds the ice cream here for 6-10 hours with very cold wind of high velocity – lowers temperature from 21F to minus 20F – continuous process.



# Ice Cream 101

Upon exiting rapid hardener, the ice cream is taken to the palletizing room where it is stacked on pallets.

The temperature in this room is 10F.



# Ice Cream 101

Pallets are then conveyed to a wrapping machine which stretch wraps plastic around the entire contents of the pallet, ensuring that during shipment the packages remain intact. A shipping UPC is attached for tracking purposes.



# Ice Cream 101

Wrapped pallets are placed in the racking of the warehouse – constant temperature of minus 20F is maintained.





# Ice Cream 101



Finally: The pallets of ice cream are loaded into a refrigerated trailer which maintains the temperature until delivery is made to the store.



# Ice Cream 101

