The Grade “A” Pasteurized Milk Ordinance, 2009 Revision ITEM 18r. states:
Raw milk for pasteurization shall be cooled to 10°C (50°F) or less within 4 hour or less, of the
commencement of the first milking, and to 7°C (45°F) or less within two (2) hours after the completion
of milking. Provided, that the blend temperature after the first milking and subsequent milking does
not exceed 10°C (50°F).

The 3-A Sanitary Standards for Farm Milk Cooling and Holding Tanks, Number 13-10 is a second
standard that deals with cooling milk on dairy farms. Section E1.1 deals with cooling. This standard
states:
Cool the product to 50°F (10°C) or less within 4 hours or less of the commencement of the first milking
and to 40 F (4.4 C) or less within 2 hours after the completion of milking. Provided, that the blend
temperature after the first milking and subsequent milkings does not exceed 50 °F (10 °C).
COOLING METHODS

• Bulk Tank. Can be thought of as floating down a lazy river

• Chiller to Storage or Trailer. Like floating down a river... but with rapids
COOLING LINGO YOU NEED TO KNOW

• BTU – British Thermal Unit – The amount of energy to change one pound of water one degree F.

• Ton of Refrigeration – Ton(s) – The amount of energy to melt one ton of ice in a 24 Hours. 288,000 BTU/Day or 12,000 BTU/Hr.

• BTU/Hr – Term used to standardize the steady state capacity of a system... The Rate.

• Delta T – Change in Temperature

• But what about HP?
FLOW RATE: Part of the Puzzle

• This is the speed the car is going.

• Examples and Assumptions 2,000 Milking @ 90 Lbs/Cow.
  • 2,000 X 90 = 180,000 Lbs/ Day
  • 180,000 Lbs/Day / 24 Hrs = 7,500 Lbs/Hr
  • 180,000 Lbs/Day / 21 Hrs = 8,571 Lbs/Hr  Whoops forgot wash
  • 180,000 Lbs/Day / 20 Hrs = 9,000 Lbs/Hr  Whoops forgot treated time

• 7,500/9,000  It is only a 16% Error
• Same as asking our haulers to pickup 85,000 Lbs when they show up!
FLOW RATE: Part of the Puzzle

- But wait... there is more
- If you average the entire milk over the 24HR period... you miss morning milking
- What about the “High Producing” Group (s)?
- Undersized Balance Tank?
- Suddenly 9,000 Lbs/Hr is really 10,800 Lbs/Hr for our Cooling System

- Well that is only... 7,500/10,800 = 30% off
DELTA T : How Big the Difference in Temperature

• This is how steep the hill the car is going up.
• The Water Pass is probably the most variable part of the equation.
• Where is the water coming from and what is the flow rate?
• What is the Temperature?
• I always use the warmest temperature at the lowest practical flow rate. This is not the time for optimism.
• 2:1 Ratio or more is desired.
• The Temperature never can match! 8F – 3F depending on design of the plate cooler.
DELTA T : How Big the Difference in Temperature

• Typical Calculation
  • 98F Milk (Yes I know... but it cools in the lines)
    55F Well Water
    + 8F Thermal Transfer Loss
  We can assume the milk is exiting at 63F (55+8)
  35 DELTA T (98-63)
  • This is the amount of Temperature Drop of the Milk in the First Part of the System
  • 35F x 10,800Lbs/Hr = 378,000 BTU/Hr or 31.5 Tons of Cooling

• Water is a big deal and worth figuring out correctly!
DELTA T : Cooling Side

• Typical Calculation
  • 63F Milk From Previous Step
  - 38F Target Temperature
  25 DELTA T
  • This is the amount of Temperature Drop of the Milk in the Second Part of the System
  • 25F x 10,800Lbs/Hr = 262,500 BTU/Hr or ~22 Tons of Cooling
Horsepower Right?

• There is no correlation between tons of cooling and HP that is meaningful unless we are going to use them to haul the blocks of ice.

• General rules apply but most of it is based on system design and ambient temperatures.

• Working backup in divisible increments. i.e.

• BTU/Hr vary with Ambient Temperature and Temperature of the Coolant.