SUPPLY FONTERRA

Milk Cooling

New Milk Cooling Regulations Proposed

The Ministry of Primary Industries is proposing new cooling requirements to replace those currently used on-farm in order to align our standard with those of our international trading partners. While this proposal has yet to receive final confirmation, it is likely to happen shortly so we recommend you check your milk temperature now to allow time to make any changes if required.

The following changes will be introduced progressively from 1 August 2016 through to 1 January 2018.

Raw milk must:

a. be cooled to 10ºC or below within 4 hours of the start of milking; and
b. be cooled to 6ºC or below within 6 hours of the start of milking and within 2 hours of the end of milking; and
c. be held at or below 6ºC until collection or the next milking; and
d. not exceed 10ºC during subsequent milkings.

In situations where there is continuous milking, such as automated milking systems, the milk must enter the bulk milk tank at 6°C or below, continuous milking being defined as milking for 6 hours or longer from the time that milk first enters any bulk milk tank.

Data Collection

To confirm the capability of milk cooling equipment, farm dairy operators must have an auditable system that confirms milk cooling requirements are met. As a minimum, milk cooling performance must be monitored and recorded on at least three occasions per dairy season, including:

i. within the first two months of lactation, once the full herd has calved;
ii. about the time of peak milk production; and
iii. February each year.

Where electronic data capture and recording systems are installed, it is recommended that such systems be capable of holding delivery line and bulk milk tank temperature data for the previous 30 days for both milk and CIP.

The proposed timeframes for implementing the new standards are

- **1 August 2016 for:**
  - New farm dairies
  - Farm dairies undergoing a material change to the milk cooling system
  - Farm dairies not capable of meeting current milk cooling criteria.
- **1 January 2018 for**
  - All farm dairies.

To check if your current cooling system will meet the proposed new regulations, we recommend you refer to the table below. This will show whether you will need to take further action (for example, seek expert advice from your cooling supplier) to ensure your system will meet the new regulations on time.

Milking time (hours)	Milk Temperature at end of milking	Milk Temperature after the end of milking	
		Time (hours	Temp (°C)
1.0	N/A	2.0	6
1.5	N/A	2.0	6
2.0	N/A	2.0	6
2.5	N/A	2.0	6
3.0	N/A	2.0	6
3.5	N/A	2.0	6
4.0	10	2.0	6
4.5	9	1.5	6
5.0	8	1.0	6
5.5	7	0.5	6
6.0	6	0	6

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ASSESS YOUR CURRENT MILK COOLING PERFORMANCE

We recommend you use this checklist to assess your farm dairy's ability to meet the proposed MPI cooling regulations. For the majority of farms the milk cooling system is most challenged during peak milk flows. It is advised that you carry out three assessments:

1. Within the first two months of lactation, once the full herd has calved
2. About the time of peak milk production
3. February.

If you answer **No** to any of the questions below that apply to your situation, please seek advice from your cooling provider.

	Y/N	Temperature at time of assessment		
		1	2	3
If you milk for less than 4 hours				
Is the milk temperature two hours after milking less than 6°C?				
Does the milk temperature stay below 10°C during the next milking?				
If you milk for 4-6 hours				
Is the milk temperature less than 10°C four hours into milking?				
Is the milk temperature less than 6°C six hours from the beginning of milking?				
Does the milk temperature stay below 10°C during the next milking?				
If you milk for 6 hrs +				
Does the milk enter the vat at less than 6°C?				

Note:

- Outside of the above, raw milk must be held at or below 6°C until time of collection.
- If you remove milk from the milking system to determine its temperature, do not return it to the vat.
- Use an accurate temperature gauge suitable for use in the farm dairy (i.e. no glass thermometers).

Please note: By completing this assessment you are only taking a snapshot of your cooling performance, which only provides an indication of current temperature. It does not necessarily mean that you will meet the standard 365 days of the year.

Fonterra

Dairy for life

Getting ready for the new raw milk temperature standards.

Effective milk cooling is a key determinant of milk quality. The more rapidly milk is cooled the better quality it will be when it is collected from the farm.

A basic understanding of milk cooling systems can help you make a more informed decision about what option or options will best suit your situation. Unfortunately one size or one solution does not fit all.

Primary Cooler

Your primary cooler is the cheapest way to cool your milk and even if your source of water is not as cold as you would like it is still worth maximising your primary cooler efficiency to get the best out of it, saving on your power bill. A plate cooler that is working well should cool milk to within 2 to 3 degrees of the temperature of the incoming cooling fluid, that is to say the milk exiting the cooler should be no more than 3 degrees higher than the water entering the cooler.

Seek advice from your milking machine fitter to assist in maximising your primary cooling efficiency.

Factors affecting performance of pre-coolers

1) Flow rate of cooling water : milk
   a) The cooler should be sized for the peak milk flow from the milk pump. (Where possible have the milk pump going as slow as possible during milking without flooding the plant.)
   b) 'M series' plate coolers work most efficiently with a water to milk flow ratio of 3:1 that is for every litre of milk passing through the cooler 3 litres of water must pass through. 2:1 is adequate for newer industrial coolers.
   c) Water flow rate can be restricted by: -Over compressed cooler plates allow about 3mm per plate.
      -Pipe line sizes to and from the cooler.
      -Pump insufficient to provide required flow rate.

2) Source water temperature- Ideally plate coolers should use the coldest water available
   a) Ensure any water lines are buried from the water source(bore, stream, dam)
   b) Avoid recirculating water going through the primary plate cooler back into the same tank as the tank water temperature will increase during milking increasing the milk temperature entering the vat requiring additional refrigeration in the vat.

3) Number of plates.
   a) The peak flow of milk from the milk pump will determine the type (m series or industrial) and the number of plates required. There is little benefit in adding more plates to a cooler without ensuring the water to milk ratio is correct.

4) Plate cleanliness- Contaminates in either the milk or water (i.e. iron water) that adheres to the plates will affect a coolers capacity and reduce performance.

5) Correct plumbing- The water should flow in the opposite direction to the milk. If not the heat transfer capability is reduced. Costing you more money to cool it in the vat.

Seek advice from your electrician, if any electrical changes are required. You will need a qualified electrician to carry out the work.

Electrical factors you might want to consider if you require additional Kw.

a) Is your transformer big enough to take the additional load
b) Are line sizes and pole fuses sufficient?
c) Will additional line charges be incurred if using more peak load Kw
d) Can items like effluent irrigation be locked out during milking to reduce the peak load
e) Are you limited by single phase power

If you require additional refrigeration and are perhaps limited by some of the above factors you might consider a thermal storage solution.

Seek advice from your Refrigeration providers to assist with maximising your vat refrigeration efficiency and finding solutions if you require 1st stage refrigeration prior to your vat.

The refrigeration system

The size of you vat refrigeration pad dictates the maximum amount of kW of refrigeration heat removal it is capable. Once you have reached that maximum size adding additional Kw will not increase its heat removal capacity. If you can't meet the new incoming requirements with your vat 1st stage cooling will be required prior to the vat.
Vat refrigeration units should only be serviced or maintained by a suitably qualified refrigeration expert. However you can complete some simple checks to make sure that it is functioning efficiently:

- Check and clear any debris from the condenser / condenser fins to ensure a clear flow path for the cooling air
- Check that the airflow over the condenser is cool fresh air. You don't want the warm air from behind the refrigeration unit to reticulate back to the front of the condenser. A piece of plywood may be all it takes prevent that occurring.
- Check how often your refrigeration unit is switching on and off once your milk is down to temperature / the duty cycle of the unit i.e. if it is still on most of the time or constantly clicking on and off, your system is not working efficiently.

Options for 1st stage cooling.

There are many systems available on the market, they can be categorised into four categories.

When looking at options ensure you deal with reputable companies, who guarantee 24hour parts and servicing are available. This is a long term investment and components need to be readily available now and into the foreseeable future.

Thermal Storage

Chilled water
Thermal storage systems chill water in a large tank to be reticulated through a plate cooler positioned after the primary cooler (you can use a double banked cooler). Advantage: reduction of peak power consumption. You could us off-peak power. Water is usually chilled to 7 - 10 degrees.
Ice Banks
Ice banks generate ice along evaporator coils using. The ice is used to chill water for the pre-cooler. The warm water is then returned from the pre-cooler to the top of the ice bank and cooled again as it runs down the ice. Ice banks take up less space than storage of chilled water. Advantage: reduction of peak power consumption. You could us off-peak power. Lower milk temperatures can be achieved than chill water system if desired.

Instant Chillers

Another option is to use a refrigeration system a food grade glycol/water mixture. Glycol systems tend to use a small volume of fluid and create the chilled fluid on demand (at milking time). You will need a larger compressor than other systems. If you use larger compressors, there can be problems in areas of the country with limited power supply.ie transformers, lines sizes fuses. Advantage relatively compact, can cool milk to lower temperatures than chilled water if desired. No energy loss from storing a large volume of ice or chilled water.

Cooling Towers

Cooling towers can be very effective at cooling water especially in areas of low humidity. Water can be cooled to within 5°C of the wet bulb temperature in a properly designed plant. The most effective plants are fan forced and turn over a large store of water every hour. They operate overnight to cool a large volume of water, usually 4½ times the volume of the daily milk yield. *Cooling towers are* usually *not suitable for high humidity areas.*