Improving the Welsh Dairy Supply Chain

Milk Plate Coolers

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The basics

Milk has to be reduced in temperature from 37°C to 4°C and the bulk tank refrigeration equipment does most of the work. Many farmers reduce the load on the bulk tank by using a plate heat exchanger with mains or borehole water to pre-cool the milk. Plate heat exchangers can reduce milk cooling costs by as much as 50%. Savings in energy have to be weighed against the capital cost of installation and the cost of water if taken from the mains. Water cost savings can be made by re-use in drinking systems or for washing.

Plate cooler

CASE STUDY

Gwyndaf Davies, of Trefwtial Fawr Farm Tremaen, near Cardigan who milks 230 cows and averages 6,900 litres of milk per day, uses a plate heat exchanger supplied with well water to pre-cool his milk.

"The plate cooler does a really good job and takes the milk temperature down to 17°C in the winter. The run time of the tank is longer in the summer months when we have less water available."

It is estimated that the plate cooler has saved him £1,224 worth of electricity per year since installation on milk cooling costs. Additional water from a planned borehole would give further savings of £1,000 per annum.

In practice

Using water to cool milk involves the use of a plate heat exchanger, a device which passes water and milk either side of heat conducting plates to allow the water to partially cool the milk. To be effective the plate area needs to be maximised and the ratio of water to milk flow needs to be as high as possible. A water-milk ratio greater than 1:1 and ideally 2:1 is required. So, for example, a 200 cow herd producing 4,000 litres of milk per day would need between 4m³ to 8m³ of cooling water per day.

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To conserve water and obtain the best energy performance, the water flow needs to be controlled by a solenoid valve connected to the milk pump control. When the pump starts the solenoid allows the water to flow. When the milk pump stops, the water should continue to flow for between 10 and 20 seconds to ensure that the milk left in the exchanger is adequately cooled.

To enhance the performance of the plate cooler milk flow should be minimised and water flow maximised. A partially closed valve fitted in the milk line can be used to slow the throughput of milk. A better solution to this is a variable speed milk pump.

Partially closed ball valve

Water flow can be maximised by ensuring that the water delivery and drain pipes are well sized and the water delivery pressure is high. A separate pump set can be used to boost pressure if natural water pressure is low.

To check performance, measure the temperature of the milk entering the tank, following its passage through the cooler. A milk temperature drop of at least 10°C and ideally close to 20°C should take place.

Potential savings

For a 200 cow herd which produces 1.6 million litres of milk per year and has a an ice bank cooling system, a plate cooler reducing milk temperature by 15°C will save approximately 20,600 kWh of electricity. This equates to an annual saving of approximately £1,850.

For more information on plate coolers for milk pre-cooling please contact:

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Table indicating potential milk cooling costs

Type of bulk tank	Milk Cooling Cost (pence per 100 litres of milk cooled)		
	No Plate Cooler	10°C cooling from Plate Cooler	15°C cooling from Plate Cooler
Ice bank tank without E7 control	26.5	17.4	12.9
Ice bank tank with E7 control	18.3	10.4	7.9
DX tank	16.6	10.5	8.3