DAIRY WATER HEATING[1]

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For many years it was sufficient to base the size of the water heater in the milk house on the size of the herd. The rule of thumb was:

> 50-gallon size up to 25 cows
> 66-gallon size for 26 to 35 cows
> 80-gallon size for 36 to 50 cows

This rule can still be applied with a fair degree of adequacy to dairy farms that operate with conventional milker units and can type coolers. When a change is made to bulk handling of milk (bulk cooler & pipeline) these standards will no longer assure an adequate supply of hot water. Automatic washing of modern bulk tanks and pipeline milkers requires a dependable supply of hot water in varying amounts based on the type of equipment.

Hot water requirements should be calculated for each pipeline and bulk tank installation. For example, the amounts of hot water to wash a bulk tank can vary from 2½ gallons of 160° water to 24 gallons depending on the size and type of tank (vacuum or atmospheric) and the method employed in washing the tank. The requirements for washing a pipeline milker can vary considerably. The type of washing system (slug or flood), number of cleaning cycles, type of equipment all are factors affecting the quantities of hot water required.

Figuring the amount of hot water that a heater will have to supply for the various cleaning operations is not difficult. For example, let it be assumed that 40 head of cattle are housed conventionally in stalls. A 225 foot pipeline is cleaned requiring 25 gallons of water for each of four cleaning cycles; a 600 gallon bulk tank is installed requiring 12 gallons of 160° water for washing; and 1/5 of gallon of 160° water is allowed for washing the udder of each cow. The amount of hot water at 160° to be supplied by the heater for these operations can be calculated as follows:

(1) Calculate the amount of 160° water required for blending with 50° water (temperature of incoming cold water) to make up 25 gallons of sanitizing solution at 90° —

$$\frac{90 - 50}{160 - 50} = \frac{40}{110} \times 25 = 9.1 \text{ gallons of } 160° \text{ water}$$

(2 & 3) Calculate the amount of 160° water required for blending with 50° water to make up 25 gallons of 90° tepid water for each of the pre-rinse and final rinse —

Pre-rinse $\dfrac{90 - 50}{160 - 50} = \dfrac{40}{110} \times 25 = 9.1$ gallons of 160° water

Final rinse $\dfrac{90 - 50}{160 - 50} = \dfrac{40}{110} \times 25 = 9.1$ gallons of 160° water

(4) Since the washing cycle of the pipeline is done with 160° water, 25 gallons must be supplied by the water heater.

(5) Calculate the number of gallons of 160° water required for washing the bulk tank allowing 2 gallons of 160° water for each 100 gallons of tank capacity = 12 gallons.

(6) Also allow 2 gallons of 160° water for rinsing the bulk tank when the milk is collected = 2 gallons.

(7) Calculate the number of gallons of 160° water required for udder washing allowing 1/5 of a gallon per cow = 8 gallons for milking.

The amount of hot water at 160° required at this farm for each milking and cleanup period would be —

Sanitizing pipeline with 90° solution	- 9.1 gallons
Pre-rinsing of pipeline with 90° water	- 9.1 gallons
Washing pipeline with 160° water	- 25 gallons
Final rinse of pipeline with 90° water	- 9.1 gallons
Rinsing bulk tank	- 2.0 gallons
Washing bulk tank	- 12.0 gallons
Washing udders	- 8.0 gallons
	74.3 gallons

To assure an adequate supply of hot water for all uses an 82-gallon water heater should be recommended for this *farm*.

Electric Water Heating Equipment

Generally, a conventional 82-gallon electric water heater will meet the needs of most dairymen. However, there will be cases when this conventional (referred to by the industry as NEMA Standard) water heater will not supply the requirements. In these cases, alternatives exist. A second heater can be placed in series with the first or a quick recovery heater may be installed. A quick recovery heater is the same as any other electric water heater, with the exception of the heating elements. A quick recovery heater of any capacity may have two 4500 watt heating elements compared with heating elements of 1500 watts and 1000 watts in a 50-gallon conventional heater and 2500 watt and 1500 watt elements in the 82-standard gallon tank. A quick recovery heater will raise 18 gallons of water 100 degrees in one hour. Considering a two-hour period for milking and final cleanup time, this water heater will recover a total of 36 gallons of hot water during this period, therefore, the capacity of either the 80 or 50 gallon tank is greatly increased. A farmer should check with his individual power supplier before installing a quick-recovery water heater. Rates and regulations may vary from those stipulated for water heaters of the conventional type.