UMC

Science and Technology

GUIDE

Published by the University of Missouri - Columbia Extension Division

Providing Hot Water for Milking Parlor Chores

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Water suitable for drinking must be used for cleaning food contact surfaces, and most of it must be heated. Plenty of hot water reduces the amount of detergent needed, promotes quick drying after the final rinse, and helps prevent deposits from remaining on stainless steel, glass, or plastic surfaces.

The quantity of hot water 150 to 160° F, of warm water about 100 to 110° F, and of cold water needed for the milking and cleaning operations can be determined from UMC Guide 3411, "Water Needs for Dairy Farms," Table 3. Frequently, warm water is provided by blending hot and cold water. The temperature desired can be adjusted as more or less cold or hot water is introduced.

For cleaned-in-place (CIP) pipelines, bulk tanks, and other milking equipment, automatic controls usually blend hot and cold water through preset valves to get a desired temperature for each sequence in the cleaning cycle. Water heaters and valves must be kept free of mineral deposits so that the desired water temperature can be reached quickly.

Saving Energy

Keep lines short and insulate hot water lines to save energy.

Another way to save energy is to heat water to the desired temperature rather than blending hot and cold water. This frequently can result in a savings in plumbing costs as well.

The principal use of warm water is for washing udders in the milking parlor. With increased use of warm water, a heater primarily for this purpose is desirable. This provides warm water at a constant preset temperature. It eliminates the need for dual supply lines for hot and cold water and mixing valves. A full tank at 100° F will require less than half the energy a full tank at 150° F. This warm water tank may also feed a hot water tank.

Figure 1 illustrates two water heaters in series. On a dairy farm the peak use for warm water 100 to 120° F will extend throughout the milking period as it is used for washing udders. Preparing 120 cows for milking in a period of three hours may use 12 gallons per hour. One 42 gallon heater with a 4500 watt element provides 18.5 gallons per hour (allowing a 20% surplus) at a 50° F temperature rise. Thus, there would be a full tank of warm water at all times. For a higher use rate of 40 gallons per hour, a 42 gallon tank with two 4500 watt elements providing 37 gallons per hour with a 50° F rise would run out of warm water in about three hours.

If the other tank operating at 150 to 160° F received its supply from the warm water tank, it would be necessary to raise the water only an additional 40 to 50° F. The need for this water is greatest twice daily for washing pipelines, equipment, and utensils. A full tank of hot water is available at the end of milking to meet this demand. Supply lines between these two tanks should be kept short. There must be no restriction in the supply line that would cause a pressure drop when using water from either tank.

With the two heaters in series, household or utility type water heaters will meet the needs of all but the largest dairy herds. Before purchase, one should determine the minimum temperature setting possible on the heater to be used to supply warm water. Some heaters have a rather high (above 120° F) minimum setting. A minimum setting of from 110 to 120° F is preferred. Few people can tolerate their hands in water of 120° F. However, with a minimum setting of 120° F there will be sufficient heat loss from heater to point of use to provide comfort to milker and cow.

Saving Heat From Milk Cooling

Heat recovered in the milk cooling process can be used to supply warm water. Water cooled condensers usually heat water to about 100° F. However, until recently this water had to be used immediately or wasted to provide continuous cooling of the consenser. Recently developed commercial heat recovery units can be installed to capture most or all of the heat available from cooling milk. One unit will provide one gallon of water at 140° F for every gallon of milk cooled. Another unit is a two-stage tank storing 2/3 of the unit's capacity at 110° (from heat recovered from milk) and 1/3 of the unit's capacity at 150 to 190° F (from heat from supplementary energy). Such heat saving devices merit consideration because they help reduce the energy demand, especially during a peak demand period, and result in savings over time.

Selecting Water Heaters

While it is possible to choose a heater that will provide ample capacity and a high recovery for your entire dairy operation, consider the installation of two water heaters in series at different operating temperatures, as previously explained. With 100° F water supplying a 150 to 160° F heater, the amount of hot water continuously available is double that

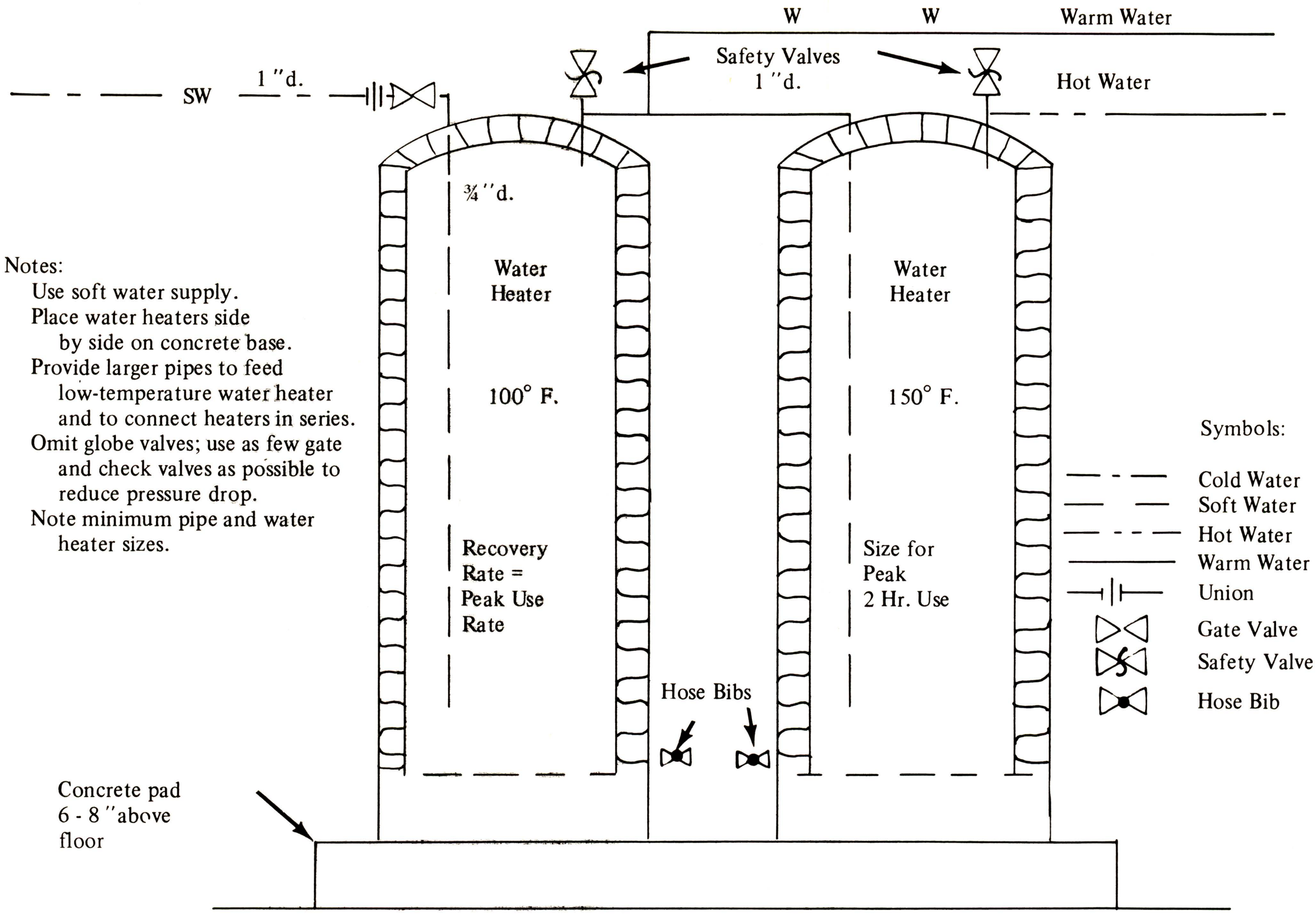

Figure 1. Water Heaters in Series.

where the water in the higher temperature tank must be raised from 50° F to 150 to 160° F.

For a quick estimate of recovery rates (gallons per hour x temperature rise in °F) divide the watts of the heating element by 5 or the rating in British Thermal Units per hour by 12.

$$\frac{\text{Watts}}{5} \text{ or } \frac{\text{BTUH}}{12} = \frac{\text{gallons}}{\text{hours}} \text{ x temperature rise °F}$$

Examples:

A 30 gallon natural gas heater with 53,000 BTUH input is advertised to deliver 44.5 gallons per hour at a 100° F temperature rise.

$$\frac{53{,}000}{12} = 44.5 \times 100$$

$$4{,}412 = 4{,}450$$

This shows the heater can deliver approximately the amount of hot water in the quantity claimed by the advertisement. Certainly no heat loss has been allowed. The BTU input provides for 4,412 gallon degrees temperature rise while 44.5 gallons x 100° F would require 4,450.

At an expected 50° F rise, the heater could deliver about twice this quantity, or 88 gallons per hour.

A 42 gallon electrical water heater with two 5500 watt low density heating elements can provide 2,200 gallon degrees per hour. If a 100° temperature rise is expected, the output would be 2,200 divided by 100, or 22 gallons; or if a 50° rise is anticipated, 44 gallons per hour.

The two most important rules for selecting water heaters are:

1. Select a heater with capacity to provide the maximum amount of water needed at any one time. Assume that you would be using a full tank within two hours but would not need another tankful for an additional four hours or more.
2. Select a recovery rate close to the use rate if use extends three hours or longer. If you start with a full tank of hot water and if you use it faster than it is heated, you will deplete the supply of hot water unless the heater has the capacity for this rate of recovery.

In electric heaters, low density heating elements with fewer watts per inch of element last longer and frequently are looped to flex and remove minerals.

Top quality water heaters usually have better insulation, and their costs may be offset by reduced heat losses in less than four years.

Using soft water prevents buildup of minerals in heaters, reduces the amount of detergent needed, and improves cleaning.

■ Issued in furtherance of Cooperative Extension Work Acts of May 8 and June 30, 1914 in cooperation with the United States Department of Agriculture. Carl N. Scheneman, Vice President for Extension, Cooperative Extension Service, University of Missouri and Lincoln University, Columbia, Missouri 65211. ■ An equal opportunity institution.

Revised 11/78/5M