MILKING INTERVAL AND FREQUENCY

During lactation, milk is secreted continuously. As milk accumulates in the alveoli and the ducts, the increased internal pressure slows down the rate of milk secretion. Thus when milking takes place twice a day, equal milking intervals of 12 hours each give the highest lactation yields. For most cows, the reduction in milk yield remains small, even when milking intervals are 16 and 8 hours. However, the effect of unequal milking intervals is more important for first-calf heifers (because of the limited size of the udder) and for high-producing cows (because of high rates of milk secretion). Milking these cows first in the morning and last in the late afternoon helps to maintain maximum milk yield.

Frequent removal of the milk prevents pressure build-up. As a result, three milkings per day may increase yields by 10 to 20% without alteration in milk composition. However, this practice is more labor intensive.

TEN STEPS TO MAXIMIZE YIELD AND MINIMIZE RISKS OF MASTITIS TRANSMISSION

Modern milking machines are designed to remove 80 to 90% of the milk in the udder of a cow in just a few minutes, and without recourse to additional cluster weight or manual assistance. Efficient milking can be achieved by following the routine described below. Each step in the milking procedure should be performed gently and without trauma to the cow. The milk let-down reflex is more pronounced when cows are relaxed. In contrast, yield may be reduced by more than 20% when cows are frightened or feel pain during milking.

The operator, the environment (stanchion or milking parlor) and the cows, must be clean. General hygiene helps reduce the spread of mastitis and preserves the quality of milk. For example, the cow’s udder should be clipped to remove long hair and reduce the dirt, manure and bedding that may adhere to the hair and skin.

1) Let the cow know you are about to milk her.

—Give the cow a simple touch on the back, the flank, or the udder or say a few words gently to signal your presence and readiness to proceed with milking. An unexpected or rough approach will startle the cow and inhibit the milk let-down reflex.

2) Check udder and foremilk for mastitis.

—Observe and feel the udder for signs of mastitis (warm, hard, or enlarged quarters).

—Strip out foremilk and look for signs of pain by the cow, and for the presence of clots, stringiness or wateriness of the milk. To reduce the rate of transmission of mastitis, foremilk should never be stripped directly into the hand. In a stanchion barn, a strip cup1 should be used and rinsed thoroughly between each cow. In a milking parlor, a strip cup should be used and rinsed thoroughly between each cow. In a milking parlor, a strip cup should be used and rinsed thoroughly between each cow. In a milking parlor, a strip cup should be used and rinsed thoroughly between each cow.

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1 A strip cup is a cup equipped with a filter that allows clots in the milk to be identified easily.
3) **Wash teats with a warm sanitizing solution.**

—Wash and massage all teats with warm water containing a mild disinfectant.

—Use water sparingly and avoid wetting much of the udder as water draining down onto the teats increases the risk of mastitis and the number of bacteria in the milk.

—Use a single cloth or paper towel for each cow. Use of the same cloth from one cow to the next increases the risk of contamination and transmission of mastitis-causing bacteria from cow to cow.

4) **Dip teats with a safe and effective disinfectant (optional).**

—“Predipping,” if allowed by the law, is an effective practice that reduces the number of new infections by environmental microorganisms. Only products tested for predipping should be used. Predipping consists of immersing the teats in a disinfectant. To be effective, most predip disinfectants must remain in contact with the teats 20 to 30 seconds.

5) **Dry teats thoroughly.**

—Dry the teat thoroughly. Single use disposable paper towels are the best way to dry the teats, but are expensive. Cloths are acceptable when used only for one cow and provided they are laundered between milkings. Residual moisture on the teat, and water on the side of the udder, is loaded with bacteria and will eventually contaminate the liner, the teat, and the milk, creating risk of mastitis and lowering milk quality. In addition, dry teats minimize slippage of the milking unit during milking.

—The cow’s milk let-down reflex is initiated as the teats were cleaned, massaged and dried.

6) **Attach teatcup within one minute.**

—Attach the milking unit to the teats within one minute after the start of preparation. Each teatcup should be slipped onto the teat with minimal entrance of air into the milking unit.

7) **Check milk flow and adjust milking unit as needed.**

—Check that milk flows from each teat.

—Adjust the position of the milking unit. Rapid and complete milking is possible only when the milking unit is properly aligned. Usually, the front teatcups need to be positioned slightly higher than the back teatcups. Some milking machine manufacturers recommend a support arm on which to rest the long milk and vacuum tubes and to adjust the milking unit into its best fitting position. Improperly aligned milking units slip often and milk flow may be restricted, both of which contribute to the development of mastitis.

—Do not leave a milking unit squawking.

—Readjust milking unit as needed during milking. Air entering the teatcup may cause tiny droplets of milk to back flush at high speed into the teat canal. If contaminated, these droplets allow bacteria to enter the udder and cause mastitis. This process occurs more often near the end of milking, when milk flow is decreasing.

8) **At the end of milking, shut off the vacuum before removing teatcups.**

—Do not overmilking. The majority of cows will milk out in 4 to 5 minutes. The fore quarters are usually milked out earlier than the rear quarters, which produce more milk. Thus the fore quarters tend to be slightly overmilked. Usually, this is not a problem; one or two minutes of over milking with a properly functioning machine does not predispose the udder to mastitis.

—Avoid stripping. In the past, it was a common practice to massage the udder with the milking machine in place to collect

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the last milk (stripping). This practice should be completely abandoned because it increases the stress on the teat tissue and the risk of air admission in the unit, thereby increasing the risk of mastitis.

—Shut off the vacuum to the milking unit before detaching the teatcups from the teats. Pulling a teat from a teatcup under vacuum increases the risk of teat damage and infection because it creates a massive liner slip.

9) Dip or spray teats with a safe and effective disinfectant (teat dip).

—Dip or spray the bottom two-thirds of each teat with a mild disinfectant. Solutions that will not chap or irritate the teats include many commercial products, chlorhexidine (0.5%), iodine (0.5-1%) low in phosphoric acid, and hypochlorite (4%) low in sodium hydroxide.

10) Disinfect milking units (optional).

—To prevent the spread of infection between cows, it is becoming more common to disinfect teatcup liners before using them for the next cow. The preferred procedure is to dip the teatcup liners in a bucket filled with clear water to rinse milk residue. Then, the teatcups are submerged in a bucket with water and a mild disinfectant (15 to 25 milligrams iodine per kg of water, that is, a 15 to 25 ppm iodine solution) for 2.5 minutes. Finally, the liner must be dried before attaching the milking unit to the next cow. If not done properly, this step may enhance more than hinder the spread of mastitis. Many milking machine may be equipped with an automatic system to disinfect liners rapidly and effectively (backflushing).

HANDLING THE COLLECTED MILK

The collected milk should be filtered, cooled and stored in a separate, clean milk room. The milk can be filtered using an inline filter as the milk is pumped out of the machine or by passing the milk collected in a milking bucket through a filter manually. If the filter is disposable, it should be used only once. Alternatively, a cloth filter may be used, washed and disinfected after each milking. The filter retains milk clots and other large particles, and after usage its inspection helps to evaluate the overall hygiene of milking—in particular, the thoroughness of carrying out Steps 2 and 3 above.

Prompt refrigeration of the milk after collecting is vital to prevent multiplication of bacteria and loss of quality. If refrigeration facilities are not available, milk should be cooled to within 2°C of the temperature of the local water supply. Cooled milk should be stored ideally at 4°C until transported to the processing plant. Note that even good quality milk containing less than 10,000 bacteria/ml cannot be stored more than two days at 4°C without risk of quality deterioration. Milk not stored at 4°C should be transported to a milk processing plant as soon as possible.

CLEANING THE EQUIPMENT

A milking machine functions properly only when cleaned thoroughly after each use. An impeccably clean machine is necessary to harvest a milk of high quality that is safe and flavorful for human consumption, and that remains stable for a long time (long keeping time or shelf life).

When a milking machine is designed, the ease of cleaning must be taken into account:

• The material used to construct pipelines must be smooth (aluminum, stainless steel, etc.), durable and resist the corrosion of acids and alkaline solutions;

• The machine must be constructed with a minimum of right angles (joints) to reduce flow disturbance and the formation of deposits;

• All pipelines need to be adequately sloped to provide drainage after milking and cleaning.
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Cleaning the outside of milking units

When milking is finished, all visible dirt and milk deposits must be removed from the outside of the milking units and the flexible tubes by scrubbing and rinsing in clean water.

Washing the pipelines and the inside of the milking units

Strong flow turbulence of milk passing through a right angled pipeline and heat may cause milk components (protein) to precipitate and form “milkstones.”

The basic steps to adequately clean a milking machine manually or with a “clean-in-place” system are summarized in Table 1. It is not possible to combine all the necessary properties of a cleanser in one preparation because elimination of fat and protein film normally requires alkaline detergent, whereas an acid solution is needed for mineral deposits. Thus alternative use of alkaline detergents and acids is recommended. In addition, to assure the proper cleaning action of many detergents, the following must also be part of the cleansing process:

1) A mechanical action (manual scrubbing) or a high velocity flow (“clean-in-place” system) are needed for a sufficient amount of time (contact time) to lift and carry particles away;

2) The total volume of water used must be sufficient to ensure contact between the detergent solution and the equipment;

3) The concentration of detergent must be adequate to obtain the desired cleaning action;

4) The water temperature must not be too high or too low; temperature dictates the effectiveness of many detergents.

Table 1: Basic steps in cleaning milking equipment.

<table>
<thead>
<tr>
<th>Step</th>
<th>Water temp</th>
<th>Duration (min.)</th>
<th>Action and comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Pre wash</td>
<td>35° to 45°C</td>
<td></td>
<td>Remove the bulk of the residual milk in the milking machine; “Pre-warm” the equipment for better action of the cleaning solutions.</td>
</tr>
<tr>
<td>2-Wash</td>
<td>min. 50°C</td>
<td>10</td>
<td>A chlorinated product helps remove protein; the alkalinity removes the fat, and a complexing agent (EDTA) prevents the formation of salt deposits depending on water hardness. (optional)</td>
</tr>
<tr>
<td>3-Water rinse</td>
<td>max. 75°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Acid rinse</td>
<td>35° to 45°C</td>
<td>5</td>
<td>Neutralizes chlorine and alkaline residues (prolongs life of rubber parts); prevents mineral deposits and helps prevent milkstones; kills bacteria.</td>
</tr>
<tr>
<td>5-Water rinse</td>
<td></td>
<td></td>
<td>Warm water helps the equipment dry faster.</td>
</tr>
<tr>
<td>6-Sanitation</td>
<td></td>
<td></td>
<td>Before using the equipment again, a sanitizing solution of hypochlorite (200 mg per kg of water, or 200 ppm) reduces the number of bacteria on the equipment.</td>
</tr>
</tbody>
</table>

1 Examples of active agents in alkaline detergents: sodium hydroxide, sodium carbonate, trisodium monophosphate, and polyphosphates. Dilution rate must be as indicated by manufacturer’s label.

2 Examples of acids: phosphoric acids or organic acids (acetic acid, citric acid, etc.). Most acid products contain corrosion inhibitors. Dilution rate must be as indicated by manufacturer’s label.