Proper milking procedures, a positive attitude, and a clean environment are required to minimize mastitis and maximize the production of quality milk from a herd. Milking should be done by people who are responsible, trained, and conscientious.

Provide a Clean, Low Stress Environment for Cows
A consistent operating routine for bringing cows and milking machines together is essential. Cows that are frightened or excited before milking may not have a normal milk letdown response in spite of an effective preparation routine. Hormones released into the bloodstream during periods of stress may interfere with normal milk letdown. A milking environment that chronically stresses cows may predispose cows to a greater rate of mastitis. Proper udder stimulation enhances oxytocin release and milk letdown (Figure 1).

Figure 1. Milk flow in an unstimulated (Cow 1) and properly stimulated (Cow 2 - oxy) cow.

The milker’s hands can spread bacteria between cows. Latex gloves help to keep hands clean, and should be worn by all milkers during milking. Gloves can be cleaned periodically by washing them with warm water and sanitizer. Milking with clean gloves is an important way to reduce the level of mastitis on many dairies.

Check Foremilk and Udder for Mastitis
Mastitis can be detected by using the hand to physically examine the udder and by using a strip cup or plate to examine foremilk prior to each milking. Correct use of a strip cup can be a valuable aid in detecting mastitis symptoms which include “clotty, stringy, or watery” milk. This observation should be made on each quarter of every cow at each milking. Because organisms may be spread by using unclean strip cups, strip cups should be cleaned and sanitized after each milking. A common procedure for forestripping in parlors is to strip directly onto the floor, followed by hosing the floor immediately. Milk should never be stripped into the hand because this routine spreads organisms from teat-to-teat and from cow-to-cow.

Wash Teats with an Udder Wash Solution or Predip Teats in an Effective Product
Using a wash solution in a bucket and individual paper towels to prepare teats for milking is frequently necessary in stanchion barns. Individual paper towels are highly preferred because sponges and common cloths transfer mastitis-causing organisms to uninfected quarters and cows.

Producers with parlors or stanchion barns may elect to use predipping instead of washing when preparing cows for milking. Predipping works best when teats are relatively clean. The entire length of the teat should be immersed in the sanitizer. Predip should remain in contact with the teat for 30 seconds and then be thoroughly wiped-off prior to attaching the milking unit.

Removing hair from udders reduces the amount of dirt and manure that may adhere to the udder and contaminate milk. Udders with long hair are difficult to clean and dry. Milking wet and/or dirty teats increases the risk of high bacterial counts in milk and also increases the probability of new intramammary infection.
Dry Teats Completely with an Individual Towel
Regardless of how the teats are prepared they must be dried. Dry with single service paper towels. As an alternative to paper towels, some producers use individual cloth towels. A separate cloth towel is used on each cow and towels are laundered, sanitized and dried after each milking. Washing teats without thorough drying leaves many organisms on the teats. During milking, water which contains mastitis-causing organisms can drip down the sides of teats and may be drawn into teat cups, exposing the teat ends to bacteria. Milking wet teats increases the likelihood of mastitis and reduces milk quality.

Attach Milking Unit within Two Minutes After the Start of Stimulation
The milking machine should be attached as soon as possible after milk letdown occurs. Attachment should be done carefully to prevent excessive air from entering the milking system. Milk letdown causes maximum udder pressure approximately one minute after first stimulation and lasts about ten minutes. Therefore, the ideal lag time from the start of udder stimulation to unit attachment is 60 seconds, with a maximum time of two minutes. There should be a consistent sequence of udder preparation and attachment of milking units so that units are attached within two minutes after the start of udder stimulation. An easy way to determine if the lag time is appropriate is to evaluate the teats. Teats will be plump and full of milk if stimulation and lag time have been adequate, while they will be empty if stimulation and lag time are inadequate. For comparison purposes, producers can use the following to evaluate their own operations:

<table>
<thead>
<tr>
<th>Production (pounds/day)</th>
<th>Predicted Average Milking Time (minutes/milking)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2X/day</td>
</tr>
<tr>
<td>50</td>
<td>6.5</td>
</tr>
<tr>
<td>75</td>
<td>8.0</td>
</tr>
<tr>
<td>100</td>
<td>9.4</td>
</tr>
<tr>
<td>From National Mastitis Council Annual Meeting Proceedings, Stewart et al., 1993</td>
<td></td>
</tr>
</tbody>
</table>

Adjust Units as Necessary for Proper Alignment
Observe units while they are attached to the udder to be sure they are adjusted correctly to help prevent liner slips. If teat cups are seated excessively high on teats, irritation to the lining of the teat may result. Improperly aligned units may block milk flow and increase the amount of milk remaining in the udder at the end of milking. Of greatest concern is slipping or squawking teat cups. Only about one-third of slips produce audible squawks. Such occurrences can result in an increase in infected quarters.

The majority of new infections resulting from liner slips occur near the end of milking. Toward the end of milking, when a teat cup liner slips and the liner opens, small droplets of milk may be propelled back against the end of the teat. These droplets may contain mastitis-causing organisms which in some instances may enter the udder. Since milk flow near the end of milking is minimal, chances of the organisms being flushed out of the quarter are reduced and an infection may result.

Machine stripping should be avoided. It is habit-forming and leads to increased milking time. The risk of liner slips, squawking, and milk impacts against the teat end increase dramatically during machine stripping.

Shut Off Vacuum Before Removing Unit
The unit should be removed as soon as the last quarter milks out. In parlors equipped with automatic detachers care should be taken to ensure that they are properly adjusted. A minute or two of overmilking with a properly functioning milking machine is not a major cause of mastitis. However, the risk of liner slip and possible new infection is greatest during overmilking. The way in which teat cups are removed is usually more important than when they are removed. Vacuum should always be shut off before teat cups are removed. The practice of pulling the unit off under vacuum should be avoided because it may result in liner slip and new infection in one of the other quarters. A question often asked is "how should a quarter that milks out ahead of others be handled"? In general, if the teat cup will stay on a teat without slips, it should be left on because removing the cup simulates liner slip and may result in new infection. Incorrect removal of units constitutes a very significant threat to udder health.

Dip Teats Immediately After Unit Removal with an Effective Product
Dip at least the lower one-third of each teat in a commercial teat antiseptic product after every milking. A good teat dip destroys organisms on
teats, prevents teat canal colonization of organisms, and eliminates existing teat canal infections. A variety of teat dip products are available. Many commercially available products are known to reduce the rate of new infections by more than 50 percent. Ask a dealer for research results that demonstrate the product's effectiveness.

The “paper towel test” can be used to evaluate the thoroughness of the teat dipping or spraying procedure. When dip is properly applied, all of the paper towel coming into contact with at least the lower third of the teat should be wet. Dry spots indicate a lapse in coverage, and an opportunity for infection to occur.

Maintain teat dip cups in a clean and sanitary manner and never pour the remaining dip back into the original container. When dip becomes cloudy or contaminated with bedding or manure, discard the remaining dip, clean dip cups thoroughly and refill with fresh dip. Continue teat dipping during cold weather. However, when the temperature is below 10o F or there is a strong wind chill factor, allow dip to remain in contact with the teat for at least 30 seconds and then wipe off excess teat dip with single service paper or cloth towels.

Teat spraying is an alternative to teat dipping. Results may be acceptable if done correctly with a suitable spray device that provides adequate coverage of each teat. A common problem frequently observed with spraying is that only a portion of the teat is sprayed.

Other management factors can add significantly to the benefit of good milking procedures. The order in which cows are milked can have an impact on controlling the spread of mastitis. By milking first lactation cows first, second and later lactation cows with low somatic cell counts second, cows with high somatic cell counts third, and cows with clinical mastitis last, the chance of spreading mastitis organisms from cow-to-cow is reduced.

Good management dictates that the person milking must be constantly alert to conditions that may spread mastitis organisms from cow-to-cow. Correcting such conditions assists in the production of high quality milk from healthy udders.