



# Good farm equipment sanitation means better milk quality tests

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Milk of consistently good quality increases or maintains dairy product consumption and sales. For any dairy food, milk bacteria counts, handling, and cleanliness dictate the flavor and keeping quality of the finished product. High-quality milk with low bacteria counts and the potential for long shelf life starts on the farm with clean, sanitized cows and equipment.

## What is proper cleaning?

Bacteria use milk nutrients that remain on your dairy equipment to grow and multiply between milkings. The most important step in reaching top milk quality is to remove all milk residues (or "soil") after each milking.

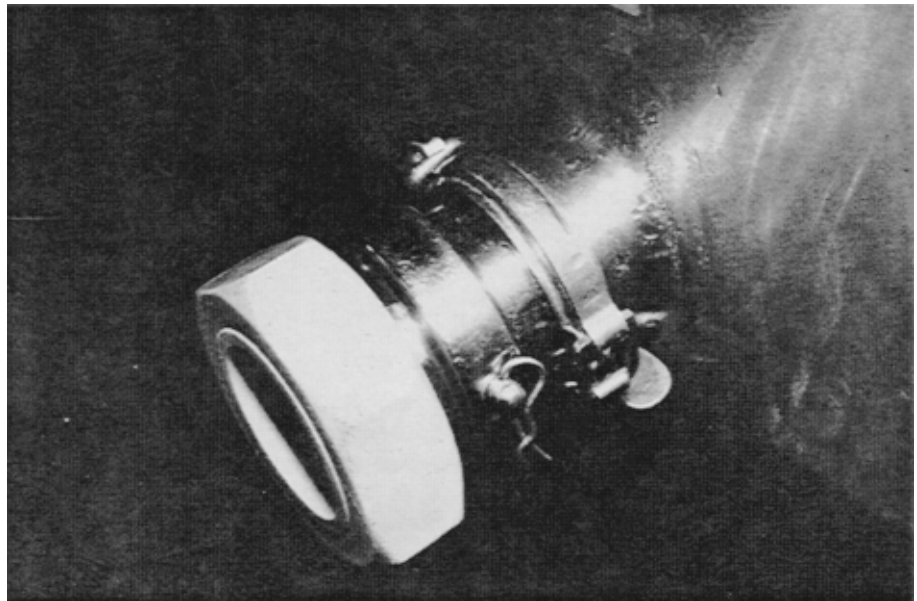
An adequate cleaning program for dairy farm equipment is designed to remove the following milk components:

- **Milk sugar** (lactose) is very soluble in water.
- **Milkfat** is water-insoluble. Suspend fat in hot, alkaline detergent solutions and rinse the milkfat from equipment.
- **Milk proteins** become insoluble. Disperse them in chlorinated, alkaline detergent solutions and rinse them from equipment.
- **Mineral salts (milkstone)** are derived from the water supply and from milk itself. Dissolve them in acid cleaning solutions and drain them.

## Four basics of cleaning

### 1. Time

Cleaning solutions need some time to work. In most farm equipment cleaning, about 10 minutes is adequate to dissolve or suspend milk soils.



Pay special attention to the bulk tank outlet valve for lower bacteria counts. Brush it thoroughly as the cleaning solution is discharged after routine tank cleaning.

### 2. Temperature

Hot water is critical to emulsify milkfat, to disperse milk proteins, and to allow the "chemistry of cleaning" to proceed. Water for chlorinated alkaline detergent solutions must enter the wash sink at no less than 150°F, and it must be discharged to the drain at no less than 120°.

This means you'll probably need to wear gloves for manual cleaning of buckets, milking units, bulk tanks, and filter pans.

Dairy farms require heavy-duty, commercial water heaters or on-demand flow heaters to produce the volume of hot water necessary for cleaning cows and dairy equipment. Supplemental heaters in the wash vat can boost the temperature of

cleaning solutions during washing, but keep them working.

Generally, adequate temperature is more critical than the precise minutes of contact time of cleaning solutions. Therefore, don't circulate solutions until they cool below minimum recommended temperatures (120°F), even if contact time is slightly shorter than the time recommended.

### 3. Concentration

Always use the recommended amounts of the better quality cleaners and sanitizers. Don't try to save money on

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bargain-priced cleaning chemicals. Carefully measure the amounts of water and cleaners you use.

Hard water can reduce the effectiveness of dairy cleaning chemicals. Most package labels will specify the amounts to use per quantity of water, according to the grains of water hardness.

Occasionally, have your water hardness tested so you can determine proper concentrations of cleaners to use; install a commercial water softener when necessary.

If the label is unavailable, a rule of thumb for adding chlorinated cleaners to water is 1% weight per volume. For example, 1.25 ounces of cleaner to 1 gallon (128 ounces) of hot water would be suitable until you can find the label directions.

Chlorine detergents and sanitizers can lose their strength when stored in warm, moist areas. Keep all containers of alkaline cleaners and sanitizer concentrates tightly closed. Store them in a cool, dry room.

#### 4. Physical action

In modern, clean-in-place (CIP) systems, we've replaced the scrub brush with fast-moving solutions pushed by "slugs" of air. For pipelines, air injectors are essential for proper CIP cleaning. Make sure the injectors are set correctly, and operating for good scrubbing action. Check the design of your equipment for dead ends, rough spots, and sharp corners that can slow cleaning solutions.

Physical action is important in automated bulk tank cleaning, too. The spray ball or tube must direct cleaning solution to contact all interior parts of the bulk tank with sufficient force to remove milk soil. Watch for plugged spray heads; never let the level of the cleaning solution cover the spray head during the wash cycle. Always use a brush of a proper size and shape to manually clean the outlet valve as the cleaning solution drains.

## The ideal CIP procedure

1. **Prerinse** all equipment with luke-warm water (110°) to remove most of the remaining milk from equipment surfaces. Hot water cooks (bonds) protein films to surfaces; cold water tends to "set" milkfat.
2. **Wash** for about 10 minutes with a hot solution of chlorinated, alkaline cleaner. Maintain solution between 135 and 155°F. Drain thoroughly.
3. **Rinse** equipment completely with modest amount of cold water.
4. **Postrinse** with a dilute acid solution (pH 5.0 to 5.5) for 5 minutes. This will limit mineral or milkstone buildup and bacterial growth between milkings. *Never mix acid cleaners with chemicals that contain chlorine.* Alternately, you can clean the system with a stronger acid solution (pH 3.5 to 4.0) each week to remove milkstone that may build up.
5. **Drain** the system completely. Residual water can allow bacterial growth to occur before the next milking.
6. **Sanitize** immediately before the next milking. This will destroy bacteria that may have grown on equipment surfaces between milkings. Newer, more sensitive milk quality tests can readily show the difference between equipment sanitized just before milking and equipment not sanitized. Use iodine (at 25 parts per million) or chlorine (at 100 ppm) sanitizers according to directions. Chlorine can gradually deteriorate rubber and corrode stainless steel if it's left in contact with equipment surfaces too long (45 to 60 minutes) before milking.

## Cleaning other parts of the system

Air can carry bacteria into milk from other equipment surfaces. Cleaning air lines and the sanitary or moisture trap every 2 weeks will help keep bacteria counts low.

To clean the air or pulsation lines, start the vacuum pump and draw a measured amount (less than the moisture trap will hold) of hot, low-foaming

detergent solution through the stall cock furthest from the trap.

Stop the pump and allow the trap to drain. Repeat the procedure, occasionally lifting the hose; this draws the solution out of the bucket and injects some air to increase the scrubbing action.

If the pulsator line is capped at both ends, you can simply flush it with a high-pressure hose, with the vacuum pump turned off. This requires much less time and effort than stopping the pump and letting it drain.

Manually clean the sanitary trap and the pipe leading from it to the receiver after cleaning the air lines.

## Evaluating sanitation

Milk processors and regulatory agencies use bacteria counts to evaluate the effectiveness of your cleaning program. Understanding the test results can help you maintain high quality and low bacteria counts.

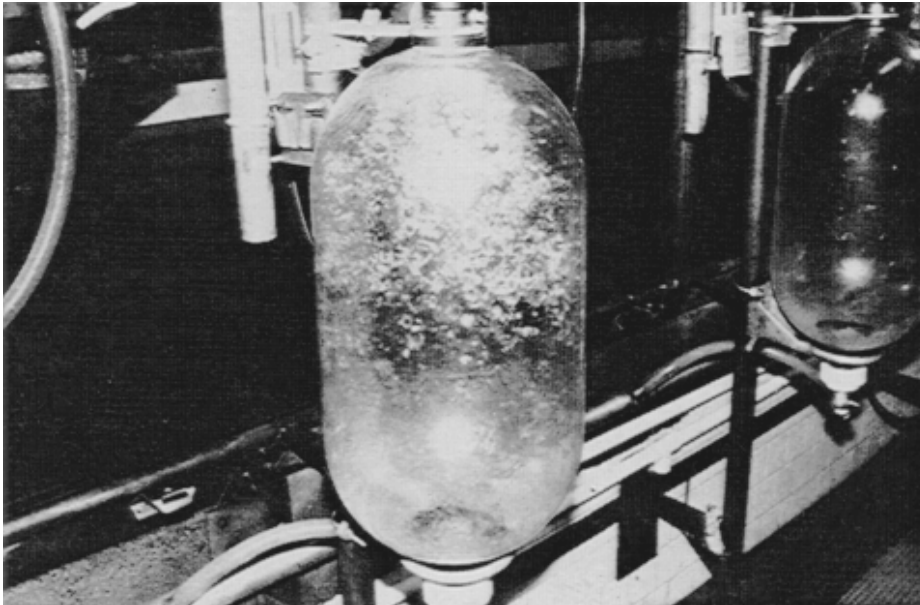
### Standard Plate Count (SPC)

This is a universal quality test for milk and many other foods. It's run under strict standards that assure uniform results in any laboratory. A raw milk sample is diluted and mixed with a standard culture medium that supports bacterial growth. This mixture or "pour" plate is incubated (cultured) for 48 hours at 86°F (30°C).

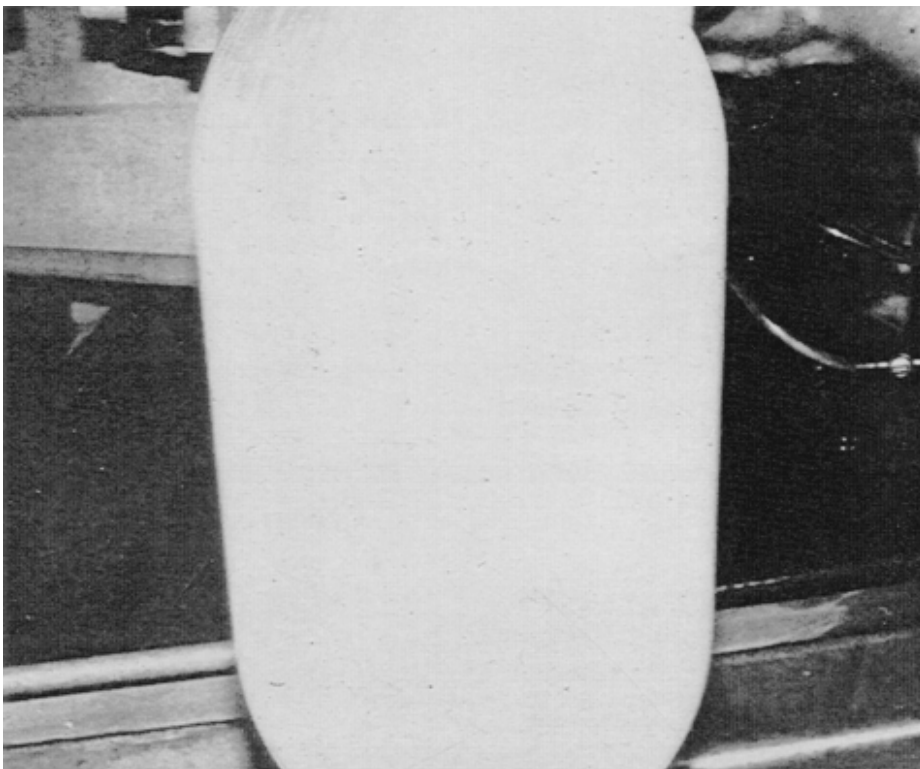
This procedure counts most live bacteria in the milk, whether they're derived from equipment, cows, or the environment. This method is also called the "total aerobic plate count."

For Grade A raw milk to be pasteurized, the upper legal limit of the SPC is 80,000 colony-forming units per milliliter (cfu/ml) in Oregon. However, an excellent goal for highest quality milk is to consistently keep this count under 5,000 cfu/ml.

Unfortunately, the SPC may provide only limited information on your milk quality program. Undesirable bacteria can come from many sources, and rapid milk cooling will hide the presence of those bacteria that later deteriorate milk flavor or severely limit product shelf life—or both.



Always rinse equipment before milking with an effective sanitizer solution in the proper concentration. New milk quality tests like the "PI" count are sensitive to bacteria that grow on equipment surfaces between milkings.



Milk "soil" means the protein, lactose, milkfat, and minerals that remain on equipment after milking. Proper cleaning time, scrubbing action, chemical concentration, and hot water will make cleaning easy and give you better quality tests.

The SPC is a standard measure for determining safety of food products, but it's limited in evaluating your sanitation program.

### **Preliminary Incubation Count (PI)**

This is a somewhat different approach for conducting the SPC. The raw milk sample is held at 55°F (13°C) for exactly 18 hours, simulating poor milk refrigeration, then an SPC is performed on the "cool" incubated sample.

Holding the sample at 55° lets the milk-spoilage bacteria "bloom," if they're present, making this an excellent measure of sanitation practices in milk production.

While the PI count isn't an official test of regulatory agencies in Oregon, it's frequently part of milk quality premium programs of processors and cooperatives.

The PI count allows bacteria from dirty cows and equipment to multiply faster than the SPC. Milk that's cooled slowly or held in farm bulk tanks above 40°F (4.4°C) will also have higher PI counts. Whenever your PI count is more than four times your SPC, or when the PI exceeds 50,000 cfu/ml, check "Common trouble spots."

Generally, PI counts over 100,000 cfu/ml indicate serious cleaning problems. It's possible to keep your PI count below 40,000 cfu/ml on a consistent basis.

### **Laboratory Pasteurized Count (LPC)**

For the LPC, raw milk is first pasteurized in the laboratory by heating in a water bath, then an SPC is performed. This test counts bacteria that survive pasteurization and remain in processed milk. Many of these bacteria come from the farm environment and grow readily on improperly cleaned or unsanitized milk equipment.

Typically, a high SPC with a low LPC indicates that many of the bacteria in milk are directly from cows' udders. This points to a mastitis problem, rather than dirty equipment or cows. However, certain environmental mastitis bacteria, like *Streptococcus uberis*, can initially come from cows in low numbers.

These organisms grow out on dirty milking equipment between milkings or on the in-line milk filter during longer milking cycles (more than 4 hours),

resulting in a high SPC and a low LPC with few infected cows.

Guidelines for satisfactory pasteurized counts are approximately 500 cfu/ml, but maintaining the LPC under 100/ml should be your “high quality” goal.

### Coliform Count

Coliform bacteria in milk indicate unsanitary production conditions. While coliforms come from the digestive tract of animals, they can be carried on hands, on clothes, on milk-handling equipment, in mud, and even in the air.

They’re easily killed by pasteurization, so they don’t often cause milk spoilage; but high number of coliforms in milk usually come with high counts of cold-loving, pasteurization-resistant spoilage bacteria.

Here’s a sound goal for the producer: Always have a coliform count under 10/ml in raw milk. If you have 25 or more, watch for dirty cows, milking wet udders, or poor premilking sanitation. Worn rubber hoses and gaskets in the milking equipment permit growth between milkings.

### New laboratory tests

There are newer tests being developed to more accurately reflect or predict the keeping quality or the shelf life of processed milk. One of these methods screens milk for the number of heat-resistant, spore-forming bacteria in milk.

These bacteria resist pasteurization and grow readily at refrigeration temperatures, reducing the shelf life of processed milk and causing objectionable off-flavors.

Even low counts of these heat-resistant bacteria indicate dirty cows and/or equipment, especially problems with bulk tanks or outlet valves.

## Remember the four cleaning basics:

- ✓ Time
- ✓ Temperature
- ✓ Concentration
- ✓ Physical action

## Common trouble spots

### Cows

- Mud and manure on the skin of the udder. Clip hair from the udder regularly to reduce the presence of dirt and moisture during milking.
- Milking wet udders and teats. Bacteria can move into milk with the water.
- Bacteria from mastitis-infected cows. Cows can shed bacteria into milk without showing clinical mastitis.

### Equipment

- Dead ends and sharp corners in pipelines can reduce cleaning action. Check for them.
- Incorrectly placed and sized air injectors.
- An undersized CIP wash line to milking units.

- Environmental bacteria growth, especially on in-line filters, during milkings longer than 4 hours.
- Vacuum air flow not strong enough for adequate CIP washing. Maintain at least 6 cubic feet per minute per unit, measured at the receiver.
- Loose-fitting pipeline joints. If milk can leak out, bacteria-laden air can get in.
- Poor drainage after cleaning. Bacteria need moisture to grow.
- Worn rubber parts: gaskets, inflations, milk hoses, diaphragms on automatic take-offs.
- Incomplete cleaning of the top interior or sides of the bulk tank, the agitator paddle, the dipstick, or the outlet valve.
- Soiled air lines, sanitary trap, and/or the pipe connecting the trap to the receiver.
- Inadequate cooling. Milk should reach 40°F or below within 2 hours after milking.

### Other

- Contaminated water supply.

## Remember...

High-quality milk is important to continuing increased sales of dairy products. Processors recognize the value of high-quality milk with premium or incentive payments to dairy farmers.

Follow the sanitation basics and receive this additional income. It requires only your attention and followthrough.

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