

6.1

Milk harvesting facilities

A. Basic milking shed

Your milking area should be sited and constructed to ensure satisfactory hygienic conditions during milking. The area and immediate surroundings must be kept clean and you should have an adequate supply of clean water in the area for cleaning.

You must take adequate measures to control insects, rodents and birds on the premises to prevent milk contamination. Do not allow pets or poultry into the milk storage, milking or animal housing areas.

A milk storage room is considered a food storage area. As such, it should be used only to cool and store milk, and for the cleaning and storage of milking equipment. The room should be clean at all times and must be sited in a clean area, away from obvious sources of contamination. It is good practice to have separate milk storage rooms and wash-up areas.

Holding yards should be constructed in such a way that a high standard of cleanliness and hygiene can easily be complied with. Regularly clean or scrape passageways to remove manure.

If you are determined to grow your farming operation, it is a good idea to start planning for the future. One of the most important plans that you can make, is the expansion of your milking shed.

An expanded milking shed should rather be a single structure, but with different sections. A facility master plan is a plan that uses drawings to put your vision on paper. This plan will show where the site, building and sections will be.

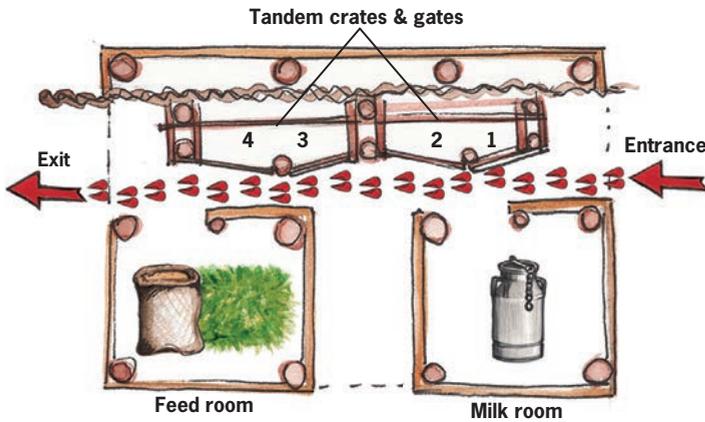
Important things to remember

- The shed must be designed for maximum ventilation (air flow).
- Plan for good water supply and feed trough placement.
- Plan for proper holding yards.
- Plan for proper walkways, so that your animals can be easily handled and you can move easily between sections and animals.
- Walkways should be constructed in such a way, that equipment can be easily handled.
- Install gates and fencing so that you can separate cows.

- Draw your facility master plan for the future on paper.

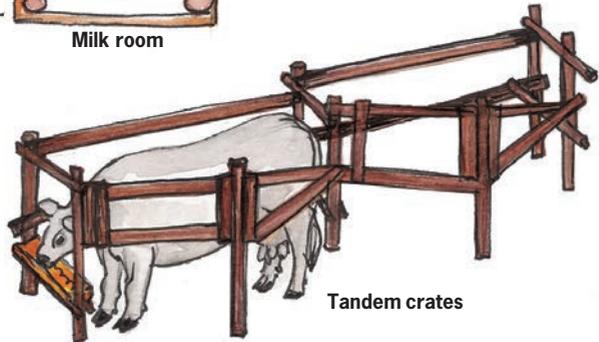


- Your milking shed should be a single structure with different sections.



- Cows should enter on the one side and exit on the other side.

- Build crates from wooden poles and planks.
- Fix feed troughs to the front of the crates.



Tandem crates



Manure

Compost

Fertiliser

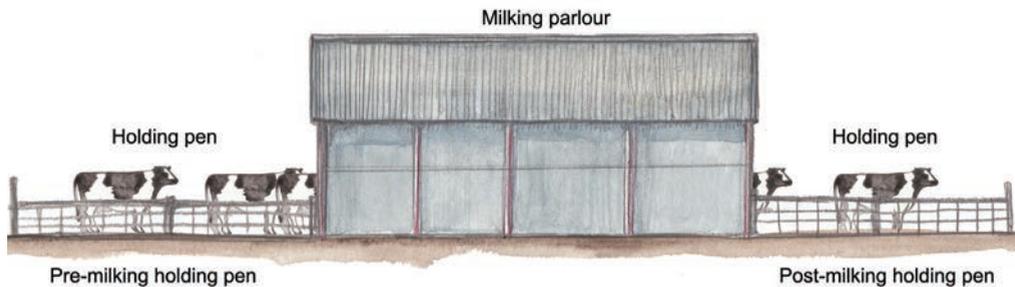
- Scrape manure up and use it to fertilise your crops.

The milking shed should consist of the following sections:

- The **milking parlour** in which the cows are milked.
- A **manure canal** for removing animal waste.
- **Feeding troughs** for animal feed while the cow is being milked.
- A **milk room** that can be used as a cooling room, where the milk cans are stored to keep the milk cool. It can also be used as a wash room, where the equipment is washed.
- A **feed room** used for storing feed.

Plan your shed so that the cows can walk in on the one side, and walk out on the other side. Remove manure from the manure canal on a regular basis and use it to fertilise your crops.

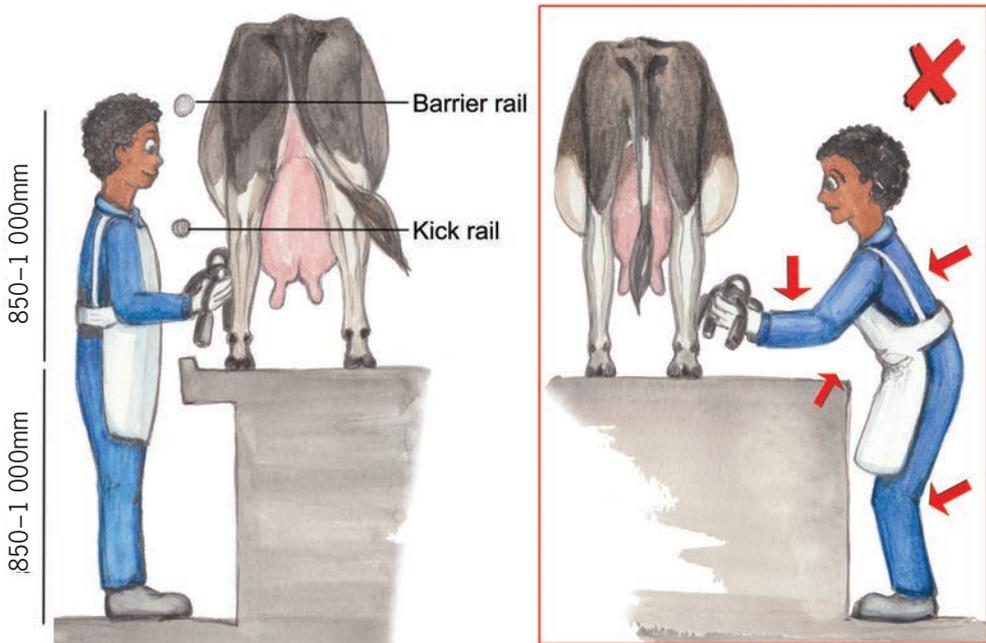
You may also want to make provision for a holding yard or holding pens before and after milking.



B. Layout of milking parlours

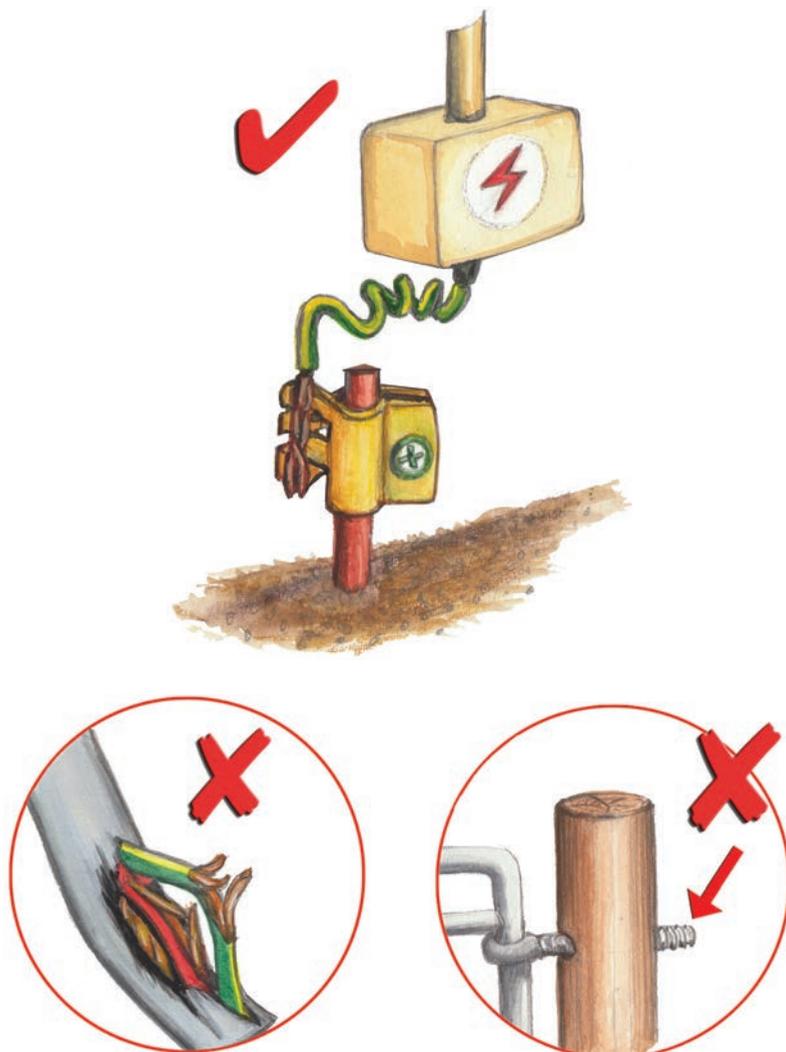
The milking parlour is a specialised facility that can increase a farm's milk production and profits. However, a milking parlour can only be successful if it is well designed and provides a good environment in which the cow can be milked and the milking team can deliver its best work.

In the milking parlour there is close contact between the milker and the cows, and a balance should be reached between the comfort and safety of the milker and that of the cow. The design of the parlour and the yard must ensure that the cows can be milked safely and rapidly. There must be enough ventilation, light and space for the cows to move, non-slip floors and no sharp edges. A well-designed layout with a comfortable milking position will reduce the risk of injuries.



Electricity in milking parlours must be well earthed, as stray electrical current in equipment will stress the cows and make them difficult to handle. Cows that are otherwise docile, may become nervous and even kick the milker. Regular checks should be made to measure any stray electrical current in the pipework or coming through the milking machines.

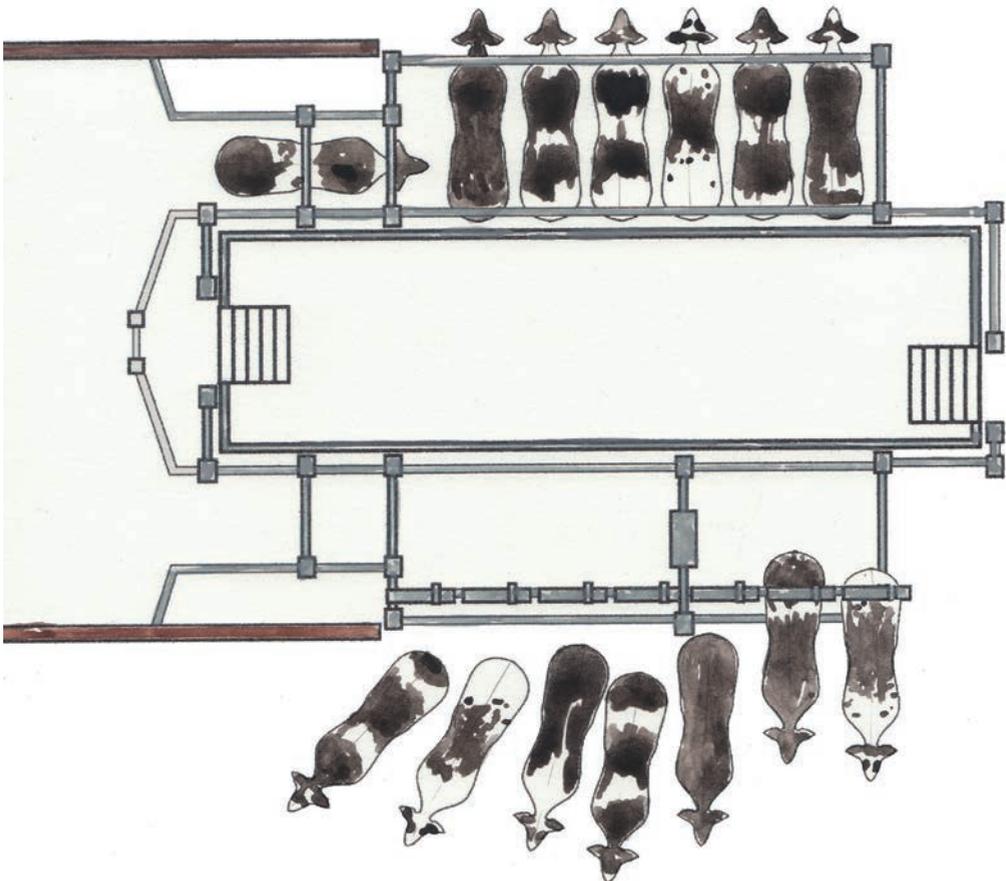
The size of the milking herd will determine the type of parlour best suited for that specific farm. The name of the type of milking parlour indicates the formation in which cows will stand in the parlour. The following are the most common types of milking parlours used in South Africa.



Quick exit (parallel) milking parlours

Each cow has its own clearly defined space, which results in much quicker and easier loading. Cows stand on an elevated platform at a 90° angle, facing away from the operator area.

The cow platform is wider than a herringbone parlour, to accommodate the length of the cow. Stall fronts use chutes or small gates to position each cow. To ensure that each position is filled in order, a series of interlocking fronts prevent a position from being used until the one next to it has been occupied. Most parallel parlours use rapid exit stall fronts and use dual return lanes. Once milked, the bailing raises to facilitate an unobstructed exit.



Advantages:

- This configuration makes the walking distance shorter than in a herringbone parlour.
- It is easy for cows to enter the milk place, with the wide, large turning area and front exit segment open below.
- Each cow has its own clearly defined space, which results in much quicker and easier loading.
- Cows have a natural and comfortable position during milking, since there are no horizontal bars.
- Fast and easy exiting contributes to efficiency in the milking parlour.

Disadvantages:

- Access to the udder is between the rear legs, which reduces visibility of the front quarters.
- It can make unit attachment and udder sanitation more difficult.

Herringbone milking parlours

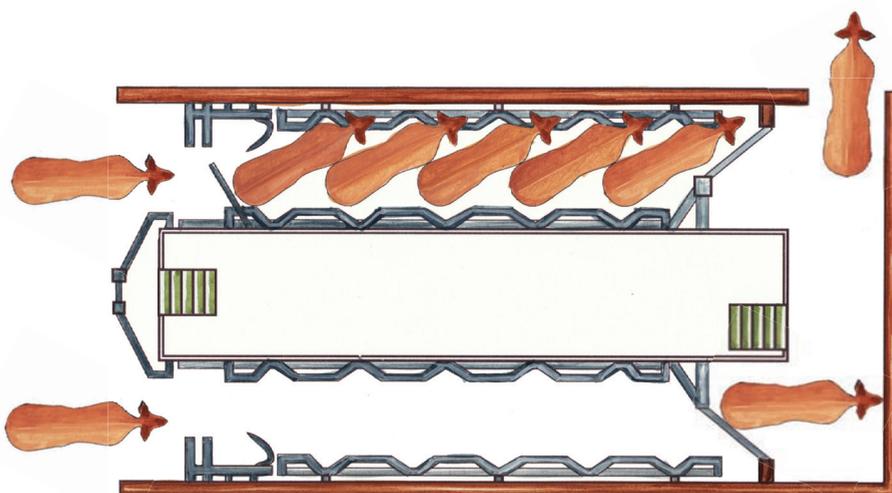
This parlour requires the use of an operator pit. Cows enter in groups (usually no more than 12 per group) and stand at an angle to the pit. No side passages are necessary. They are usually milked from the side. In a double-sided herringbone parlour, about 308 cows can be milked in two hours. With centrally mounted units milking 12 cows at a time, about 200 cows can be milked in two hours.

Advantages:

- Construction is cheaper than other parlours and requires less maintenance.
- Milking machine installation is simple and the parlour is easy to clean.
- The system is ideal for an expanding herd.
- Milkers do not get as tired while milking, because the udders are only about a metre apart.

Disadvantages:

- A slow milker can hold up a batch of cows.
- Udders are farther away from the operator than in tandem side-gate parlours.
- Less individual attention is given to cows.



Tandem side-gate parlours

If the site is level, cows are elevated by means of steps or ramps. This means that the operators do not have to bend as much while milking. If there is no elevation, then a pit can be provided for the milkers. The parlour consists of side passages with individual stalls off the passages. Cows stand head to tail alongside the edge of the pit (behind each other). This parlour is suitable for herds of 10 to 200 cows.

Advantages:

- Milkers can enjoy a more even pace of work.
- Cows are handled individually.
- Slow milkers will not delay other cows.
- One whole side of the cow is visible for inspection purposes.

Disadvantages:

- The parlour area is much more expensive and larger than a herringbone system.
- Six separate gate operations are necessary per cow.
- The stall gates are expensive to install and are quite noisy.
- Operators can become quite tired, due to udders being almost 2,5 metres apart.
- A large area has to be washed and the upright stall construction can make cleaning difficult.



Rotary milking parlours

Cows are milked on a rotating, elevated circular platform. Cows stand in an abreast formation. They can face towards the inner or the outer edge of the platform. The abreast type takes up the least space per number of cows milked. The milker stands in one place outside the platform and the cows are moved to him.

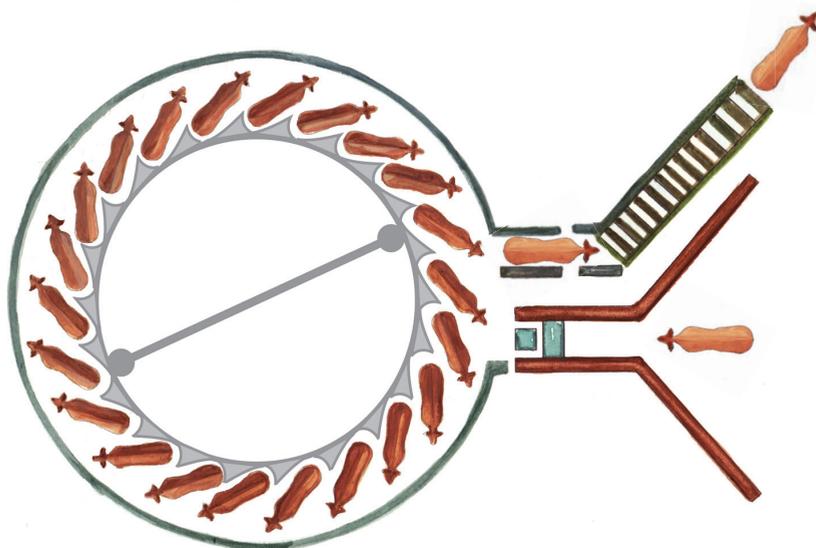
The platform speed can be regulated, giving the milker time to prepare each cow and attach a milking unit. Up to 40 cows can be milked on a rotary unit. Rotary parlours normally consist of a circular steel platform. The platform rotates on rollers and is driven by electric or hydraulic motors.

Advantages:

- This parlour accommodates a steady output of cows.
- Operators do not have to walk much.

Disadvantages:

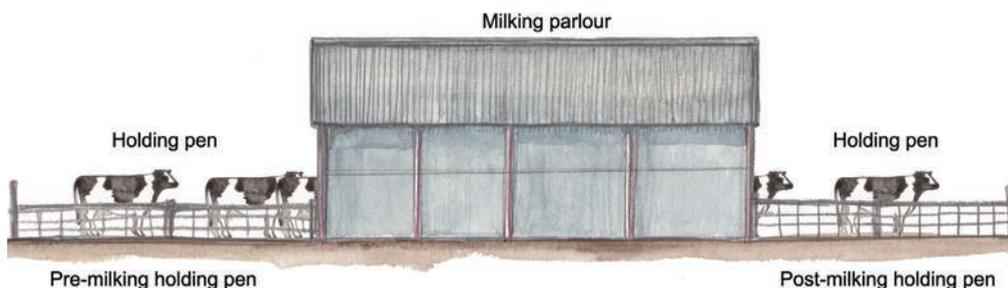
- This system is quite expensive to maintain.
- There is a big risk of mechanical failure, which can halt the entire milking process.
- The rotary parlour cannot be expanded as far as building is concerned.
- Over-milking or under-milking can occur.



C. Holding pens and walkways

Holding pens and walkways close to the milking parlour should also be well designed and well maintained. It is important for the welfare of the animals and the safety of everybody associated with handling the animals.

It should be well drained, well lit, have non-slip surfaces and be spacious enough to accommodate the number of cows at a given moment. The amount of time cows spend standing in the holding area of the milking parlour, away from feed, water and resting areas, should be minimised.



D. Moving dairy animals to and from the parlour

When dairy cows are moved to and from the milking parlour, special care should be taken to avoid placing any undue stress on the animals, as this will affect their milk production.

Animals have a natural fear of humans. If you get too near to an animal, it will usually move away from you. If the animal cannot move away from you, it will move towards you. Animals also have a natural fear of anything that enters their protective space. We call this space their flight zone.

Take note of the following when you have to move animals:

- Do not shout or make sudden movements, as this can frighten animals.
- Do not put an animal in a situation where its flight zone is closed off and it does not know where to go. If this happens, it will try to find a way to escape and can seriously injure you or itself.
- Do not use sticks, whips, dogs or prodders to herd animals.
- Announce your presence to the animal by talking to it.
- Animals will not move into dark places, so make sure that there is adequate lighting.
- Make sure that the path to the milking parlour is wide enough for the animals to walk comfortably and that there is no risk of slipping or injury.

6.2

Milk harvesting process

A. Good milking practices

The milk harvesting process is a routine where each person involved should know the right procedures and apply it every time milking is done. Proper milking management can contribute to the success of the milk harvesting process and problems can be avoided if the correct procedures are followed.

Milking should not be a source of stress for cows. Proper milking procedures, gentle handling, calm cows, clean udders and a clean environment contribute to the production of quality milk.

The following three aspects will contribute to good milking practices:

Cow cleanliness

- Look at the general health of the cows before you start milking.
- Cow cleanliness can influence milking efficiency and lessen infections.
- Dirty cows waste time. It takes longer to prepare dirty cows for milking.
- Teat ends exposed to dirt can cause mastitis.
- For better cleanliness, remove udder hair twice yearly and keep tails trimmed.

Cow handling

- Cows must be calm when they enter the milking parlour.
- Stressed cows do not want to enter the milking area and leave many droppings.
- Make sure that cows are handled with care.
- Stress can have a bad effect on milking efficiency.

Milking order

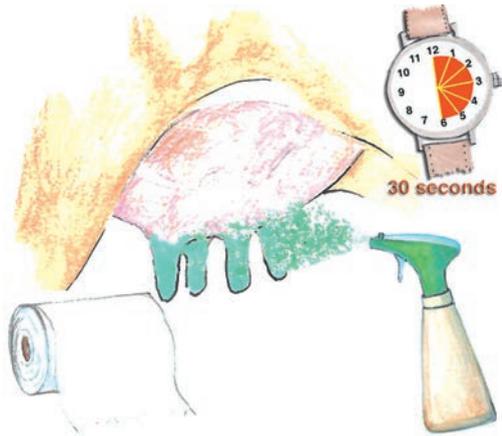
- First milk the healthy cows without mastitis and the fresh heifers.
- Group the cows according to their mastitis infection status.
- Milk the cows that you are not sure of next.
- Milk the cows infected with mastitis last (always keep mastitis milk separate from good quality milk).

- Keep cows calm and handle them carefully.
- Remove udder hair twice yearly and keep tails trimmed.



- Keep cows clean to prevent mastitis.
- Wash teats with a little water if dirty and dry properly with a paper towel.

- Disinfect teats with pre-dipping for 20 to 30 seconds.



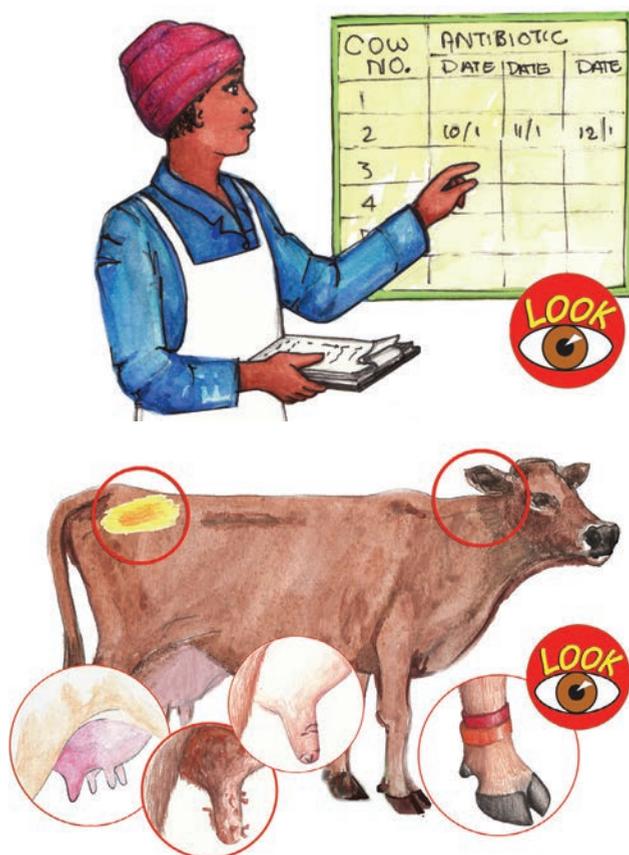
- Milk cows with mastitis last.
- Do not mix mastitic milk with other milk.

B. Pre-milking preparation of a cow

In order to milk cows more effectively, attention should be given to cow preparation, the stimulation of milk let-down and proper procedures used to apply or remove teat cups.

The right pre-milking procedures

- Check on the notice board in the parlour for cows treated with antibiotics.
- Check and identify all cows with special markings (paint markings, leg bands, ear tags) and records that could indicate that the cow has been treated with antibiotics.
- Look for hard, red or swollen quarters to detect mastitis, or for cuts and bruises on the teats and udder.
- Check for loose debris such as straw, mud or sand and remove it with your fingers.
- Check for very dirty teats and udders, especially during the rainy season. Wash dirty teats or udder with a low pressure water hose. Dry it with individual paper towels.



Pre-milking procedures and observations

- Clean teats before milking.
- When teats are clean, fore-strip before disinfecting teat ends, to check for mastitis and abnormal milk.
- If cows are clean, teat-ends can be disinfected by pre-dipping.
- Make sure that the teat-ends are completely covered with disinfectant.
- Keep the dip in contact with the teat for 20 to 30 seconds.
- Proper teat-end disinfection will reduce the number of bacteria.
- If washing is required to remove excess manure:
 - Wash only teats.
 - Use the minimum amount of water.
 - Dry teats properly with a paper towel.
- Check for mastitis and abnormal milk by using stripcup or CMCT method.

Good teat cleaning together with forestripping will usually provide enough stimulation for milk letdown in cows.

Teat dipping before milking

Teat dipping is one of the most important management practices to combat and control mastitis. For this to happen, certain rules have to be followed.

The teat dips must be evaluated by the following criteria:

- **Killing ability:** the dip must kill up to 99,99% of the germs that cause mastitis within 30 seconds.
- **Cleaning ability:** the dip must remove milk film left behind after milking.
- **Skin conditioning ability:** the dip must contain glycerine, lanolin or any other skin conditioners.

Dipping before milking

Before you start dipping, carefully read the instructions. Follow the instructions to prevent teat dip residue from entering the milk.

When you dip, you must:

- Pre-clean teats.
- Apply teat dip, allow 30 seconds' contact time after teat dip has been applied before stripping (testing for mastitis).
- Dry teats with a single disposable paper towel per cow.

VERY IMPORTANT: There is a big difference between pre-milking dip and post-milking dip. Use dip only for its intended purpose.

- First wash very dirty teats with water.
- Prevent mastitis by disinfecting the teats and udder with a teat dip.
- The teat dip will kill germs quickly, and remove dirt and/or milk left on the teats and condition the skin.
- It will condition the skin by keeping the teats supple and free from cracks.
- Use a dip cup or dip spray.



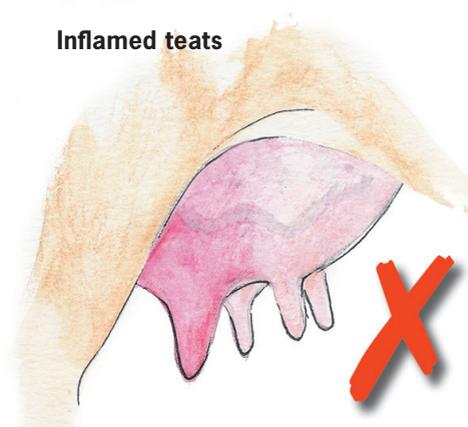
- Ensure that the teat dip is thoroughly applied to the teat canal.

When do we clean them?

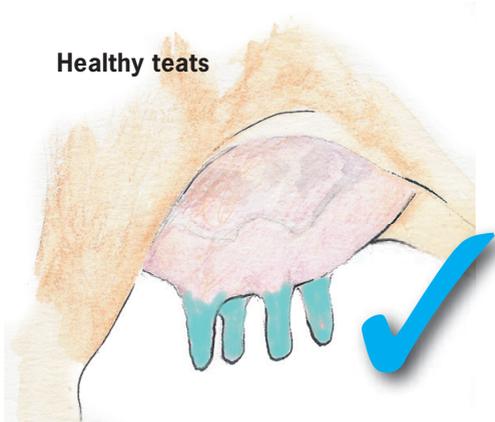
- **Before milking.** Dip the teats for 30 seconds. Test for mastitis and dry the teats with a paper towel.
- **Immediately after milking.** To remove milk that is left on the teats.



Inflamed teats



Healthy teats



Forestripping

Principles to respect

- Good stimulation enables fast milking and complete milkout. Forestripping is the best stimulation activity.
- Early detection of mastitis allows you to withhold mastitic milk from the bulk tank. Early treatment of a clinical case, can also increase the cure rate.
- Milk that is forestripped from an infected cow, may contaminate hands, towels and the environment. Eventually it will contaminate other quarters or other cows' udders.
- Once teats are sanitised, we should not touch them. Therefore it is better to forestrip before teat dipping.

How to do forestripping

- Collect at least two good streams from each teat into the strip cup or other suitable container.
- Observe the milk for any abnormalities.
- Never strip the milk directly onto the floor in a milking parlour.

Never forestrip on your hands, on the towel or on the cow's leg.

Remember

Forestripping may help you to achieve:

- ✓ Early detection of clinical mastitis.
- ✓ Faster milking.
- ✓ Higher production.



C. Ways to milk a cow

Cows can be milked by hand or by machine. The principles applied during the two methods differ from one another.

Hand-milking

During hand-milking, the milk is pressed out of the teat. Only a certain amount of milk can be expressed by hand and some milk will remain in the cow's udder.

Golden rules for hand-milking:

- Milk the cow with clean, dry hands.
- Wash dirty udders with water and look out for signs of udder infections.
- Tie the cow's hind legs so that the tail does not swish around during milking.
- Milk into a stainless steel bucket; NOT a plastic bucket.
- Milk regularly (e.g. every 12 hours) and complete milking in five to seven minutes.
- Use a milking salve to lubricate teats – do not use milk for this purpose.
- Dip your hands in teat dip between milking of different cows.

Machine-milking

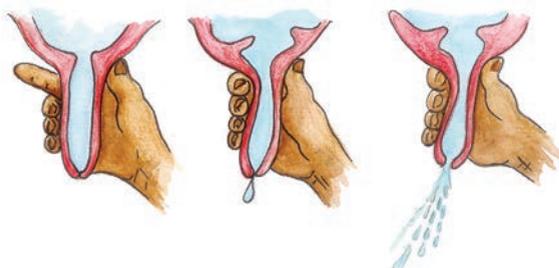
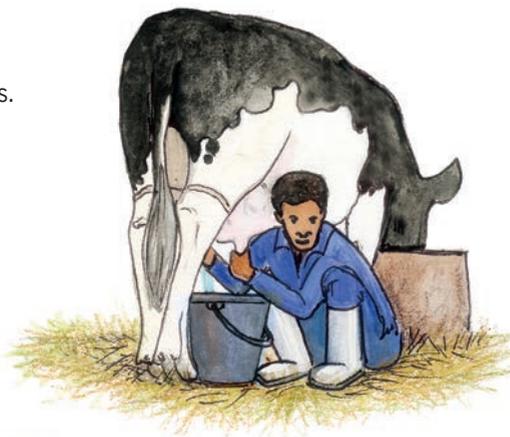
During machine-milking, the milk is literally sucked out by means of a vacuum supplied by the machine. A milking machine enables us to milk out the udder so that no milk is left. In this way we get between 30% and 40% more milk than with hand-milking.

The correct technique for machine-milking is as follows:

- Prepare and clean animals properly before milking.
- Attach the cups to clean, dry teats.
- Avoid unnecessary air entry at cup attachment.
- Avoid over-milking.
- Remove cups gently by breaking the vacuum.
- Apply teat disinfectant to each teat after milking, according to recommendations and regulations.

Hand-milking

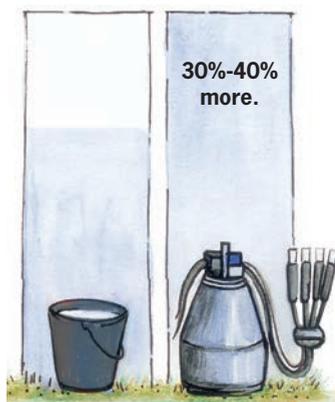
- Some milk will stay in the cow's udder.
- Dip your hands in teat dip between milkings.
- Complete milking in five to seven minutes.



- To avoid injuries don't pull the teat.
- Start pressing fingers from the base of the teat down to the tip of the teat.

Machine-milking

- Machine-milking stimulates the udder to produce more.
- A simple way to milk a few cows, is by using a mobile milking machine.
- Wash and maintain your milking machine properly.



- Machine-milking gives you 30% to 40% more milk.

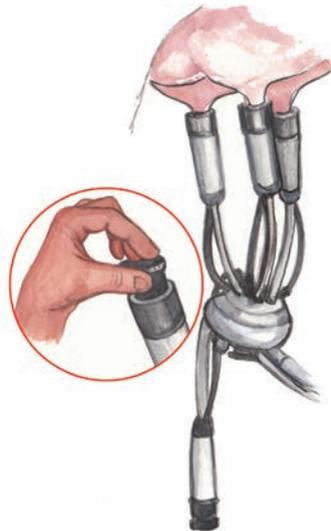
Attachment of the milk unit

Important principles:

- To have the maximum benefit of oxytocin and to obtain a rapid and complete milkout, the unit should be attached about 60 seconds after the beginning of stimulation, always using the same delay time.
- Attaching the unit on teats filled with milk is an indication that stimulation and lag time have been adequate.
- Do not let any air enter the clusters during attachment. Doing this will lead to:
 - Vacuum fluctuations that could lead to mastitis.
 - Milk slugs in the milkline and milk foaming that could lead to a rancid flavour in the milk.

Procedure:

- Always use the same delay (length of time) between the beginning of teat prepping and unit attachment. It is a good idea to use a 60-second lag time. Use a wall clock or wristwatch to time yourself.
- To limit the admission of air into the teat cups, hold the unit level with the teat cups hanging down, before opening the vacuum valve.
- To prevent the admission of air, hold the teat cup so that the short milk tube is bent in the form of a Z, until the teat cup is close to the teat.
- Start with the least accessible teat (the one most difficult to reach from where you are standing).
- With a three-teated cow, you still use the whole unit, but you insert a plug into the unused teat cup.



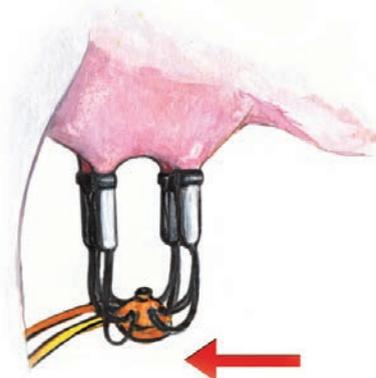
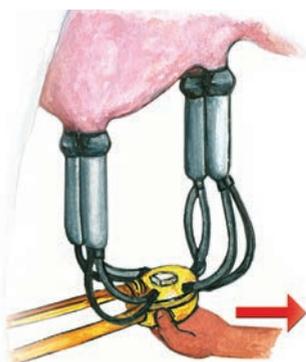
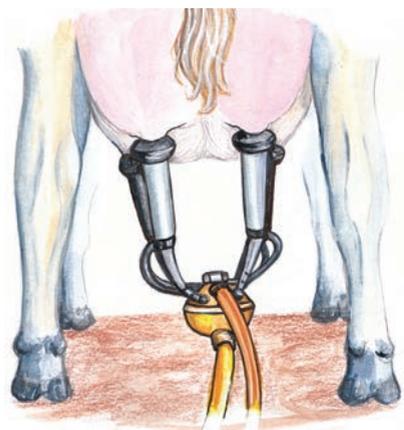
Adjustments of the milk unit

Important principles:

- Adjusting the unit properly reduces the incidence of liner slip which makes an equal and complete milkout possible.
- If some quarters are more developed, drawing the unit slightly forward (or backward) will result in faster milking of these quarters.
- After unit adjustments, a continuous and increasing flow of milk should come within 15 seconds.

Procedure:

- With a well-balanced udder, adjust the unit so that it hangs squarely under the udder and all teatcups are vertical.
- If the rear quarters are more developed, pull the unit slightly forward.
- Make sure the milking claw is not twisted.
- Depending on the installation, the claw outlet should be pointed at the head of the cow or towards the hind legs.



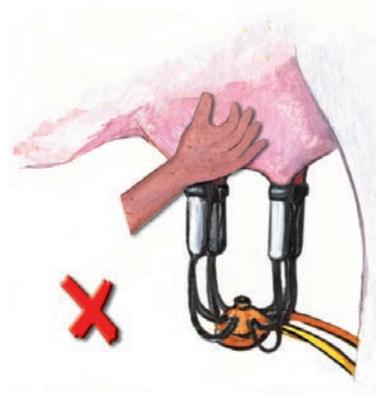
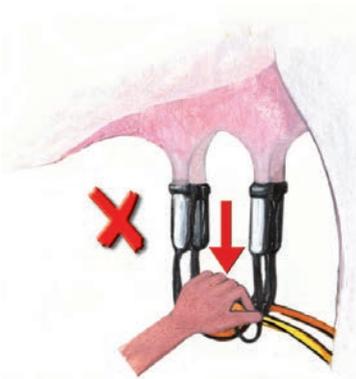
Prevention of liner slip

Important principles:

- Vacuum fluctuations in the claw can encourage the entrance of bacteria into the teats, as well as mastitis.
- Liner slips will greatly influence vacuum fluctuations.
- Squeezing the short milk tube is another cause of vacuum fluctuations at the teat end.
- Machine stripping (pushing down on the claw and/or massaging the udder) and the removal of one teat cup result in air admission and vacuum fluctuation.
- With machine stripping, cows get used to waiting for stripping to milk out completely.

Procedure:

- If there are liner slips, react immediately. You may have to readjust the unit.
- Don't pinch the short milk tube.
- Avoid removing one teat cup before the others.
- Avoid pushing down on the claw.
- Avoid massaging the udder, especially close to the teat cup.



Removal of clusters

Important principles:

- Over-milking stresses the cow. It increases risk of liner slip and increases teat damage.
- With automatic take-offs, routine use of “manual” indicates malfunctioning equipment or improper procedure.
- Taking off a unit that is under vacuum, stresses the cow. It causes an air admission which encourages vacuum fluctuation, the entrance of bacteria into the teat and mastitis.
- The same is true with the removal of one teat cup.

Procedure:

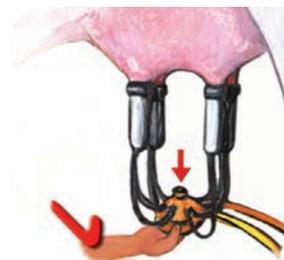
- With a well-adjusted automatic take-off, the use of “manual” should be infrequent.
- Without an automatic take-off, watch carefully for the end of milking and avoid over-milking.
- Close valve properly to shut off the vacuum before unit removal.
- Wait one or two seconds and pull down gently to remove all teat cups at once.
- Avoid removal of a unit that is still under vacuum.
- Don't remove the teat cups one by one.



1. Close valve



2. Wait 1-2 seconds



3. Remove all teat cups at same time

D. Post-milking cow care

The final step in a successful milking procedure is teat disinfection. Post-milking teat dip must be applied immediately after the milking procedure has been completed. The longer you wait, the better the chance that bacteria can enter the teat canal. Mastitis often develops in conditions where the teat-end is exposed to bacteria.

There are two acceptable methods to apply teat dips, the most important factor being that the entire teat is covered with dip.

Special teat dip cup or spraying system

- Use the non-return teat dip cup.
- Wash the teat dip cup after each milking.
- Discard any left-over dip from the cup.
- Check regularly to ensure that all nozzles or the spraying system are still working.

Principles to respect:

- Teat disinfection after milking is a universally recognised method of preventing mastitis and should be applied as quickly as possible after the milking unit has been removed.
- Teat disinfection decreases the number of bacteria on the teat skin by:
 - Destroying micro-organisms.
 - Sealing the teat canal.
- Teat dips also contain a skin conditioner that improves skin condition.
- Teat coverage is critical. The best disinfectant won't do any good if it is not applied correctly.
- Dipping or spraying immediately after unit take-off allows the disinfectant, and not the bacteria, to enter the teat canal before it closes.

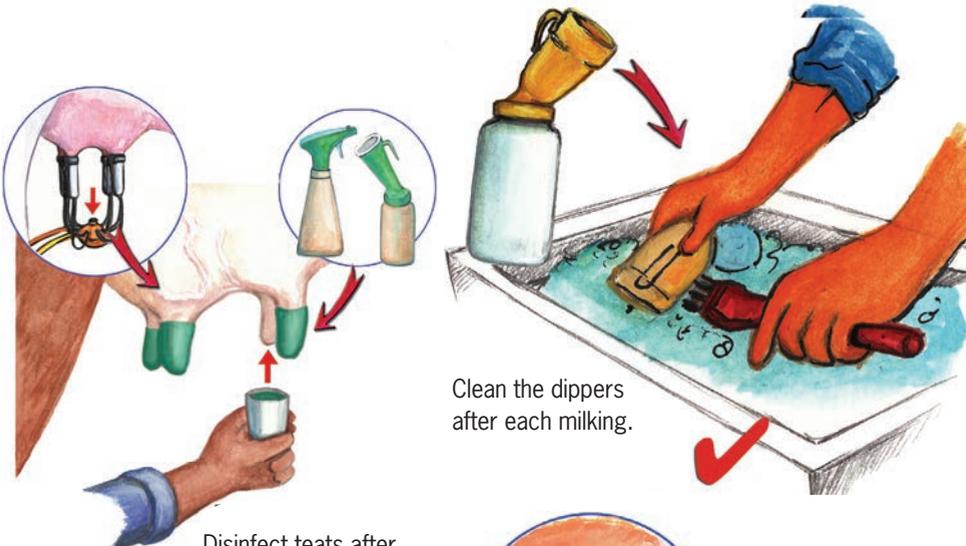
Proper dipping or spraying

- Dip the whole teat, not only the tip.
- Spray the whole teat, not only one side or the tip.

Teat dip storage and handling

- Use only approved teat dips.
- Clean the dippers after each milking.
- Never pour left-over dip from the teat dip cup back into the original container.
- Keep containers closed.
- If a product has expired, get rid of it.
- Never mix different products.
- Use quality, clean water to reconstitute teat dips.

The streak canal (opening at the tip of the teat) stays open for about 30 minutes after milking, therefore it is a good idea to make feed (often hay or silage) and water available to the cows after they have been milked. Cows will remain standing while eating. This reduces the chances of the cow lying in an unhygienic environment that may contaminate the teat end before the streak canal closure.

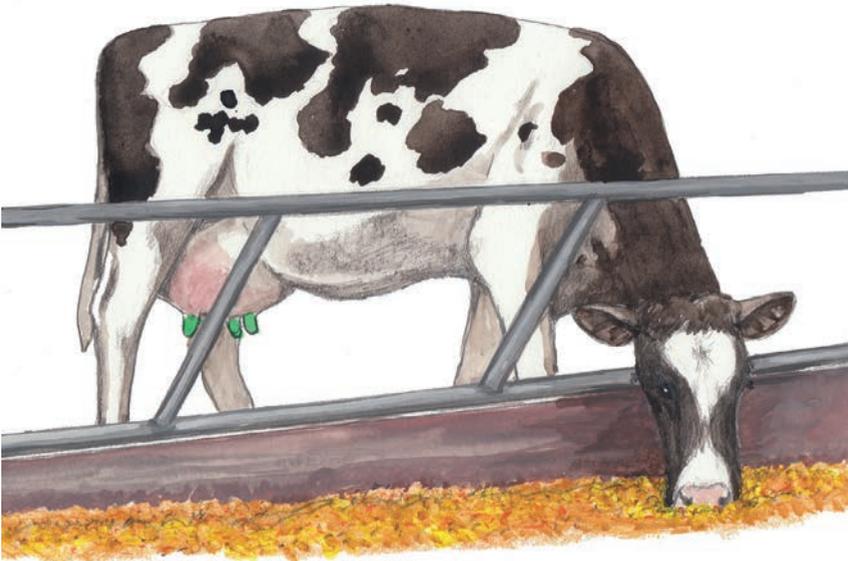


Disinfect teats after removing milking unit.

Clean the dippers after each milking.



Cover the whole teat with disinfectant.



Provide feed immediately after milking.

E. Handling of contaminated milk

Good quality milk is essential for the production of good quality dairy products, and should be as follows:

- Free from debris and sediment.
- Free from off-flavours.
- Low in bacterial numbers.
- Low in somatic cell counts.
- Normal composition and pH.
- Free of antibiotics and chemical residues.

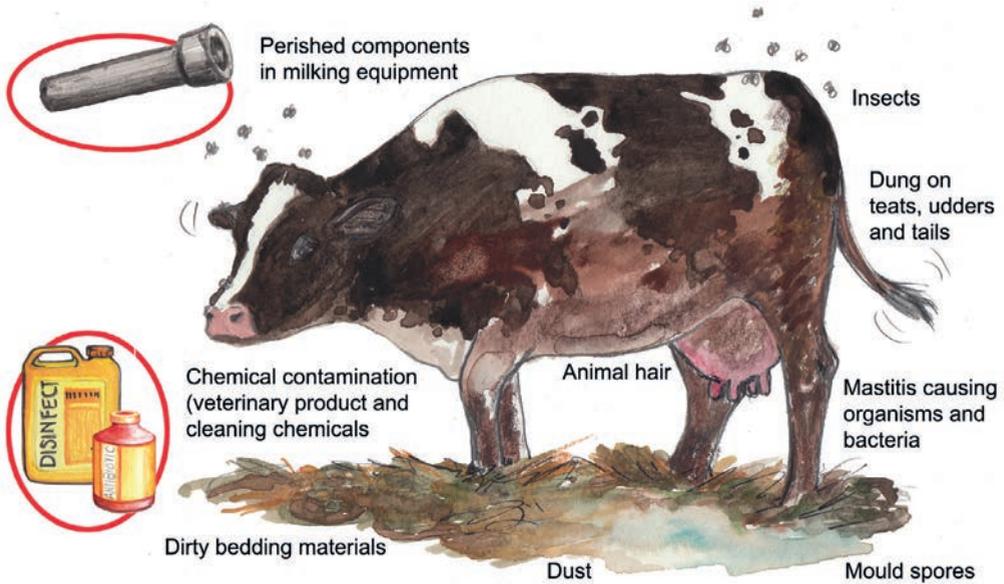
Milk can be contaminated at any point in the production process. Weak points should be identified and protective control measures should be introduced. Contaminated milk is not to be used and should be handled according to prescribed procedures.

There are several sources that can cause the contamination of milk:

- Bacteria, e.g. from poor milking practices and poor hygiene.
- Mastitis organisms (bacteria), blood and clots, from undetected abnormal milk.
- Dung from soiled animals, especially on teats, udders and tails.
- Mould spores.
- Perished components in milking machines and bulk tanks.
- Dust.
- Unclean bedding materials.
- Insects.
- Animal hair.
- Chemical contamination from veterinary product residues or cleaning chemicals.

Identify cows secreting abnormal milk and discard this milk. It is not fit for human consumption and should not be mixed with the milk of healthy cows for further processing. No contaminated milk, such as the milk from a cow treated with antibiotics, should ever be put into the bulk tank.

Factors contributing to contaminated milk



Foremilk examination is the technique used to identify abnormal milk before applying the milking unit. Early detection of mastitis allows one to prevent mastitic milk from entering the bulk tank.

Although milk filtration removes larger particles of dirt and sediment, it cannot remove bacteria. A filter does not provide an alternative to good dairy parlour management practices. Having a filter is part of minimum standard operating procedures.

Colostrum from cows that recently calved is not fit for human consumption. Contaminated colostrum should be discarded according to protocol on the specific dairy farm.

6.3

Dairy parlour equipment

A. Milking equipment

The milking system is used daily and the efficiency of the milking machine and other equipment can deteriorate gradually without being noticed.

Regular testing, service and maintenance of milking equipment are essential and will have the following benefits:

- Maintain good mechanical performance.
- Improve the speed and completeness of milking.
- Improve mastitis control.
- Provide an early alert to emerging problems.

For continuous trouble-free operation with high-quality milk, regular maintenance and replacement of wear-and-tear parts are necessary.

The milking machine

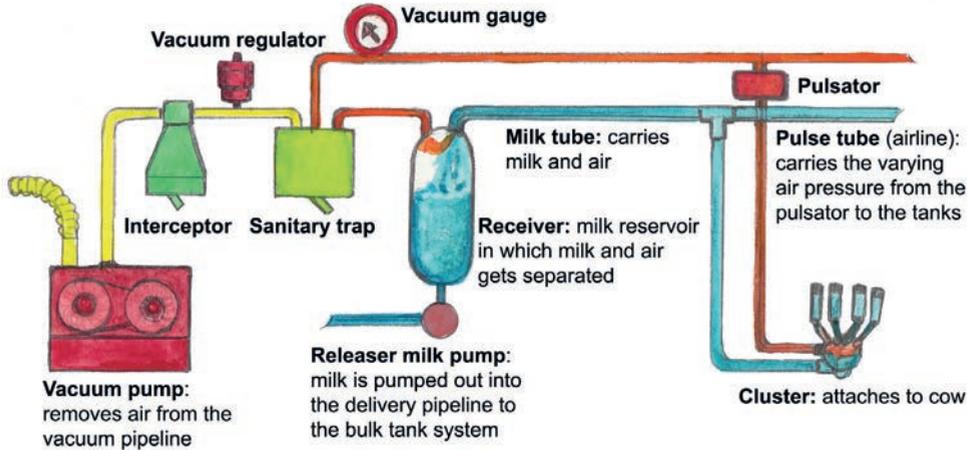
On the modern dairy farm, the milking machine is a vital piece of equipment in the dairy parlour, which should be tested and serviced at least once a year.

The milking machine has nine components:

- **Vacuum pump:** The pump creates a vacuum by sucking air out of the pipes, to suck milk out of the udder. The vacuum pump must be drained to remove all moisture.
- **Sanitary trap:** The trap protects the vacuum pump against moisture and dirt.
- **Vacuum regulation:** This section controls the vacuum level by letting in extra air when the level rises too high, and closing when the vacuum level drops too low.
- **Vacuum line:** The line transports the vacuum to the pulsators and the clusters.
- **Pulsator:** This device regulates the work and rest phases of the teat clusters.
- **Receiver:** This section collects the milk and pumps it to the cooling tank.
- **Milk line:** The line transports the vacuum to the cluster, then the milk from the cluster to the receiver.
- **Cluster:** The cluster fits around the teats and has rubber teat liners.
- **Cooling tank:** The cooling tank cools the milk down as fast as possible, preferably to 4 °C within three hours of milking.

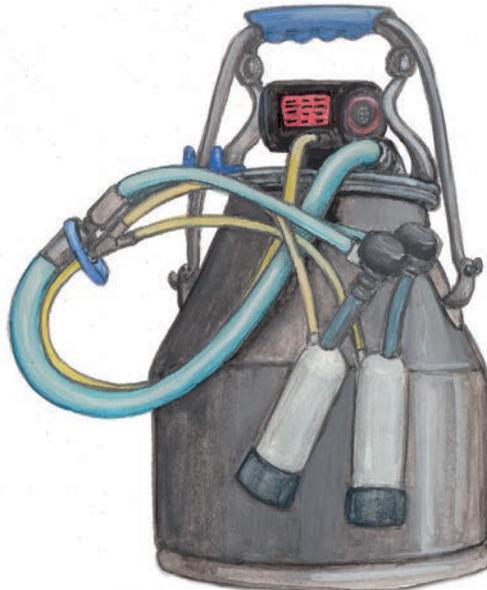
Many milking machine systems are regulated by a computer system and can generate data about the cow and its milk as milking is occurring.

Milking machine components



Portable milking machine

A portable milking machine is ideal to use if you don't have a large herd, but it still needs to be efficient when milking cows.



Milking machine maintenance

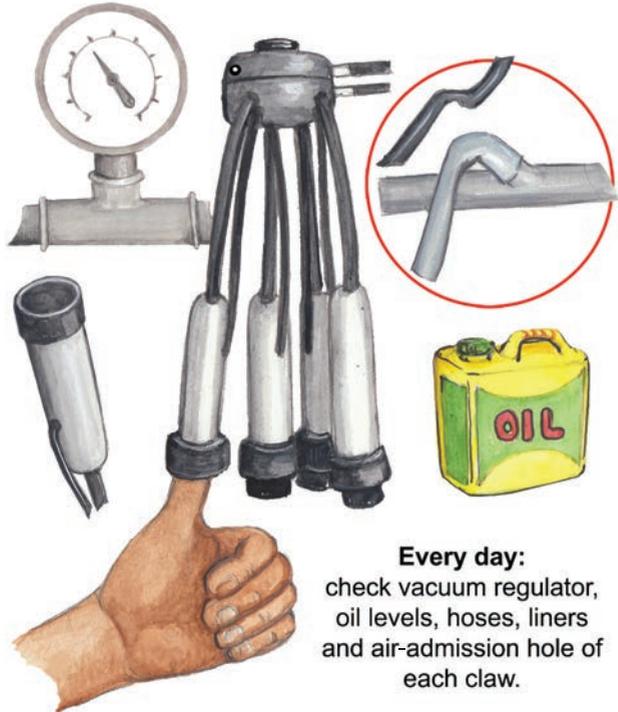
For a continuous trouble-free operation with high-quality milk, regular maintenance and exchange of moving parts are necessary.

A reliable supplier and installer will offer a scheduled plant service to give the required maintenance. Such a service will include dismantling and a complete cleaning of the plant, exchange of all required moving parts according to established time limits, checking of all essential functions and parameters, and a complete test run.

Such preventive scheduled services will markedly reduce operational breakdowns that will be more costly in the long run. A preventive service works as an assurance and reduces production losses, giving peace of mind.

Daily maintenance checks

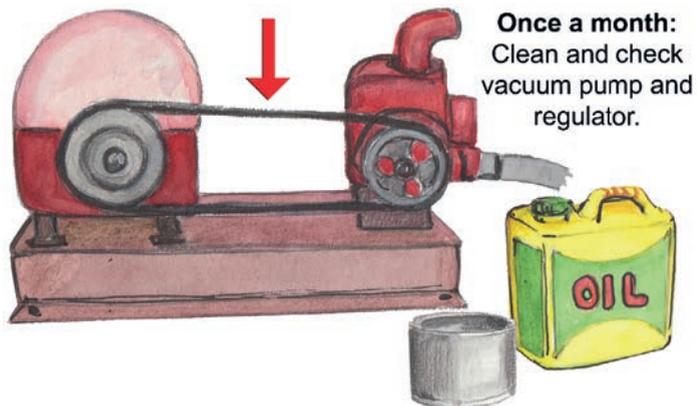
- Vacuum regulator operating properly.
- Vacuum level at desired level.
- Check for air leaks in liners and hoses.
- Ensure vacuum pump oil level is satisfactory.
- Check that air-admission hole in each claw is not blocked.



Every day:
check vacuum regulator, oil levels, hoses, liners and air-admission hole of each claw.

Monthly checks

- Clean vacuum regulator.
- Check belt tension and belt condition on vacuum pump.
- Check lines, couplings and inlets for leaks.
- Clean interceptor, check seal and drain plug.



Once a month:
Clean and check vacuum pump and regulator.

The milk cooler

- Check the agitator motor for grease leaks or noisy operation, also worn shaft shields and bearings.
- Check the timer to be sure that it will start the agitator motor and advance to the off position.
- Check the thermometer for accuracy. It should read 0 °C when submerged in ice water. Be sure it is not sticking.
- Check milk-tank outlet valve for leaks.
- Check the running time of the cooler. It should cool to 10 °C within one hour of first milking and cool to 4 °C and hold that temperature after the second hour. The blend temperature of the second, third and fourth milking should remain under 10 °C.
- Check for foam, churned milk and frozen milk on the milk surface.



- **Once a year:** service and test performance of the milk cooler.



- **Milk cooler:** check thermometer for accuracy and milk outlet valve for leaks.

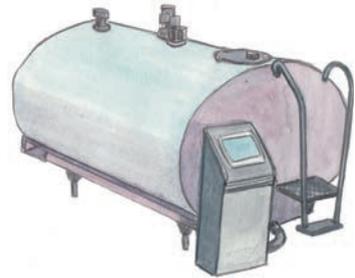
B. Other equipment

Bulk storage equipment

The bulk milk cooling tank is an important piece of dairy farm equipment. It is usually made of stainless steel and used every day to store the raw milk in favourable conditions on the farm, at a temperature of 4 °C. It is kept ready for collection by the dairy milk tanker.

Take note of the following:

- Ensure unobstructed access for bulk milk collection.
- Ensure that milk is cooled or delivered for processing within the specified time.
- The milk storage area should be clean and tidy.
- The milk storage equipment should be adequate to hold milk at the specified temperature.
- The milk storage equipment must be cleaned and sanitised after each milk collection.



Inline wash system

This is an ideal labour-saving system that automatically washes your milking plant. After the entire herd has been milked, the milking system needs to be cleaned thoroughly. A clean milking machine is essential for udder health and milk hygiene.

To operate, you simply set the system to wash and the following procedure will then be carried out:

- Initial rinse with luke-warm water until the water is clear.
- Alkaline wash in combination with cleaning and disinfecting agents.
- A final rinse.

The following aspects are of main importance for efficacy:

- Water temperature (beginning and end of washing).
- Quality and concentration of the cleaning or disinfecting agents.
- Washing time.
- Turbulence in the line during washing.
- Water quality.

An acid rinse with hard water is used weekly or more frequently, to get rid of milk-stone in the milking system. When the procedure is completed, the inline wash system will shut down until the next milking session.



Standby power generator

A generator is needed for standby service in case of a power failure. The generator's characteristics must match the commercial power with regard to voltage, phase, cycles, etc. The standby generator should be set up in a safe, dry place. It should be conveniently located, especially when controlled manually, so that no time is lost in an emergency.

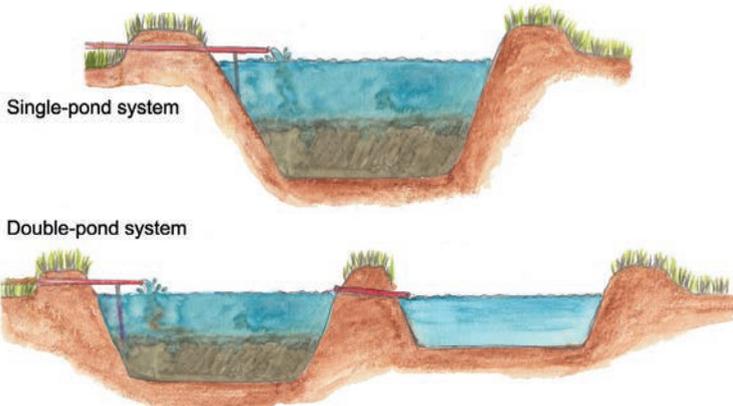


The standby generator unit should be kept clean and in good running order at all times so that it will be ready for immediate use. An accumulation of dust and dirt on the generator can cause it to overheat when in operation. Always follow the maintenance instructions in the manufacturer's manual.

Wastewater treatment systems

The potential impact of dairy farming practices on the environment should be limited by proper management of the storage and disposal of wastewater. When processing milk, large amounts of water are used mainly for cleaning the plant's systems and the vehicles. Thus the wastewater treatment of dairies needs to be able to handle large amounts of wastewater. The wastewater of dairies is loaded with micro-organisms, detergents, solids and organic substances such as fat.

A good draining system is needed because a large amount of water is used to clean in and around the dairy parlour. If not drained properly, it can create problems such as mud, bad smells and a breeding place for insects. Improper discharge of wastewater to surface and groundwater may result in health risks and pollution.



6.4

Dairy parlour hygiene

A. Personal hygiene

Bacteria or germs are everywhere. We must always be on guard to make sure that we have these germs under control. Therefore we start with our own hygiene.

People have as much as ten thousand to ten million bacteria on each hand! The only way to fight bacteria such as *E. coli*, is to **wash your hands** regularly. *E. coli* is a type of bacterium that can cause great damage to your dairy cow's udder, if it is transferred during milking. *E. coli* is an important cause of mastitis amongst dairy cows.

The first thing that you should do before you enter the milking parlour and work with raw milk, is to wash your hands. Always use warm water. Wet them thoroughly, up to the elbows. Apply soap and rub your hands together for at least 30 seconds. Remember to wash between your fingers and scrub your nails with a nailbrush.

The washing of hands between the milking of each cow will reduce the chances of cross-contamination and helps prevent the spread of diseases.

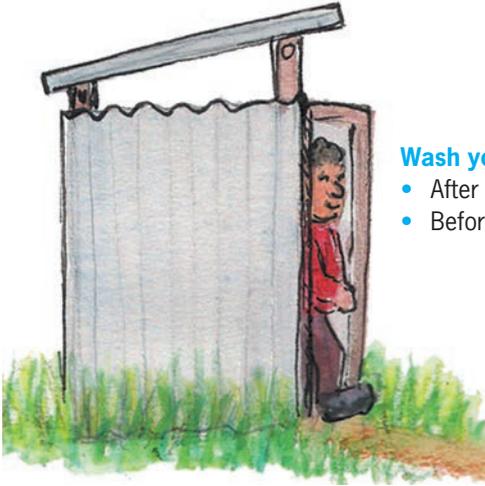
Remember to wash your hands when you have been to the toilet, have smoked, milked out a cow with mastitis, worked with money and after treating a sick person or animal.

Other measures

- Wear a hair cover. This will ensure that no hair falls into the milk.
- Wear an overall with short sleeves, so that your clothes do not come into contact with the cow's udder and teats.
- Wash your overalls regularly and, if possible, wear a waterproof apron.
- Wear plastic gloves, especially if you have open sores or cuts on your hands. Replace the gloves as often as possible.
- Wear rubber protective boots.

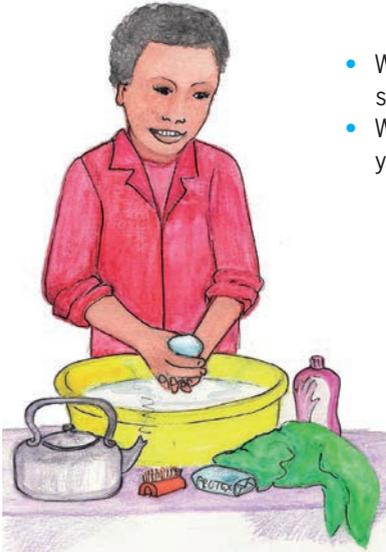
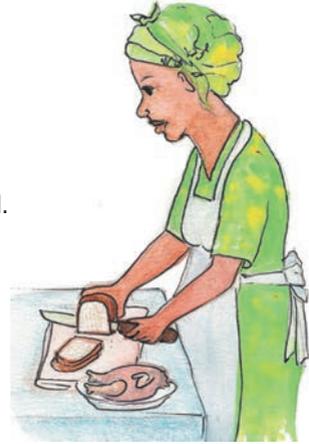
Disease and germs

Many germs are found in the human nose, throat and ears. If you have a cold, take special care to wash your hands more frequently. Visit the doctor if you cough, have diarrhoea, fever, sore throat, TB, skin lesions, etc. Wear a nose and mouth mask when working with cattle while you are sick.



Wash your hands

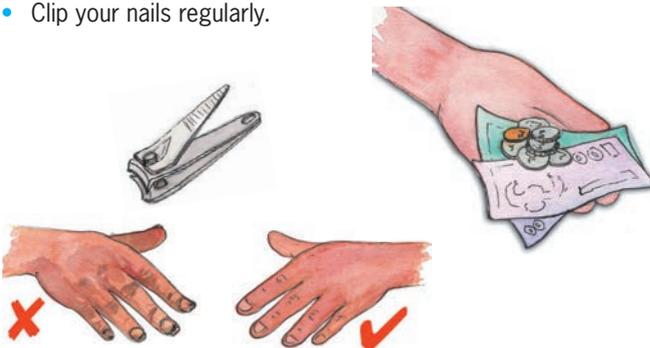
- After visiting the toilet.
- Before you prepare food.



- Wash your hands with soap and warm water.
- Wash your hands often if you have a cold.



- Clip your nails regularly.



- Wash your hands after handling money.
- Antibacterial soap works well.



B. Parlour and equipment hygiene

The milking parlour can be considered an important link in the dairy food chain. It is, however, an area challenged by heavy soiling with manure, urine and micro-organisms.

Consistent and sufficient milking parlour hygiene is therefore critical to:

- Minimise the risk of milk and dairy product contamination.
- Minimise the risk of cross-contamination between animals.

In the milk parlour cleanliness and hygiene are of utmost importance at all times. If possible, it should have a cement floor for easy cleaning.

- Clean the parlour after every milking.
- Locate and remove the source of any bad smell in the parlour.
- Sufficient clean water must be available at all times.
- Provide hand-washing facilities with antimicrobial soap.
- Provide drying-off facilities and a bin for used paper towels.

Clean parlour equipment and utensils

The most important step in achieving good quality milk, is to clean your equipment properly and to remove all milk residue from your buckets and cans. It is recommended that only stainless steel equipment is used, for they are more hygienic and easy to clean.

Four things that are very important to remember for proper cleaning:

- **Time:** Cleaning solutions often need time to truly work. About 10 minutes contact time is needed for a cleaning solution, soap or disinfectant to kill all germs.
- **Temperature:** Hot water is necessary for removal of milk fat. Water must be hot enough, so that you have to wear plastic gloves.
- **Concentration:** Always read the instructions on the cleaning solution and dilute it as directed. Use the correct amount of cleaning solution. Too little will not clean the equipment and too much will cost you a lot of money.
- **Physical action:** A good scrubbing action is necessary to clean equipment properly. Be sure to use a clean brush with good bristles designated only for the cleaning of that equipment. Ensure that all surfaces are scrubbed well, both inside and outside.

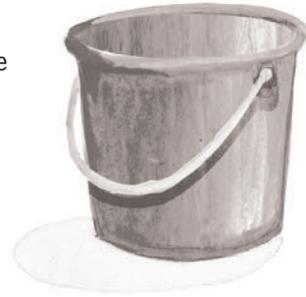
Cleaning and disinfection

To effectively clean your equipment, you will need a good cleaning chemical that has been registered with the South African Bureau of Standards. A standard procedure for cleaning and removing the lime that comes from the warm washing water is to use acid. However, take great care when using acid. This product can be very dangerous if not used correctly. Wear the correct

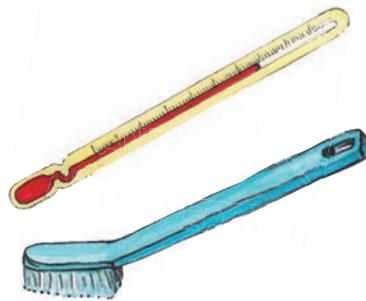
clothing to ensure there is no chemical contact with your skin and always protect your eyes. A sanitiser can be used once the soap has removed all residue and the acid has removed all the lime. Sanitising will remove any remaining bacteria.

Basic cleaning regime for steel buckets and cans

- Rinse with cold water first.
- Scrub with a brush and warm water containing detergent.
- Rinse again with cold water.
- Sterilise with boiling water (or use disinfecting solutions like hypochlorite).
- Dry the cans on a drying rack, preferably in the sun.

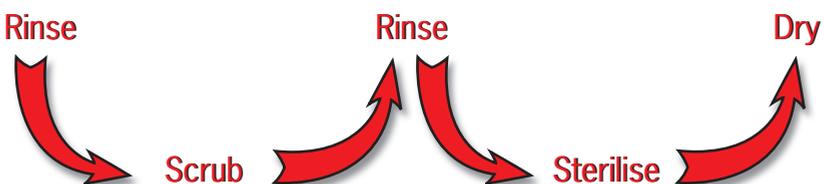


- Use steel buckets for hygienic milking.
- Running hot water is necessary for proper cleaning.
- Use only SABS-approved cleaning chemicals.



- Good scrubbing is required for proper cleaning.
- About 10 minutes are needed for cleaning solutions to work properly.
- Follow a good cleaning regime.

Cleaning regime



Clean milk churns

Hygiene is very important at all stages of milk collection and processing. It is important for the quality and shelf life of dairy products.

Each farmer is responsible for ensuring that their stainless steel milk churn or churns are cleaned correctly and disinfected after each delivery to the milk collection centre. The incorrect cleaning of cans is a major contributing factor to the production of poor quality milk.

The most important points for good hygiene are:

- Use clean containers and equipment.
- Use seamless stainless steel cans, as plastic cans are not hygienic.
- Use containers that are easy to clean with a wide opening at the top.

Cleaning and disinfection

There is a difference between cleaning and disinfection. Cleaning removes materials such as dirt and any residues of milk. Disinfection kills most harmful bacteria.

Clean the containers as follows:

- Rinse with cold water first.
- Scrub with a brush and warm water containing detergent.
- Rinse again with cold water.
- Sterilise with boiling water (or use disinfecting solutions like hypochlorite).
- Dry the cans on a drying rack, preferably in the sun.
- Do not use the milk room to wash your churns.
- Use a scullery for washing. The scullery should preferably be a separate room.
- Store your cleaning tools in a permanent, easy-to-reach space.
- Use brushes with nylon bristles. Do not use wooden brushes.

Follow the 5-step cleaning regime

1 Rinse with cold water.



2 Scrub with brush and warm water and detergent.



3 Rinse again with cold water.



4 Sterilise with boiling water.



5 Dry the cans in the sun.



Clean milk tank

If you are using a bulk milk tank to store and keep your milk cool, it is very important that your tank is kept clean – just as you would clean buckets and milk churns.

For effective cleaning, you will need:

- Soap, which helps to remove food from the system.
- Acid, which is used to remove lime that comes from the warm water used for washing.
- Sanitiser, which kills the last remaining bacteria.

Important principles

A good wash programme for your milk tank and for your milking machine is based on the following basic rules:

- **Temperature:** Fat and protein must be removed at a temperature of approximately 75 °C. If the water becomes cold, fat and protein will be left behind.
- **Concentration:** The right amount of soap, acid and sanitiser (all SABS-approved) must be used with the right amount of water. Do not try to save by using less and do not waste money by using more than the required amounts. Do not use old chemicals.
- **Time:** Every tank and milking machine is washed for a different length of time. The washing time should not be shorter than six minutes or longer than 10 minutes.
- **Action:** This is achieved by using a tank brush to scrub the tank.

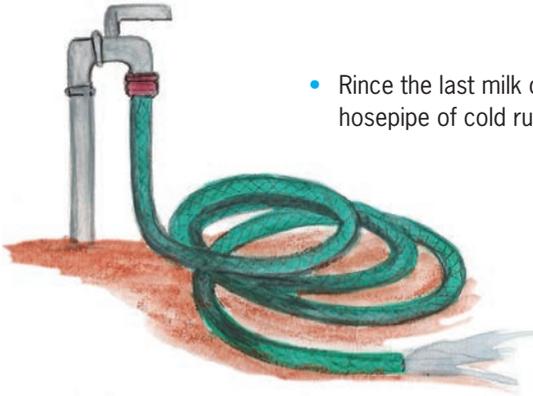
Washing programme

Clean the tank regularly by following these steps:

- Rinse the last milk out of the tank with cold running water – a hosepipe works best.
- Mix a solution of about 15 litres of warm water and foaming soap or detergent in a bucket.
- Place the bucket in the tank and wash it from top to bottom with a proper brush.
- Remember to wash the tank outlet.
- Rinse the tank.
- Apply sanitiser with a spray bottle or wash the tank with a tank brush.
- Drain the sanitising water.

VERY IMPORTANT

- Never rinse the tank with clean water after it has been sanitised.
- Do not use strongly scented or phenolic cleaning products.
- Check labels of chemicals and make sure that they are suitable for dairy use.

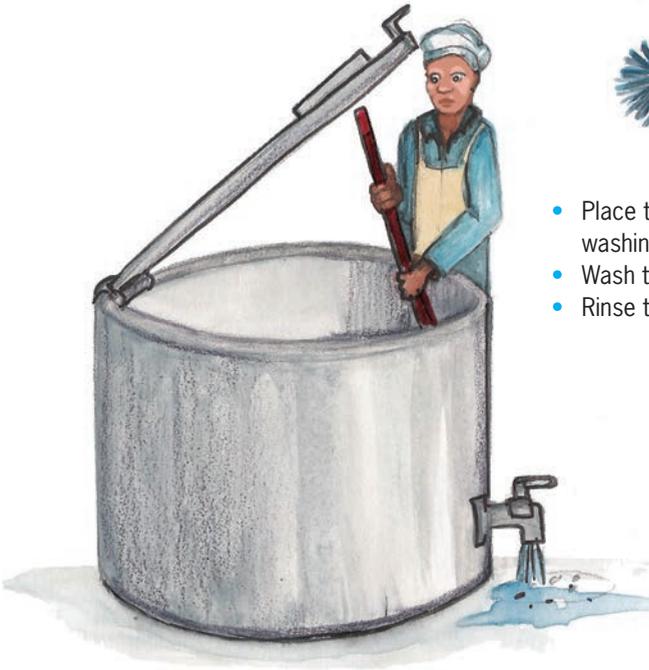


- Rinse the last milk out of the tank with a hosepipe of cold running water.



- Mix 15 litres of warm water and soap or detergent.

- Place the bucket in the tank for easier washing.
- Wash the tank thoroughly with a brush.
- Rinse the tank with cold water.



- Apply sanitiser with a spray bottle.
- Wash with a strong acid once a week to remove lime-scale.
- **DO NOT** rinse the tank after sanitising.



C. Safe handling of chemicals

Cleaning agents such as sanitisers and disinfectants, are dangerous and must be handled with care. They can be dangerous to your eyes, nose and even your skin.

Treatment of wounds

An accident can happen very quickly. Immediate treatment is necessary, especially when it comes to saving your eyes, throat and stomach.

Skin: If your skin comes in contact with soap or acid, wash it thoroughly. If the skin shows a serious reaction, you may have to visit the clinic or doctor.

Eyes: If soap or acid gets in your eyes, it should be rinsed immediately with as much water as possible. If any pain persists, you must visit the clinic or doctor.

Mouth: If you or a family member should accidentally drink soap, drink as much water or milk as possible, to dilute the soap. Put your finger in your throat to help you vomit.

If you have drunk acid in any form, also drink lots of water or milk, but do not try to vomit. Visit your clinic or doctor to make sure that you are fine.

Storing and using chemicals

- Store chemicals and cleaning agents in a separate area, away from the section where you work with your milk.
- Keep this storage area locked.
- Clearly mark the door of the storage facility.
- The storage facility should not be an outside cage.
- Do not use buckets or food containers to store chemicals, as an unknowing person might think it is drinkable or edible.
- Containers must always be clearly marked. Use labels if you can.
- Soap that is poured into a jug, must be poured into the water for washing immediately and must never be allowed to stand unused.
- The jug used for scooping out the soap, must be rinsed after it has been used.
- Empty soap containers must be rinsed before it is stored or used for water.



- Store chemicals in a safe place so that children and animals cannot reach it.
- Lock the area.
- Keep cleaning chemicals in a separate area, away from milk and feed.

- Mark containers clearly.
- Never use food containers for storage.



- After cleaning the dairy and storing the chemicals, always wash your hands properly.
- If you get it in your eyes, wash them out with clean water immediately.



6.5

Record keeping

There are many animals involved in a variety of activities on a dairy farm, and the farmer must know what to do, why it must be done and when to do it. The farmer can only be a good manager if he has correct and sufficient information available to base decisions on, therefore good record keeping is essential.

Consider the following advantages of record keeping in general:

- Helps with planning, as decisions can be based on facts, not assumptions.
- Areas of inefficient management can be identified.
- Feeding problems can be identified.
- Breeding problems can be identified.
- Information on record will assist the veterinarian or the agricultural extension officers in their task.
- Helps you to make sound financial decisions.

A. Milk collection records

Keeping records of all milk that is collected is important. The goal of milk collection records is to keep track of the quality and quantity of milk that is produced by your herd. Once you have a good record of these factors, your milk buyer will also know what to expect from you.

Why is it important?

This information is needed to determine the amount of money that you, as a milk producer, will get. The better the records of a producer's milk, the more likely he or she is to receive a better price for the milk. The level of information required depends on many factors, for example whether the recording is done by hand or by computer. A large part of the milk collection recording is done by hand and later entered on a computer. The most important thing is to entrust this very important task to a single person, although it will help to have one more person who can help out and understand the records if the responsible person is not there.

Do not keep your records on loose scraps of paper. Rather keep it in a book. Clearly indicate the date and period for which the collection records are, on the front cover. Keep the book in a safe place. Inside, provision must be made for your milk and, if you are part of a group, for all the other producers as well. Be sure to record the date with every collection, before the information is entered. These records should include the results of milk testing.

Recording the information

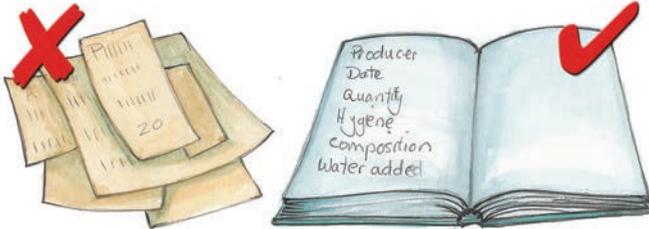
When milk arrives at the processing plant or factory, some information about the milk is needed. This information should include:

- Quantity (volume of milk delivered by each producer).
- Quality.
- Temperature.
- Hygiene.
- Composition (the results of milk testing).
- Whether water has been added.



- Milk collection records keep track of milk quality and quantity.
- It determines how much money the producer will receive.
- Recording can be done by hand or on computer.

- Do not record information on loose scraps of paper.



Keep records of:

- Milk quality.
- Milk quantity.
- Hygiene.
- Milk testing results.
- Water addition.



B. Other records

Records are of little or no value if not kept properly. Therefore attention to detail and accuracy of recorded information are very important.

Consider the following basic guidelines when doing any recording of data:

- Do not record useless information.
- Organise the records properly by making use of headings, tables, columns, etc. so that it can easily be converted into useful information.
- Keep your system simple, basic and to the point.
- Use your records to improve your farming enterprise.

The following data should be recorded in the herd register:

- Identification (ear tag, branding, etc.).
- Names of the bulls and the cows.
- Birthdates of the calves.

Cow charts or individual records of cows should provide the following information on reproduction:

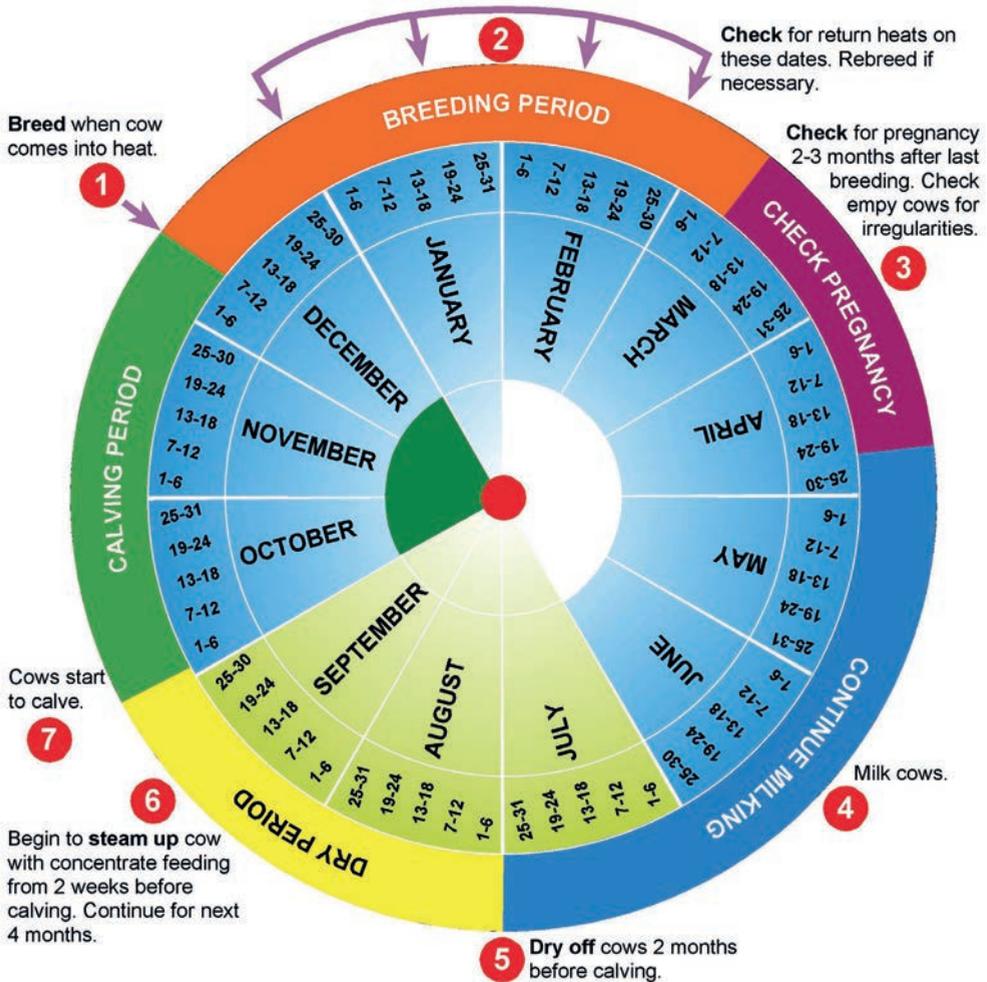
- Calving date.
- Calving problems.
- Date of oestrus (when the cow is on heat).
- Date of breeding.
- Pregnancy diagnoses.
- Body-conditioning scoring.
- Abortions and possible reasons for aborting.

Health records need to reflect information regarding health issues, such as:

- Occurrence of mastitis.
- Calving problems.
- Immunisation.
- Occurrence of other diseases and treatment.
- Dosing for parasites.

A cow or heifer calendar enables you to keep track of all cows in the herd regarding the breeding and calving status at all times. It will greatly assist you with record-keeping. Working with a cow calendar can be best explained by someone familiar with the concept. You can buy a cow calendar or obtain one free of charge from suppliers of dairy equipment.

Example of a cow calendar



Example of record keeping on a dairy farm

Record keeping will help you to keep track of important matters, such as cow performance, cow health, calving dates, milk volume and milk sales.

Consider the following scenario as an example of how the information obtained from good record keeping will assist you in managing your animals optimally.

For example: You have five cows. Two are in milk, two are in heat and one is ready to calf. By keeping records of each cow's performance, you can determine when she will be dried off, when she will come on heat, when she is expected to calf down, how much forage is required at each stage and how much milk she will give if she is healthy.

Milk sales should also be recorded. Small-scale farmers are encouraged to take part in the recording process to ensure that accurate figures are recorded. This way you can better determine your own income, without being totally dependent on others.

The records

Draw up a recording sheet for your cow. If you have more than one cow, each cow should have its own sheet. On this sheet you should be able to enter the cow's name (or number) as well as its date of birth. If you have just bought or received a new cow, remember to get all the details from the seller.

If the cow is going to be inseminated, there should be a space to record the insemination/mating date. Also make space for the calving date, vaccinations, veterinary treatments, milk volumes and feed volumes.

Here is a simplified example of a weekly milk recording form. Enter the amount of litres that each cow gives during the morning (AM) and the evening (PM) milking sessions. You can adapt the form or enter insemination dates, calving dates, etc, in the "comment" column.

DATE																						Comments	
Cow nr	Monday			Tuesday			Wednesday			Thursday			Friday			Saturday			Sunday				
	AM	PM	Total	AM	PM	Total	AM	PM	Total	AM	PM	Total	AM	PM	Total	AM	PM	Total	AM	PM	Total		

Various activities need to be recorded:

- Milk production, volumes and sales



WHEN?



- Feed volumes

- Calving date



- Reproduction and insemination

- Veterinary treatments

- Record keeping helps you to plan ahead



6.6

Composition of milk and quality indicators

Composition of milk

Milk is a complex nutritional product. The nutritional value of milk as a whole is greater than the value of its individual nutrients, because of its unique nutritional balance.

The main carbohydrate in milk is lactose (milk sugar). Although it is a sugar, lactose is not noticeably sweet to taste. The concentration of lactose in the milk is relatively constant and averages about 5%. As opposed to the concentration of fat in milk, lactose concentration is similar in all dairy breeds and cannot be altered easily by feeding practices.

The concentration of protein in milk varies from 3,0% to 4,0% (30 to 40 grams per litre). The percentage varies with the breed of the cow and in proportion to the amount of fat in the milk. There is a close relationship between the amount of fat and the amount of protein in the milk – the higher the fat, the higher the protein.

Normally, fat (or lipid) makes up from 3,5% to 6,0% of milk, varying between breeds of cattle and with feeding practices.

Milk is an excellent source of many vitamins and minerals required for the growth of the young. Milk is high in calcium and phosphorus and therefore milk is a good source of calcium for skeletal growth in the young and maintenance of bone density in adults.

Factors influencing milk composition and quality

Cells in milk: Somatic cells in milk do not affect the nutritional quality as such. They are only significant as indicators of other processes that may be taking place in the mammary tissue, including inflammation. The occurrence of somatic cells in milk is normal; however, when somatic cell count is higher than the recommended values, there is reason to suspect udder irritation and/or mastitis.

Undesirable components in milk: The milk leaving the farm must be of the highest nutritional quality – unaltered and uncontaminated. Some of the most common undesirable substances found in milk are additional water, detergents and disinfectants, antibiotics, pesticides or insecticides and bacteria.

Feeding: This can influence components such as butterfat, milk protein and milk urea nitrogen (MUN). The occurrence of milk urea nitrogen in milk is normal; however, when the MUN count is higher than the recommended values, it is indicative of either protein over-feeding and/or energy deficiency.

Quality indicators include:

- Somatic cell counts.
- Bacterial counts.
- Milk urea nitrogen (MUN).
- Butterfat percentage.
- Protein percentage.
- Lactose percentage.



6.7

In-parlour processing and quality control

A. Cold chain requirements and bulk tank management

Cold chain handling of milk and dairy products is a big responsibility. During the processing of raw milk, there could be quality problems such as sourness, unpleasant taste and odour, texture and appearance problems, colour changes, pH reduction, and health risks associated with bacterial growth.

The cold chain logistics required to maintain the high quality of milk and dairy products must be carefully monitored and managed. If the cold chain is broken, the breach can have a severe impact on product quality.

The recommended temperature range for retaining optimal freshness and taste of milk and dairy products is usually 0 °C to 4 °C. Maintaining this narrow temperature range is critical at every stage of transport, from dairy farms to supermarket shelves to home refrigerators.

When you are making decisions about your refrigeration system, consider the following:

- Tank design.
- Type of refrigeration unit.
- Volume of milk to be cooled.
- Schedule of pick-ups.
- Normal environmental conditions.

Cooling milk

Cooling is a very good method to keep milk fresh and its quality at a high level. Refrigerating or cooling milk on the farm, prevents bacteria from growing. At body temperature, bacteria will grow quickly. Even milk with a low bacterial count will go sour quickly. Clean and correct milking techniques and quickly cooling the milk to 4 °C, is the best way to keep the milk from spoiling.

Milk must be produced under clean conditions, and be refrigerated as soon as possible. The time it takes to reach a storage temperature of 4 °C is also critical. Bulk milk coolers are specially

designed to quickly cool milk to 4 °C. Check that the thermometer is calibrated and in proper working condition.

Pasteurisation

Milk is pasteurised when it is heated above a certain temperature for a certain time, depending on what system is used. It is critical to cool the milk immediately after pasteurisation. It is also important to remember that you still have to work hygienically, even if you have chilled or pasteurised the milk.

The consistency and quality of milk do not change when it is stored. You cannot add quality or change the quality of the milk by cooling it. Quality milk starts where you milk the cow, and cool the milk down to 4 °C as soon as possible.

Make a charcoal box

If you do not have a cooling tank, refrigerate the milk or cool it using ice-packs or a charcoal box. A charcoal box can be made of wood. Divide the box into two sections with some wire mesh. Put charcoal into one of the sections. The most important thing is that the charcoal needs to be watered in order to cool down and keep the box cold. Water it by dripping water onto it twice per day.

Remember that the box is going to be a permanent fixture. Therefore, it must be placed somewhere where it will not have to be moved. Do not use charcoal dust, as it can contaminate your milk. Put a door onto your box to keep animals away and to keep the temperature low.

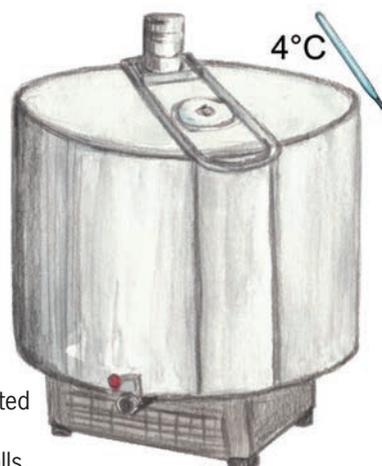
Bulk tank management

The bulk milk cooling tank is an important piece of dairy farm equipment. It is a large stainless steel storage tank for cooling milk and holding it at a cold temperature until it can be picked up by a milk tanker. It must be cleaned after each milk collection. Samples of bulk tank milk are collected regularly and milk quality tests are performed by the milk processor.

- Cool milk by putting the can into a charcoal box if you cannot afford a bulk milk cooler.



- A bulk milk cooler can cool milk quickly.
- A proper bulk tank has a stirring mechanism, calibrated thermometer and is properly insulated.
- Install at least 0,5 m away from roofs, ceilings or walls.



B. Important processes

Pasteurisation

Raw milk contains micro-organisms that can spoil the milk if the cold chain is not maintained. It can also contain pathogenic micro-organisms (germs that make a person sick). It is therefore very important that milk is pasteurised. Pasteurisation is a heat treatment that kills germs and reduces the number of micro-organisms that can make milk sour or rotten. Pasteurisation can take place at a temperature of 62 °C for 30 minutes or at a higher temperature of 75 °C for 15 seconds.

Pasteurisation process

- The pasteuriser must be sanitised with water before use.
- Steam is opened and hot water (above 85 °C) is circulated through the pasteuriser for more than 20 minutes.
- Cold water valves are opened so that the equipment can be cooled to operating temperature.
- The water is replaced with milk.
- The milk is heated to pasteurisation temperature for the specified time.
- The milk is cooled to storage temperature.

Fat separation

Cream contains about 40% milk fat (butterfat). Cream is separated from milk in a separator. The purpose is to remove some or all of the fat, and standardise the fat in milk.

Fat separation process

- Hot milk is pumped from the pasteuriser into the bowl of the separator.
- The cream and the skimmed milk leave the separator at the top.

Homogenisation

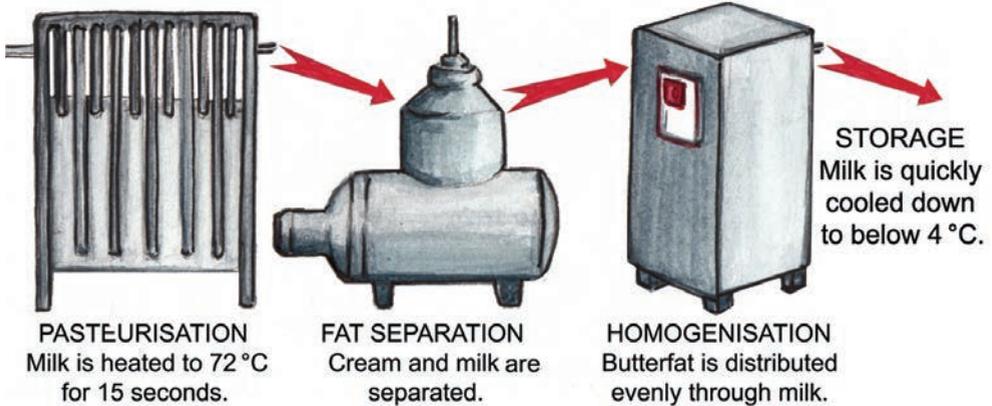
The fat in milk is in the form of big and small droplets that float in the liquid. The fat droplets rise to the surface and form a cream layer. Bigger droplets rise faster. Milk is homogenised to prevent a layer of cream from forming on top of the milk.

Homogenisation process

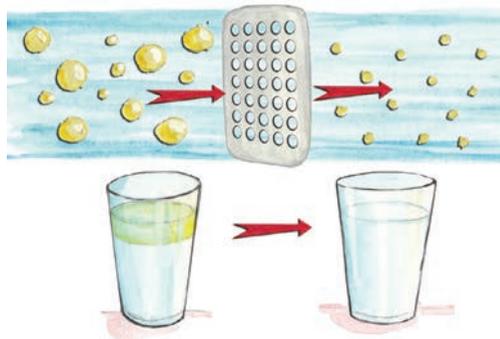
- Milk is pumped through small openings at high pressure.
- Fat droplets are broken up into smaller droplets, which are more or less the same small size and float evenly throughout the milk.

Raw milk is processed to give it a better shelf-life and comply with specific standards.

- **Pasteurisation:** Milk is heated to a specific temperature and cooled down quickly to kill any germs.
- **Fat separation:** Cream is separated from milk to remove some of the fat and standardise the fat content in milk.



- **Homogenisation:** Milk is homogenised to prevent a layer of cream from forming on the milk.



C. Hygiene in the processing environment

Personal hygiene, proper conduct (good behaviour) and preventative actions all contribute towards food hygiene and safety in a manufacturing environment. By being too confident and taking short cuts, you can cause contamination in food products. Dairy products spoil very easily, because of the way in which its nutrients are composed. For example, pasteurised milk can rot as a result of contamination AFTER pasteurisation (from packaging materials and the environment) if handled carelessly.

Personal hygiene

- Always ensure that your body is clean – especially your hands.
- Wash your hands frequently, especially after eating, sneezing, coughing, smoking and visiting the toilet.
- Never work with food or packaging materials when you are sick or have uncovered sores.
- Maintain proper locker hygiene. Do not store opened food in your locker – it will attract insects and rodents.
- Always wear clean protective clothes to every shift.

Protective clothing

Protective clothing such as overalls, boots and caps protects you against heat, cold, chemicals and injuries and protects the food against contamination.

What not to do

- Never wear jewellery when working with food, as it can contaminate the food, is difficult to clean and can be dangerous if it gets caught on machines. This also applies to cosmetics, especially nail polish, which can chip off and end up in the food.
- Never bring open food into the manufacturing environment and do not eat, drink or smoke there.
- No playing is allowed in a processing area, as it can lead to injury and damage.

What you should do

- Always conduct good housekeeping in the processing area, as it promotes personal and food safety, and limits contamination.
- Clean out dustbins frequently.
- Handle packaged products with care to prevent damage and breakages.
- Keep your work area clean and without obstructions.
- Store every tool and utensil in its proper place after use.



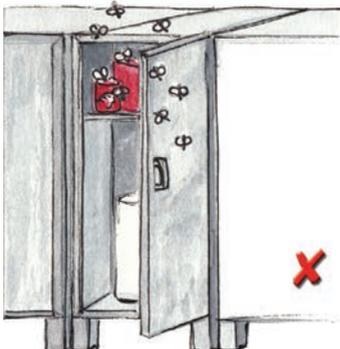
Prevent contamination

- ✓ Wash your hands after eating, sneezing, coughing, smoking and visiting the toilet.
- ✓ Wear clean protective clothes to every shift.
- ✓ Keep your work area clean.



DO NOT:

- ✗ Work with food or packaging materials while you are sick.
- ✗ Wear jewellery and nail polish while working with processed food.
- ✗ Leave opened food in your locker.
- ✗ Eat, drink or smoke while working with the processed food.
- ✗ Play in the processing area.



D. Basic milk testing

Milk is tested to determine its quality and composition. Composition refers to the elements that make the milk nutritious.

Good quality milk will:

- Contain enough fat, protein, lactose and minerals.
- Not be mastitic milk.
- Not be sour.
- Not be mixed with water.
- Be clean and hygienic.

The methods used for milk testing often depend on the payment system used by the centre. There are different methods for milk testing and can easily be carried out at collection centres.

The simplest, most cost-effective test is the taste, smell, visual observation and temperature test. This is always the first and cheapest test and is also called an organoleptic test.

Smell: The tester smells the milk for any off or sour aroma.

Visual observation: The tester looks at the appearance of the milk. He or she checks the can for cleanliness and looks for any sediment in the milk. The milk is also filtered to check its cleanliness.

Taste: If necessary, the tester will taste the milk (especially if the smell is off).

Temperature: The milk is tested for temperature by using a thermometer. Milk should preferably not be warmer than 4 °C.

Clean equipment

Remember to always make sure that milk testing equipment, such as thermometers, are cleaned thoroughly after use.

Clean equipment by:

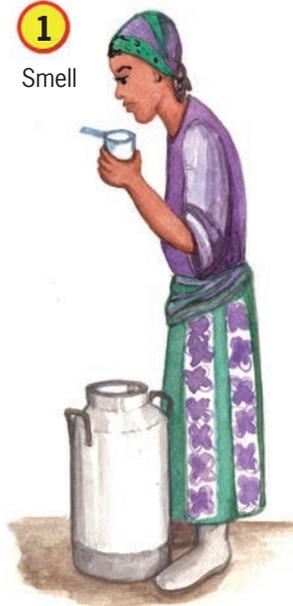
- Putting it in boiling water for at least one minute.
- Cleaning it with 70% alcohol.
- Holding the equipment (not plastic equipment!) over a flame.

If the tester is not sure about the quality of the milk after this test, other tests can be done to determine the quality.

Testing for quality

1

Smell



2

Look



3

Taste



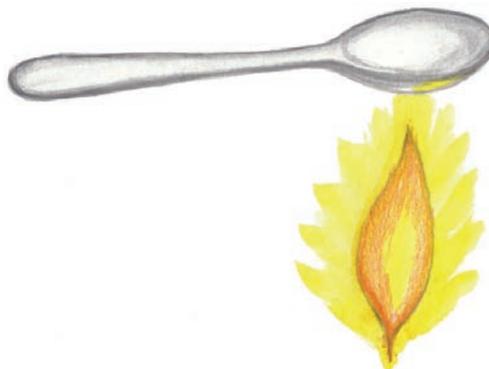
4

Temperature (should not be warmer than 4 °C).



Clean testing equipment

- Put it in boiling water for one minute.
- Clean it with 70% alcohol.
- Hold equipment over a flame.



E. Other testing methods

Density meter or lactometer test: The normal density of milk ranges from 1,028 to 1,033 g/ml. Water has a density of 1,0 g/ml. When you read the lactometer, you can determine whether water has been added to the milk. It is best to combine the lactometer reading with the fat test: If the results of the fat test are low and the density is high (e.g. 1,035), then the milk might have been skimmed. If the results of the fat test are low and the density is low (e.g. 1,027), then water might have been added.

Clot-on-boiling: This test is simple, quick and cheap. If the milk is sour or abnormal (such as colostrum or mastitic milk) the milk will not pass this test. Place a test tube with 5 ml of milk for up to four minutes in boiling water or over a flame. Examine the tubes. If you can see the milk clotting, reject the milk. This test is not very sensitive to slightly sour milk. An alternative is the alcohol test.

Alcohol test: If the milk is sour or abnormal (such as colostrum or mastitic milk), the milk will not pass this test. Carry out the test by mixing equal amounts (2 ml) of milk and a 68% ethanol solution (made by mixing 68 ml of 96% alcohol with 28 ml distilled water). Milk that contains more than 0,21% acid, will coagulate (become jelly-like) when alcohol is added.

Alizarol test: This test measures the acidity of milk. To perform the test, you will need an acidimeter and a 76% Alizarol solution. Mix 2 ml of milk with 2 ml of the Alizarol solution. If the milk is normal, it will turn a brick-coloured red. A pink or rosy colouring indicates little acid, while yellow colouring indicates a lot of acid. Alkaline milk will turn violet (purple).

Acidity test: This test measures the lactic acid in the milk. If the acidity is higher than 0,18%, then the milk quality is poor and cannot be processed. If the acidity is lower than normal (for example 0,14% lactic acid), then the milk is of poor bacterial quality or sodium hydroxide/bicarbonate might have been added. For this test you will need some basic test equipment.

Gerber test for fat: This test is used to determine the fat content of the milk and is performed by all dairy processors. An amount of 10,94 ml of milk at 20 °C is added to a butyrometer together with sulphuric acid and amyl alcohol. Some expensive equipment is needed for this test. The fat content from this reading should not be less than 3,2% as whole milk.



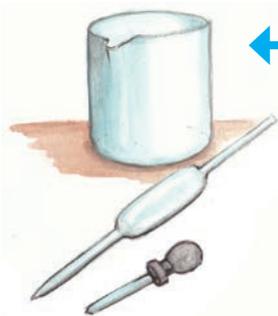
Clot-on-boiling

- Sour or abnormal milk will clot.



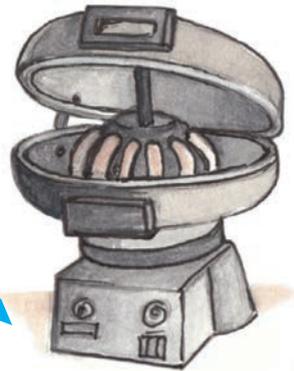
Alcohol test

- Sour or abnormal milk will become jelly-like (coagulate).



Acidity test

- Measures the lactic acid in milk.



Gerber test for fat

- Measures fat content.
- Fat content should not be less than 3,3%.



Lactometer

- Measures whether water has been added.

RECOMMENDED ADDITIONAL READING

1. C. Muller en N.H. Robertson. November 2010. *Melkbeeshandleiding – voeding, reproduksie, teling & melkwinning*. Instituut vir Diereproduksie, Elsenburg, Departement Landbou: Wes-Kaap, Diereverbeteringsinstituut, Landbounavorsingsraad, Elsenburg. ISBN: 978-0-620-43844-5.
2. J.H. du Preez and F. Malan. 2011. *Vaccines and Immunisation of farm animals*. Agri Connect (Pty) Ltd. ISBN: 978-0-620-38932-7.
3. W. Steenkamp. 1999. *Dairy farming – a practical manual*. J.L. Van Schaik Publishers. ISBN: 0-627-02445-9.
4. L.W. van Heerden and J.H. du Preez. 1993. *Zoonoses – animal diseases and man*. Butterworth Publishers (Pty) Ltd. ISBN: 0-409-11380-8.
5. I.-M. Petzer. 2003. *Uiergesondheid en die melkmasjien – 'n praktiese gids*. Agri Connect (Pty) Ltd. ISBN: 0-620-32922-5.
6. W.H. Giesecke, J.H. du Preez and I.-M. Petzer. 1994. *Practical mastitis control in dairy herds*. Butterworth Publishers (Pty) Ltd. ISBN: 0-409-10923-1.
7. A.P. Schutte en E.L. Dicks. 1995. *Kunsmatige inseminasie en aspekte van beheerde teelt by beeste*. Klem Loyd Uitgewers. ISBN: 0-620-19497-9.
8. E. Lindeque. March 2003. *Dairy cattle manual*. ARC-Institute for agricultural engineering (ARC-ILI).
9. J.H. du Preez, J.J. de Beer and M.S. Brett. 2003. *Protecting your farm animals through immunisation*. United Litho. ISBN: 0-620-29840-5.
10. P. Oberem, D. Odendaal, P.T. Oberem, M.G. Snyman, L. Ludwig, M. Mynhardt, R. Patzelt and J. van Rensburg. 2009. *Diseases and parasites of cattle, sheep and goats in South Africa*. Afrivet Business Management. ISBN: 978-0-620-43028-9.