



## Best practice guide on udder health in European dairy farms using automatic milking systems & other dairy technologies

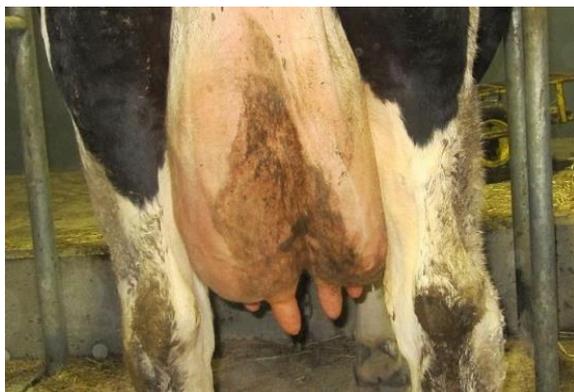
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**This guide aims to assist dairy farmers using new milking technologies and automatic milking systems (AMS). It outlines the different technologies available for monitoring mastitis, and offers some general advice on maintaining a good udder health.**

### Mastitis in dairy cattle

Mastitis, an inflammation of the udder tissue, is one of the most common and most costly diseases in dairy cattle. The majority of mastitis cases are caused by bacteria that enter through the teat canal. The most important bacteria include *Escherichia coli*, *Klebsiella spp.*, *Streptococcus uberis*, *Streptococcus dysgalactiae*, *Streptococcus agalactiae* and *Staph. aureus*.

The symptoms of clinical mastitis (**Photo 1**) include a drop in the milk yield, flakes or clots in the milk, watery milk, swelling of the mammary quarter, redness of the udder skin, fever and general illness.



**Photo 1.** A cow with case of clinical mastitis in her left hind quarter.

The economic repercussions of mastitis are considerable. Possible financial losses include a decreased milk production, discarded milk, treatment costs, additional labor, veterinary services and a higher culling rate. **The average cost of one case of mastitis is estimated at +/- €300**, with large differences depending on the severity,

withdrawal times and veterinary legislation differing between countries. Mastitis therapy and dry-cow treatment are also the primary indication of antibiotic use in dairy cattle.

Maintaining a good udder health on AMS farms can be quite challenging. The somatic cell count and the total bacterial count of milk is often higher in AMS farms compared to conventional dairy farms, whereas treatment cases are reported to be lower. Special attention should be paid to the hygiene management of the milk robot, the cubicles and the floors in the dairy barn.

### Collecting the right data

To monitor the udder health on a dairy farm, various parameters should be taken into account. This list gives an overview of the most important (paper-based and sensor-derived) indicators for udder health:

- Cow ID
- Days in lactation
- Milk production (kg) per quarter
- Difference in milk production (kg)
- Somatic cell count (or indication thereof)
- Electrical conductivity
- LDH (lactate dehydrogenase)
- Milking speed, time, interval
- Number of (incomplete/failed) milkings
- Milk temperature
- Milk color
- Number of visits to the milking robot
- Mastitis Detection Index™ (DeLaval)
- Registration of mastitis cases (including treatment)



- Dairy Herd Improvement records
- Microbial analysis from individual

### How to monitor udder health

Milking robots are equipped with a variety of sensor technologies to detect mastitis and abnormal milk. Milking robots combine a number of different types of sensors to improve the detection rate of mastitis, and reduce the number of false alarms.

Every commercial AMS model has sensors for electrical conductivity, milk color and milk yield. Some AMS brands, like DeLaval or Lely, also offer the possibility of measuring the somatic cell count. (either directly, or as an estimate).

- **Electrical conductivity (EC, mS/cm):** The EC of the milk will increase in inflamed quarters due to the higher salt content of mastitic milk. The EC of healthy quarters lies somewhere between 4.5 – 5.5 mS/cm at 25°C. Because the EC of milks depends on various factors (e.g. temperature, % fat, ...), it is not a reliable mastitis test in itself.

However, it can be used to compare the 4 quarters within the same cow (because the external factors are the same in that case). Many milk meters in conventional milking parlors are also equipped with conductivity sensors. Separate handheld conductivity meters are also available (**Photo 2**).



**Photo 2.** An example of a portable conductivity meter (Draminski®).

- **Somatic cell count (SCC, cell/mL):** The SCC increases during mastitis because white blood cells are drawn to the site of infection. The cell count threshold for

diagnosing mastitis lies at 150.000 cells/mL for heifers, and 250.000 cells/mL for older cows.

The SCC (at cow level) can be used to determine possible infection status and thus further actions: microbial culturing, treatment options in lactation or at drying off (e.g. milking order, breeding or culling decisions or discard bad quality milk. From a milk quality point of view, one should strive for a bulk milk SCC of <200.000 cells/ml.

The [DeLaval VMS™](#) dyes the nucleus of the cell, whereas the [Lely MQC-C™](#) sensor estimates the cell count through gel formation (comparable to the classic CMT-test). Some companies, like DeLaval, distribute benchtop cell count meters.



**Photo 3.** The Direct Cell Counter (DeLaval).

- **Milk color:** The color of mastitic milk and colostrum will deviate from normal milk. However, the reliability of color sensors is limited, except for the detection of blood. In practice, a milk color sensor is always combined with other mastitis sensors.
- **Milk temperature:** The milk temperature reflects the body temperature of the cow, and can be indicative of fever or even heat. However, once the milk leaves the udder, the temperature quickly starts to decline. The measurement will depend on the position and accuracy of the temperature sensor, the milking speed and the overall production.



- **Lactate dehydrogenase (LDH):** LDH is an enzyme that occurs in nearly all living cells, and the concentration rises during infection. [Herd Navigator™](#) (DeLaval) is currently the only commercial system capable of registering LDH.
- **Udder skin temperature:** Mastitis can increase the blood flow to the udder, resulting in elevated udder skin temperatures. According to research, infrared thermography (IRT) cameras are a promising tool for diagnosing mastitis. [Commercial IRT cameras](#) are now available on the market.

## Labor protocol in AMS farms

Although the milking process is fully automated, the milking robot still requires regular check-ups to ensure an optimal performance. Technical issues, if not caught in time, can quickly cause a lot of damage.

The following items should preferably be checked at least **twice a day** (e.g. in the morning and in the evening).

### Milking robot

- Listen for irregular sounds, noises
- Check on concentrate feeder
- Replace and examine filter
- If needed, clean the floor, robotic arm, camera, teat cups, and waiting pen.
- Check the milking process of cows with failed or incomplete milkings, and look for the causes
- Check cows with an alert for mastitis (stripping, CMT-test)

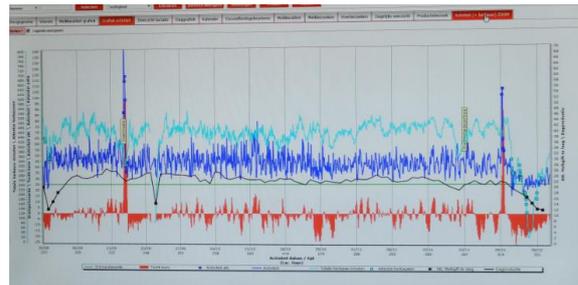
### Barn

- Observe the cows and youngstock (check their roughage intake, drinking troughs, ...)
- Clean the cubicles
- Fetch the cows with long milking intervals and incomplete milkings

### Computer

- Go over the attention lists: mastitis / electrical conductivity, concentrate intake, milk production, milking interval, ...

These AMS settings should also be examined on a **weekly basis**: milking permissions, concentrates, supply of disinfection products, the cleansing and rinsing of the system.



**Photo 4.** Example overview of the activity, milk production and rumination of one cow in the software T4C (Lely).

## Hygiene management on AMS farms

### Teat preparation

The pre-milking preparation of teats serves a dual purpose: (1) the teats are cleaned before cup attachment, and (2) the process stimulates the milk let-down through the release of the hormone oxytocin, resulting in shorter milking times.

Although the method of teat cleaning varies greatly between different AMS brands (**Table 2**), the technical success mostly depends on the initial hygiene of the cows.

Reasons for unsuccessful teat cleaning include:

- [Insufficient hygiene](#) (i.e. very dirty cows & udders)
- Dark pigmentation of the teat skin (for some AMS brands)
- Long udder hairs
- Unusual udder or teat conformation
- Incorrect teat coordinates or device malfunction
- Brushes or teat cup liners are in need of replacement



More than 95% of all teat cleanings should be technically successful!

**Table 2.** Comparison of the teat cleaning process in different AMS brands

AMS model	Teat preparation
<ul style="list-style-type: none"> <li>• DeLaval VMS™</li> <li>• Boumatic MR-S1™</li> <li>• SAC Futurline</li> </ul>	A separate teat cleaner cup washes and stimulates each teat individually using (warm) water. The teats are then dried and stripped.
<ul style="list-style-type: none"> <li>• Lely Astronaut</li> <li>• Fullwood M<sup>2</sup>erlin</li> </ul>	The teats and the base of the udder are cleaned by 2 rotating brushes, which ought to be disinfected automatically in between milkings.
<ul style="list-style-type: none"> <li>• GEA MIone</li> </ul>	Teat cleaning and pre-milking occurs in the same milking cluster. The cleaning solution & stripped foremilk are separated in a waste jar.

#### Post-milking teat dipping or spraying

Post-milking teat disinfection, through dipping or spraying, is an effective preventative measure against infections.

On average, in nearly 1 out of 5 milkings, the teats are not covered with any spray after milking. A lot of the times, only a small area of the teats are covered in disinfecting spray.

When choosing a teat spray or dip, be sure to check the suitability with the AMS distributor.

If you own an milking robot, be sure to periodically check the teat preparation and disinfecting process.



**Photo 5.** Teats should be thoroughly sprayed (or in case of the GEA MIone; dipped) after milking.

#### Rinsing of teat cups

To lower the bacterial load, teat cup liners should always be rinsed with water (25-40°C), a disinfecting solution or steamed (150°C) between 2 milkings.

Most AMS brand offer the option of teat cup disinfection with steam, except GEA. In the MIone and M<sup>2</sup>erlin milking robot, the teat cups are (optionally) rinsed with a peracetic solution.

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