

MANAGING MASTITIS ON DAIRY FARMS: THE BIOPROTEXION CONCEPT

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BIOPROTEXION is a concept developed by **CID LINES**, to implement preventive measures on farm level to protect the farm, the people and the environment from the entry of unwanted animals, pests and diseases.

Hygiene on dairy farm does not always meet the highest standards compared to intensive production like poultry or pig production.

As mastitis is a multifactor disease, a global management is necessary. **FAO** describes a guideline with 10 key points on milk and milking hygiene to maintain or achieve a low level of mastitis on the farm. **CID LINES** has taken these rules into account for the development of the **BIOPROTEXION** program on dairy farms.

1. Adopt sound method of feeding, housing, milking and managing cattle
2. Adopt good general hygiene including cleaning of milking machines
3. Dip or spray teats of all cows in disinfectant after each milking
4. Renew the bedding materials frequently, preferable daily and do not keep cows in dirty paddocks
5. Avoid teat damage and use emollients in teat dip to encourage healing of teat sores
6. Use a milking machine that conforms to international standards, that prevents 'reverse flows' or the 'impact' of milk droplets during milking
7. Detect clinical mastitis and treat with antibiotic preparation under veterinary supervision
8. Give antibiotic treatment to cows at drying off
9. Adopt good fly control for dry cows
10. Keep records and cull cows with repeated clinical mastitis

Figure 1: FAO advice

These key points are grouped in 4 categories: environmental hygiene, cow hygiene, equipment hygiene and personal hygiene and management. The **BIOPROTEXION** concept describes in details how hygiene methods can be adopted to control mastitis.

ENVIRONMENTAL HYGIENE

ADOPT SOUND METHODS OF FEEDING, HOUSING, MILKING AND MANAGING CATTLE

Mastitis development is multifactor; especially feeding and housing are involved. As you may know, housing is very important for the cow's welfare. It can be the cause of feet pathology, underfeeding and stress conditions. Some guidelines that can be followed:

- Respect the density requirements (5m² per cow for laying down and extra place for drinking area and passages)
- Change the litter every day if necessary: it must remain dry.
- Minimum once a year it is important to establish a sanitary stop to reduce infection pressure. Bedding and straw must be removed, surfaces must be cleaned and disinfected.

CID LINES has developed a hygiene program that explains the cleaning and disinfecting procedures on a dairy farm. Annexe 1 shows the checklist of the hygiene program and an example for animal houses cleaning and disinfection.

RENEW THE BEDDING MATERIALS FREQUENTLY, PREFERABLE DAILY AND DO NOT KEEP COWS IN DIRTY PADDOCKS

Several studies underline the link between dirty paddocks and udder infections. Lactating cows but also heifers and dry cows should be housed in clean conditions. A study to determine the parameters (feed, hygiene, management practices...) found on farms that have mastitis problems. One frequent characteristic of these farms is that the dry cow shed is of poor cleanliness. Environmental hygiene has a direct impact on the level of mastitis. (Chassagne, 2005).

ADOPT GOOD FLY CONTROL FOR DRY COWS

The one but last advice of FAO should be enlarged: "Adopt good fly control for dry and lactating cows". Several methods can be used to reduce the number of flies on cows (pour-on, ear tag). The difficulty with lactating cows is to reduce the number of flies on teats where milk rests are attracting flies. *Hydrotea irritans* is capable of transmitting summer mastitis pathogens (Chirico, 1997). Lesions on the teat orifice may be a predisposing factor in the development of the disease. Therefore the use of a teat dip containing proven fly repellent activity is strongly recommended. It avoids stress and agitation, irritations of the teats and transmission of pathogen responsible of mastitis.

2. COW HYGIENE

Cow hygiene is essential to prevent mastitis. Even a general disease like lameness influences the overall profitability of dairy farms. Reduced milk production and increased mastitis are noticed in herd with lameness problem (Terry, 2008).

Mastitis has to be managed because of the consequence on the cows' health but also for economic and regulatory reasons. A European regulation describes the specific criteria on hygiene level for foodstuffs (**REGULATION (EC) No 853/2004**):

<p>CRITERIA FOR RAW MILK (...) 3. (a) Food business operators must initiate procedures to ensure that raw milk meets the following criteria: (i) For raw cows' milk: Plate count at 30 °C (per ml) ≤ 100 000 (*) Somatic cell count (per ml) ≤ 400 000 (**) (...) (*) Consider the rolling geometric average over a two-month period, with at least two samples per month. (**) Consider the rolling geometric average over a three-month period, with at least one sample per month, unless the competent authority specifies another methodology to take account of seasonal variations in production levels.”</p>
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Figure 2 European legislation on milk hygiene criteria

Understanding the European legislation, you will learn that hygiene is a necessary investment for any dairy production that is striving for quality.

There are three dangerous periods when cows are more vulnerable to mastitis causing agents:

- during milking, if teat preparation is not optimal,
- after milking, if the cow lies down in dirty area with open sphincters
- during the dry period

a) During milking, cows “share” the milking machine and it is a source of contamination from one cow to another cow or one quarter to another quarter. Cleaning and sanitizing the teats before milking is necessary to reduce infection risk.

ACTION	AIM
Cleaning	Removes dirt (80% bacterial reduction)
Sanitizing	90 to 99 % germ reduction
Teat conditioning	Relaxed cows for a fast and total milking

Figure 3: Activity requires for pre-milking solution

KENOTMPURE is a concentrated cleaning, disinfecting and conditioning solution to be applied on the teats before milking. Pre-milking hygiene has consequences on udder health, milk quality and milk production. Udder preparation (30s – 1 min) allows time for

the oxytocin reaction hence optimum milk release during milking. See below a graph explaining that premilking is not a loss of time.

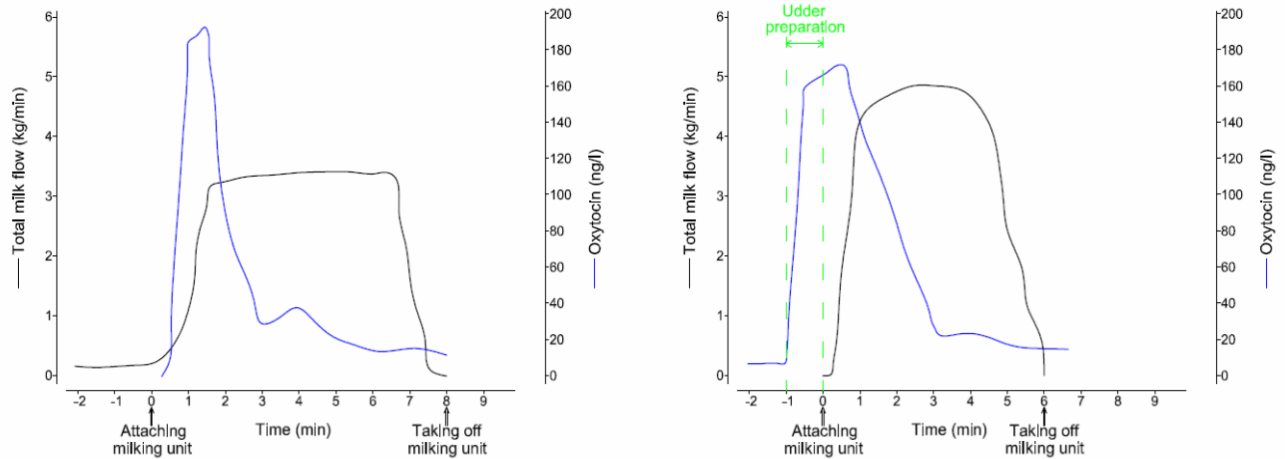


Figure 4: Impact of teat preparation on oxytocin and milk releases

Pre-milking preparation can be realised in different manner: reusable cloths, soaked in a bucket of detergent solution is the traditional method. Because reusable cloths can be a source of transmission from one cow to another cow, it is strongly advised to use one cloth per cow and to disinfect them between each milking. A detergent and disinfecting solution can be sprayed on the teats, then the teats are dried with one single paper towel per cow. With the foaming dip cup it is even better: no water is applied on the udder, thus there is no dissemination of the dirt. Foam can be considered as a semi-dried method allowing the most hygienic preparation of the teats before milking.

b) After milking, risk of contamination is high because the sphincter is open and can stay open up to 2 hours after milking. The FAO highlights the importance of the post-milking teat disinfection because it kills possible germs that got on the skin during the milking process.

c) During the dry period

Hygiene of the cows, directly linked with environment hygiene, is of great importance in mastitis control and prevention.

DIP OR SPRAY TEATS OF ALL COWS IN DISINFECTANT AFTER EACH MILKING

A lot of dip and spray products are being sold but they don't achieve the same effect. Choose a teat dip or spray with guarantees on its efficacy:

- Efficacy proven by in-vitro test according to European Norms: determination of bactericidal activity according to standard EN 1656, chemical disinfectants and antiseptics used in veterinary field.

- Efficacy proven by in-vitro test according to AOAC Official Method 960.09
- Efficacy proven thanks to field trials.

Only medicinal teat dips have to prove their efficacy in field trials. The National Mastitis Council (NMC) in United States recommends two methods for testing teat disinfectant effectiveness (NMC Factsheet – Post milking Teat Disinfection).

In Europe, such protocol doesn't exist. This void is partly filled by a general guideline on clinical trials "Good Clinical Guidelines" published by the EMEA.

For its medicinal teat dips, Cid Lines has chosen the Natural Exposure evaluation and proposes a protocol for evaluation of teat dips efficacy on mastitis prevention (Charier, 2008).

Medicinal registration certifies quality and securities of the product whereas freely sold products have no proves and are prohibited to claim anything.

The products of **KENO™** - range have proven their efficacy against the main germs causing mastitis. Contagious and environmental pathogens have been tested.

Contagious and environmental germs:
<i>Staphylococcus aureus,</i> <i>Corynebacterium bovis</i> <i>Streptococcus agalactiae</i> <i>Streptococcus dysgalactiae</i> <i>Streptococcus bovis</i> <i>Escherichia coli</i> <i>Streptococcus uberis</i> <i>Enterococcus hirae</i> <i>Proteus vulgaris</i> <i>Klebsiella pneumoniae</i> <i>Pseudomonas aeruginosa</i> <i>Citrobacter freundii</i> <i>Enterobacter aerogenes</i>

Figure 5: Bacteria tested according to European norms EN 1400 and EN 1656

Dipping products allow better coverage and longer contact between the teat dip solution and the teat than spray products. The viscosity of **KENO™START**, **KENO™CIDIN** and **KENO™LAC** has been studied to obtain a chemical protection of the teat, and especially of the teat end: the drop is not falling but stays at the extremity of the teat to plug the sphincter by capillarity.



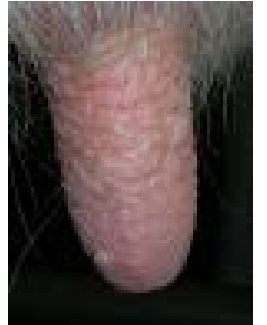


Teat skin condition is also a main point of a mastitis control strategy. FAO advices to:

AVOID TEAT DAMAGE AND USE EMOLLIENTS IN TEAT DIP TO ENCOURAGE HEALING OF TEAT SORES.

Chapped and cracked teats are a perfect environment for bacteria to develop: warmth, humidity and food are available and *Staphylococcus aureus* or *Streptococcus agalactiae* like to colonize these places. Thus, the quarter easily gets contaminated: directly (propagation of the germs) or indirectly (via milking machine contamination).

Because of the impact of teat skin and teat end quality on mastitis, **CID LINES** has tested the conditioning effect of the whole **KENO™** - range: either **KENO™START**, **KENO™CIDIN** or **KENO™LAC** improve the teat skin and sphincter condition after a few weeks of use.

Teat dip has to be applied on the $\frac{3}{4}$ of the length of the teat to moisturize both skin and sphincter.

Score 1	Score 2	Score 3	Score 4	Score 5
Teat skin is smooth , free from scales, cracks or chapping.	Teat skin shows some evidence of scaling .	Teat skin is chapped . Some small warts may be present.	Teat skin is chapped and cracked . Redness, indicating inflammation is present. Numerous warts may be present.	Teat skin is severely damaged and ulcerative with scabs or open lesions .
				

Score 1	Score 2	Score 3	Score 4	Score 5
Teat end sphincter is smooth , with no evidence of irritation.	Teat end has a raised ring	Teat end sphincter is roughened with slight cracks , but no redness is present.	Teat end sphincter is inverted with many cracks, giving a “flowered” appearance. Teat end may have old but healing scabs.	Teat end is severally damaged and ulcerative with scabs or open lesions . Large and/or numerous warts present, which interfere

				with teat end functions.
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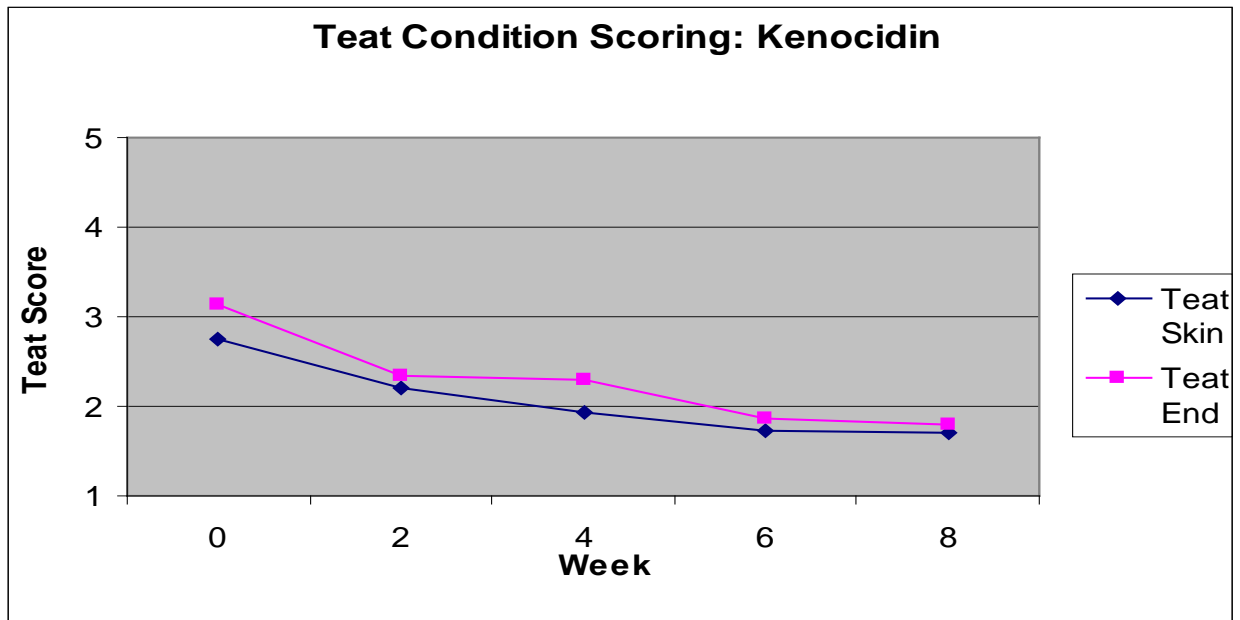


Figure 6: Teat condition scoring

The above figure shows the result of a field trial done during 8 weeks in Belgium. At the beginning, the average teat condition was scored 3, and after only 8 weeks it was scored less than 1.5. Consequences: better skin and teat end condition thus better protection against mastitis.

3. EQUIPMENT HYGIENE

ADOPT GOOD GENERAL HYGIENE INCLUDING CLEANING OF MILKING MACHINES.

The milking machine can be a source of infection and can lead to increased bactoscan results. Therefore it is of great importance that a strict cleaning protocol is followed. For the milking machine as well as the milk tank, use alternatively acid and alkaline products. Pay attention to: temperature of the water, time of cleaning, good circulation of cleaning solution and concentration of the product. All these parameters are correlated and the optimum combination must be found. Here is the most common advice:

- The temperature of the water has a very important influence on the cleaning result. Make sure that the water temperature at the beginning of the cleaning is between 65-80°C and never below 40°C at the end of the cycle (otherwise fat and proteins will adhere again on the cleaned surfaces inside your machine and tank).
- Use an acid cleaner for pipes and tanks and alternate with an alkaline product. An acid cleaner removes calcium and iron deposits. An alkaline product removes fats and proteins. It's formulated to clean and disinfect pipes and tanks. The presence of sodium hypochlorite provides an excellent disinfecting result.
- Rotation of acid with alkaline products will vary the pH, therefore stress bacteria and slow their development.
The frequency of rotation depends on the hardness of the water:
Soft water (<20°dH): use an acid product twice a week.
Hard water (>20°dH): rotate every day with an acid product.

Annex 2 is a document describing the parameters to check if the cleaning protocol of the milking machine is correct.

USE A MILKING MACHINE THAT CONFORMS TO INTERNATIONAL STANDARDS, THAT PREVENTS 'REVERSE FLOW' OR THE 'IMPACT' OF MILK DROPLETS DURING MILKING.

Some teat cup liners are equipped with "shields" which prevent milk droplets impacting the teat ends when vacuum fluctuates in the liner.

One-way valves, fitted in the claw, in the short milk tube or in the teat cup liner reduce mastitis by preventing reverse-flow of milk.

4. MANAGEMENT AND PERSONAL HYGIENE

Some measures should be taken to keep the herd healthy: drying and culling strategies have impact on herd results (bulk somatic cell count, milk quality...).

DETECT CLINICAL MASTITIS AND TREAT WITH ANTIBIOTIC PREPARATION UNDER VETERINARY SUPERVISION

- Check the udder before each milking, compare the different quarters. The local signs of mastitis are: redness, heat, oedema and pain all characteristics of inflammation
- Antibiotic administration: wash your hands and disinfect the teats before applying the tubes
- To avoid subclinical mastitis or relapse, apply at least 3 tubes during three milkings even if there's no more sign of inflammation
- Use the Californian Mastitis test (**KENO™TEST**) after a treatment to control if the somatic cells have decreased and therefore if the treatment has been effective

GIVE ANTIBIOTIC TREATMENT TO COWS AT DRYING OFF

Some pathogens are difficult to treat during lactation period. The curing rate of *Staphylococcus aureus* mastitis with local antibiotic treatment during milking is only around 40%. That's why the local antibiotic treatment is not done systematically during lactating period and the stress is put on the drying period. A drying period allows the use of long acting antibiotic without the problem of a longer withdrawal period.

Moreover, lots of after calving mastitis appear because of infection occurred during the dry period. General hygiene and udder hygiene during the dry period are really important to start a new lactation in good conditions.

KEEP RECORDS AND CULL COWS WITH REPEATED CLINICAL MASTITIS

Information on mastitis, cows with infected quarters, the period and time of recovery have to be analyzed when mastitis becomes a herd problem. Herd information but also individual information should be taken into account to manage the mastitis herd problem. Individual figures allow defining the culling strategy. Cows with high somatic cell counts are a source of contamination to the herd.

KEEP HANDS CLEAN

This is a general management measure but as farmers hands are directly in contact with the animal and the equipment, hand hygiene is directly involved in mastitis prevention.

- Wash your hands before each milking, use a cleaning and decontaminating soap. **KENO™DERM** is approved according official test EN 1040 and EN 1500.
- Wear gloves to avoid transmission of pathogens. *Staphylococcus aureus* colonizes fingers cracks and it can also grow in teat fissures and sores.
- Use a disinfecting alcohol solution certified for agriculture and food processing industry and approved according to EN 1040 and EN 1500. It is useful even if wearing disposable gloves because it helps to decrease infection pressure and transmission from cow to cow during milking via the gloves. **KENO™SEPT G** can be used after the milking of a cow with mastitis: the goal is to avoid transmission of germs to the next cow.

CONCLUSION

Mastitis is the costliest disease for dairy producers. As it is a multifactor pathology, a complete management program to control mastitis must be established. Realistic goals that can be achieved should be fixed (less than 3% new clinical cases per month or less than 5% of the herd culled yearly due to mastitis for instance). Together with a team of consultants (veterinarian, nutritionist, milking equipment representative and hygiene consultant), the mastitis management program is implemented on farm level. With the BIOPROTEXION concept, CID LINES proposes a tool to achieve and maintain high hygiene level, an essential parameter to manage mastitis.

ANNEX 1



DAIRY FARM OVERVIEW BIOPROTEXION PROGRAM

Farmer	Hygiene Consultant	
Name: _____	Name: _____	
Address: _____ _____	Phone number: _____	
Phone number: _____	E-mail: _____	
E-mail: _____		
Protocol	Already applied	Applied in future
1 Cleaning animal houses	<input type="radio"/>	<input type="radio"/>
2 Disinfecting animal houses	<input type="radio"/>	<input type="radio"/>
3 Calving house cleaning and disinfecting	<input type="radio"/>	<input type="radio"/>
4 Calf huts & housing cleaning and disinfecting	<input type="radio"/>	<input type="radio"/>
5 Drinking water treatment	<input type="radio"/>	<input type="radio"/>
6 Pre-milking udder hygiene	<input type="radio"/>	<input type="radio"/>
7 Post-milking udder hygiene	<input type="radio"/>	<input type="radio"/>
8 Milking parlour cleaning and disinfecting	<input type="radio"/>	<input type="radio"/>
9 Milking machine cleaning and disinfecting	<input type="radio"/>	<input type="radio"/>
10 Hoof hygiene	<input type="radio"/>	<input type="radio"/>
11 Cadaver house cleaning and disinfecting	<input type="radio"/>	<input type="radio"/>
12 Personal hygiene	<input type="radio"/>	<input type="radio"/>
13 Trucks cleaning and disinfecting	<input type="radio"/>	<input type="radio"/>
14 Boot baths	<input type="radio"/>	<input type="radio"/>



Remarks: _____





BIOPROTEXION PROGRAM: DAIRY FARM

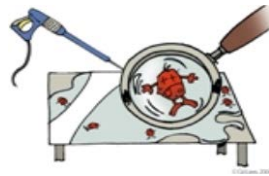

PROTOCOL: Cleaning animal houses

APPLICATION	PRODUCT	PRODUCT DESCRIPTION	FREQ	DOSAGE	CONTACT TIME	SAFETY
<i>1. Dry cleaning: Take away all rests of manure</i>						
<i>2. Soaking with water during 6 hours, low pressure</i>						
2. Gel forming (high pressure) 	BIOGEL	Gel-forming alkaline cleaning product	After every batch (when the house is empty)	3 - 5% (use 0,3L solution / m²)	10 - 60 min	
<i>4. Rinse with water (high pressure cleaner (50 – 150 bar and 12 – 30 litres per min) and <u>let dry</u></i>						



BIOPROTEXION PROGRAM: DAIRY FARM

PROTOCOL: Disinfecting animal houses

APPLICATION	PRODUCT	PRODUCT DESCRIPTION	FREQ	DOSAGE	CONTACT TIME	SAFETY
1. Disinfecting (spray or foam) 	VIROCID	Broad spectrum disinfectant (quat and aldehyde based)	3 x / year	0,25 - 0,5 % (use 0,3L solution / m²)	minimum 15 minutes	

For specific countries, adjust concentration and volume of solution according to the registration

ANNEX 2



Checklist milking hygiene

1 Farm data

Name:

Address:

Number of cows: Type milking parlour:

Hardness water: pH water used for cleaning:

Source water:

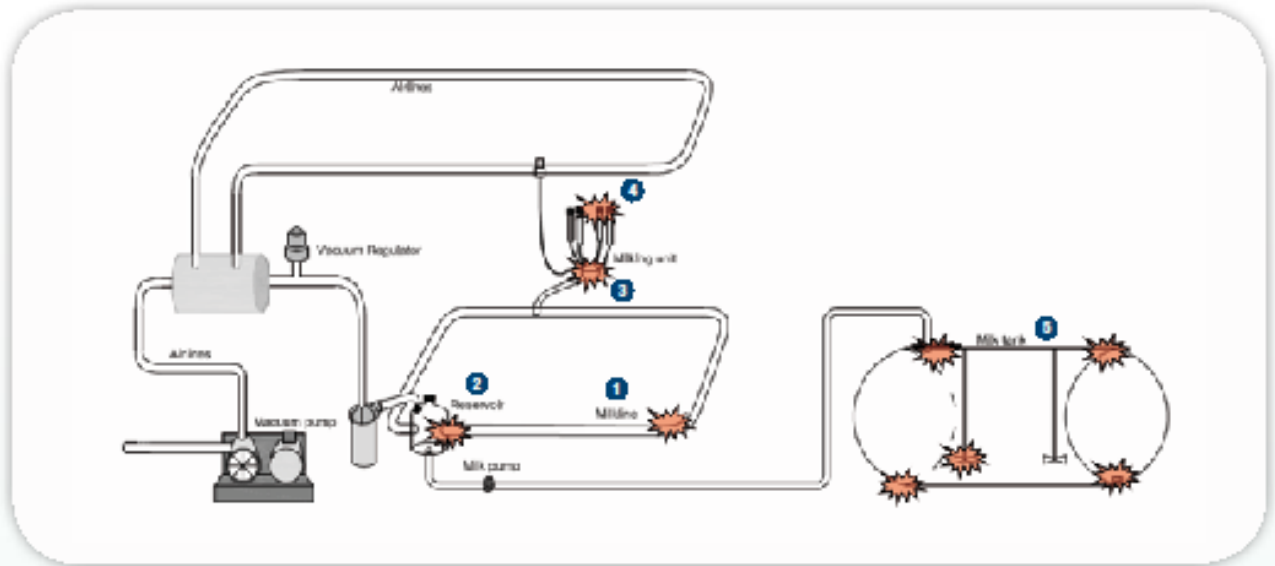
2 History of milk quality in the last six months

Germs	Coll	Cells
.....
.....
.....
.....
.....
.....

3 Characteristics of the cleaning protocol

Parameters cleaning cycle	Milking Machine	Milk Tank	Norm
PRE RINSE			
- Time (min)	5 min
- Temperature of the water (°C)	37-43°C
MAIN CLEANING			
- Time (min)	10-15 min
- Water hardness (°d)	
- Water volume (L)	(1)
- Concentration product (%)	(2)
- Boiler capacity (L)	(3)
- Temp. water at the boiler (°C)	<90°C
- Temp. water at the beginning cycle (°C)	<90°C
- Temp. water at end cycle (°C)	>40°C
POST RINSE			
- Time (min)	5 min
- Temperature of the water (°C)	Cold
- pH of water	Same as water used for cleaning

- (1) Follow instructions manufacturer or:
Volume milking machine cleaning = (n+1)*10L with n=number of milking units
Volume milk tank cleaning = 1% of milk tank capacity
- (2) Follow instructions manufacturer (e.g. DM CID and PHO CID: 0,5 % or 0,5L in 100L water)
- (3) Follow instructions manufacturer or take Volume = n*18L+ 0,1t with n=number of milking units and t=tank capacity



4 Visual control

	Checkpoint	OK	Not OK
1	Milk line	<input type="checkbox"/>	<input type="checkbox"/>
2	Reservoir	<input type="checkbox"/>	<input type="checkbox"/>
3	Claw	<input type="checkbox"/>	<input type="checkbox"/>
4	Liner	<input type="checkbox"/>	<input type="checkbox"/>
	a. Date of last change of liners: b. Calculation of lifetime liners = $(2500 \times N) / (C \times M) = \dots\dots\dots$ days With N- number of milking units C- number of cows M- number of milkings a day		
5	Milk tank	<input type="checkbox"/>	<input type="checkbox"/>

Recommendations:

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Name: Date:

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