DLG Test Report 6235 F

Lemmer-Fullwood GmbH

Fullwood Merlin

Hygiene, consumption figures

DLG FOKUS TEST

10/14 Hygiene, consumption figures

Test Center
Technology and Farm Inputs

www.DLG-Test.de

Overview

The FokusTest is a smaller-scale DLG usability test intended to allow product differentiation and special highlighting of innovations in machinery and technical products used primarily in agriculture, forestry, horticulture, fruit cultivation and viticulture, as well as in landscape and municipal management. This test focuses on testing a product's individual qualitative criteria, e.g. fatigue strength, performance, or quality of work.

The scope of testing can include criteria from the testing framework of a DLG SignumTest, the DLG's extensive usability test for technical products, and concludes with the publishing of a test report and the awarding of a test mark.

This DLG FokusTest examined various hygiene aspects of the "Fullwood Merlin" automatic milking system (AMS) in the laboratory and in practice. The main focus was on teat cleaning and teat care, as well as on the various cleaning processes on the parts of the AMS that carry milk. Furthermore, laboratory measurements were carried out to determine the specific consumption values for power, water and chemical supplies during milking, cleaning and idling. The testing was based on the DLG testing framework for automatic milking systems, as at April 2013.

Criteria other than those described were not investigated.

The Product

Manufacturer and Applicant

Manufacturer:
Fullwood Limited,
Ellesmere, Shropshire,
SY12 9DF,
England

Applicant:
Lemmer-Fullwood GmbH,
Oberstehöhe,
D-54790 Lohmar

Product:
"Fullwood Merlin"
automatic milking system

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Description and Technical Data

Testing was carried out of the Fullwood Merlin automatic milking system from Lemmer-Fullwood:

- Individual cubicle in right and left configurations
- Milking station made entirely of stainless steel
- Milking arm powered by compressed air with 3D laser, udder cleaning unit and milking unit
- Udder cleaned by roller brushes, four-way spray dipping
- Recording of total composite milk, individual cup removal at each of the quarters with adjustable removal threshold, measurement of conductivity at the individual quarters
- Optional: inline milk analysis (IMA) system (fat, protein, lactose) after the collection tank
- Aid for encouraging milk flow, grating in the standing area, pneumatic cow expeller
- BWAC boiling-water cleaning, external boiler
- External compressor and refrigeration dryer
- Dispensing of feed concentrate and fixed stainless-steel trough
- Animal identification and activity measurement via pedometer
- Optional: intermediate cluster disinfection (steam or peracetic acid)

Length: 4,305 mm

Width: 1,175/1,815 mm (dimension during transport/use)

Height: 2,200 mm

Weight: 1,390 kg

According to the manufacturer, all Merlin models are compatible with one another, and models built from 1998 onwards can be retrofitted to the current state.

Assessment – Brief Summary

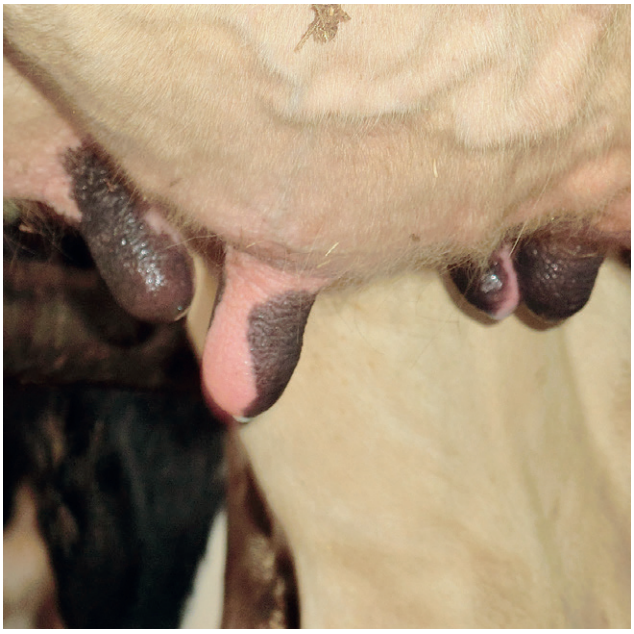
The Fullwood Merlin automatic milking system exhibited the weaknesses that are typical of all automatic milking systems in the cleaning of teats and intermediate cluster cleaning, which is usually performed without the addition of cleaning agents. The spray-dipping device worked comparatively well thanks to its individual application to each quarter. The cleaning and disinfection of the roller brushes were also impressive, as was the optional intermediate cluster disinfection. One big plus point of the boiling-water cleaning process is its short duration of just five minutes.

Table 1:
Overview of results

Test characteristic	Test result	Evaluation*
ANIMAL-SPECIFIC CRITERIA		
Teat cleaning		
End/barrel of teat		○ / –
Resoiling by milking arm	not observed	+
Teat changes	to an extremely small extent	+
Teat care and disinfection		
Uniformity of distribution	spray shadows remain	○
Drop formation on the teat canal	observed in majority of cases	+
Effectiveness of spraying device	22 % on the teats	+
TECHNICAL CRITERIA		
Consumption figures		
Consumption of power, water, resources		○[1]
Process consumption		
– Milking “light milkers” (9 min, of which 1.6 min is idling)	0.147 kWh / 1.2 l water / 3.7 g PAA	
– Milking “heavy milkers” (12 min, of which 1.8 min is idling)	0.182 kWh / 1.2 l water / 3.7 g PAA	
– Intermediate cluster disinfection (peracetic acid)	14 g PAA	
– Intermediate cluster disinfection (superheated steam)	0.03 kWh	
– Main cleaning process, water inlet temperature 11 °C	3.48 kWh / 49 l water / 208 g acidic cleaning agent	
– Main cleaning process, water inlet temperature 11 °C and 45 °C (from heat recovery)	2.69 kWh / 15/35 l water / 208 g acidic cleaning agent	
– System flushing	0.048 kWh / 19.8 l water	
– Localised flushing	0.045 kWh / 17.1 l water	
– Idling (60 min)	0.182 kWh	
Hygiene		
Teat cleaning by brushes	brushes are microbe-free	+ +
Intermediate cluster cleaning	residual microbes remain	○
Intermediate cluster disinfection		
– Peracetic acid	heads and shafts of cluster are microbe-free	+ +
– Superheated steam	> 95 °C for 1 sec.	N/E
Cleaning of the milk-carrying system	with boiling water, 77 °C for 2 min cleaning time: 4.9 min	+
Verifiability of cleaning agent concentration	test strips, easy	+

* Evaluation range: + + / + / ○ / – / – – (○ = standard, N/E = not evaluated))

[1] No reference values currently available



Figures 2 and 3:
Teats before (left) and after (right) cleaning for classification into levels of soiling

Teat cleaning

To assess the quality of teat cleaning, the udder cleaning process is documented in twelve successive milkings in each of three herds by direct observation and by photographing the udder before and after cleaning.

In particular, the tester assesses the teat ends for cleanliness and/or completeness of cleaning, as well as for visible strain on the teats. Later, the image materials are used to assess the degree of udder soiling before and after teat cleaning; the teats are assigned to four levels of soiling. Annex B to ISO 20966 for the testing of automatic milking installations is used as a guide here.

Teat disinfection

At three farms, the tester also observes and documents the distribution of the teat spray over the teats, as well as the drop formation at the opening of the teat canal. In addition to this, the weight difference is measured in the laboratory. Gauze fingerstalls are pulled onto the teats and weighed individually before and after spraying.

The quantity of teat spray taken from the tank is measured using a balance to allow the average quantity arriving at the teats to be calculated based on the weight increase of the fingerstalls.

A record is also made of the spray shadows that occur in the event of different positioning of the teats, e.g. as an unbalanced udder.

Consumption figures

All essential processes taking place in the course of a day – from milking with high and relatively low utilisation of capacity to the various cleaning processes and idling – are mapped and measured under standardised ambient conditions (20 °C ± 3 °C) so that the specific consumption values for power,

Figure 4:
Differentiation measurement to assess the effectiveness of the teat-spraying device

water and chemical supplies can be determined independently of influences that are specific to the individual farm.

The milking processes are carried out largely realistically on an "artificial cow" whose udder is supplied with milk (UHT milk, 3.5 %) according to defined milk-flow curves for light and heavy milkers. The measurement technology records the power consumption for the vacuum pump, the compressor, the internal boiler, the steam disinfection (which can optionally be connected), and the AMS itself, as well as recording the consumption of compressed air, water, cleaning agents and teat spray.

As a basic principle, the milking robot is configured according to the manufacturer's recommendations; these specify a milk line length of 25 metres and the dispensing of 1 kg of feed concentrate per milking.

Hygiene

All of the automatic milking system's cleaning options are investigated.

Cleaning of the udder cleaning device

A bacteriological investigation is conducted on swab samples from the cleaning device, i.e. from the cleaning brushes in the case of the Fullwood Merlin. Samples are taken from the brushes after six of twelve milkings at three farms; sampling begins at least one hour after the last main cleaning process. Furthermore, the concentration of the cleaning agent (peracetic acid) in the cleaning water is checked at each farm using test strips.

Intermediate cluster cleaning and disinfection

To check whether microbes are passed from cow to cow via the teat cups or whether the AMS prevents this effectively through intermediate cleaning, a further four swab samples are taken from the head and shaft of each cluster and analysed using bacteriological techniques within the framework of the same sampling procedure, i.e. after six of twelve milkings in at least three farms.

At at least one farm, swab samples are taken to check the effectiveness of the optional intermediate cluster disinfection with peracetic acid. The samples are also taken after six of twelve milkings, starting no earlier than one hour after a main cleaning process.

In the laboratory trial, with the intermediate steam disinfection (another optional tool) connected, measurements are taken of both the temperature of the steam produced at the cluster head and the cleaning time.

Intermediate cleaning (local flushing)

The water consumption and cleaning time are determined within the framework of the consumption measurements, as are the consumption of cleaning agents and the water temperature, where necessary.

Main cleaning process

Consumption values for cleaning agents are determined as part of the consumption measurements and compared with the manufacturer's recommendations. In addition, their concentration in the cleaning water is checked using test strips at the real-life farms.

Figure 5:
Artificial cow in the Fullwood Merlin

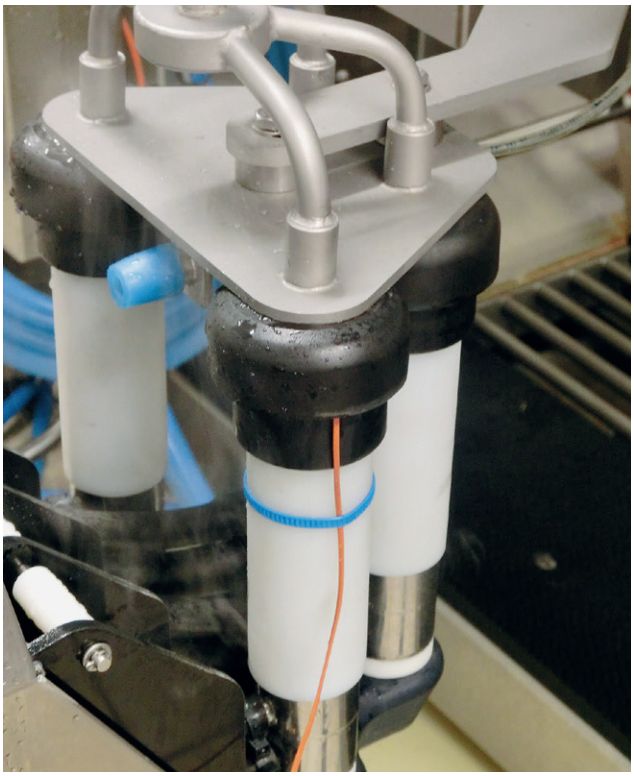


Figure 6:
Measuring the steam temperature

The Test Farms

Four farms were visited for the practical investigations: two spotted cattle farms in Bavaria and two black and white cattle farms in Baden-Württemberg and North Rhine-Westphalia respectively.

The spotted cattle farms each operate a Fullwood Merlin installed in December 2012, with one farm milking an average of 60 and the other an average of 57 cows on the robot. The cows roam freely in both cowsheds; the raised pens have a minimal quantity of chopped straw as bedding, with one farm additionally using bedding treatment. The walkways have a slatted floor and are cleaned twice a day with an electric scraper at one farm and nine times a day by a robot scraper at the other. The average herd outputs of the spotted cattle farms are 8,300 and 8,460 litres respectively. The microbial count in the bulk milk tank is permanently below 10,000/ml. In both herds, no cows were suffering from udder diseases at the time of the DLG's investigations. Neither of the two farms was using the Merlin's dipping device. It is worth noting that one of the farms uses the so-called "Bavaria Edition" of the Merlin, in which the baseplate of the robotic arm sits 30 mm lower, which is advantageous for the udders of the spotted cows, which are often low.

The black and white cattle farm in Baden-Württemberg operates two Merlins built in different years; the tested robot was installed in December 2013. Only 47 cows were being milked on this robot at the time of the DLG's investigations because of an above-average number of dry cows. The low pens in the lying area are built up with a mixture of horse manure and straw and are cleaned and scattered with new chopped straw manually twice a day. The walkways in the lying area have a slatted floor and are cleaned twice a day with a hand-operated slatted floor scraper. The walkway at the feeding table consists of a continuous solid floor and is cleaned eight times a day by an automatic scraper. The average herd output is 9,200 litres, and the microbial count in the bulk milk tank is generally below 10,000/ml. No cows were suffering from udder diseases at the time of the investigations. The dipping device was in use.

In the second black and white cattle farm (in North Rhine-Westphalia), two Fullwood Merlins from the years 2012 and 2013 are installed. The Merlin from 2013 was used as the test robot. At that time, 52 cows were being milked on this robot. The raised pens in the lying area are scattered with a minimal amount of chopped straw; bedding treatment is used in addition. The pens are cleaned twice a day by hand, and a robot scraper cleans the slatted floor hourly. The average herd output is 9,300 litres; the microbial count in the bulk milk tank is max. 10,000/ml. No cows were suffering from udder diseases at the time of the investigations. The dipping device was in use on both Merlins, and the test robot was additionally using intermediate cluster disinfection with peracetic acid.

The Test Results in Detail

ANIMAL-SPECIFIC CRITERIA

Teat cleaning

The udders are cleaned by two brushes rotating in opposite directions, and it is possible to adjust the number of cleaning cycles, or their duration, from one to three cycles on an animal-specific basis. In principle, this allows the intensity of cleaning to be adapted to the animals. Two cleaning cycles per teat are recommended.

The teat position is determined from the positioning data saved during the last milking. The vertical movement of the brushes in the direction of the base of the udder can be adjusted on a herd-specific basis.

It is largely only the teats – and not the base of the udder – that are cleaned, and the overall cleaning quality is just satisfactory. Dirt that has dried onto the teats strongly is not removed to a satisfactory extent. Residual soiling was found largely on the teat barrel and only rarely on the teat ends. Resoiling of the teats by parts of the milking arm was not observed. In the assessment at the three real-life farms, the following picture was obtained of cleaning quality (Table 2): whereas before cleaning only just over a third of the teats were "completely clean" (level 1), this rose to almost three quarters after cleaning. On average, the AMS was able to improve teat cleanliness by one

Table 2:
Quality of udder cleaning

Level of soiling	Before cleaning [%]	After cleaning [%]
1	35.8	72.4
2	38.2	19.5
3	18.7	6.5
4	7.3	1.6

Figure 7:
Drop formation after application of the teat spray

level of soiling using the udder cleaning process. However, teats with heavier soiling (levels 3 and 4) are left, at best, "slightly soiled" (level 2) after the udder cleaning process. As a basic principle, the udder-cleaning device requires good, hygienic housing conditions in order to achieve successful cleaning. Such conditions were not present to the same extent at all three of the test farms.

The teats are moist after cleaning. No strain was observed on the teats due to being cleaned by the brushes.

Teat disinfection

After milking, a round nozzle on the cluster plate sprays the teats to disinfect them. For this purpose, the milking arm moves below each teat individually and applies the fluid – at an angle and from the front – in four pulses of spray.

The pulse characteristics, i.e. the timing ratio of spray blasts to pauses, can be varied between 10 % and 100 % on a herd-specific basis; the factory setting is 40 % (40 % spray blasts to 60 % pauses). In the real-life observations, spray shadows were only occasionally identified; drop formation was observed on the teat cups in the majority of cases.

In the DLG's laboratory trials on an artificial udder with idealised teats, spray shadows were primarily visible on the outer sides of the teats. In the "40 % pulsed" setting, 2.1 g of the teat spray, out of 9.5 g on average, reached the teats (end and barrel); this is equivalent to 22 %. The majority of the fluid was sprayed onto the base of the udder. In the case of unbalanced udders, slightly more of the hygiene product tends to reach the teats when the rear quarters are lower, and slightly less when the front quarters are lower.

TECHNICAL CRITERIA

Consumption figures

The consumption measurements on the Fullwood Merlin were carried out under laboratory conditions (20 °C ± 3 °C) with an RSDK-C 3.0 compressor with an air output of 300 litres per minute and a separate refrigeration dryer. The AMS vacuum was set to the recommended value of 43 kPa. The cleaning water was heated with an unpressurised boiler with a capacity of 240 litres (standard: 90 litres for 1 AMS). Depending on the inlet temperature (45 or 10 °C), the insulated boiler switches on approximately 1.5 or 2.5 hours (for the 90-litre tank) before the programmed start of the main cleaning process and heats the water to 95 °C.

The energy consumption for one milking depends primarily on the milking time (light/heavy milkers). Because the length of a milking is fixed within the framework of the measurement log, each milking contains an idling period, which for the Fullwood Merlin amounts to 1.6 minutes for light milkers and 1.8 minutes for heavy milkers. It takes, on average, 0.6 minutes per milking to bring the animals in and out, leaving 1.0 and 1.2 minutes respectively of idling, which can be included as potential milking time in a rough calculation. It must also

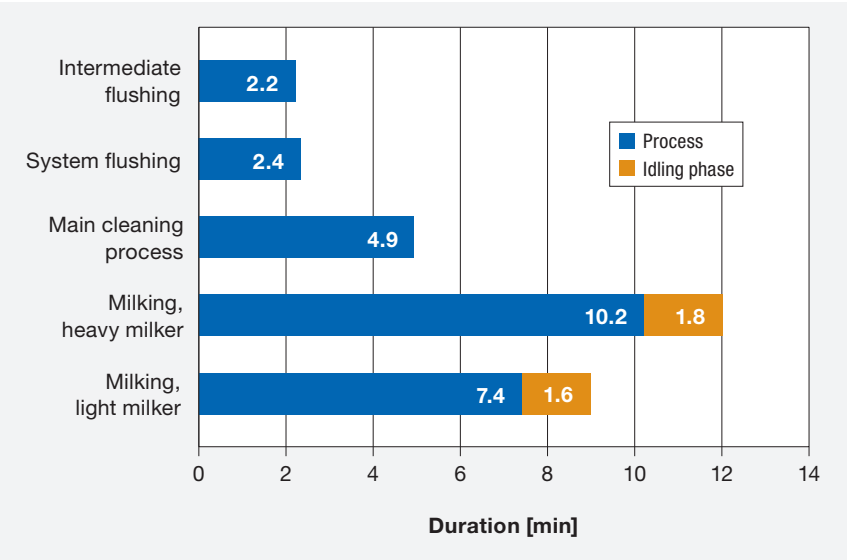


Figure 8:
Process duration

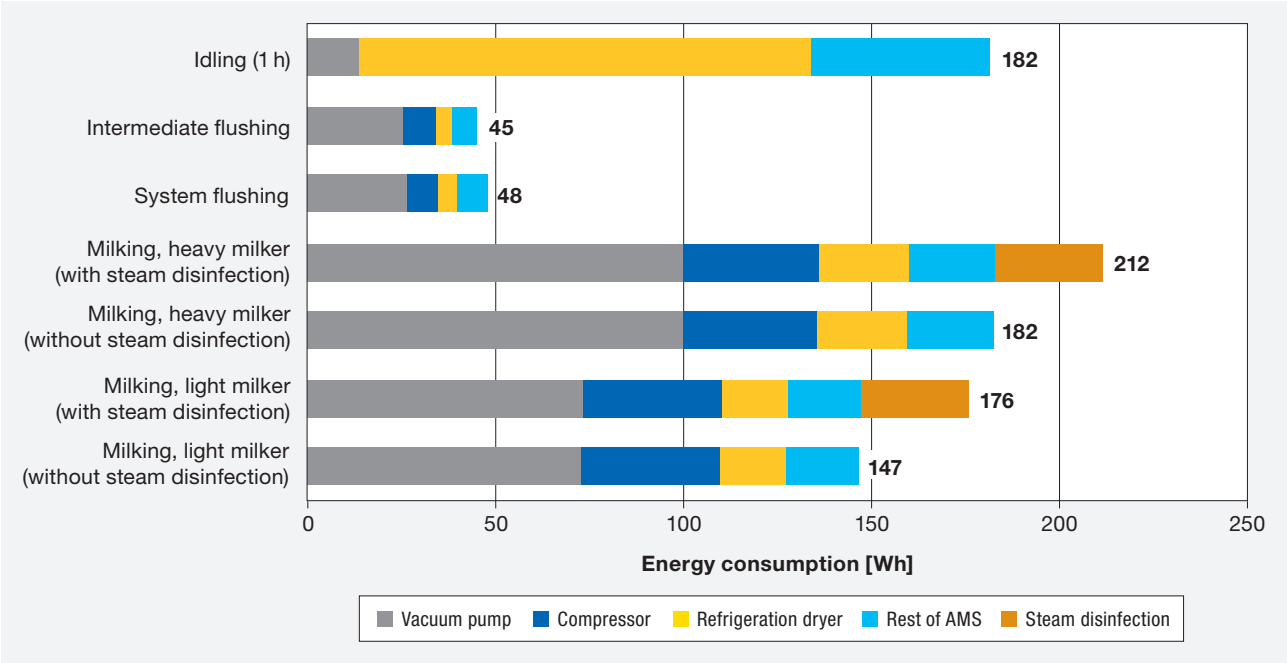


Figure 9:
Measured energy consumption (without main cleaning process)

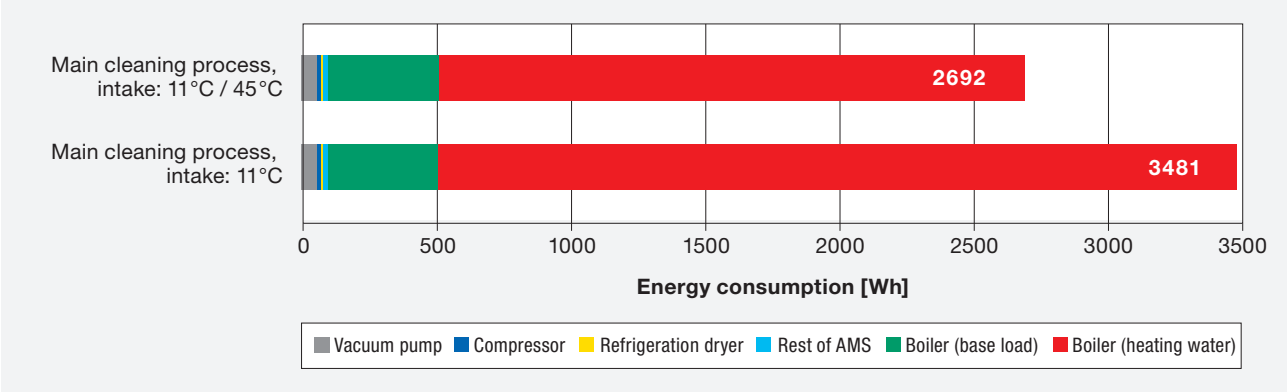


Figure 10:
Measured energy consumption for the main cleaning process

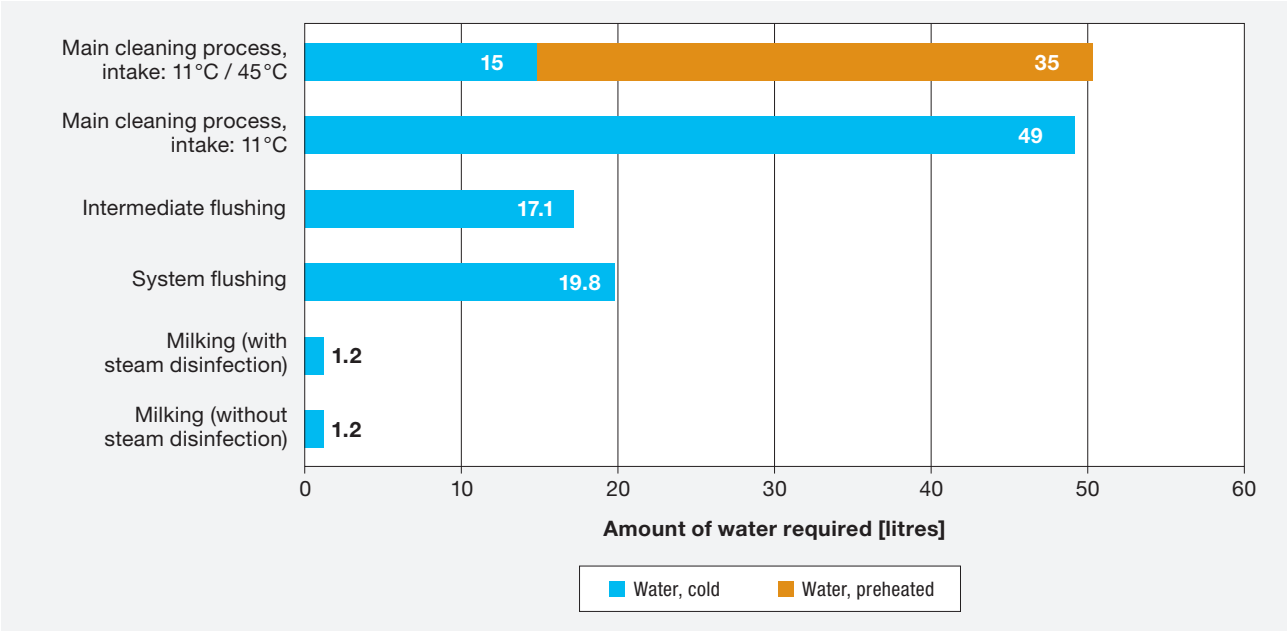


Figure 11:
Measured water consumption of all processes

be noted that the milking arm does not need to be repositioned in the measurements with the artificial cow.

As the Fullwood Merlin's arm is powered by compressed air, the compressor's energy consumption may be higher in practice than the measured values. Similar is true of the water consumption for the main cleaning process: depending on the length of the milk line and the pressure head of the milk pump, the required cleaning time and the corresponding volume of water may differ from the values determined under laboratory conditions. In the consumption tests under laboratory conditions, the milk line was 25 metres long and the pressure head was approximately 3.5 metres.

The utilisation of the milking system's capacity and therefore the operating costs depend strongly on how the housing is managed and on the state of the animals with regard to performance and health.

Using the preheated water from the heat recovery process can save on costs for heating the cleaning water. With a temperature difference of approximately 35 kelvin between the mains water and the water from the heat recovery process, the potential savings amount to 0.8 kWh per main cleaning process.

Because of the boiling-water cleaning process, only acidic cleaning agent is used for descaling in the main cleaning process. Peracetic acid is used for brush cleaning and for one version of the intermediate cluster disinfection. Dipping agent was added in doses for the measurements in the "30 % pulsed" setting, leading to differences between the quantities measured within the framework of the consumption measurements and those for the teat spraying tests (9.5 g in the "40 % pulsed" setting).

Hygiene

Cleaning of the udder-cleaning device

To clean the roller brushes used for udder cleaning, a cleaning solution consisting of water and peracetic acid is sprayed onto the rotating brushes at a water pressure of 1.5 bar. According to the recommendations, the cleaning solution should contain peracetic acid at a concentration of 600 ppm. In the check at the three real-life farms using test strips – after collecting the cleaning solution in a container – this concentration was adjusted well (in the 600–700 ppm range) at one farm, but slightly elevated (in the 900–1,000 ppm range) at the other two farms. The quantity of water used for brush cleaning can be adjusted; a quantity of 400 to 500 ml is recommended.

During the consumption measurements in the laboratory, the product "FullPerCid" (5 % PAA) was used; this is diluted in the AMS to give a 0.5 % peracetic acid solution. For each brush cleaning process, an average of 4.2 g of cleaning agent (3.8 ml) is dispensed in 430 ml of water. Compliance with the recommended cleaning agent concentration was checked using test strips.

The microbiological analysis of the swab samples from the three real-life farms showed that the roller brushes are microbe-free and disinfected after cleaning, even if occasional dirt particles remain stuck in the brushes because of the low spraying pressure.

Intermediate cluster cleaning and disinfection

Once milking is finished, the teat cups and milk hoses are moved to the cluster holder and cleaned with cold water, assisted by compressed air, up to the premilking unit. The rubber heads for the teats are also rinsed in this process.

The swab samples at the real-life farms showed that microbes in the head and shaft of the teat cups cannot be completely removed simply by rinsing with water without the addition of cleaning agents. Here, the microbial load tends to be higher in the head of the teat-cup cluster than in its shaft. The possibility of microbes being transferred from cow to cow by the cluster cannot therefore be ruled out.

Lemmer-Fullwood offers two optional ways to carry out intermediate cluster disinfection, either by adding peracetic acid or using superheated steam.

For intermediate cluster disinfection with peracetic acid, the recommendations state that the cleaning solution should have a peracetic acid concentration of 800 ppm, or up to 1,000 ppm if the pathogen pressure is high. In the check using test strips at the real-life farm, the recommended concentration was configured correctly (in the 800–900 ml/l range). The additional average consumption figure for intermediate disinfection by peracetic acid was 15.3 g (13.8 ml) per milking.

The microbiological analysis of the swab samples from the real-life farm with intermediate disinfection by peracetic acid shows the disinfection process to be fully effective. The cluster was left clean and disinfected after cleaning between milkings.

In the intermediate disinfection with steam, steam is forced into the teat cups, assisted by compressed air, at the end of the intermediate cluster cleaning. To produce the steam, water is heated to 150 °C. During disinfection, the steam valve is opened for 13 seconds in the standard setting; the opening time can be adjusted to between 1 and 60 seconds. Figure 13 shows the temperature graph of an intermediate disinfection process with steam. According to the temperature measurements in the top third of the teat-cup shaft, the temperature at the wall of the teat cup reaches 96 °C for a period of 1 second. This forms a good basis for the disinfectant effect, but this effect cannot be proven using swab samples because this technique is not used in practice.

The graph indicates that the teats may be exposed to elevated temperatures of the teat cup liners, depending on the time interval between steam disinfection and the start of the next milking (in the graph, this interval is 155 seconds).

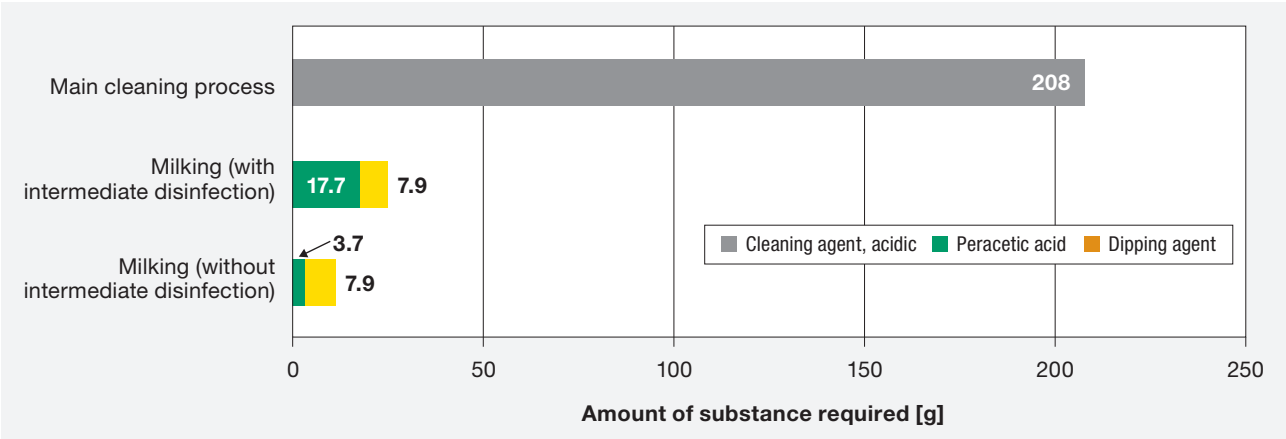


Figure 12:
Measured consumption of supplies

Intermediate flushing

After cows are milked whose milk is not marketable, the milk-carrying parts, including the collecting container, are cleaned up to the end of the cleaning valve (the valve after the separation valve for milk that must be separated off) using cold water and without the addition of cleaning agents. An intermediate disinfection process lasts approximately 2.25 minutes.

The manufacturer recommends carrying out intermediate flushing after milking cows that have been treated with antibiotics.

In the visited real-life farms, cows treated with antibiotics are milked:
- (1 and 3) separately during the waiting period, i.e. not in the AMS. Intermediate flushing is performed after milking.
- (2) in the AMS. Intermediate flushing is performed after milking.
- (4) as a separate group in the AMS. A main cleaning process is performed after the last milking.

DLG note: intermediate flushing is no substitute for the main cleaning process after milking cows treated with antibiotics!

System flushing

After a longer period of idling, which can be set to between 1 and 99 minutes (standard setting: 45 min, recommended: 60 min) the Fullwood Merlin carries out a cleaning process of the milk-carrying parts, including the milk line as far as the tank. This is performed with cold water and without the addition of cleaning agents with a view to dissolving dried-on milk residues and removing them from the pipes. System flushing lasts just under 2.5 minutes.

Main cleaning process

The main cleaning process is performed by cleaning with boiling water with the addition of an acidic cleaning agent ("FullAcid 500") for descaling.

The cleaning agent is added directly after the boiler outlet and at the start of the main cycle with boiling water. The amount to be dispensed must be adjusted based on the hardness of the water. The 208 g per main cleaning process measured in the consumption measurements corresponds to a value for medium water hardness.

A temperature-check sticker on the milk line leading to the tank can be used to check whether the water temperature in the system as a whole meets the required 77 °C for 2 minutes. In the laboratory measurements, this was confirmed during three main cleaning processes. The sticker's sensor changes colour from grey to black if the required conditions are met (77 °C for 2 minutes).

The water consumption for a main cleaning process depends primarily on the local conditions. Depending on the length of the milk line to the tank and the pressure head of the milk pump, there may be a difference between the cleaning time –

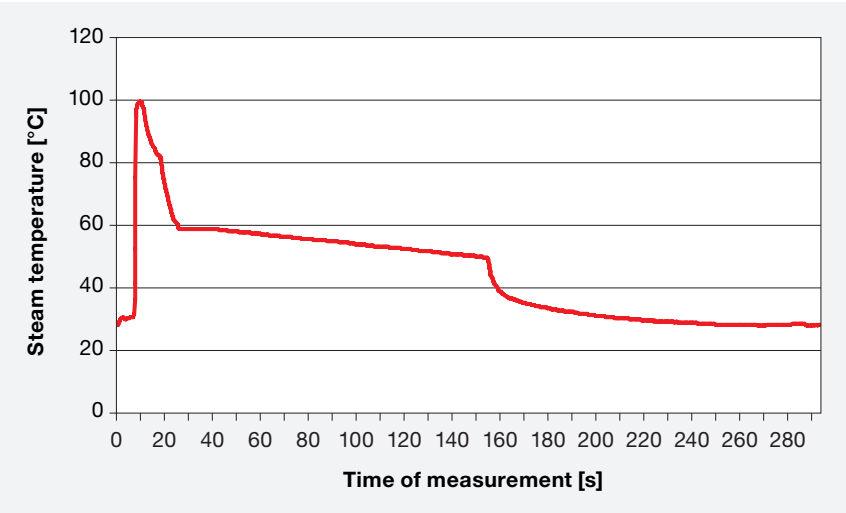


Figure 13:
Temperature in the teat cup during and after steam disinfection (until the next steam disinfection)

and therefore the water consumption – and the values determined in the laboratory.

The concentration of cleaning agent was not checked at the three real-life farms; the cleaning effect could not be assessed because of the closed nature of the system.

All four farmers confirmed the acid resistance of the milk-carrying parts up to this point in time. In the course of servicing, regular replacements are made of parts that are subject to wear, such as sealing rings or the milk pump's check valve.

According to the manufacturer's recommendations, the automatic milking system should be put through a main cleaning process, as far as the tank, three times a day. The very short cleaning time of only 4.9 minutes for cleaning with boiling water means that the cleaning times can be spread throughout the day and do not have to be adapted to the herd's rest times.

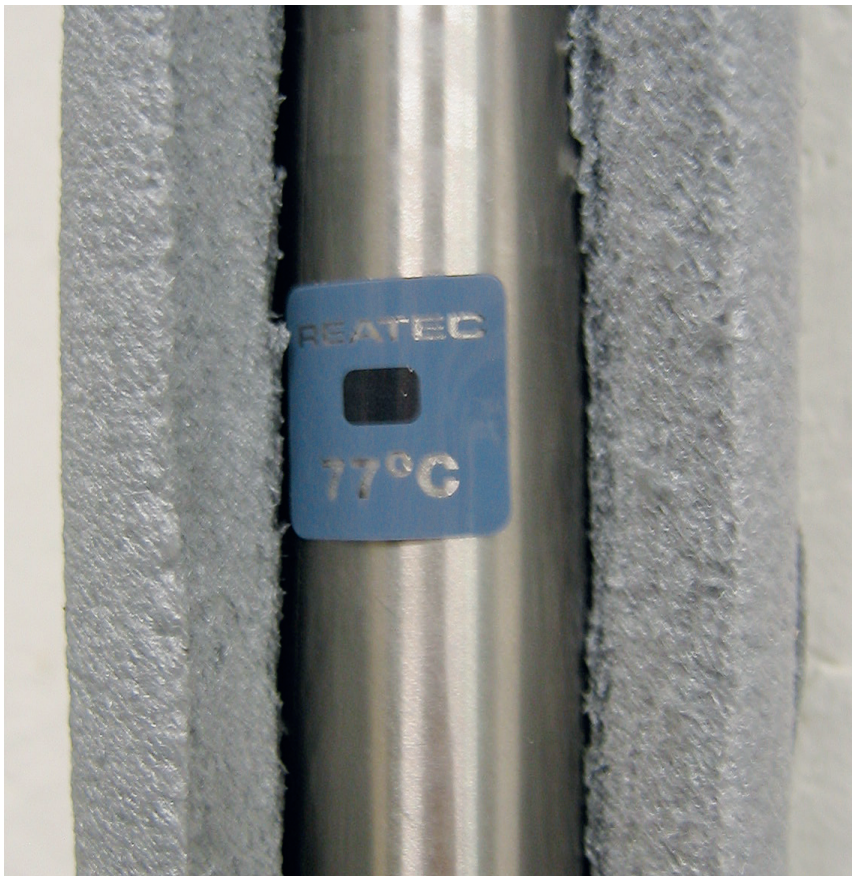


Figure 14:
Temperature-check sticker

Summary

This FokusTest investigated the cleaning options and cleaning quality of the Fullwood Merlin automatic milking system.

The quality of udder cleaning and care was analysed visually and using swab samples at four real-life farms. Swab samples were also taken from the teat-cup cluster and brushes to allow evaluation of the quality of the intermediate cleaning and disinfection of the brushes and cluster.

Laboratory measurements were performed to determine the Fullwood Merlin's specific consumption values for energy, water and chemical resources during milking and cleaning processes.

The Fullwood Merlin exhibited the weaknesses that are typical of all automatic milking systems in the cleaning of teats and intermediate cluster cleaning, which is usually performed without the addition of cleaning agents. On the other hand, the cleaning and disinfection of the roller brushes were impressive, as was the optional intermediate cluster disinfection. The boiling-water cleaning process earns praise for its effectiveness, especially given its short duration of just under five minutes and the correspondingly low water consumption.

The product satisfies the requirements of the DLG testing framework for the investigated criteria.

Further information

Further test results relating to cattle farming are available to download at: **www.dlg-test.de/stalleinrichtungen**

The relevant DLG committees have published various instruction leaflets on the topics of animal welfare and cattle farming. These are available free of charge in PDF format at: **www.dlg.org/merkblaetter.html**

Test execution

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Test Center
Technology and Farm Inputs,
Max-Eyth-Weg 1,
64823 Groß-Umstadt

DLG Testing Framework

Automatic milking systems
(as at 04/2013)

Field

Indoor operations

Laboratory manager

Dr Hermann Buitkamp

Test engineer(s)

Dipl.-Ing. agr. Susanne Gäckler*

* Reporting engineer

Die DLG

In addition to conducting its well-known tests of agricultural technology, farm inputs and foodstuffs, the DLG acts as a neutral, open forum for knowledge exchange and opinion-forming in the agricultural and food industry.

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The DLG Test Center Technology and Farm Inputs

The DLG Test Center Technology and Farm Inputs in Groß-Umstadt sets the benchmark for tested agricultural technology and farm inputs and is the leading provider of testing and certification services for independent technology tests. With the latest measurement technology and practical testing methods, the DLG's test engineers carry out testing of both product developments and innovations.

As an EU-notified test laboratory with multiple accreditations, the DLG Test Center Technology and Farm Inputs provides farmers and practitioners with important information and decision-making aids, in the form of its recognised technology tests and DLG tests, to assist in the planning of investments in agricultural technologies and farm inputs.

ENTAM

European **N**etwork for **T**esting of **A**gricultural **M**achines is the association of European test centres. ENTAM's objective is the Europe-wide distribution of test results for farmers, agricultural equipment dealers, and producers.

More information about the Network is available at www.entam.com or by writing to ENTAM at the email address: **info@entam.com**

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