GEA Engineering for a better world.

TRANSPARENT & SUSTAINABLE

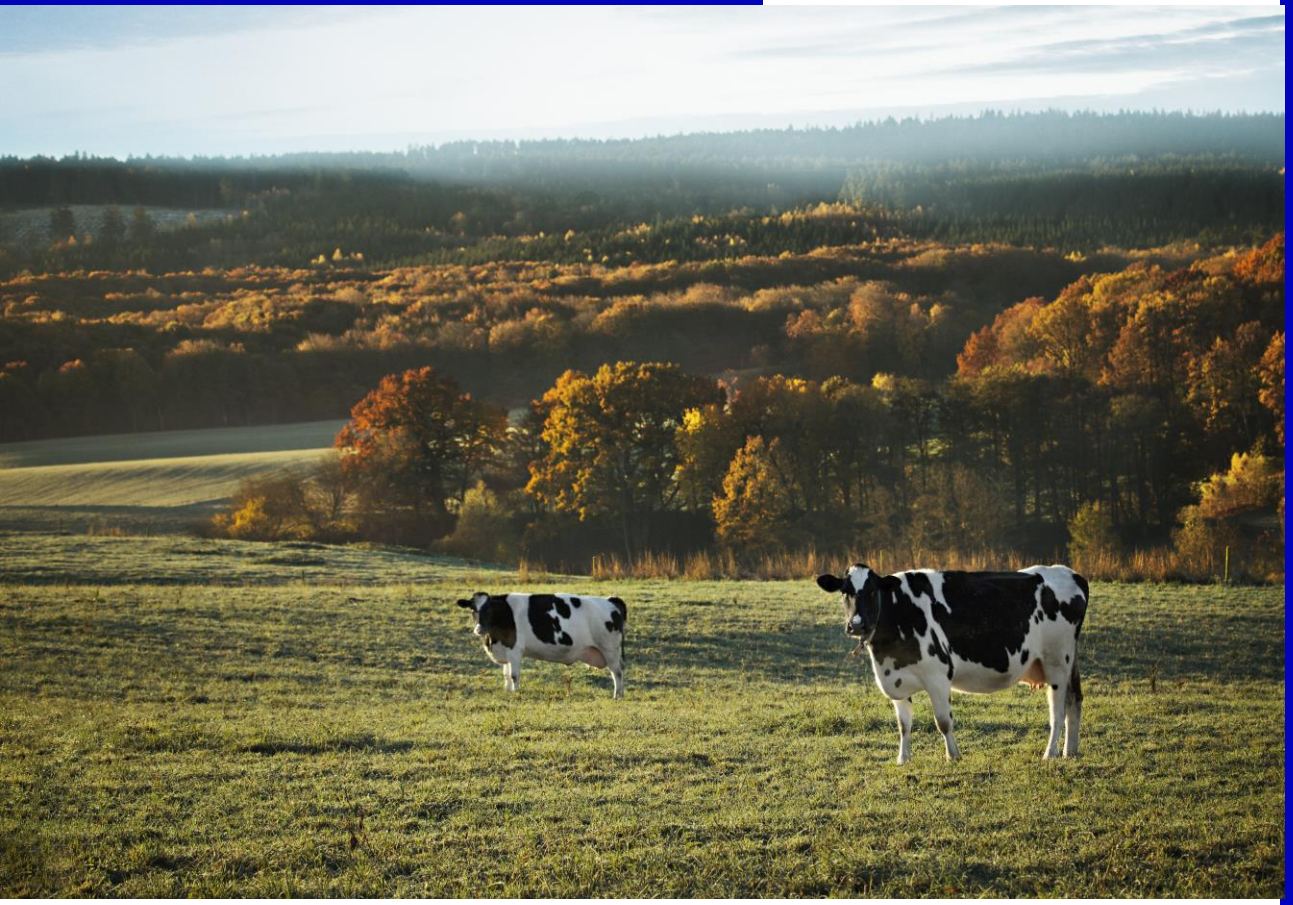
Automatic milking with GEA

We‘ve had the consumption of the DairyRobot R9500 independently tested by the DLG again. Here you can find all information about the DLG test and our results!

DLG

Transparency and Sustainability in focus

Why do we focus on these topics?



Resources such as gas, electricity and water are

- increasingly scarce,
- more and more expensive and
- increasingly regulated (requirements & promotion).

What does that mean to you?

- The consumption of your automatic milking system and the associated running costs are decisive for
- the sustainable, economic success of your operation.
- In order to make the right decision for the future of your business you need a cross-manufacturer comparison of the consumption and
- facts as a planning basis for your investment.

What does this mean for us as manufacturers?

- As manufacturers, we have to develop products that offer you sustainable added value with low consumption.
- To this end, we optimize and review our consumption values internally and in comparison with our competitors, and
- provide you with the results transparently.

Transparency and Focus on sustainability

What can you as a customer expect from GEA?

Only with transparent data you get planning reliability for your sustainable system solution.

An **individual** solution
for your individual needs
from our modular system toolbox

with which you can work
efficiently & comfortably

with full
transparency

in a **partnership**
at eye level

for a future-proof
system solution with
which you can
operate **sustainably**

Transparency and Sustainability in focus

How do we implement this?

WITH

a holistic approach to climate and sustainability as a corporate goal

The topic of sustainability plays a very important role for GEA. We develop solutions that are proven to save resources, energy, time and money. By **2040**, we want to reduce our overall greenhouse gas emissions worldwide to **net zero.**

freely accessible electricity and water meters

Our DairyRobot R9500 is the only system with built-in electricity and water meters - daily consumption values remain in view at all times. In addition, the consumption of dipping, disinfecting and cleaning agents is calculated on the basis of pump revolutions.

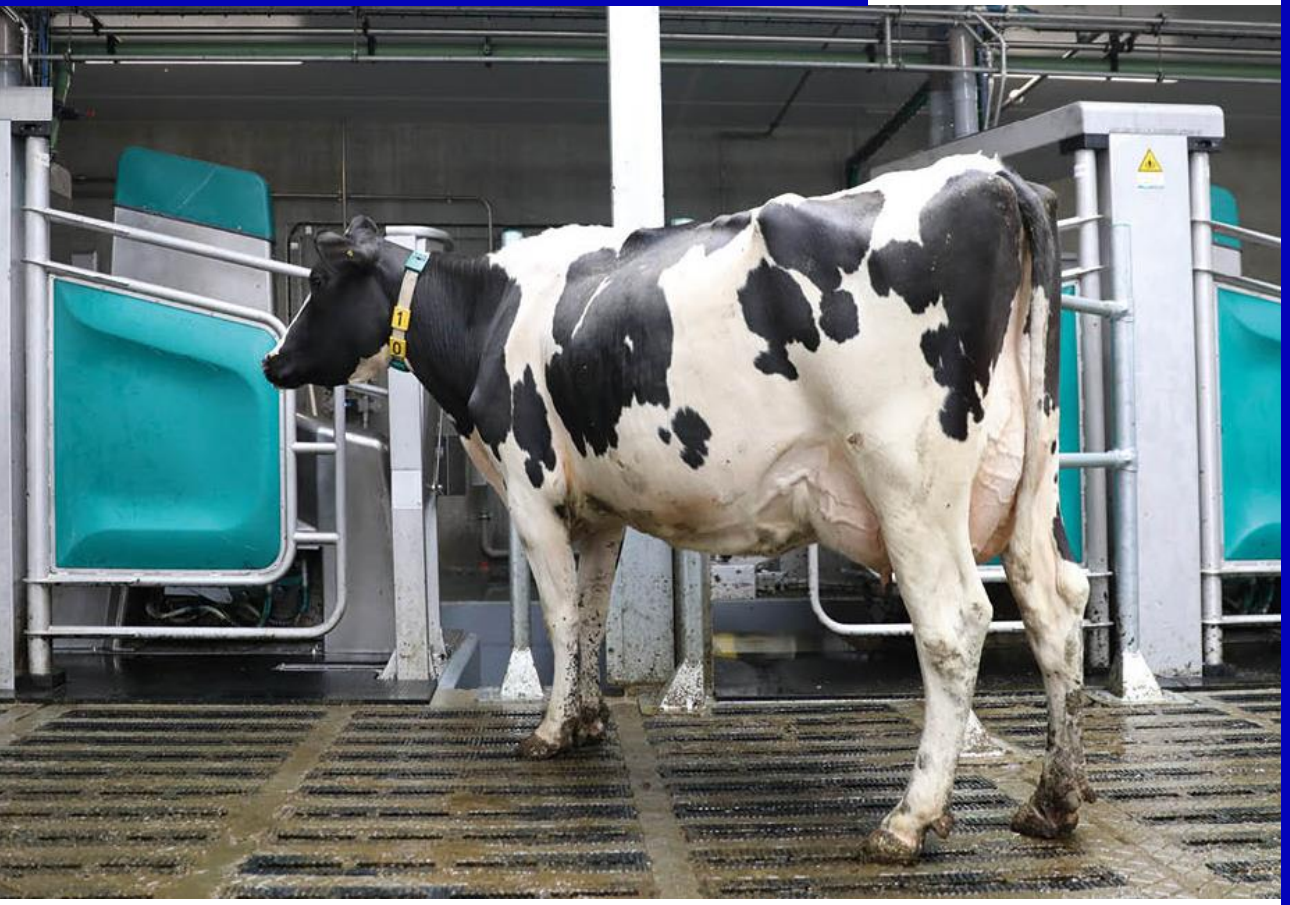
independently verified consumption values.

Alongside another manufacturer, GEA FarmTechnologies took part in the DLG consumption test for the second time with a DairyRobot R9500 mono and multibox system.

With the results that we make available to you for download on our website, you can compare the GEA DairyRobot R9500 1:1 across manufacturers with other systems on the market, provided that they have been tested.

Focus on transparency and sustainability

Is a measurement on a real dairy farm not sufficient?



No, a measurement in practice does not provide comparable values.

Without a standardized test procedure, no comparison of consumption across manufacturers is possible.

Why? System and operational management have a significant impact on consumption.

Influence system:

- The age, settings & condition of the equipment,
- the connected components,
- the line lengths and heights, and
- the required water temperature (depending on the season and supply) would be different

Influence operations management:

- the animals (milk quantities & milk flows),
- the system utilization (number of milkings & cleanings)
- the milking process (time, incomplete milkings, etc.) would be different

This is also proven by results from practice:
The energy consumption of a milking robot can vary by up to 30% depending on farm management.

Focus on transparency and sustainability

The DLG test method is the gold standard.

Why?

Based on the experience gained in the tractor sector, the

- German Agrarmagazin profi took the initiative in 2012 and developed together with
- the milking technology manufacturers GEA, Lely, DeLaval and Fullwood,
- the German Agricultural Society (DLG) and
- the German Bavarian State Institute for Agriculture (LfL)

the world's only measurement standard for a

- cross-manufacturer and
- independent test

of automatic milking systems.

The first tests were carried out in 2014.
Since then, any manufacturer can be tested at the DLG Test Center Technology and operating resources in Groß-Umstadt (Germany).

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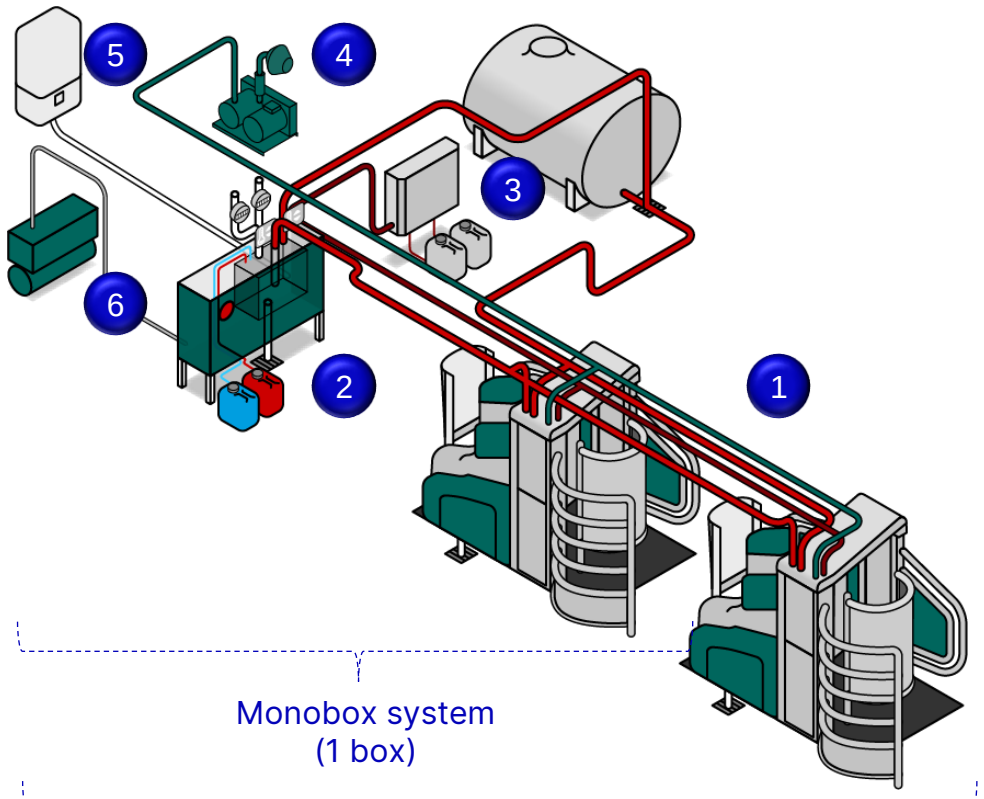
Under which conditions are which components tested?



General conditions:

The general conditions for the measurements
(influence of the system) are the same for all suppliers on the market.

- The manufacturers provide a new milking robot
- With factory default settings
  (The selected setting corresponds to the manufacturer's recommendation for proper milking operation).
- All components required for milking operation, integrated in the automatic milking system or connected externally, are connected by the manufacturer
  (except milk filters, plate coolers, calf milk separations & sampling devices).

Components tested by GEA include:

1. DairyRobot R9500 (1-Box / 2-Box)
2. external central supply unit
3. external disinfection unit
4. external 400 l vacuum pump
5. external hot water supply (Vaillant eloSTOR VEH exclusive, 120L)
6. external air compressor (Altlas Copco SF2)

Keyword consumption degression

In order to be able to illustrate the savings effect that occurs with a multibox system, not only a monobox system (1-box) but also a multibox system (2-box) of the DairyRobot R9500 was tested. This allows us to show how the consumption per box decreases with each box that is additionally connected to the supply unit.

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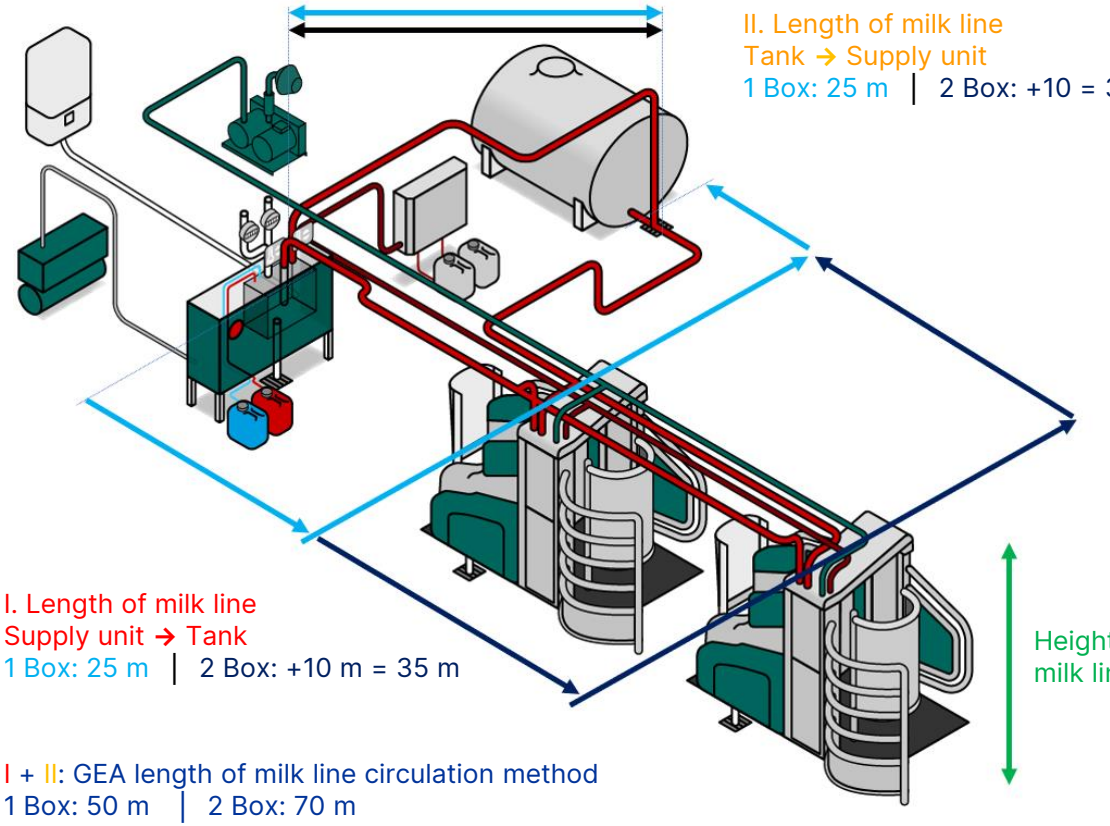
How is comparability ensured?



I + II: GEA length of milk line circulation method
1 Box: 50 m | 2 Box: 70 m

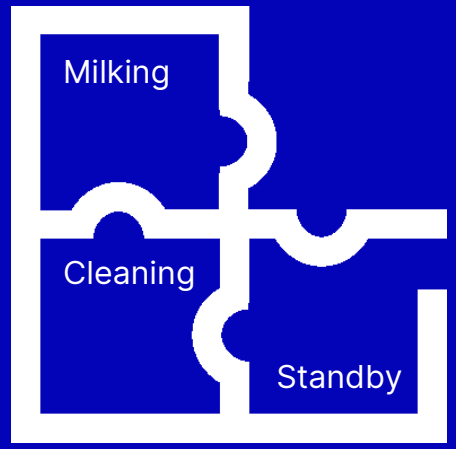
Through standardization!

The influence of the system is standardized:

- Line lengths and heights are specified,
- the water temperature is always corrected to 12 °C

The influence of operational management is also standardized:

- the consumptions that occur during the day in the practice are divided into the process sections shown below and recorded separately from each other



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How is it measured?

With a complex measuring technique.

All consumptions are measured with the help of calibrated and gauged,

- digital electricity meters,
- flow meters and
- scales determined.

The data is forwarded centrally to a measuring, control and recording program specially developed for DLG.

The following values are determined for the individual process sections:

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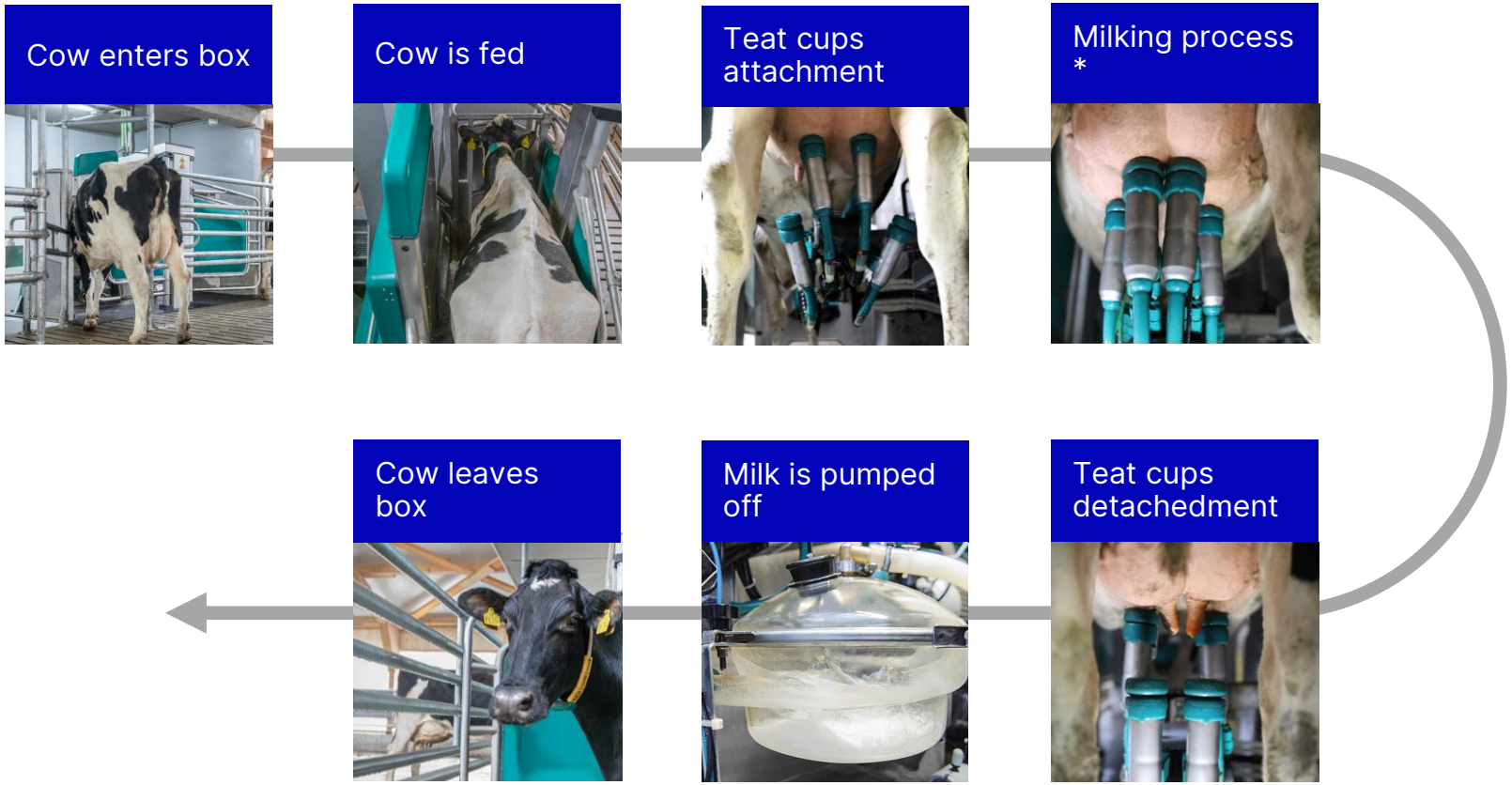
Is the measurement nevertheless practical?



* InlinerEverything^{R} : At GEA, stimulation, teat cleaning, pre-milking, milking and dipping are done in the teat cup. Teat, teat cup exterior and camera cleaning is done with warm water (min. 35 °C). This is more pleasant for the animal and improves hygiene.

Milking

Yes, in the test the entire milking process, without cows, is simulated in the "laboratory".

Each milking process begins with the opening and closing of the entry gate and the simulation of one feeding

Then, all 4 teat cups are attached to an artificial udder and the teats are stimulated and cleaned (the order varies depending on the manufacturer).

Unlike in practice, the udder does not move, as this is technically not feasible. A reattachment of kicked off teat cups is not considered.

At the end of the milking process, the teat cups are removed, the robot arm moves into the cleaning unit and the exit door opens and closes.

In order to be able to completely record the processes - depending on the manufacturer -, an idle time of approx. 1 minute is built in.

The measurement processes are repeated and can take between 8 and 12 minutes, depending on the milk type (milk flow curve).

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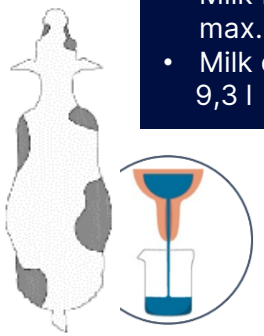
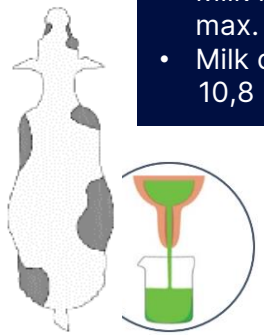
And what about the cows? How is the influence of the animal taken into account?

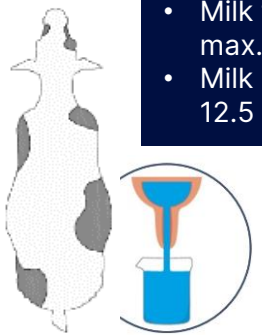
Slow milking cow
- Milk flow: ø 1.25 l/min to max. 2.0 l/min
- Milk quantity/milking: 9,3 l



Fast milking cow
- Milk flow: ø 2.1 l/min to max. 3.5 l/min
- Milk quantity/milking: 10,8 l



Very fast milking cow
- Milk flow: ø 2.9 l/min to max. 6.0 l/min
- Milk quantity / milking: 12.5 l



Milking

An artificial udder simulates different milk flows, milk quantities and milking times.

- Milking is done with milk (UHT milk), e.g. to ensure that the sensors can work.
- This flows through a specially developed artificial udder with teats made of silicone.
- The artificial udder is divided into a front and rear part so that milk flow and milk quantity can be distinguished.
- As in practice, the milk does not flow evenly, but reaches a plateau after a short rise until - after a set time - it dries up.
- Since in reality not the same amount of milk flows immediately on all four quarters, the artificial udder equipped with solenoid valves simulates the milk flow curves of a „slow milker", „fast milker" and „very fast milker".

Focus on transparency and sustainability

How is the cleaning of the robot taken into account?

Main cleaning
(for GEA system cleaning)

cleans
- Entire system incl.
- Calf milk separation
- Plate cooler
- Buffer tank
- Milk line
- Tank connection

For the main hygienic cleaning of the system
- At GEA min. 2 x daily

Local cleaning
(for GEA box cleaning)

cleans
- Box
- Calf milk route

e.g. after milking cows treated with oil-based antibiotics.

System rinsing
(GEA interval cleaning)

rinses
- Box
- Calf milk route

e.g. for rinsing out milk residues in freshly calved cows (beestings)

Local rinsing
(GEA box flushing)

rinses
- Route of good milk
- Calf milk route
- Milk line

e.g. if the box has not been visited for a longer period of time at night (interval adjustable)

Different cleaning processes are recorded separately with hot and cold water.

Compared to the milking process, the cleaning process usually has the highest electricity and water consumption.

For this reason, system and box cleaning as well as system and box rinsing are recorded separately.

Since the input temperature of the water to be heated has a great influence on the power consumption, the measurements are carried out both with 12°C cold water (corrected mathematically depending on the season) and with 45°C hot water (from heat recovery).

Takes place at GEA:

- Pre-rinse with warm water (min. 35°C)
- Main cleaning with hot water (min. 65°C)
- + Detergent
- Rinse with cold water

Focus on transparency and sustainability

Is the consumption in standby standby mode recorded?

Standby

Of course.
The plant also consumes electricity when it is not milking.

The automatic milking system is available to the cows around the clock in standby mode. This means that even when no cow is being milked, the system consumes electricity.

This base load depends on the energy efficiency of the box connected to the system, including the associated components.

These include, in addition to the automatic milking system:

- the vacuum pump,
- the air compressor and
- the equipment used to provide hot water.

As part of the DLG test, the base load of the entire system is recorded overnight.

Focus on transparency and sustainability

Are the results understandable?

Yes. In order to be able to comparably consider and represent the management factors that are decisive for consumption, the milking technology manufacturers have agreed on defined practical scenarios. For this purpose, the process parts individually recorded by the DLG are put together again by the Bavarian State Institute for Agriculture (LfL) into the operating scenarios shown below.

Process part	Not optimized farm			Average farm			Optimized farm			Elite farm		
Milking	Milking	Liters per milking	Liter milk	Milking	Liters per milking	Liter milk	Milking	Liters per milking	Liter milk	Milking	Liters per milking	Liter milk
Slow milker	85 x	9,3 L	= 790 L	10 x	9,3 L	= 93 L						
Fast milker	35 x	10,8 L	= 378 L	140 x	10,8 L	= 1.512 L	170 x	10,8 L	= 1.836 L			
Very fast milker										170 x	12,5 L	= 2.125 L
Total	**120**		**1.168 L**	**150**		**1.605 L**	**170**		**1.836 L**	**170**		**2.1525 L**
Cleaning	Quantity	Type		Quantity	Type		Quantity	Type		Quantity	Type	
	4 x 1 x 1 x	Main cleaning (Local cleaning*) System rinsing Local rinsing		3 x 1 x 1 x	Main cleaning (Local cleaning*) System rinsing Local rinsing		3 x 1 x 1 x	Main cleaning (Local cleaning*) System rinsing Local rinsing Heat recovery		3 x 1 x	Main cleaning (Local cleaning*) System rinsing Local rinsing	
Standby	Utilization			Utilization			Utilization			Utilization		
	84 %			87 %			96 %			94 %		

*When the scenarios were decided upon in 2014, "Local Cleaning" did not yet exist at all manufacturers.

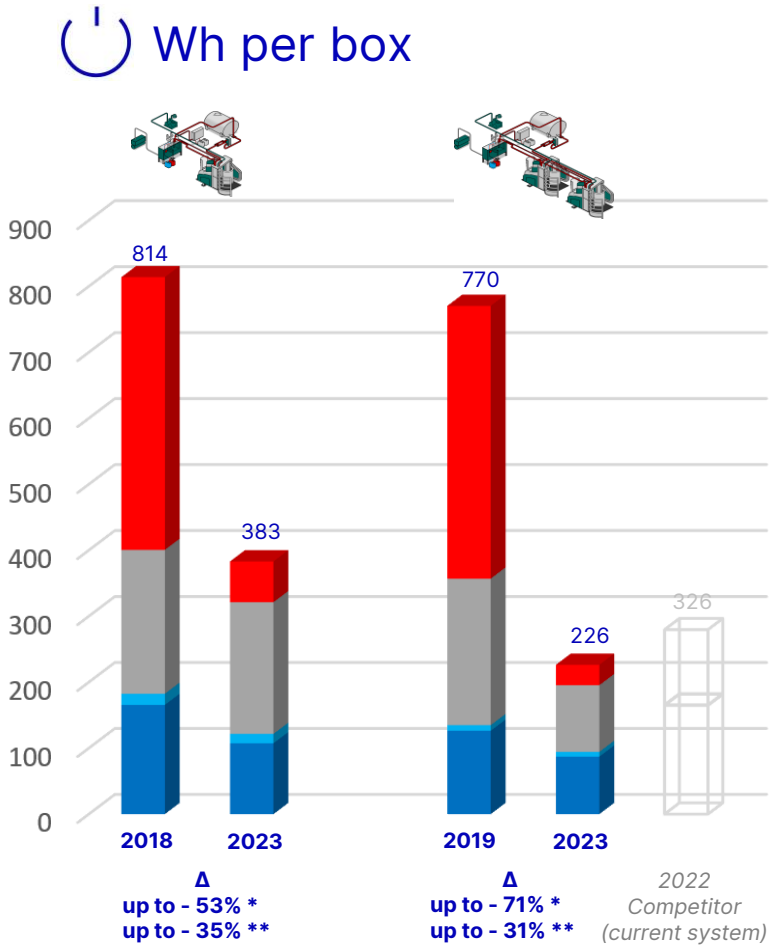
„Slow milker"
ø 1.25 l/min to max. 2.0 l/min

„Fast milker"
ø 2.1 l/min to max. 3.5 l/min

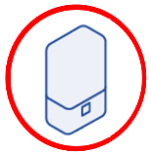
„Very fast milker"
ø 2.9 l/min to max. 6.0 l/min

Focus on transparency and sustainability

How did GEA perform in standby power consumption?



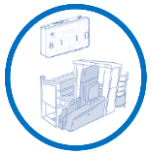
The GEA DairyRobot R9500 is the most economical AMS on the market in terms of standby power consumption tested by the DLG.**



Hot water boiler

Air compressor

Vacuum pump



Automatic milking system **

= total system *

Focus on transparency and sustainability

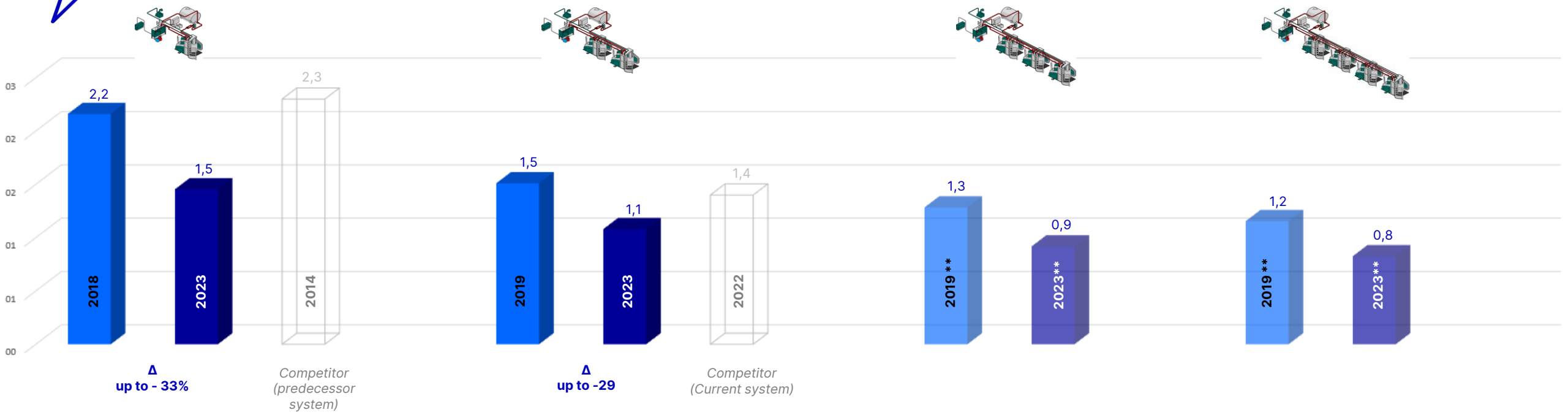
And in terms of power consumption?

Based on the DLG results, the profi magazine has confirmed:

The GEA DairyRobot R9500 (2-Box) achieves excellent results in power consumption.

Especially in scenario 1, optimized operation, the DairyRobot R9500 2-box system performs up to 20% better than the other 2-box systems tested by the DLG, with 1.1 kWh per 100 l of milk.

KWh per box & 100 liters tank milk



* Multibox system with two boxes, scenario 1 "Optimized operation"; With 170 milkings per box, 1836 l milk per box & day, 3 main rinses, 1 local rinse, heat recovery.
Since 2021, we have been cleaning the teats, the outside of the teat cups and the camara with warm water. This increases animal comfort, hygiene and system performance. A direct comparison with cold water would lead to even lower values.

The DairyRobot R9500, built specifically for the U.S. market (according to U.S. Food and Drug Administration requirements), is not the subject of the DLG test report and the results shown here.

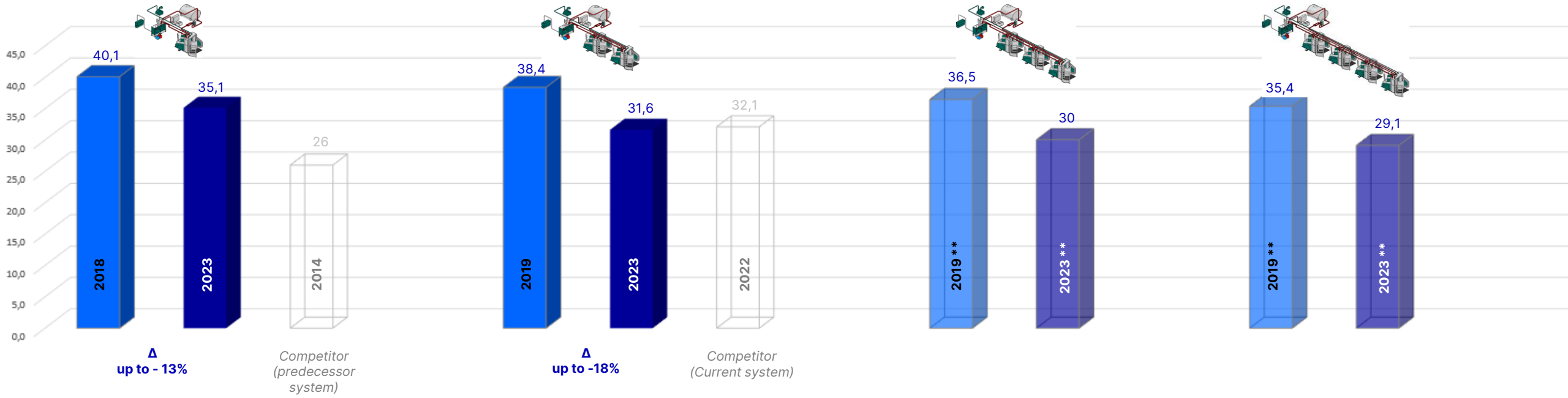
** Values derived from DLG data for the third and fourth box

Focus on transparency and sustainability

And in terms of water consumption?

The GEA DairyRobot R9500 (2-box) is the most economical automated milking system (AMS) tested by the DLG in terms of water consumption. The profi magazine confirmed the best values for water consumption in all calculated operating scenarios.***

Liters per box & 100 liters tank milk



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** Values derived from DLG data for the third and fourth box

Focus on transparency and sustainability

Why does the DairyRobot R9500 consume such a small amount of power?

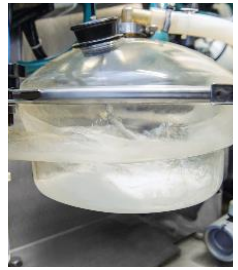
Energy-saving thanks to minimal robot movements

- Optimal positioning for defined udder position
- In-Liner Everything milking process: no separate processes for teat cleaning and stimulation
- MilkRack follows every movement of the cow without energy consumption

Short, vacuum-optimized milk paths (only approx. 1.5 m) for blowing out the residual milk = **little compressed air**, with **low vacuum in comparison**

Robot unit with electric motors and counterweight - **no conversion losses**

Disinfection with peracetic acid reduces energy consumption - no steam generation required



Thanks to circulation cleaning

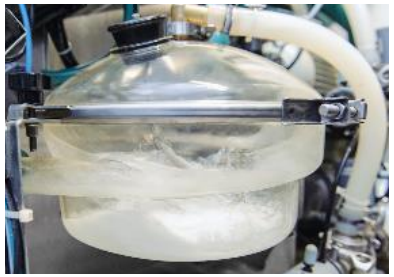
- Less heating power required
- Cleaning with 65°C warm circulating water instead of boiling water

Focus on transparency and sustainability

Why does the DairyRobot R9500 need such small quantities of water?

Less cleaning effort

- In-Liner Everything milking process:
  Teat stimulation with liner movement
  - No additional cleaning and stimulation unit needed
- teat cups cannot fall on the floor;
  the short milk hoses can hardly get dirty



Energy efficient circulation cleaning

- Selectable/composable as required cleaning modes
- Post-rinse water is collected and reused for the next pre-rinse

Low volume to be cleaned

- Short milk paths within a box and between several boxes
- Good milk receiver holds only 5 liters;
  Is emptied by economical frequency-controlled milk pumps

Focus on transparency and sustainability

Why does GEA rely on circulation cleaning?

Instead of sending the water through the system only once, the water always circulates in a circle in a connected pipe. This creates additional turbulence.

Additional turbulence = higher cleaning effect

With approx. 21 min, a circulation cleaning (main cleaning) takes longer than a boiling water cleaning, but this additional time is used very sensibly with regard to plant hygiene.

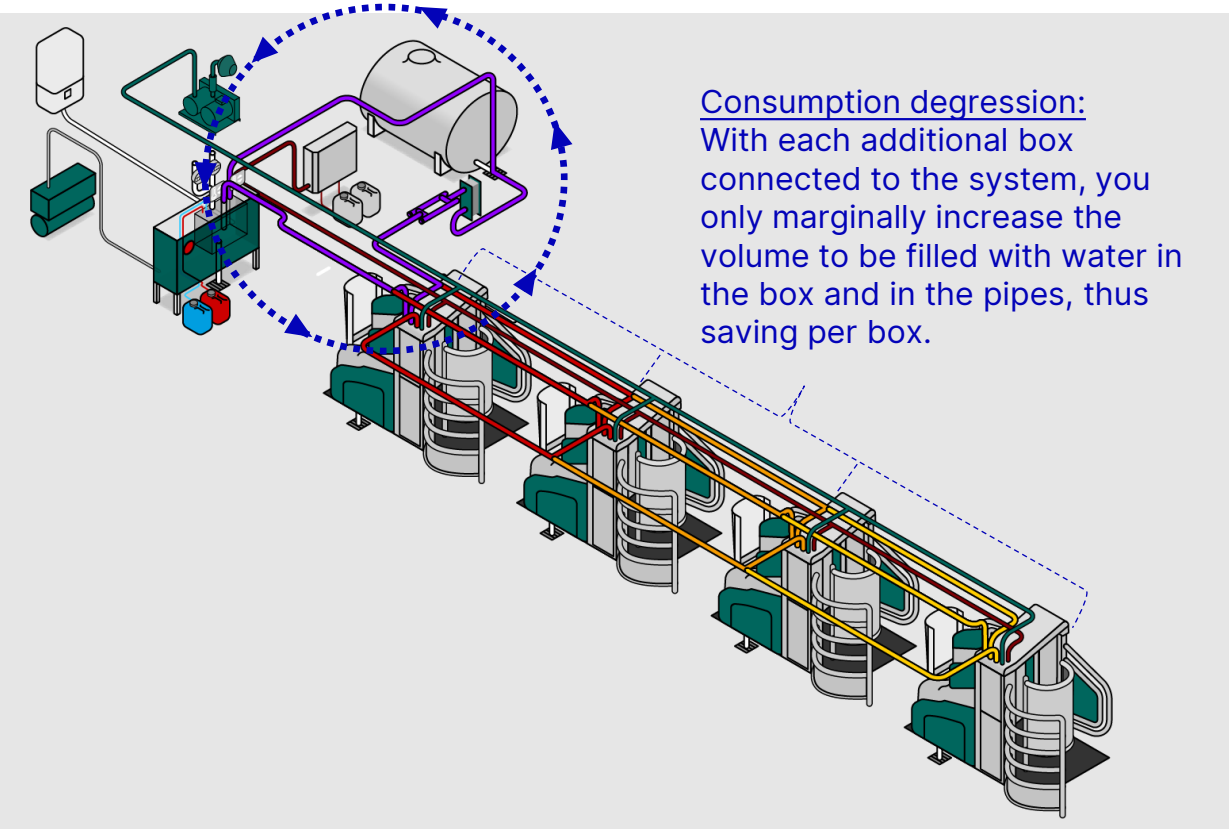
Additional time = higher cleaning effect

With detergent we clean alternately:
- acidic (dissolves mineral deposits) and
- alkaline (disinfects, dissolves milk fat & protein)

Different cleaners = high cleaning effect

Heating water is extremely expensive. We accept this for better system hygiene in the pre-rinse cycle with water at 35°C, but reduce the temperature in the main rinse cycle to a moderate maximum of 65°C.

Temperature in the right place at the right time = higher cleaning effect



Consumption degression:
With each additional box connected to the system, you only marginally increase the volume to be filled with water in the box and in the pipes, thus saving per box.

This saves up to 25 % energy compared to cleaning with hot water at approx. 95° C and at the same time protects seals and plastic parts.

Focus on transparency and sustainability

Did you know...

- ...that the energy requirement for the **hot water supply of** an AMS can be **> 40% of the total electricity demand** per day?
- ..that **electric water heating** by a boiler is currently one of the **most expensive forms of hot water supply**?
- ... that the **use of heat recovery** can save **>50% of** the energy consumption for hot water supply?
- ..that the **energy consumption of a milking robot** can **vary by up to 30% depending on** farm management?
- ...that even small faults, e.g. an **undetected leak in** the air compressor, can cause **considerable consumption**?

Our recommendation:

- Put your hot water supply to the test.
  Does the capacity and efficiency of your system still meet today's requirements?
- Are there alternatives in your business; is an investment in photovoltaics worthwhile?
- Invest in heat recovery and save money
- Talk to our herd management consultants. They will be supporting you with optimizations
- Regular maintenance and servicing of your plant not only ensures function but also helps to save costs.

Prof article Monobox

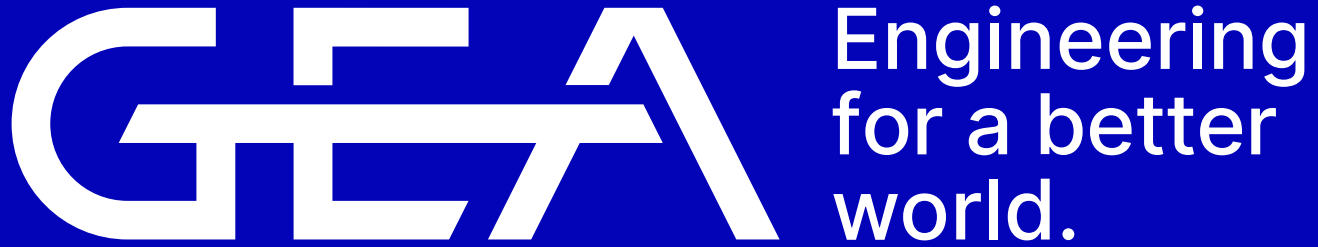
Profi article Multibox

DLG test report Monobox

DLG test report Multibox

See also: [DLG TestService GmbH (dlg-testservice.com)]

DOWNLOAD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