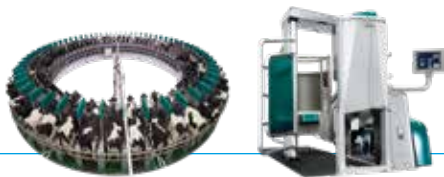


# GEA In-Liner Everything

Harvest high-quality milk in one attachment.



For all **DairyRobot R9500**  
and **DairyProQ** automated  
milking systems





## **G5 TIME-OF-FLIGHT CAMERA**

The G5 time-of-flight camera uses new 3D images at each milking to match the teat cup with the teat in a minimal amount of time – helping add efficiency to the in-liner milking process.



# One and done teat cup attachment

GEA's proven In-Liner Everything technology performs every step of the milking process—stimulation, teat cleaning, forestripping, milk harvest and post-dipping—in a single attachment.

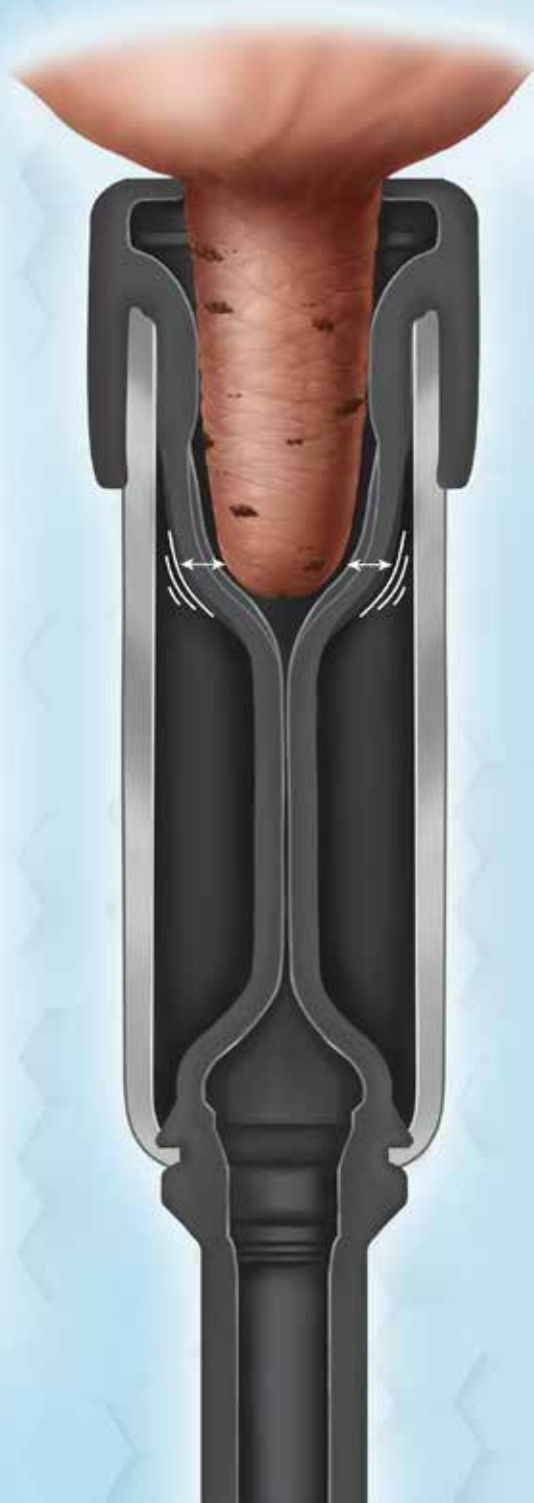
This uniform, quick and comfortable process, all occurring within the teat cup, is key to harvesting excellent quality milk while maximizing the efficiency of your robotic milking facility.

Each step of the In-Liner Everything process is designed to:

- ✓ Be sure cows receive the best possible milk let-down process
- ✓ Deliver a fast, gentle, complete milk-out
- ✓ Protect udder health
- ✓ Harvest quality milk and deliver it quickly to the milk tank



# STIMULATION



# Proper stimulation at every milking

While some sounds and smells in the milking area help influence the stimulation process, it is well-documented that manual stimulation must occur for a cow to optimally release oxytocin. With a robotic milking machine, this manual stimulation must occur mechanically.



GEA robots are equipped with patented and legendary **StimoPuls technology** – a mechanical stimulation system backed by decades of use with GEA pulsators on conventional parlors. StimoPuls stimulation begins as soon as the teat cup attaches, at the same time as cleaning in an ideally timed sequence.



StimoPuls stimulation is essentially a reduced “B-Phase” or liner open phase where the liner is gently compressed around the teat in the closed position (no active milking). The pulsation rate can go from 60 - 300 pulses per minute so the liner starts to vibrate, replicating tactile stimulation by the operator. The StimoPuls action can be programmed for each individual cow based on stage of lactation – e. g. 20-30 seconds for a fresh cow and 60 - 70 seconds for a late-lactation cow.



You are still milking a clean, well-stimulated teat – without making compromises.

The transition from StimoPuls stimulation to milk harvest is completely seamless and stress-free for the cow. Oxytocin is in full motion and the teat is clean, well-stimulated and dried-off with an injection of air into the liner – just in time for quick and gentle milking.

The In-Liner Everything process replicates the ideal prep procedure you use for milking operator training but now it is 100% process controlled for every cow at every milking.

## How can you prove cows are properly stimulated?

The numbers don't lie. Look at these key milking performance indicators:

### GEA DAIRYROBOT R9500 PERFORMANCE

| Average                                  | Milk flow/<br>minute  | Milking<br>duration    | Box time               |
|--|-----------------------|------------------------|------------------------|
| <b>DairyRobot<br/>R9500</b><br>(Monobox) | <b>2,44</b><br>kg/min | <b>4:50</b><br>minutes | <b>6:32</b><br>minutes |

Data gathered from GEA DairyRobot R9500 test farms worldwide over a 5-month period in 2019/20. Farms vary in size and number of boxes.

Results on individual farms may vary depending on factors such as (but not limited to): system configuration and settings, herd characteristics, management protocols and equipment maintenance. No specific results are guaranteed. This data does not constitute warranties of any kind.



#### DID YOU KNOW?

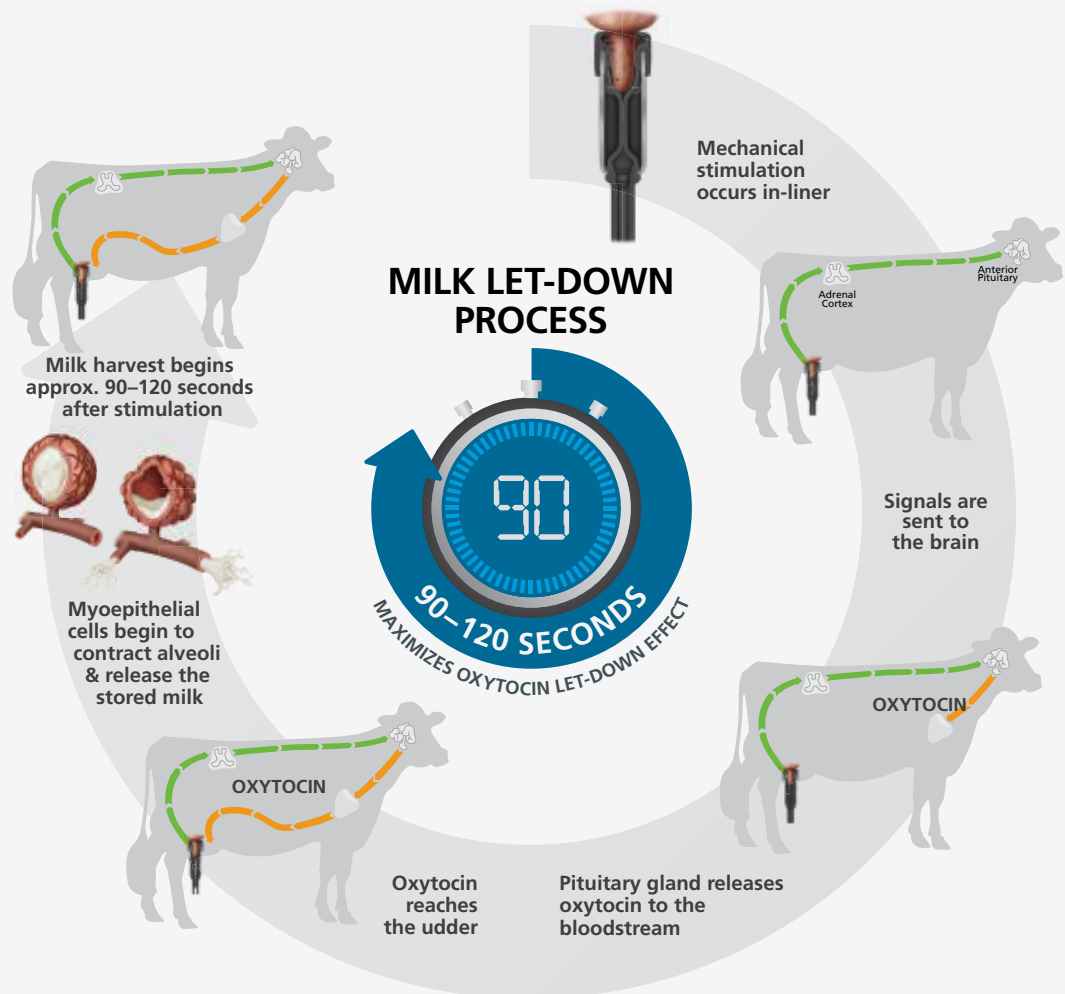
US farms have reached an average milk flow of over 3 kg/min in DairyRobot R9500 and DairyProQ farms within a milking duration of 4 minutes.

Data gathered from U.S. herds over a 6-month period. Farms were robot rotaries or had 4 or more boxes and over 400 total cow milkings per day.

## STREAMLINED EFFICIENCY TO OPTIMIZE OXYTOCIN LET-DOWN

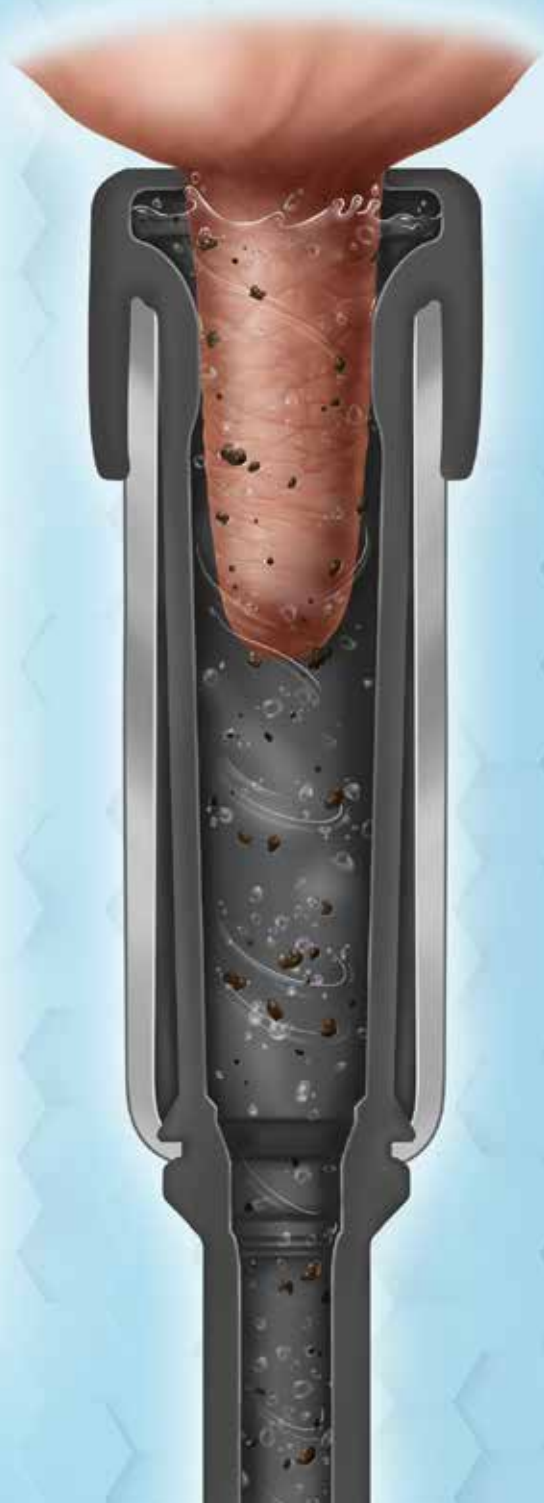
One of the keys to optimal milking is to capitalize on the short timeframe when oxytocin is released into the bloodstream. Milking outside of this timeframe can extend milking times and have long-term impacts on teat-end health.

With the In-Liner Everything process, you only need to locate the teat and attach the teat cup once – not twice like other robots on the market that prep and milk with separate systems. You have more control of the prep time and you can take advantage of the cow's natural milk let-down process for maximum milking speeds.





# TEAT CLEANING





# Superior teat cleaning process

The In-Liner Everything process delivers the most hygienic teat cleaning on the market.



Each teat gets their own individual teat cup for cleaning – there are no shared cleaning cups or brushes. This hygienic process helps prevent cross-contamination of mastitis-causing bacteria from teat to teat.

**One teat cup per teat for every cow at each milking provides sophisticated teat cleaning and the best in teat hygiene.**

Once the teat cup is attached, cleaning or pre-dipping begins – depending on country-specific regulations – at the same time as stimulation. The combined action of the liner pulsating in a timed sequence and the injection of water (or specially formulated germicidal pre-dip) into the liner head, effectively cleans the soil load on the teat. Any wastewater or residual pre-dip is safely diverted to the dump line and will not come along with the primary, saleable milk supply.

### Teat cleaning with water

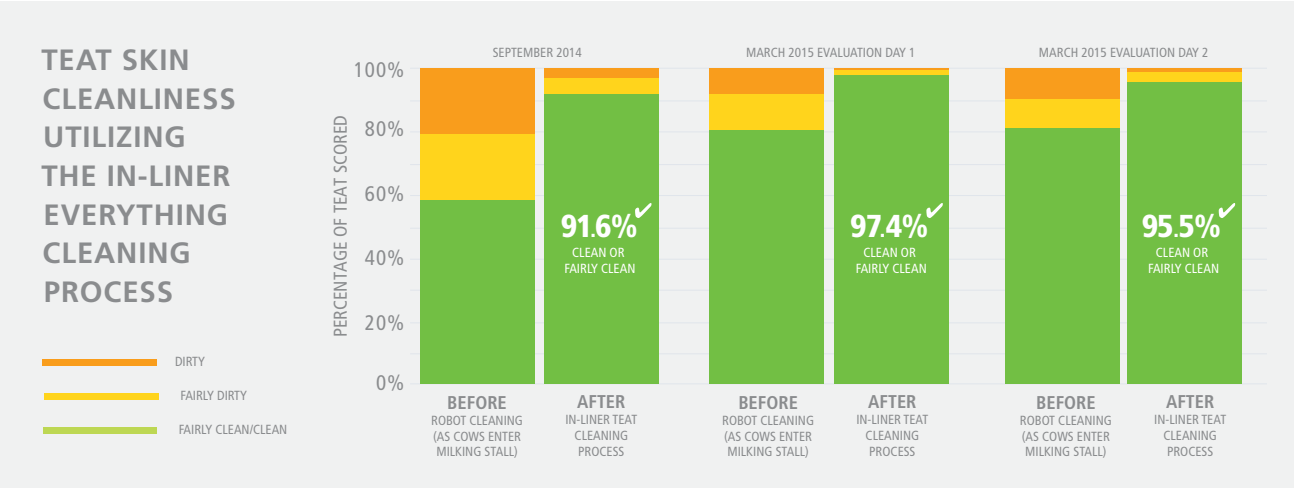
The teat wash time can be adjusted to account for average udder cleanliness on your farm. Herds with cleaner than average udders and teats can expedite the cleaning process while those with more challenging environments can extend the cleaning process.

### Teat cleaning incl. pre-dipping (optional)

A specially formulated pre-dip can be utilized for a more effective kill of mastitis-causing organisms. The National Mastitis Council (NMC) has recommended pre-dipping procedures on conventional farms for decades as a primary protocol to prevent intramammary infections. At GEA, we believe you shouldn't have to compromise essential mastitis prevention practices just because you are milking with robots. Pre-dipping is a proven win for mastitis control.

### Teat cleanliness and thereby robot efficiency is enhanced by:

- ✓ Udder hair removal on a regular basis
- ✓ Frequent cleaning of manure alleyways throughout the day
- ✓ Clean, dry, well-bedded stalls



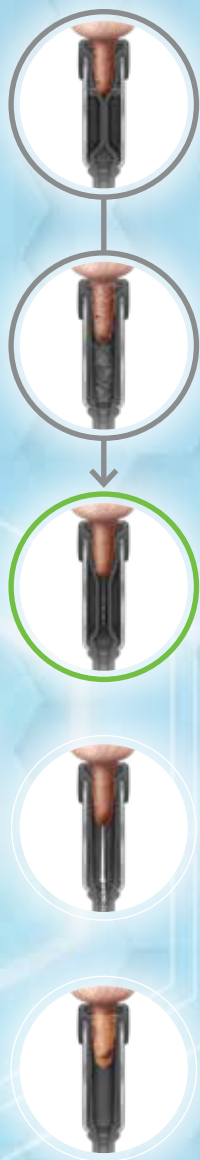
Data adapted from testing performed by the HTW Dresden (University of Applied Sciences) in 2014 and 2015 on a GEA DairyProQ robotic rotary parlor.

## WHY GEA INVENTED THE IN-LINER EVERYTHING PROCESS

- Many other robotic systems do not offer pre-dipping and GEA wanted to offer a model that could safely accomplish this task (depending on country-specific regulations, either as standard function or as an option).
- Other robots were cleaning teats at a satisfactory level, but GEA thought it could be done better.
- Research from Penn State showed robot systems were missing teats when attempting to clean – 10% on average and up to 50% if there was a technical difficulty<sup>1</sup>. GEA wanted to facilitate a higher percentage of teats being cleaned – and cleaned more effectively.
- GEA wanted to speed up the milking process and decrease box times. Other robots were prepping too slow – requiring two trips to the cow while using the camera twice to locate teats (the most-time consuming variable in the prep process). With In-Liner Everything, cow prep and milking all occur in-liner in one simple attachment – making milking faster and allowing for more milkings per box per day.
- GEA wanted to reduce movements underneath the cow to reduce stress levels and generate a more calm milk harvest process.

<sup>1</sup> Penn State Extension. 2014. Milk Quality on PA Dairy Farms Using Robotic Milking Systems – Part 2. [accessed 2019 Oct 24]. <https://extension.psu.edu/milk-quality-on-pa-dairy-farms-using-robotic-milking-systems-part-2>.





# FOR STRIPPING & MILK ANALYSIS



# Keep quality milk in the tank

Manual forestripping has been recommended as an essential step in the milking process for decades by milk quality experts around the world.



## Welcome to the new era of modern, mechanical forestripping.

Part of the In-Liner Everything prep process is to extract those first few streams of milk from each teat. This milk undergoes a rigorous evaluation procedure through a system of milk sensors that replace the operator's eyes and supports the decision-making process.



## Forestripping helps:

- The operator gain visual assurance of milk quality
- Identify clinical mastitis as soon as possible





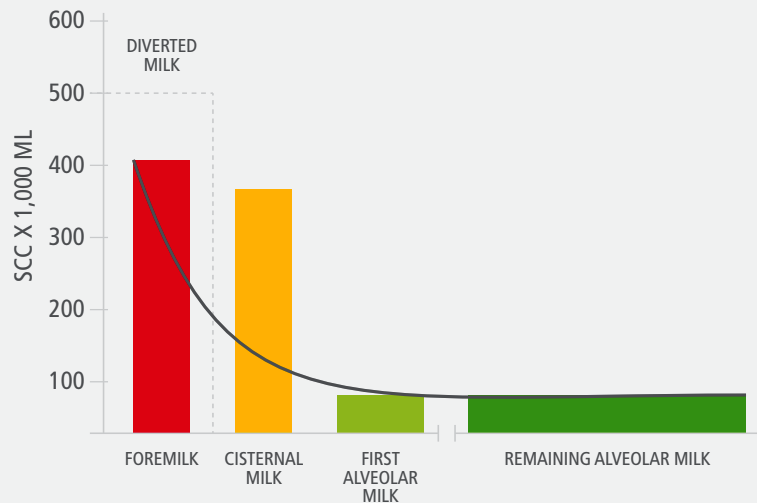
## How does the system of sensors work?

If foremilk fails a quality check – such as color, which may indicate blood in the milk – it will automatically be diverted to the dump line. Other quality checks such as conductivity are recorded in the herd management software. Quality checks can trigger alarms or a supervised milking on the DairyProQ, so an operator can evaluate the cow's condition. Herd management records will maintain this data – documenting historical trends to help employees make smarter decisions when identifying an illness, treating mastitis or culling.

Foremilk typically contains the highest level of somatic cells (as it has been sitting in the teat cistern between milkings). With In-Liner Everything, this milk is diverted to the waste line (just as it was stripped away on a conventional milking system) after analysis – and will not come along with the remaining milk supply, preserving overall quality.

GEA's software algorithms and sophisticated quality sensors minimize the amount of milk required for analysis so that you can maximize the amount of milk going into the tank. It is all about striking the perfect balance – discarding low quality milk and performing proper mechanized analysis to preserve high quality milk from every cow.

## SOMATIC CELL COUNT BY MILK FRACTION



This chart is based on cows with a total quarter SCC of 50,000 - 100,000.

Adapted from Sarikaya H, Bruckmaier, RM. 2006. Importance of the Sampled Milk Fraction for the Prediction of Total Quarter Somatic Cell Count. Journal of Dairy Science. 89(11):4246-4250.



### DID YOU KNOW?

North American farms proved that this sensor technology works properly:

### MILK QUALITY AVERAGE

| Average                           | Somatic cell count (SCC) |
|-----------------------------------|--------------------------|
| <b>DairyRobot R9500 (Monobox)</b> | <b>123K cells/ml</b>     |
| <b>DairyProQ</b>                  | <b>130K cells/ml</b>     |

Averages based off a random sampling of GEA robot farms in the U.S. and Canada in 2019.

Results on individual farms may vary depending on factors such as (but not limited to): system configuration and settings, herd characteristics, management protocols and equipment maintenance. No specific results are guaranteed. This data does not constitute warranties of any kind.

## DairyMilk M6850 Somatic Cell Count Classes Sensor

An additional option with GEA robotic milking systems is the groundbreaking DairyMilk M6850 Somatic Cell Count Classes Sensor – the industry's first SCC monitor that continuously analyzes milk flow from each individual quarter throughout the entire milking process.

It collects reliable data in real-time, without chemical reagents, to help detect mastitis early. This early detection helps minimize treatment time and protect the health of your herd.

### Revolutionary sensor for udder health:

- Monitors individual quarters and provides a cell count category by quarter at every milking
- Requires no chemical test reagents
- Analyzes the entire milking process in real-time – no spot samples. The flow-through sensor evaluates milk from the beginning of the milking session to the end.
- Uses the patented EPT (Electrical Permittivity Threshold) principle. This technology measures the physical properties of the milk and runs the data through a series of algorithms to determine a cell count category.
- Produces fewer false positives than traditional methods





The industry's first SCC monitor that continuously analyzes milk flow from each individual quarter throughout the entire milking process.



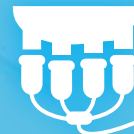
REAL-TIME  
ANALYSIS



NO CHEMICAL  
REAGENTS



INDIVIDUAL  
QUARTER ANALYSIS

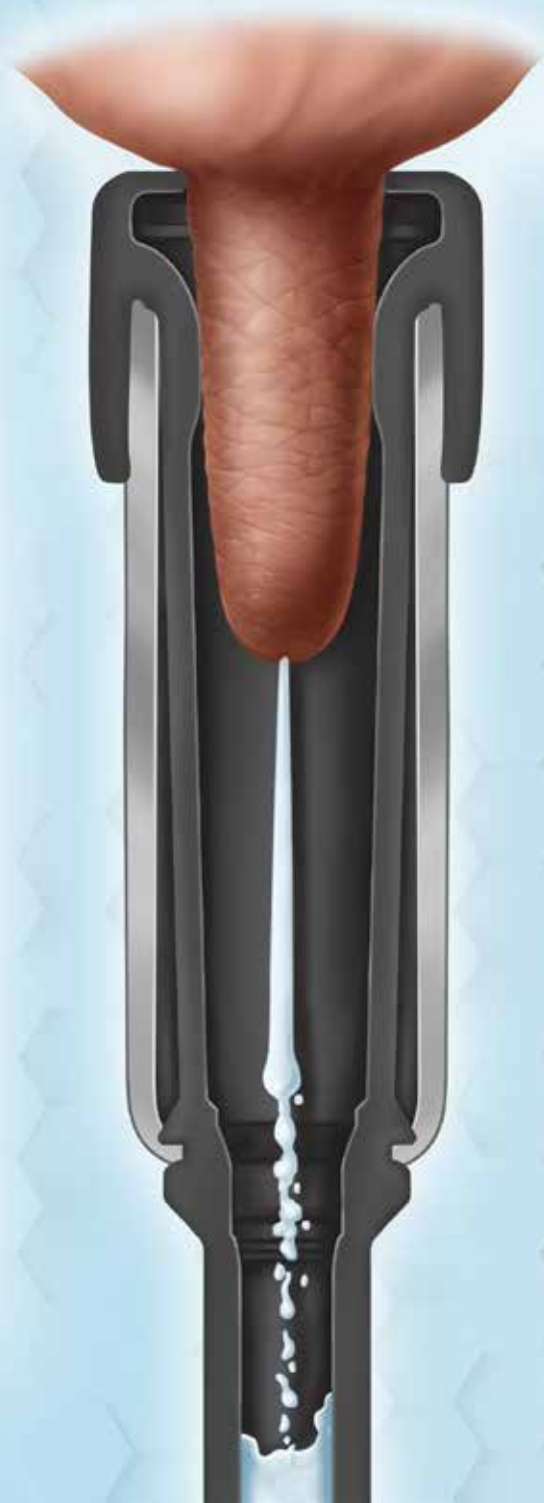


DURING THE  
WHOLE MILKING  
PROCESS





# MILK HARVEST





# Milking like no other



**Safeguard milk quality** – GEA has been a leader in milk harvest innovation for more than 100 years. We've taken decades of milking intelligence and transferred that knowledge and best practices to the many facets of robotic milking. This expertise facilitates a superior milk harvest using the most modern technologies.

After milk is analyzed by the sophisticated set of sensors and data concludes the milk is consumable, the milk-decision valves open, milking begins, and the primary, saleable milk supply is transferred through the good milk line into the tank.



**GEA robot herds worldwide experienced on average:**

**MILKING  
RATE**

**<5** minutes  
per cow



**MILK  
FLOW  
RATE**

**2,5** kilos per  
minute



**Protect teat-end health** – GEA robotic milking systems utilize the highest quality liners engineered to fit a wide variety of teat sizes for gentle, efficient milking. Our team of trained milking technicians work to be sure all system settings, such as vacuum levels, and pulsation rates and ratios, are working together in harmony. This synchronization helps maximize milk flow rates, while providing proper massage to protect teat-end health.





**Minimize milking time** – Quick milk-outs are the goal of every milking system and are even more important in box milking systems to maximize milkings per cow per day. Shorter unit on-times, as a result of proper stimulation, ideal liner design, and systems settings, are best for the cow and long-term teat health, and better for overall productivity of the facility. Cows are milked out quickly and can return to eat and rest as soon as possible.

**Benefit from quarter detach** – You can select to detach by quarter with GEA milking robots and remove the teat cups in the most optimal way. Sensors monitor milk flow by quarter – when one quarter reaches the milk flow detach threshold, the milking process for that teat stops. The milk-decision valve closes, post-dipping occurs, vacuum stops and the teat cup is removed.

For example, if the front quarters finish milking sooner than the rear quarters, the teat cups can be removed – which is simply less time the teats are stressed due to low/no milk flow. Then the rear quarters, or one slow-milking quarter, can finish milking out as needed in the most state-of-the-art manner possible. Detach by quarter helps prevent overmilking teat by teat and facilitates a complete milk-out on all four quarters.





## GEA MilkRack

Engineered to adapt

The In-Liner Everything milking process is supported by a lightweight, suspended MilkRack that adapts to a cow's natural movements without exerting any unnecessary leverage on the udder. The teat cups and MilkRack are designed so that even if a teat cup is kicked off by the cow, it cannot come in contact with the floor, further protecting milk quality.

AMSPro silicone liners



AMSLiner rubber liners



## GEA AMS liners

Automatically on the safe side

The technically sophisticated In-Liner Everything process requires specially-designed liners. GEA's range of silicone (AMSPro) and rubber (AMSLiner) liners covers all of the different barrel, mouthpiece opening and mouthpiece diameters you could need to ensure they fit your animals' teats perfectly. They are intensively tested, assessed and certified. Hence, using them provides you lasting functionality and a consistent milking routine for every milking procedure, whilst adhering to all hygiene standards applicable to dairy farms.



# POST-DIPPING & BACKFLUSHING



# Post-dipping done right

Manual forestripping has been recommended as an essential step in the milking process for decades by milk quality experts around the world.



Then, the GEA milk-decision valve automatically closes. The safety valve must be fully engaged before post dip dispenses through a valve (separate from the milk line) with the help of a pressurized injector. Dip is applied to each teat through the liner head and a burst of air pushes any remaining dip from the dip valve toward the teat. Vacuum ceases and the teat cup is removed – revealing a coating of teat dip around the teat.



Proper post-dipping is even more important with voluntary, box robotic milking systems because cows don't necessarily follow group milking behaviors or schedules. For example, cows can immediately lay down in a soiled stall after milking – when the teats have not had a chance to sufficiently close. In this situation, ideal teat dip coverage is essential since the cow heavily depends on the germicidal capabilities of the teat dip for protection.

Proper teat dipping practices remain an National Mastitis Council (NMC) recommended procedure to help prevent mastitis. In-Liner Everything provides superior, reliable coverage to protect your herd's udder health.





### DID YOU KNOW?

...how GEA's in-liner dipping impact our customers' Somatic Cell Count? The numbers speak for themselves:

### SCC AVERAGE

| Average                    | Somatic cell count (SCC) |
|----------------------------|--------------------------|
| DairyRobot R9500 (Monobox) | 123K cells/ml            |
| DairyProQ                  | 130K cells/ml            |

Averages based off a random sampling of GEA robot farms in the U.S. and Canada in 2019.

## In-Liner Everything dipping benefits:

**Proper coverage** – Achieve even dip distribution around the entire teat and teat end. In-liner dipping occurs while the teat is still slightly extended and under vacuum. This process allows dip to get into teat skin folds and creases for coverage like no other application device.

**Excellent protection** – GEA utilizes the highest quality teat dips formulated for the best performance in our In-Liner Everything process. The fresh dip provides the protection cows need against mastitis-causing pathogens between milkings.

**Economical application** – The amount of teat dip used is adjustable by farm. In many cases, dip quantities are lower than spray systems. With in-liner application, dip is applied directly to the teat and teat-end – not sprayed unevenly or covering the udder where it is not required and oftentimes wasted.

**Quick and controlled process** – Teat dip is reliably applied, coating the teat skin and teat end at every milking. The process is fast with no extra time spent in the milking box or parlor.



## Backflushing

Another way to promote high quality milk production

Within seconds of unit removal, teat cups undergo a standard backflush rinse. This step neutralizes any possible bacteria in the teat cup liners before they are used on the next cow, helping prevent the spread of mastitis-causing bacteria from cow to cow.



## GEA's milk-decision valve

GEA puts milk safety and regulatory compliance first when engineering our robotic milking systems

GEA's milk-decision valve allows the In-Liner Everything process to work smoothly and bring new levels of efficiency to robotic milking systems. The valve is used to open and close the milk line – diverting cleaning solution, foremilk, teat dip residue and backflush sanitizer into the waste line and directing high quality, saleable milk to the tank – preventing contamination and promoting milk safety.

GEA is a leader in the marketplace when it comes to robotic milking innovation and we actively make regulatory compliance a priority.



# Backed by research

Research demonstrates milk safety and proves in-liner dipping performance

GEA's in-liner dipping procedure was tested<sup>1</sup> in a laboratory trial and on farm to determine the teat dip residues in the milk and the dipping performance of the automated system compared to manual dipping.

Both trials demonstrated that there were no food safety issues with the in-liner post-dipping process. Measurements of iodine in the milk were consistent with normal on-farm levels – influenced by feed or from standard iodine dipping processes.

In addition, dip application performance utilizing GEA's automated in-liner technology was measured during the commercial farm trial<sup>1</sup>. In this trial, a total 4,541 teats from 307 cows were observed for 4 consecutive days, demonstrating a highly effective dipping rate of 91.6%.

**91.6%** DIPPING  
SUCCESS RATE\*

\*Measured by the percentage of teats with a drop of teat dip at the teat orifice.

<sup>1</sup> Berg W, Rose-Meierhöfer S, Ammon C, Kobbe C. 2014. Dipping efficiency and teat dip residues in milk using an automatic dipping system. Journal of Dairy Science. 97(6):3689–3693.

More research shows in-liner dipping is a more effective way to dip

A Cornell University study<sup>2</sup> compared manual dipping using a traditional dip cup to GEA's automated in-liner dipping process. The results found that applying the post dip automatically via the machine, had the lowest number of new intramammary infections caused by three of the most common mastitis-causing pathogens.

| METHOD  | <i>Staph aureus</i> | <i>Strep. agalactiae</i> | <i>Strep. uberis</i> |
|---|---------------------|--------------------------|----------------------|
| MANUAL post-dipping (iodine teat dip)                                 | 65.4% reduction     | 61.5% reduction          | 63.5% reduction      |
| AUTOMATIC post-dipping in-liner (iodine teat dip via milking machine) | 88.2% reduction ✓   | 94.4% reduction ✓        | 93.8% reduction ✓    |

22-week experimental challenge study on Holstein cows at two different farms. Testing compared to control group (no post-dipping).

The study also found that in-liner dipping had no effect on teat-end or teat skin condition. Most importantly, there were no differences in iodine levels found in the milk due to the application method – whether cows were dipped automatically in-liner or manually. The research concludes that machine backflushing after detachment sufficiently removes iodine residue in the teat cups.



Proven safe.  
Proven effective.  
Proven reliable.  
**GEA In-Liner  
Everything**

<sup>2</sup> Galton DM. 2004. Effects of an automatic postmilking teat dipping system on new intramammary infections and iodine in milk. Journal of Dairy Science. 87(1):225-231



## We live our values.

Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA is one of the largest technology suppliers for food processing and a wide range of other industries. The global group specializes in machinery, plants, as well as process technology and components. GEA provides sustainable solutions for sophisticated production processes in diverse end-user markets and offers a comprehensive service portfolio. The company is listed on the German MDAX (G1A, WKN 660 200), the STOXX® Europe 600 Index and selected MSCI Global Sustainability Indexes.

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