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Dairy production

Boosting productivity, reliability
and energy efficiency

How to increase profitability without compromising quality

Changing consumer tastes and demands mean dairy facilities need the flexibility to meet these trends, while avoiding high energy costs and unplanned downtime. Variable speed drives (VSDs) and motors now play an even greater role in adjusting production to meet these challenges.



Food and personnel safety



“I need to make my plant and personnel safety a priority.”

Tackle diverse safety demands...

- Employees must not be exposed to hazards: from operating heat exchangers to risks associated with hot liquids, process steam and contaminated products.

... using best-in-class technology

- Remote monitoring protects personnel from potentially dangerous machinery.
- Advanced drive functions, like safe torque off, make sure separators, conveyors and mixers come to a safe and efficient stop.
- Dust ignition-certified motor and drive packages comply with demands of dusty and explosive environments, for example in areas where milk powder is produced or stored.

“We must always meet food safety regulations.”

Conform to the latest safety standards...

- Processing equipment must meet strict hygiene standards to avoid any risk of contamination and eliminate dairy product safety recalls.

... with solutions that build trust

- Compliance with high ingress protection standards can prevent product/motor failures in hygienic areas which are due to harsh wash downs/chemicals used.



Energy efficiency



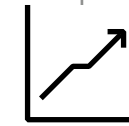
“We need to cut our energy bill and carbon footprint.”

Find the big energy users...

- Some of the biggest energy users in dairy include:
 - Pasteurization, spray drying, homogenizer, heating/ boiling
 - Pumps, compressors and separators

... unlock the saving potential

- Replacing throttle valves with VSDs on pump control, reduces energy costs and cuts maintenance needs.
- Replacing direct-on-line starting with high efficiency VSD-motor package can lower energy costs up to 60 percent and reduce carbon dioxide emissions.
- ABB Ability™ Operations Data Management zenon helps detect ways to optimize energy and resource consumption. Offers excellent reporting functions that give full production transparency.
- ABB Ability™ Smart Sensors for pumps and low voltage motors, helps identify energy saving potential.
- Upgrading to IE4 efficiency class motors, such as synchronous reluctance technology (SynRM) significantly reduces energy consumption.



Productivity improvement



“Our production must adapt quickly to meet evolving customer tastes.”

Keep production agile and accurate...

- Demand is for batches of different quantities and variants with quicker delivery.
- Changing constant-speed equipment to meet varying production volumes takes time and money.

... with flexible motor-driven solutions from one supplier

- Variable speed:
 - is cost effective when applied to separators, compressors and pumps.
 - applied to pumps increases product quality by avoiding cavitation.
 - provides greater accuracy and repeatability which can improve end-product quality.
- Safely interlink processes from production to logistics and warehousing, through fieldbus and digital variable speed drives.

“We need better intelligence on how production lines are performing.”

Locate the right information...

- Manually extracting plant data is time-consuming and inaccurate.
- Getting access to the right data and turning into useful information can be difficult.

... through digital solutions

- Multiple inputs and outputs (I/Os) provide a variety of process information from the VSD to the motor control.
- Open fieldbus systems allow easy drive integration to any PLC or similar control equipment, giving greater insight, information and better production control. This helps avoid product recalls.



Operation and maintenance



“How can I control rising costs?”

Lower operational overheads...

- Operational costs must be controlled without comprising safety of plant, personnel or end-product.

... through advanced maintenance regimes

- Soft starting avoids sudden shock loading, leading to less wear and tear to gears, belts and driven machine.
- ABB Ability™ Condition Monitoring services deliver accurate, real-time information about drive and motor events to ensure equipment is available, reliable and maintainable.
- Global service network and preventive maintenance contracts relieve pressure on in-house teams and increase speed of response to critical issues.
- Shorter cleaning times using automated CIP systems with VSD control of pumps.

“We need the most reliable products and systems to avoid unplanned shutdowns.”

Eliminate production risks...

- Plant shutdowns are costly, from lost production time, spoiled goods and reputation damage.

... by utilizing smart functionality

- Temperature, load, under/overvoltage protection and warning features within drives help anticipate breakdowns.
- ABB Ability™ Condition Monitoring for powertrains warns of impending failures, long before they happen, reducing unplanned downtime.
- A drive's real-time clock allows timed tracing of faults, so you know what happened and when.
- Stainless steel motors last five times longer than standard motors in washdown environments.
- Gearings and bearings designed for harsh conditions offer prolonged life through a best-in-class sealing system.

Improving operational efficiency helps boost output and profitability

Each stage of dairy production can be fine-tuned to improve productivity, increase sustainability and enhance safety.

1 RAW MILK HANDLING

Milk is filtered, cooled and pumped to raw milk tank farm

Applications:

- Pumps

Requirements:

- Avoid cavitation
- Energy efficient and 100 percent reliable control of vacuum pumps
- Reduce energy costs and control pump speed to maintain constant pressure and flow rate
- Eliminate contamination through cleaning and sanitizing residues
- Use equipment that meets sanitary design guidelines

2 SEPARATION

Fine control and precision necessary for separating cream from milk

Applications:

- Clarifiers or centrifugal separators

Requirements:

- Accurate speed and torque control, even if rotational speed changes with weight of raw materials
- Control centrifuge speed without inducing vibrations
- Separators must overcome long starting time and high starting torque
- Motors must tolerate high mechanical forces

3 PASTEURIZATION & STANDARDIZATION

After preheating, milk temperature raised to 72 ° C for at least 15 seconds to destroy pathogens. Milk is mixed with cream to get specified fat content levels correct

Applications:

- Pumps, heat exchangers, mixers

Requirements:

- Accurately control milk stream through heat exchanger
- Accurately control mixer and pump to achieve given fat content of milk by mixing cream and skimmed milk together

4 HOMOGENIZATION

High pressure pump driven by motor through homogenizer valve breaks fat globules into small size to prevent natural separation from milk

Applications:

- Piston pumps

Requirements:

- Compact homogenizer design impacts on components like motor
- Pump starting torque is high and speed must be accurate

5 MILK POWDER PRODUCTION

Spray drying is one of the most convenient techniques for producing milk powders and stabilizing milk constituents.

Applications:

- Milk powder spray tower comprising fan or air blower.

Requirements:

- Motor and VSD package provides correct milk sprayer speed to optimize milk droplets
- Simultaneously, fan speed controlled to optimize hot air flow to ensure highest powder quality

6 FILLING AND PACKAGING

Primary packaging and secondary packaging

Applications:

- Roll and belt conveyors

Requirements:

- High hygiene area
- High speed bottling lines
- Synchronization

7 REFRIGERATION

Refrigerated storage is the largest energy consumer, with compressors using the most energy

Applications:

- Compressors

Requirements:

- Compressor needs high level energy efficiency
- High compressor reliability to avoid downtime destroying end product
- Avoid harmonic disturbances to electric network which can impact on overall plant and effect end product quality

8 CLEAN-IN-PLACE

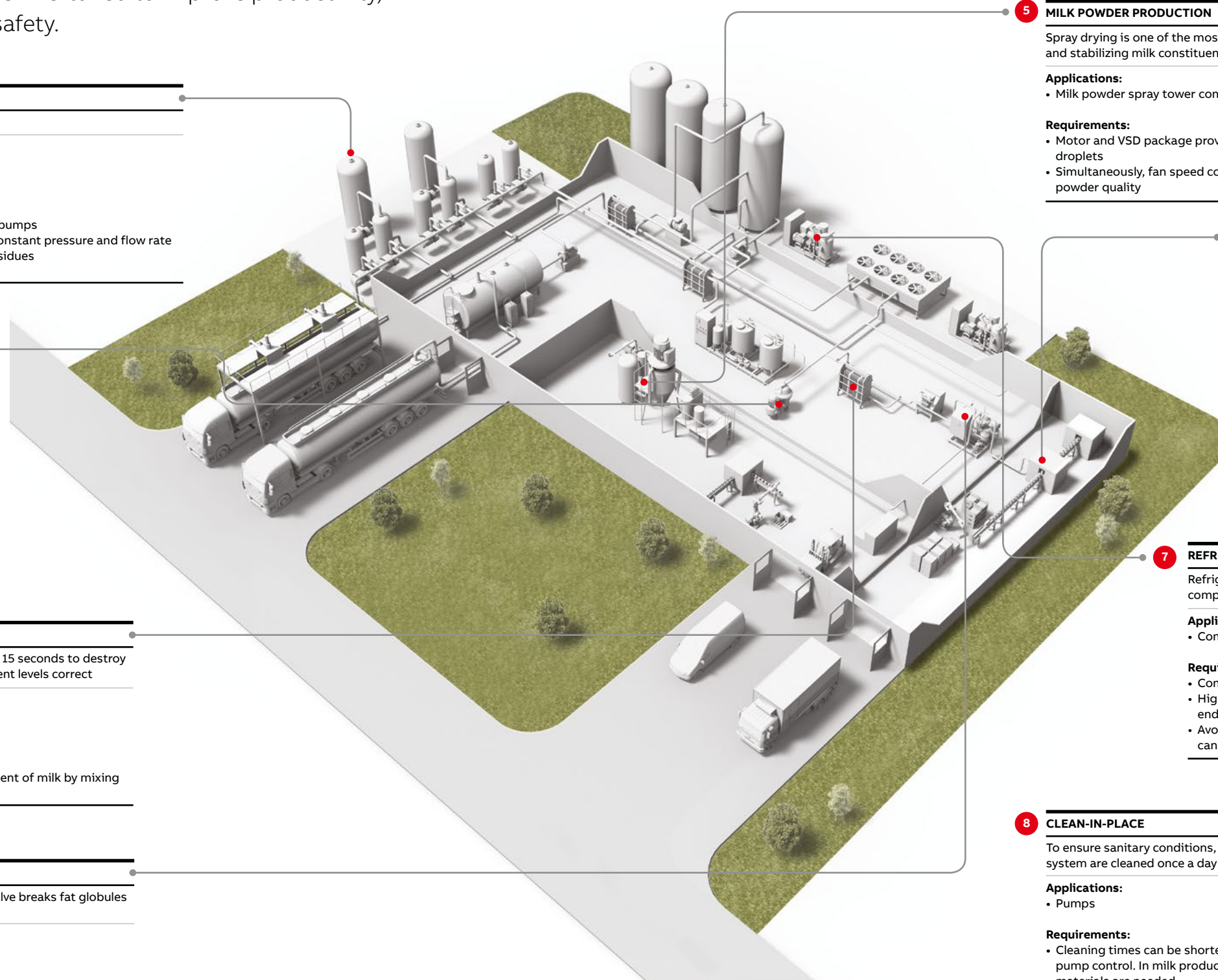
To ensure sanitary conditions, the inner surfaces of process equipment and piping system are cleaned once a day

Applications:

- Pumps





Requirements:

- Cleaning times can be shortened with automated CIP systems that use VSD pump control. In milk production, up to 50 percent less water and fewer cleaning materials are needed
- Automated CIP systems require accurate pump control to minimize water use without compromising hygiene



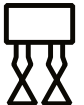

Unlock the potential in dairy-specific applications

Alongside energy saving, improved productivity and greater safety, there are many other benefits from using variable speed drives (VSDs) and high efficiency motors on motor-driven applications

	Challenge	Solution	Benefit
	Pumps		
	<ul style="list-style-type: none">Changes in liquid pressure threaten reliability of pump impeller and seals.	<ul style="list-style-type: none">Motor-drive: Anti-cavitation software measures motor torque and speed to recognize cavitation.	<ul style="list-style-type: none">Avoids cavitation that would damage milk-fat globules. Improves product quality and impellers lifetime.
	<ul style="list-style-type: none">Minimize water during process equipment and pipe cleaning.	<ul style="list-style-type: none">Drives: Clean-In-Place (CIP) with easy-to-use pump control software gives correct pressure and flow rate to pipe clean and fill functions.	<ul style="list-style-type: none">Cleaning time is shorter.Use less water and cleaning materials.
	<ul style="list-style-type: none">High energy user.	<ul style="list-style-type: none">Motor-drive: With half the speed only 1/8 of power is needed.	<ul style="list-style-type: none">Up to 60 percent energy savings compared to throttled control system.
	Compressors		
	<ul style="list-style-type: none">Cooling/ compressors are one of the biggest single energy consumers and therefore rely on energy efficient components.	<ul style="list-style-type: none">SynRM motor-drive: provides energy savings to IE4 standard.	<ul style="list-style-type: none">Between 20 to 60 percent energy savings across speed range.
	<ul style="list-style-type: none">Ensuring ultimate reliability of compressor operation.	<ul style="list-style-type: none">Softstarters: suitable for motors running at full speed.Drives: extend speed range of compressor.	<ul style="list-style-type: none">Avoids wear and tear to mechanical parts, ensuring uptime.
	<ul style="list-style-type: none">Harmonics cause interruptions, interference and downtime.	<ul style="list-style-type: none">Ultra-low harmonic drives: harmonic mitigation built-in.	<ul style="list-style-type: none">Harmonic content is reduced by up to 97 percent.Simple commissioning with no wasted energy due to overheating.
	Conveyors		
	<ul style="list-style-type: none">Circulate right amount of cooling media in pipe lines essential for correct temperature.	<ul style="list-style-type: none">Motor and drive package: vary water or glycol flow rates.	<ul style="list-style-type: none">Avoiding traditional throttling valves saves energy as right compressor speed achieved.
	Centrifugal separators		
	<ul style="list-style-type: none">Precise, smooth and consistent control and synchronization of conveyor speeds.	<ul style="list-style-type: none">Drives: built-in brake chopper provides precise control of conveyor deceleration rate(s), without external hardware.Safe torque off (SIL3) prevents unexpected movement of conveyor.	<ul style="list-style-type: none">Each conveyor speed adjusted separately and synchronized to ensure material flow between process stages.
	<ul style="list-style-type: none">Ultimate reliability so production never stops.	<ul style="list-style-type: none">Motors and mechanical power transmission products: best in class sealing system.Motor-drive: Continuous, intermittent or variable speed operation.	<ul style="list-style-type: none">Less maintenance increases process uptime.Lower maintenance costs by reducing mechanical stress on gears and belts.
	<ul style="list-style-type: none">Control centrifuge speed without generating vibrations.	<ul style="list-style-type: none">Drive: automatically changes to maximum torque above 46 Hz.	<ul style="list-style-type: none">Speed control achieved without over-dimensioning.
	<ul style="list-style-type: none">Start separator when spinning.	<ul style="list-style-type: none">Drive: flying start function.	<ul style="list-style-type: none">Saves time and reduces wear on equipment.
	<ul style="list-style-type: none">Reduce energy consumption.	<ul style="list-style-type: none">Drive: Regenerative braking.	<ul style="list-style-type: none">Braking energy fed back into the mains, lowers energy consumption.
	<ul style="list-style-type: none">Overcome high starting torque.	<ul style="list-style-type: none">Drive: Direct torque control enables extremely accurate control over entire speed range.	<ul style="list-style-type: none">No need for over dimension system.



01

	Challenge	Solution	Benefit
	Mixers		
	<ul style="list-style-type: none">High starting torque, wide mixing speed range and precise control to ensure best quality end products.	<ul style="list-style-type: none">Drives: Direct torque control provides accurate speed control and adapts to mixing load.Safe torque off.	<ul style="list-style-type: none">Optimizes production speed and process up-time.Improves operational safety
	Cooling towers		
	<ul style="list-style-type: none">Belt driven cooling towers are costly to maintain due to mechanical parts wear.	<ul style="list-style-type: none">ABB provides a unique cooling tower package which eliminates start-up current peaks, fewer parts, low noise level and increased safety.	<ul style="list-style-type: none">Lower total cost of ownership.

01 VSD pump control helps automate CIP systems, leading to less water and fewer cleaning materials.

02 High speed bottling lines require synchronized conveyor systems.

03 The CIP wash solutions are circulated in the pipelines by centrifugal wash pumps, the speed of which is controlled by VSDs.

03



02



Features and functions benefiting dairies

Drives, soft starters, motors, gearing and mounted bearings all play a vital part in keeping your production moving. Choosing the right product with the correct features is essential in ensuring an optimized production.



Variable speed drives

Anti-cavitation software

- Extend pump lifetime and secure the process by detecting cavitation and ensuring optimal process or liquid flow.

Energy efficiency

- Control operating costs by seeing energy costs in local currency, kWh and CO₂ emissions.

Fieldbus compatible

- Use information such as milk flow rates and separator centrifuge speeds to get the VSD to adjust motor speed and torque.
- Get detailed insight into productivity performance and quality control through fieldbus comms connecting VSD with plant monitoring systems.



Flying start

- Reduce wear and save time by starting a motor while the load is still spinning.

Functional safety

- Safely stop applications like mixers and separators using in-built safe torque off (safety level SIL3).

Low harmonics

- Eliminate supply disturbances that could trip production with built-in active supply unit and integrated low harmonic line filter.

Reduced noise

- Protect staff health and safety with lower motor noise through adaptive switching frequency control.

Repeatability

- Accurately adjust conveyor speed to suit filling rates of products with varying viscosities, such as milk, yoghurt and ice-cream.

Soft pipe filling

- Increase lifetime of piping and pump system by avoiding pressure peaks.

Ingress protection

- IP55 for washdown zones



Softstarters

Built-in bypass

- Reduce system complexity and size, saving time and money during installation.
- Reduce heat generation from internal losses by activating bypass at full speed.

Harsh environment use

- Ensure uninterrupted production in dusty or wet environments with IP66 keypad and coated electronics.

Flexible communication

- Operate in local and remote mode by accessing all major communication protocols and built-in Modbus-RTU.



High efficiency motor and drive packages

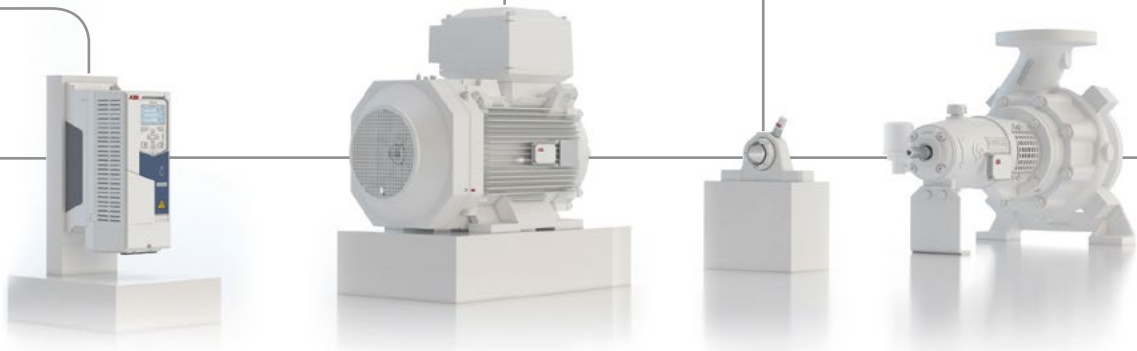
- Save energy across the dairy process with IE4 and above motors and drives packages.

Cooling tower packages

- Reduce energy, vibration, noise and maintenance costs using a package that removes the gearbox from cooling towers.
- Special low-speed permanent-magnet motor.

Globally certified drives and motors packages

- Protect plant and people and conform to global regulations using tested and certified motors and drives for potentially explosive atmospheres.



Motors



Food zone 1

- IP69 for water rating ensures suitability for aggressive, clean in place washdown procedures.
- Uses H1 grease to lower risk of food contamination.

Splash zone 2

- Eliminate risk of paint chips entering food chain with paint free motor.
- Uses H1 grease to lower risk of food contamination.
- Surface is easy to clean.

Dry zone 3

- Prevent dust explosions with certified dust ignition proof motors.
- ABB Ability™ Smart Sensor ready.
- Widest product offering

Bearings



- Stainless steel or corrosion resistance bearings in stainless or polymer housing.
- Extend bearing life in harsh washdown conditions using factory-filled food grade grease.

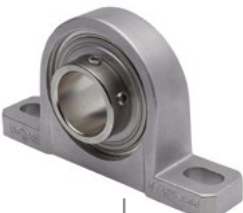
Gearing



- Two-piece harsh duty seal.
- Factory-filled H1 food grade synthetic oil.
- Totally enclosed, no paths for contamination.
- Some models available in quill style or 3-piece coupled NEMA.

- 13 step coating system.
- Provides 3x the corrosion resistance of epoxy paint.
- Factory-filled H1 food grade synthetic oil.

- Premium sealing systems used to keep contaminants out and lubrication in.
- Accessories available for protection and safety in high humidity, excessive dusty and dirty, or even extremely dry environments.



From the factory floor to the cloud and beyond

ABB Ability™ Condition Monitoring for Powertrains optimizes the performance and efficiency of rotating equipment. It enables full transparency on all parameters for drives, motors, mounted bearings and pumps.

1 Intelligent powertrain

The powertrain is equipped with sensors and cloud connectivity and can comprise motors, drives, mechanical components including bearings, couplings and gearboxes – and also pumps.

2 Turning data into valuable information

Data gathered from VSDs' inbuilt sensors and loggers together with that collected from ABB Ability™ Smart Sensors fitted to motors, bearings and pumps, can be collated, stored and further accessed via the cloud. The ability to gather and analyze this data can reveal information on the status and condition of your equipment, so that you can schedule service activities more effectively.

3 Accessing data for analytics

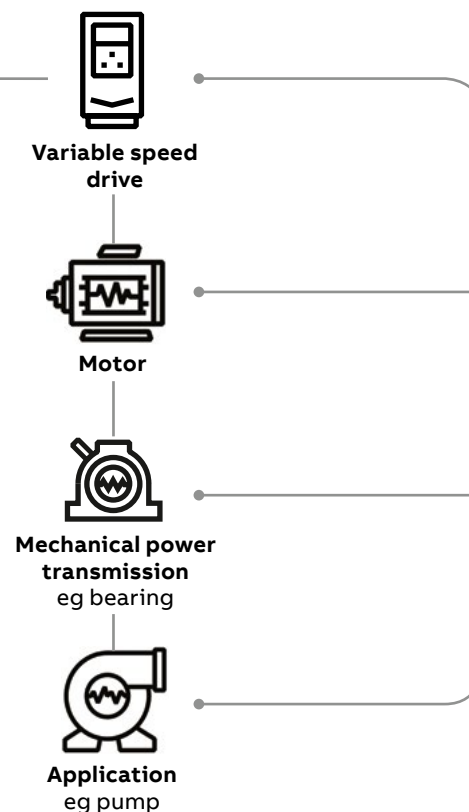
Detailed information can be extracted into a company's own portal and systems. Information on many aspects of the dairy process is available, including the ability to know exactly when and how production equipment was cleaned.

Detailed dashboards give full transparency so that you can take actions that lead to less downtime, extended equipment lifetime, lower costs, safer operations and increased profitability.

4 Gain a digital advantage

Ensuring that the right person is exposed to the right information at the right time brings:

- Appropriate response to production challenges, minimising operating costs and wastage of products.
- Greater insight into various aspects of the dairy process, thereby improving quality and reducing variations, errors and waste.
- Maximum material traceability helps fulfil regulatory compliance.
- Lower risk of production failure and change the maintenance from reactive to predictive.



Maintenance Manager



Energy Manager



Production Manager



Safety Manager



Keep your production running

From spare parts and technical support to cloud-based remote monitoring solutions, ABB offers the most extensive service offering to fit your needs. The global ABB service units complemented by external authorized value providers form a service network on your doorstep. Maximize performance, uptime and efficiency throughout the life cycle of your assets.

With you every step of the way

Even before you buy a drive, motor, bearing or softstarter, ABB's experts are on hand to offer technical advice from dimensioning through to potential energy saving.

When you've decided on the right product, ABB and its global network of Authorized Value Providers can help with installation and commissioning. They are also on hand to support you throughout the operations and maintenance phases of the products life cycle, providing preventive maintenance programs tailored to your dairy's needs.

ABB will ensure you are aware of any upgrades or retrofit opportunities. If you've registered your drives and motors with us, then our engineers will proactively contact you advising on your most effective replacement option. All of which helps maximize performance, uptime and efficiency throughout the lifetime of your powertrain.



With you, wherever you are in the world

Partnering with ABB gives you access to some of the world's most innovative technology and thinking.

Global reach

ABB operates in over 100 countries with its own manufacturing, logistics and sales operations together with a wide network of local channel partners that can quickly respond to your needs. Stock availability is good, with short delivery times for many products backed by 24-hour spare parts delivery.

In addition, we work closely with dairy producers to develop custom products, services and solutions to help standardize processes across multiple sites and streamline your supply chain.

We have seven global R&D centers with more than 8,000 technologists and invest \$1.5 billion annually on innovation.

End-to-end product portfolio

Alongside its variable speed drives, motors, soft starters, bearings and couplings, ABB's automation offering includes a wide range of scalable PLCs, a selection of HMIs, instrumentation and robotics. With functional safety options, from built-in safe torque off to safety PLCs, you can readily implement bespoke safety requirements.

ABB's offering includes:

- End-to-end **power and automation solutions**, from power distribution, raw material receipt, to process and machine control, to end of line packaging
- **Power protection and power quality solutions** to safeguard equipment and processes
- Industry leading **robotic automation solutions** that improve your speed-to-market, flexibility and help make packaging a differentiator
- A complete range of **protection, connection and wire management solutions** that withstand harsh environments and extreme

temperature swings, and provide the reliability needed for continuous operations

Streamline sourcing

ABB's end-to-end product and services portfolio streamlines your sourcing and purchasing activities and standardizes production across multiple sites, saving you money on spare part inventories while reducing maintenance costs.

