MOTION

Sugar production
Boosting reliability and cost efficiency

How to increase profitability without compromising quality

In today's sugar industry, constantly increasing competition and growing pressure for higher efficiency are forcing producers to find new ways to achieve long term success. Variable speed drives (VSDs)/variable frequency drives (VFDs), motors and PLCs are indispensible for key processes such as cane milling, or beet slicing, extraction and crystallization, and play a critical role in generating energy savings, improving productivity, and reducing costs.

Food and personnel safety

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

Tackle diverse safety demands...
- Sugar creates a fine dust which is as explosive as gas. Employees must be protected from exposure to risks associated with dust ignition, wherever in the world they work.

...using best-in-class technology
- Dust ignition-certified motor and drive packages comply with demands of dusty and explosive environments.
- Remote monitoring protects personnel from potentially dangerous machinery.

Conform to the latest safety standards...
- Applications such as milling machines can be dangerous to work around.

... with solutions that build trust
- Advanced drive functions, like safe torque off, ensure milling machines come to a safe and efficient stop.

Energy efficiency

"We need to cut our energy bill and carbon footprint."

Find the big energy users...
- Some of the biggest energy users in sugar include:
  - Milling, preparation and crystallization
  - Shredders, crushers, pumps, boilers and centrifuges

... unlock the saving potential
- Replacing traditional steam turbines with high efficiency motor and drive packages can reduce energy usage by up to 50 percent.
- Using VSDs/VFDs with regenerative functionality to control centrifuges can recover energy during the deceleration phase. The operation of the plant's centrifuges can be balanced to smooth power demand, resulting in energy savings of up to 30 percent.
- ABB Ability™ Condition Monitoring tells you how your applications are performing, giving you accurate real-time efficiency and condition data.

Productivity improvement

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"Our production must adapt quickly to meet evolving customer tastes."

Keep production agile and accurate...
- Fast throughput and delivery is key to extract optimal juice from raw product to get the maximum volume of the desired sugar quality produced.
- Changing constant-speed equipment to variable-speed in order to meet varying production volumes saves time and money.
- 100 percent reliability is crucial in production season.

... with flexible motor-driven solutions from one supplier
- Wide speed variation possible.
- Production increase often achieved without any extra investment.
- Safely interlink processes from production to logistics and warehousing, through fieldbus and built-in sensors.
- Immediate response to process demand, with no need to wait for power plant response.
- Less mechanical stress, with the possibility to drive motors in reverse direction.

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"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 it into useful information can be difficult.

... through digital solutions
- Multiple inputs and outputs (I/Os) provide a variety of process information from the VSD/VFD 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

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"How can I control rising costs?"

Lower operational overheads...
- Operational costs must be controlled without compromising safety of plant, personnel or end product.
- Maintenance must be scheduled around seasonal downtime, and carefully managed during production periods.

... 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.

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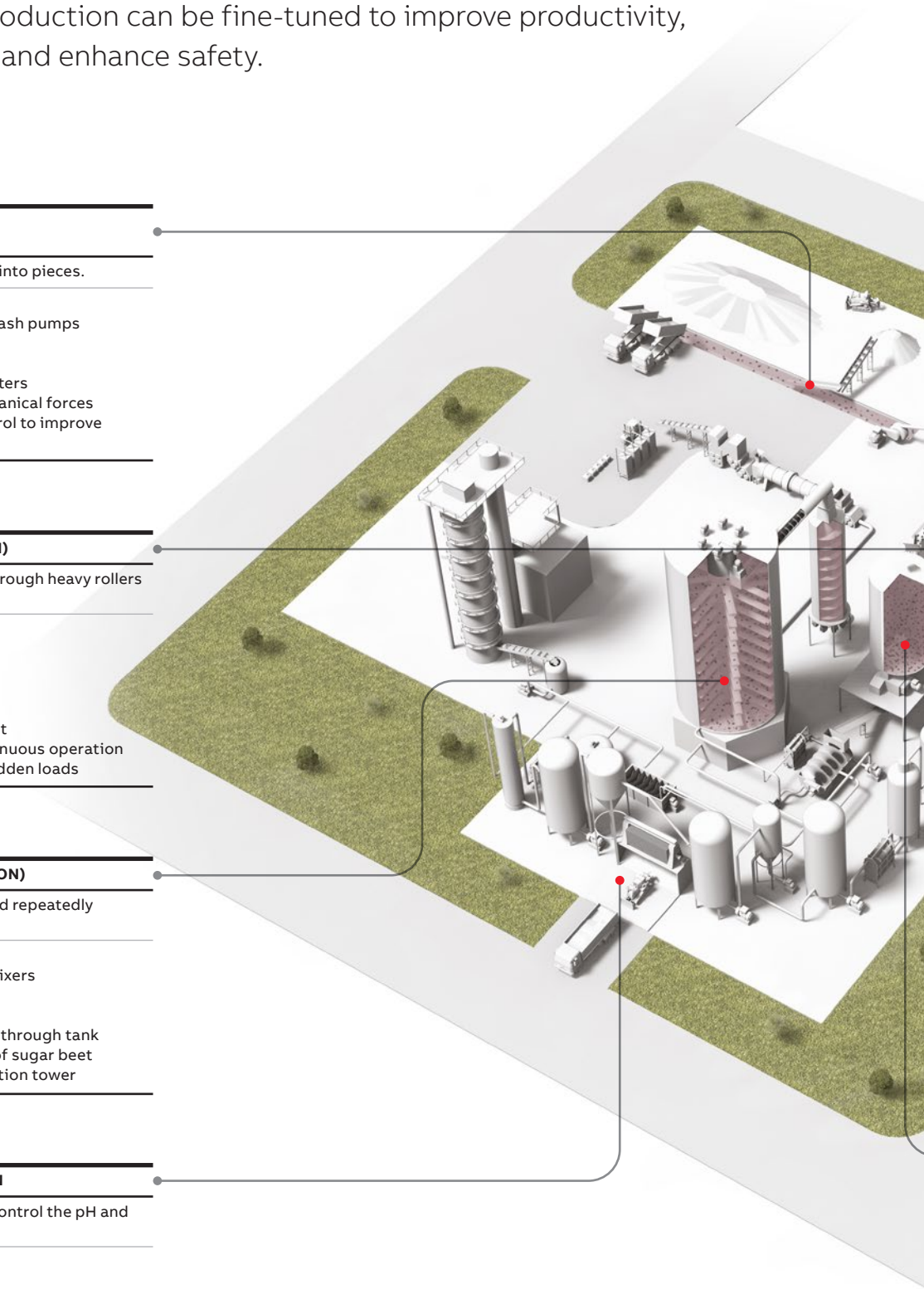
"We need the most reliable products and systems to avoid unplanned shutdowns."

Eliminate production risks...
- Plant shutdowns are costly, from lost production time, spoiled goods and reputational 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 operators know what happened and when.
- Motors 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 sugar production can be fine-tuned to improve productivity, increase sustainability and enhance safety.



1 PREPARATION AND SHREDDING (FOR BEET PRODUCTION)

Sugar beets are cut and shredded into pieces.

Applications:
- Rollers, shredders, conveyors, wash pumps

Requirements:
- Torque control of rollers and cutters
- Motors must tolerate high mechanical forces
- Accurate speed and torque control to improve process flow

2 MILLING (FOR CANE PRODUCTION)

Shredded pieces of cane are fed through heavy rollers to extract cane juice.

Applications:
- Pumps, rotation chamber

Requirements:
- Maximized juice extraction
- Dusty and explosive environment
- Accurate motor control for continuous operation
- Avoid tripping in the event of sudden loads

3 DIFFUSION (FOR BEET PRODUCTION)

Thin slices of sugar beet are passed repeatedly through hot water to extract juice.

Applications:
- Feedwater pumps, conveyors, mixers

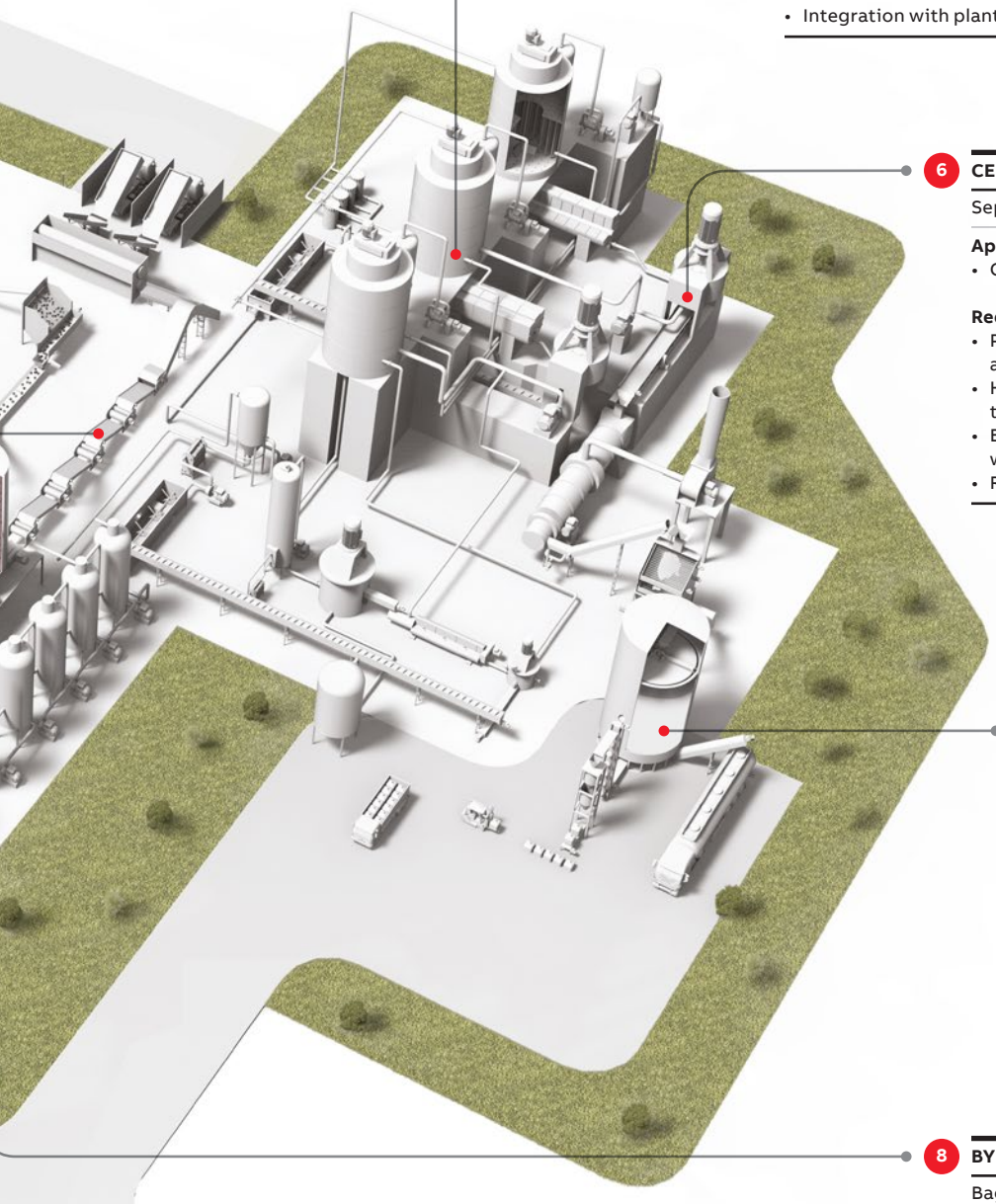
Requirements:
- Accurately control water stream through tank
- Accurately control mixer speed of sugar beet
- Control heavy load inside extraction tower

4 CLARIFICATION/CARBONATATION

Lime milk is added to the juice to control the pH and support removal of impurities.

Applications:
- Mixers, pumps

Requirements:
- Accurate monitoring and control of pH and liquid flow



5 EVAPORATION AND CRYSTALLIZATION

Juice is concentrated to increase thickness and then start crystallization in vacuum pans.

Applications:
- Water and juice pumps, evaporator, vacuum boiling pan

Requirements:
- Variable torque, high starting torque for high density liquids
- Closed loop control
- Soft start to minimize stresses in the pipes
- Integration with plant DCS via fieldbus modules

6 CENTRIFUGING

Separation of sugar crystals from molasses.

Applications:
- Centrifuges, pumps

Requirements:
- Precise speed control to handle fast acceleration and deceleration
- High starting torque and continuous constant torque
- Braking energy could be supplied back to the net with the regenerative drive
- Reliability

7 FILLING AND PACKAGING

Primary packaging.

Applications:
- Roll and belt conveyors

Requirements:
- Explosive area due to sugar dust
- High speed packaging lines
- Synchronization

8 BYPRODUCTS FOR ETHANOL PRODUCTION

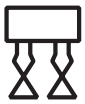
Bagasses are used for various products, for example to generate heat and electricity for a plant, while molasse can be used for ethanol production.

Applications:
- Conveyors, pumps, turbines

Requirements:
- Maintain constant required pressure in the boilers
- Hazardous area products

Unlock the potential in sugar-specific applications

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

	Challenge	Solution	Benefit
 **Crushers/ shredders**	• Steam turbines are traditionally used in milling but are inefficient	• High power motor and drive combination up to 2 MW	• 50 percent less energy used when motor-drive package is used compared to steam turbines
	• Plants are often located in areas with weak electrical network	• Slip ring motors are ideal for shredders and cutters that require high starting torque, low starting current and suitable for weak networks • High power motor and drive combination up to 5 MW	• Smooth system start-up solution with low current demand during start
	• Frequent variation in cane structure results in inefficient operation	• Superb torque response to pinionless mill for crushing process • In the event of locked mechanics the motor can be reversed	• Low energy consumption with high system efficiency, and high productivity with less cost of ownership • Less stress on machinery and network • Reduce system downtime
 **Centrifuges**	• Reduce energy consumption	• Regenerative braking • High power motor and drive combination up to 500 kW	• Significant energy savings as braking energy is returned to supply the network with extremely low harmonic emission
	• Requires high starting torque and resistance to strong mechanical forces • Requires high reliability	• Direct torque control enables extremely accurate control over entire speed range with robust process performance motors, which are designed to last in the most demanding applications	• Reduced downtime and more reliable production
 **Mixers**	• High starting torque, wide mixing speed range and precise control to ensure best quality end products	• Direct torque control provides accurate speed control and adapts to mixing load • Safe torque off	• Optimizes production speed and process uptime • Improves operational safety
 **Power production**	• Sugar production requires up to 10 MW of power. Despite this the plants are often located in remote areas with weak electrical network.	• Electrified power train with drives and motors system generates electricity that can be used for running all equipment in the production process	• Power production becomes more efficient, generating more than enough energy to run production applications. Surplus energy can be sold to the grid.
 **Pumps**	• High energy user	• Running motor at half speed requires only 1/8 of power	• Saves energy by up to 60 percent while also providing easy pump speed control, smooth process operation, and reducing number of potentially unreliable mechanical components
	• Changes in liquid pressure threaten mechanical lifetime of pump impellers	• Anti-cavitation software measures motor torque and speed to recognize cavitation and prevent it	• Avoids cavitation that would affect sugar juice properties, improving product quality and pump lifetime

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	Challenge	Solution	Benefit
Conveyors	• Precise, smooth and consistent control and synchronization of conveyor speeds	• The drives' built-in brake provides precise control of conveyor when stop command has been given, without external hardware • Safe torque off SIL 3 prevents unexpected movement of conveyor	• Each conveyor speed adjusted separately and synchronized to ensure material flow between process stages
	• Mechanically challenging and dusty environments	• Motors offer best in class sealing system • Continuous, intermittent or variable speed operation	• Less maintenance increases process uptime • Lower maintenance costs by reducing mechanical stress on gears and belts

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01 VSDs/VFDs provide precise, smooth and consistent control and synchronization of conveyor speeds.
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02 VSD/VFD control of milling machinery uses 50 percent less energy compared to steam turbines.
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03 Direct torque control provides accurate speed control of pumps.

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Features and functions benefiting sugar processing facilities

Drives, motors, PLCs and softstarters all play a vital part in keeping your production moving. Choosing the right feature for the right environment is essential in ensuring an optimized production.

Variable speed drives/ variable frequency drives

Energy efficiency
- Control operating costs by seeing energy costs in local currency, kWh and CO_2 emissions
- Regenerative drive offering for sugar centrifuges

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

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

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 sugar centrifuges using built-in safe torque off (safety level SIL 3)

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

Repeatability
- Accurately adjust pump speed to suit flow rates of products with varying viscosities

Softstarters

Soft starting and stopping
- Reliable soft starting and stopping reduces electrical and mechanical stressing

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

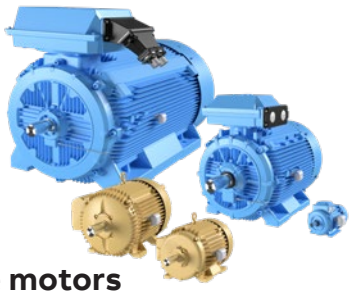
Flexible communication
- Operate in local and remote mode by accessing all major communication protocols and built-in Modbus RTU

Drive and motor packages

High efficiency motor and drive package
- Save energy across the sugar production process with IE5 efficiency motors and drive 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



Low voltage motors

Process performance motors
- Designed to last in the most demanding applications

Easy housekeeping
- Smooth painted motors for easier cleaning

Dust ignition protection
- Prevent dust explosions with certified dust ignition proof motors

Higher efficiency
- IE3, IE4 or IE5 efficiency class motors offering the lowest total cost of ownership

Service and monitoring
- ABB Ability™ Smart Sensor ready

High voltage motors

Slip ring motors
- Ideal solution for heavy load inertia applications, weak and unsteady network conditions
- High starting torque, high inertia low starting current
- High torque over the entire speed range
- Reliability and high efficiency with high power density

Built-in serviceability
- Minimized mechanical stress at starting
- Increased lifetime of driven equipment

Rib-cooled motors
- Energy efficiency tailor-made motor and drive packages
- IP66 and hazardous area designs for operating in dusty environments
- Proven insulation system for high availability
- High power density with state of the art cooling
- Always delivered with ABB Ability™ Smart Sensor

Built-in serviceability
- Cuts service downtime

Generators

Market's most powerful 4-pole generators
- For steam and gas turbines

Lower energy costs
- High efficiency use of sugar byproduct

Programmable logic controllers (PLCs)

- Comprehensive range of scalable PLCs, I/Os and robust HMI control panels delivering performance, quality and reliability
- One integrated engineering tool for programming, simulation and commissioning for PLCs, safety, drives, control panels and network
- Flexible choice of network and fieldbuses to integrate I/O's, drives, HMI, Scada and 3rd party devices fulfilling the needs of tomorrow
- IIoT gateway functionality onboard the PLCs and control panels offer secure connection to cloud
- Hot swap I/O for continued operation, during maintenance or replacement of an I/O-module
- High availability of AC500 HA prevents downtime and enhances system availability
- AC500-XC for eXtreme Condition (extended ambient temperature, corrosive gases and humidity)

From the factory floor to the cloud and beyond

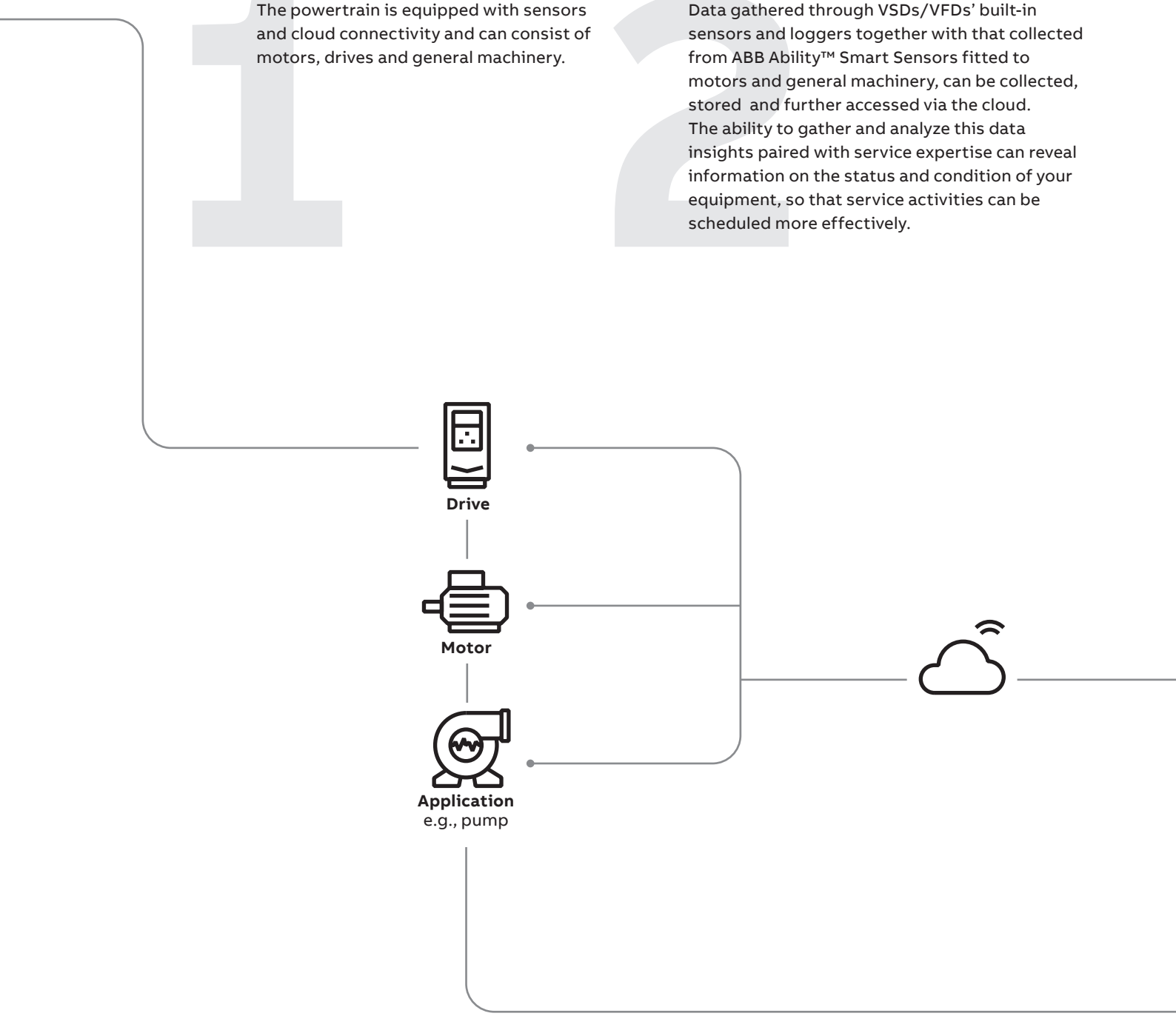
ABB Ability™ Condition Monitoring for powertrains optimizes the performance and efficiency of electric motor-driven rotating equipment. It enables better decision making by providing real-time access to data on all parameters for drives, motors and general machinery.

1 Intelligent powertrain

The powertrain is equipped with sensors and cloud connectivity and can consist of motors, drives and general machinery.

2 Turning data into valuable insights

Data gathered through VSDs/VFDs' built-in sensors and loggers together with that collected from ABB Ability™ Smart Sensors fitted to motors and general machinery, can be collected, stored and further accessed via the cloud. The ability to gather and analyze this data insights paired with service expertise can reveal information on the status and condition of your equipment, so that service activities can be scheduled more effectively.



Accessing data for analytics

Detailed information can be extracted into a company's portal and systems. Information on many aspects of the sugar 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.

Gain a digital advantage

While the data is always at your disposal, ABB service experts can work with you to provide help on how you analyze the data and define the steps for improving your operations.

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

- Appropriate response to production challenges, lowering operating costs and product waste.
- Greater insight into various aspects of the sugar 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

Our service expertise, your advantage

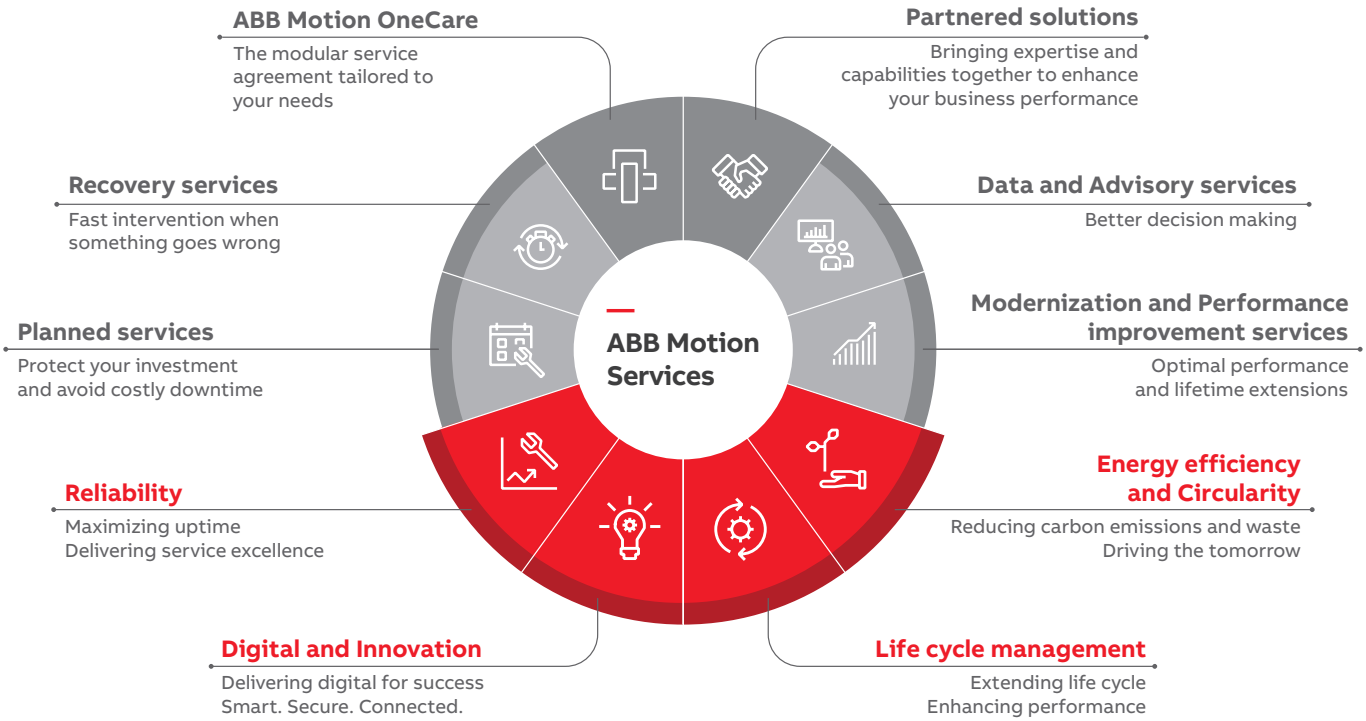
ABB Motion Services helps customers around the globe by maximizing uptime, extending product life cycle, and enhancing the performance and energy efficiency of electrical motion solutions. We enable innovation and success through digitalization by securely connecting and monitoring our customers' motors and drives, increasing operational uptime, and improving efficiency. We make the difference for our customers and partners every day by keeping their operations running profitably, safely and reliably.

With a service offering tailored to your needs, ABB Motion Services maximizes the uptime and extends the life cycle of your electrical motion solutions, while optimizing their performance and maximizing your energy efficiency gains throughout the entire lifetime of your applications. We help to keep your applications turning profitably, safely, and reliably.

Digitalization enables new smart and secured ways to prevent unexpected downtime while optimizing the operation and maintenance of your assets. We securely connect and monitor your motors, drives or your entire powertrain to our easy to use cloud service solutions. Connecting your applications also gives you access to our in-depth service domain expertise.

We quickly respond to your service needs. Together with our partners, local field service experts, and service workshop networks, we provide and install original spare parts to help resolve any issues and minimize the impact of unexpected disruptions.

Our tailored to your needs service offerings and digital solutions will enable you to unlock new possibilities. Not only are we your premier supplier of motion equipment, we are your trusted partner and advisor offering support throughout the entire life cycle of your assets. We ensure your operations run profitably, safely and reliably and continue to drive real world results, now and in the future. Our service teams work with you, delivering the expertise needed to keep your world turning while saving energy every day.



OUR EXPERTISE
YOUR ADVANTAGE

With you, wherever you are in the world

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

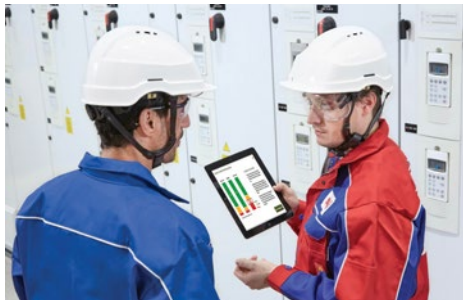
Global reach
ABB operates in over 100 countries with its own manufacturing, logistics and sales operations together with a wide network of local channel partners that can quickly respond to your needs. Stock availability is good, with short delivery times for many products backed by 24-hour spare parts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

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

We have several global R&D centers with thousands of technologists and considerable investments annually on innovation.

End-to-end product portfolio
Alongside its variable speed drives (VSDs)/ variable frequency drives (VFDs), motors and soft starters, 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 in drives to safety PLCs, you can readily implement safety requirements.



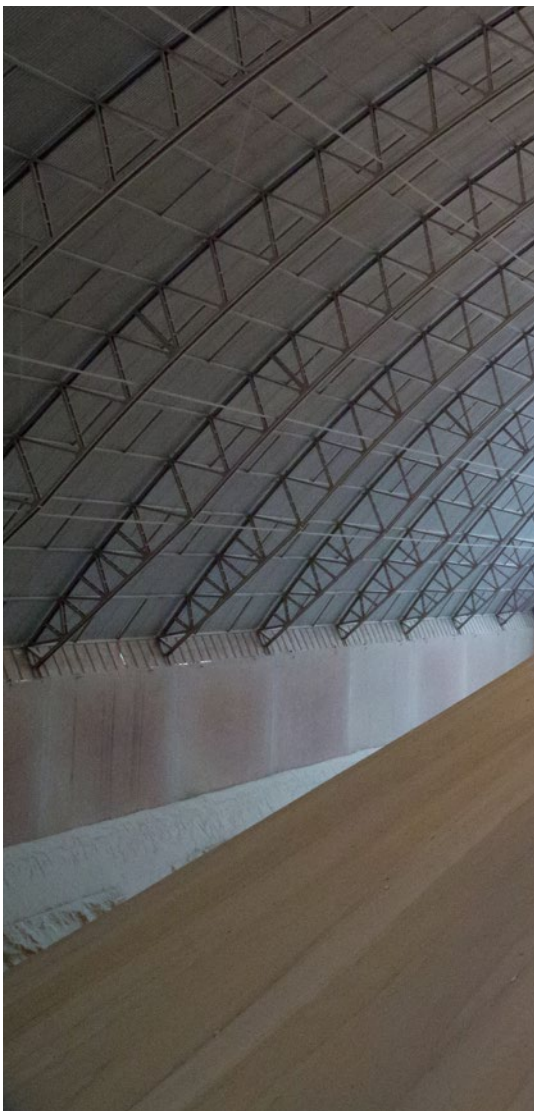



ABB's offering includes:

- 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.



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