



Wastewater treatment plant

Building resilient, safe and sustainable facilities

How to maximize treatment for a limited resource

Whether drainage, effluent, surface water or sewage, there is a need to stabilize process flow, reduce wear and tear and improve overall efficiencies: and all against a backdrop of increasing regulatory requirements which demand additional energy intensive processes.



Plant and personnel safety



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

Safety Manager

Tackle diverse safety demands...

By its very nature wastewater treatment carries risk to human health, with exposure to sewage treatment plants, sewers and sludge. Selecting the right products that minimize human exposure to the environment is critical.

...using best-in-class technology

Wheeled module drives can be rapidly manoeuvred into a panel, eliminating manual lifting which could lead to injury and reducing time exposed to potentially dirty environment.

Safe torque off, built into variable speed drives, brings motor-driven applications to a safe and efficient stop.

Arc flash-over is avoided by ensuring all panels undergo arc flash testing.

Cloud-based technology, using smart sensors, provides remote monitoring support for motors, pumps and bearings, avoiding hazards encountered in dirty and wet areas such as dosing.

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.



Energy efficiency



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

Energy Manager

Know where to look...

Pumps (14%) and aerators (53%) are the largest wastewater energy consumers. Because of catchment area characteristics pumps are often over-sized. Furthermore, overall electrical system efficiency (comprising transformers, drives, motors and load) can be up to 20 percent less efficient through poor design.

...and how to unlock the saving potential

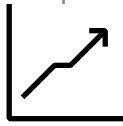
Energy optimization reduces total energy consumption and motor noise level when the drive operates below the nominal load. The total efficiency (motor and the drive) can be improved by 2% to 10%, depending on the load torque and speed.

Energy monitors works out energy savings in kWh, MWh, CO₂ emissions and money saved.

Variable speed cooling fans ensure drive modules have cooling fans for energy saving during partial loads.

ABB Ability™ Smart Sensors help to spot energy saving opportunities among the many smaller powered pumps and low voltage motors.

Synchronous reluctance motor (SynRM) can reduce losses by up to 40 percent, bringing optimal efficiency and reliability.



Productivity and resilience



“We must avoid supply interruptions and deliver high customer outcomes.”

Production Manager

Build in resilience...

Wastewater plants need to run without interruption and in the most efficient and environmentally conscious way. Ensuring the reliability of plant assets is the best way to reduce supply interruptions, lower environmental impact and keep your business efficient and effective.

... with flexible motor-driven solutions

Using an ultra-low harmonic (ULH) drive will not intensify harmonics in the power network. Instead it reduces the losses in the mains supply, improves the mains quality and reduces the risk of disturbance of other equipment connected to the mains. Using ULH drives in combination with generators will reduce the generator size required, compared to a similar standard drive

Blockage detection / Pump cleaning function keeps the pump's impeller clean by running a sequence of ramps between minimum and maximum pump speed. This feature avoids the high costs associated with removing the pumps to manually clean and the health and safety implications of the lifting operations.

Cyber security is paramount by ensuring that drives can be integrated in a system that meets IEC 62443 requirements.

Multiple inputs and outputs (I/Os) allow a variety of process information from the VSD to the motor control.

Fieldbus technology enables process equipment to integrate with any plant control systems, giving greater intelligence and better control of production.



Operation and maintenance



“Uptime is our number one priority.”

Maintenance Manager

Lower operational overheads...

Wastewater pumps suffer a higher wear rate because of grit, rags, debris and other solids. Managing these issues saves energy by avoiding pumping against partial blockages.

... by utilizing smart functionality

Temperature, load, under/overvoltage protection and warning features help anticipate breakdowns.

A real-time clock allows timed tracing of faults, so you know what happened and when.

Bearings, gearings and couplings feature best-in-class sealing system.

Soft starters gently ramp the power up to limit extreme pipework turbulence, thereby avoiding cavitation and failure of mechanical components.

ABB Ability™ Condition Monitoring services support remote pumping stations by delivering accurate, real-time information about drives and motors, ensuring equipment is available, reliable and maintainable

Finding improvements every step of the way

1 WET WELL

Collecting wastewater from domestic, commercial and industry

Applications:

- Sewage pumping stations (lift stations)
- Submersible, dry well or suspended pumps

Requirements:

- Reduce the risk of clogging/ragging with drive's built-in pump cleaning software
- Regulate inflow fluctuations by stabilizing pump on/off rates, optimizing cleaning cycle and avoiding water hammer or pressure shocks

2 GRIT REMOVAL

Process for removing sand, silt and grit from water

Applications:

- Screw conveyor

Requirements:

- Adjustable speed for variable grit loading
- Smooth start and stop, prevents heavy motor wear

3 SOLIDS DISPOSAL

The final destination of treated sewage sludge can be land, buried underground in a sanitary landfill or spread on agricultural land. Sludge may be incinerated whereby air pollution control must be considered.

Applications:

- Scrubbers and filters
- Pumps

Requirements:

See page 6 for more details on sludge treatment.

8 FINAL CLARIFIER

Flocs of biological growth are removed, making it the last chance to clean-up effluent prior to disinfection

Applications:

- RAS and WAS pumps
- Flocculator

Requirements:

- Improve clarifier efficiency by matching paddle or circular speed with chemical dosages
- Improve efficiency of clarifier by maintaining consistent sludge blanket
- Lower wear on scrapper mechanism

9 NITRIFICATION

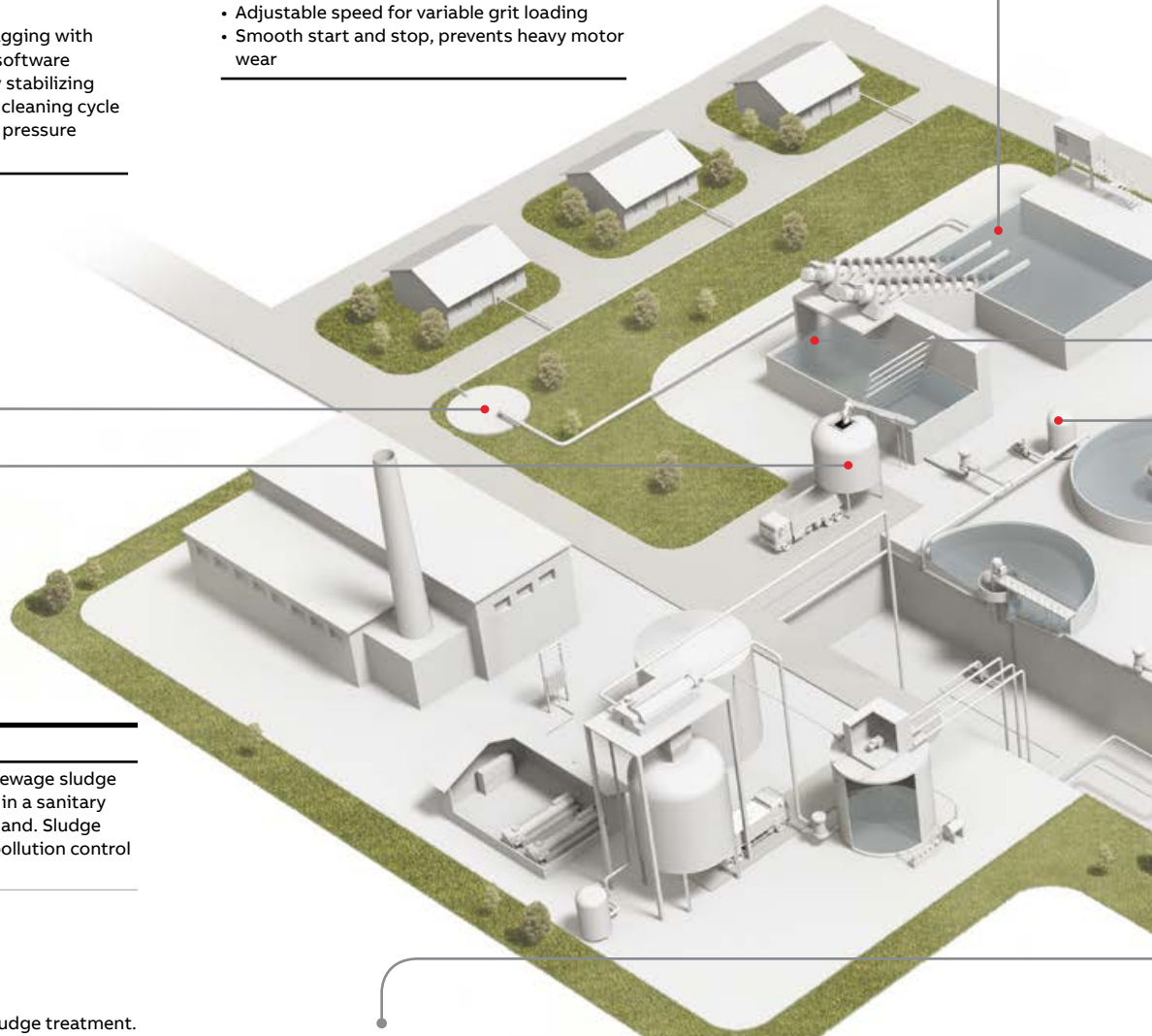
Aerobic biological wastewater treatment process converting ammonia to nitrate

Applications:

- Pumps
- Blower

Requirements:

- pH meter signal controls chemical feed pump
- meter controls aerator pump/blower speed
- Improved control of pH through drive-controlled pump to feed caustic
- Improved oxygen control through drive-controlled aerator



Every stage of wastewater treatment can be fine-tuned to improve resilience, lower energy consumption and enhance safety.

4 SCREENING

Removes large debris from wastewater

Applications:

- Bar screen

Requirements:

- Drive controls the rake in relation to solids deposited on screen by measuring water level ahead of screen
- Adjustable rake speed for varying amount of solids, lowers energy and decreases wear on mechanism
- Smooth start-and-stop decreases motor wear

5 CHEMICAL DOSING

Phosphate removal is carried out by dosing chemicals, normally iron, or occasionally aluminum, salts. Chemicals used are expensive, hence why wastewater treatment plants need to exercise strict control of the dosing regime.

Applications:

- Pumps

Requirements:

- Pump controlled by in-line chemical sensor, flow sensor or manual adjustment provides optimal chemical feed rates
- Controlled chemical dosing reduces chemical costs by minimizing overfeed and eliminating frequent on/off pump cycling of pump

6 SEDIMENTATION

Solids settle in sedimentation tank while grease floats to top

Applications:

- Primary sludge pumps
- Anaerobic digester

Requirements:

- Drive adjusts motor speed to prevent pumping of excess water
- Drive takes 4-20 mA signal from sludge density meter or pressure gauge allowing sludge withdrawal with minimal water content
- Continuous pumping to digester for even feed

7 AERATION

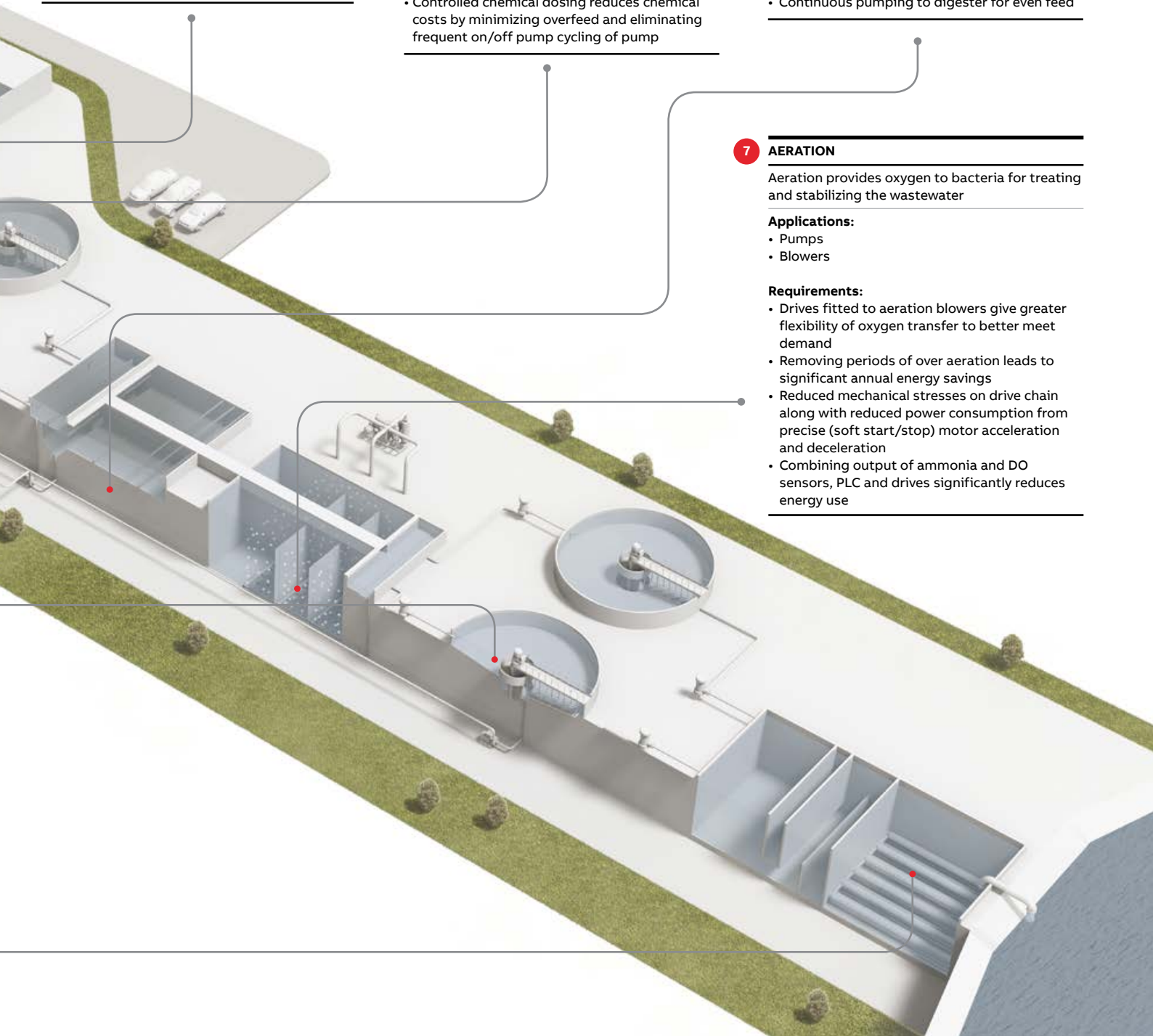
Aeration provides oxygen to bacteria for treating and stabilizing the wastewater

Applications:

- Pumps
- Blowers

Requirements:

- Drives fitted to aeration blowers give greater flexibility of oxygen transfer to better meet demand
- Removing periods of over aeration leads to significant annual energy savings
- Reduced mechanical stresses on drive chain along with reduced power consumption from precise (soft start/stop) motor acceleration and deceleration
- Combining output of ammonia and DO sensors, PLC and drives significantly reduces energy use



...improving the performance of sludge treatment

1 HOLDING TANK

An aerated tank for temporary storage of digested or raw sludge prior to further treatment

Applications:

- Mixers
- Aeration

Requirements:

- Aeration operates continuously at full capacity, thereby consuming excessive electricity
- With VSD control, dissolved oxygen sensor sends a 4-20 mA signal to control speed of aeration system, thereby providing more accurate aeration control and subsequent energy savings

2 DIGESTER FEED PUMP

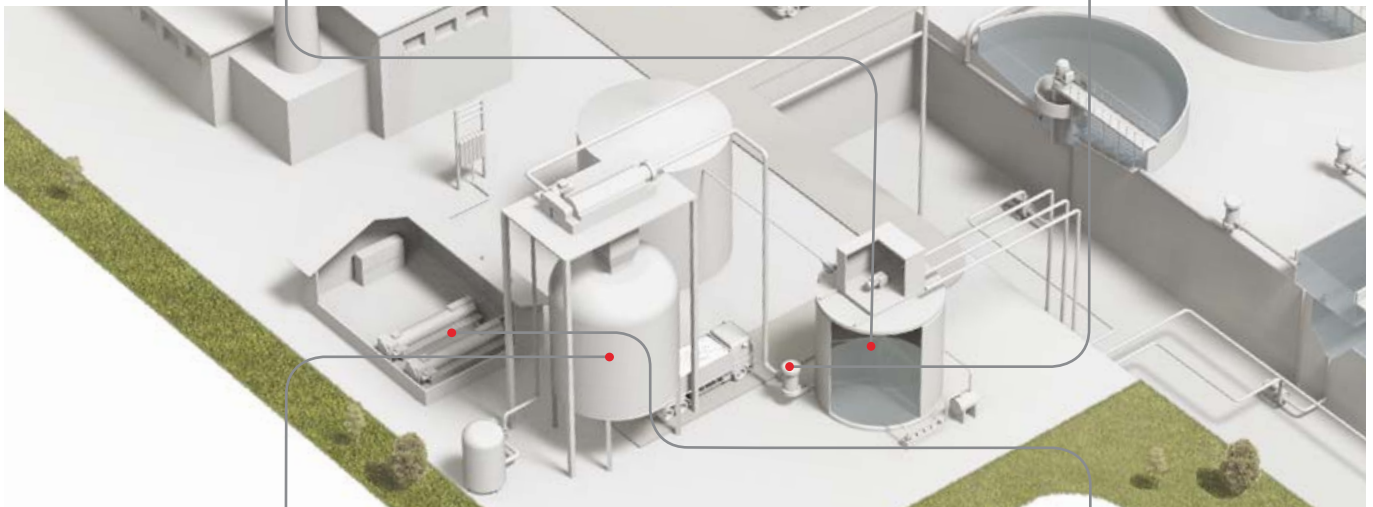
Optimal control of sludge pumping

Applications:

- Pumps

Requirements:

- Manual or automatic adjustment of pump speed based on available volume in sludge thickener or clarifier
- VSD on the holding tank sludge pump provides constant feed to digesters
- Include a sensor measuring pH tied to a alkalinity feed pump



3 ANAEROBIC DIGESTER

Anaerobic digestion is a collection of processes by which micro-organisms break down biodegradable material in the absence of oxygen

Applications:

- Anaerobic digester
- Pumps

Requirements:

- Optimal control of oxygen by using VSD to control compressor speed. Sensors measure oxygen levels in digesters
- Optimal control of sludge supernatant pumping
- Dissolved oxygen sensor sends 4-20 mA signal to control speed of aeration system similar to activated sludge system
- VSD accurately controls of aeration, pH by adjusting chemicals while sleep mode improves settling

4 DEWATERING CENTRIFUGE

Centrifuge speed manually adjusted based on visual or lab determination of de-watered sludge solids content

Applications:







- Centrifuges
- Pumps
- Conveyors
- Belt press

Requirements:

- Sludge pump speed manually adjusted based on visual observation of centrifuge throughput, thereby optimizing sludge feed rate
- Conveyor speed adjusted based on visual observation of output of centrifuge.
- With VSD, sludge feed pump control optimizes process
- Belt speed controlled by measuring solids content of filter cake
- Improved efficiency of water removal from solids resulting in drier filter cake, thereby reducing sludge disposal volume

Unlock the potential in wastewater 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"> Reduce energy use and carbon emissions 	<ul style="list-style-type: none"> Motor-drive: 80 percent speed saves half the energy, according to affinity laws 	<ul style="list-style-type: none"> Typically, between 20 to 60 percent energy savings compared to throttled control system
	<ul style="list-style-type: none"> Variations in process demands 	<ul style="list-style-type: none"> Drive: Built-in multipump control function ensures operation of pumps according to actual demand 	<ul style="list-style-type: none"> Fast response to changing demand Optimized energy consumption
	<ul style="list-style-type: none"> Complex and mechanically controlled water networks 	<ul style="list-style-type: none"> Motor-drive: Simplify the water network by eliminating need for control valves, by-pass lines and instrumentation, with speed control, built-in protections and functions 	<ul style="list-style-type: none"> Reduces wear on motors Reduces leaks caused by pressure surges Lower maintenance and life cycle costs
	<ul style="list-style-type: none"> Clogging pumps 	<ul style="list-style-type: none"> Drive and softstarter: Built-in pump clean functionality to derag 	<ul style="list-style-type: none"> Reduces maintenance cost Improved pump efficiency
	<ul style="list-style-type: none"> Precise and optimal speed control 	<ul style="list-style-type: none"> Motor-drive: Enables the Best Efficiency Point (BEP) pumping 	<ul style="list-style-type: none"> Optimal pump efficiency
	<ul style="list-style-type: none"> Direct-on-line starting creates pressure shocks that damages pumps, seals, pipe joints and valves 	<ul style="list-style-type: none"> Motor-drive and softstarter: Soft start of motor reduces stress on water and electrical network 	<ul style="list-style-type: none"> Reduced water hammer and other mechanical stress Avoids pipe burst Increased equipment lifetime
	<ul style="list-style-type: none"> High cost when operating remote sites 	<ul style="list-style-type: none"> Motor-drive: Intelligent drives and smart sensors enable remote control and monitoring of pumps 	<ul style="list-style-type: none"> Anticipate operating lifetime of pumps Reduce travel costs
	<ul style="list-style-type: none"> Due to abrasive content and cavitation the lifetime of the impeller is shortened 	<ul style="list-style-type: none"> Motor-drive: Several software features to detect and prevent cavitation 	<ul style="list-style-type: none"> Allows for planned maintenance Optimal energy efficiency
 Blowers/ compressors	<ul style="list-style-type: none"> Overrotation and foaming 	<ul style="list-style-type: none"> Motor-drive and softstarter: soft start and stop Drive: avoids mechanical resonance speeds 	<ul style="list-style-type: none"> Avoids wear and tear to mechanical parts, ensuring uptime. Savings on maintenance Reduced foam Active healthy bugs in the process
	<ul style="list-style-type: none"> High operation and energy costs 	<ul style="list-style-type: none"> Motor-drive: controls the dissolved oxygen 	<ul style="list-style-type: none"> Less mechanical wear Better blower efficiency
	<ul style="list-style-type: none"> Harmonics which can cause power quality issues 	<ul style="list-style-type: none"> Drive: Better blower efficiency Ensuring ultra-low harmonic level in supply network 	<ul style="list-style-type: none"> Harmonics can be reduced down below 3 percent Genuine unity power factor with no compensation needed.
	<ul style="list-style-type: none"> Right amount of oxygen 	<ul style="list-style-type: none"> Motor-drive: variable speed allows accurate oxygen level control 	<ul style="list-style-type: none"> Better generator stability Increased efficiency Easy link to process control system Exact amount of oxygen Reduced foaming
 Mixers	<ul style="list-style-type: none"> Better mixing quality 	<ul style="list-style-type: none"> Motors-drive: optimal speed control for the mixing operation 	<ul style="list-style-type: none"> Precise dosage and reduction of chemical waste
 Screw conveyor	<ul style="list-style-type: none"> Significant mechanical and stress on the motor during start-up 	<ul style="list-style-type: none"> Motors-drive and softstarter: torque and speed control 	<ul style="list-style-type: none"> Lower energy consumption and less wear and tear on the motor
 Bar screen	<ul style="list-style-type: none"> Avoiding jamming of the bar screen operation 	<ul style="list-style-type: none"> Motors-drive: built-in monitoring functionality in the drive to avoid overloading 	<ul style="list-style-type: none"> Less use of energy Less wear and tear of the motor
 Anaerobic digester	<ul style="list-style-type: none"> Ensuring optimal operation of pumps 	<ul style="list-style-type: none"> Motors-drive: functionality to move solids 	<ul style="list-style-type: none"> Avoidance of jamming and rake

Features and functions benefiting wastewater

Drives, soft starters, motors, gearing and mounted bearings all play a vital part in keeping water flowing. Choosing the right product feature for the right environment is essential in ensuring an optimized production.



Variable speed drives

Energy efficiency

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

Communication

- Use information such as water 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.

Ingress protection

- IP55 for wet and corrosive environments

Functional safety

- Safely stop pumps using built-in safe torque off (safety level SIL 3 / PL e).

Low harmonics

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



Softstarters

Prolong pipe and pump life

- Uses torque control to gently open and close valves and reduce water hammer during starts and stops

Protect pump system

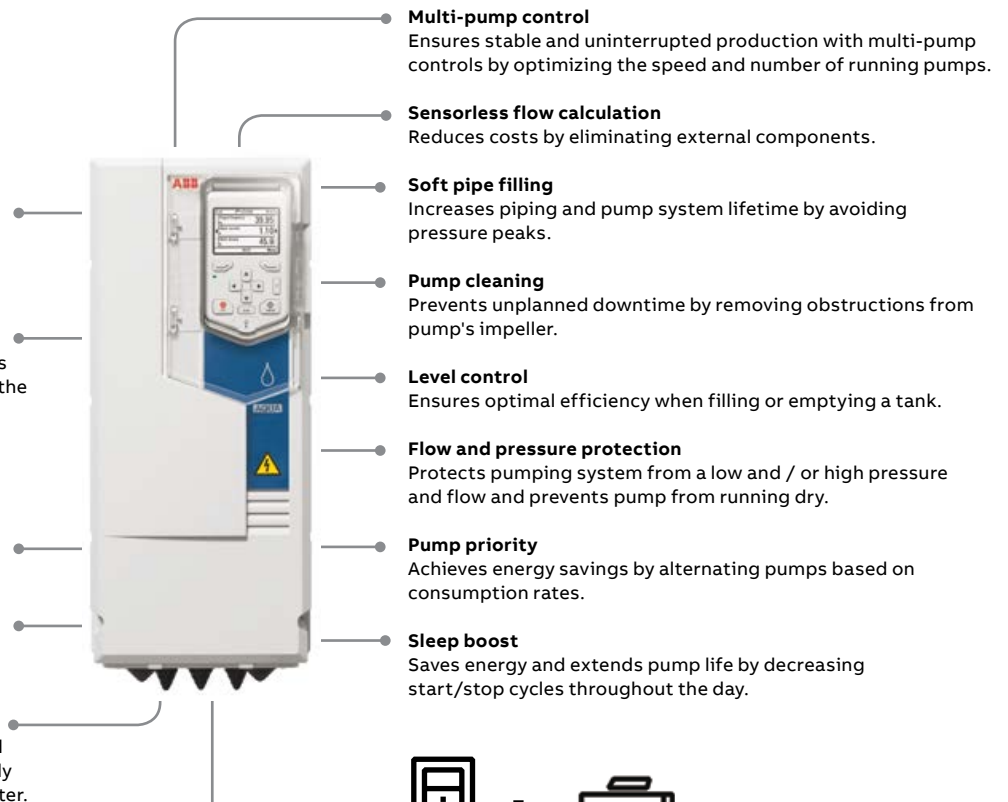
- Motor preheat ensures a dry and warm motor, prolonging pump life and increasing uptime
- Coated boards and IP66 / UL Type 4x externally mounted keypads for harsh conditions

Maintain clean pipes and pumps

- Pump cleaning feature reduces impeller build-up to prevent and clear pump clogging thereby eliminating downtime

Simplify use

- Application wizards simplify commissioning and control of pump



Drive and motor packages

Synchronous reluctance motor and drive (SynRM)

- Save energy across the water treatment process with IE4 synchronous reluctance motors and drive packages.

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



- Protection against external conditions
- Bearing locked at D-end to avoid axial play
- Bearings can be either greased for life or regreasable, fitted with grease relief systems
- Fan and motor fins optimized for low noise levels
- Oversized terminal box fitted as standard for ease of installation
- IP55 protection against ingress of water or solids. IP56 protection available as option
- Surface treatment (polyurethane or epoxy) in accordance with corrosion class C3M, with C4 and C5 as an option
- IE3, IE4 or IE5 efficiency levels to support emissions reduction
- Suitable for frequency converter operation



- General purpose modular induction motor's pre-engineered platform ensures short and on-time delivery
- High power density and efficiency reduces cost of ownership
- Provides same output power with a smaller frame size - less weight, a smaller installation footprint and lower costs
- Horizontal or vertical mounting
- Compact design, interface flexibility and low noise



- Dodge Vertical Gearmotor has smaller footprint and is lighter than traditional pump drive systems.
- Higher efficiency and power factor
- Optimal pump shaft speed



Bearings



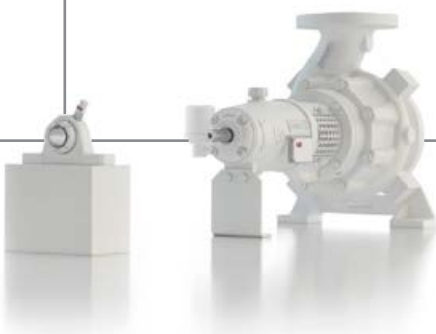
- Stainless steel or corrosion resistance bearings in stainless or polymer housing.
- Sealed and lubed for life bearings to minimize maintenance costs.
- Multiple housing styles, bore sizes and locking mechanisms.
- Variety of sealing options to protect the bearing from contamination.
- Roller bearings have patented easy-on, easy-off adapter mounting and removal system.



Gearing

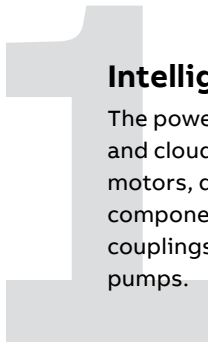


- Two-piece harsh duty seal.
- 13 step coating system.
- Provides 3x the corrosion resistance of epoxy paint.
- Premium sealing systems used to keep contaminants out and lubrication in.
- Accessories available for protection and safety in high humidity, excessive dusty and dirty, or even extremely dry environments.



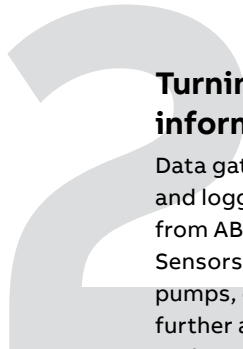
From the treatment plant to the cloud and beyond

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.



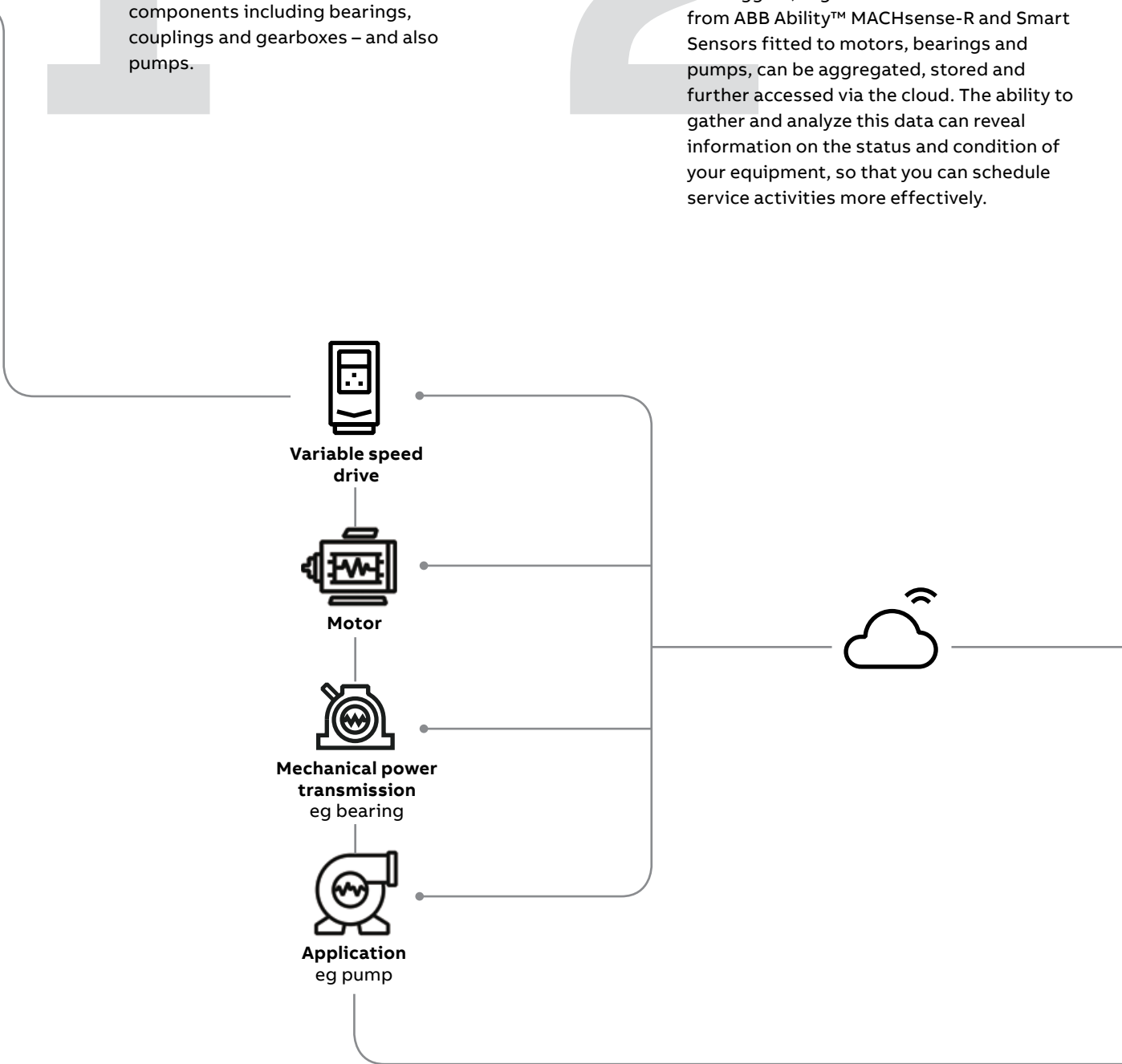
Intelligent powertrain

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



Turning data into valuable information

Data gathered from VSDs' inbuilt sensors and loggers, together with that collected from ABB Ability™ MACHsense-R and Smart Sensors fitted to motors, bearings and pumps, can be aggregated, 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

Through condition monitoring, detailed information on parameters like temperature and vibration can be extracted into a company's own portal and systems page. 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:

- Insight into production challenges, helping to control operating costs.
- Greater overview into various aspects of the water/wastewater process, thereby improving quality and reducing variations, errors and waste.
- Lower risk of production failure.
- Change the maintenance from reactive to predictive.

Maintenance Manager



Energy Manager



Production Manager



Safety Manager



Keep your treatment plant running

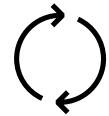
From spare parts and technical support to cloud-based remote monitoring solutions, ABB offers the most extensive service offering to fit your needs. The global ABB service units, complemented by external authorized value providers, form a service network on your doorstep. Maximize performance, uptime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

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

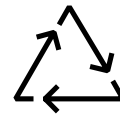
When you've decided on the right product, ABB and its global network of authorized value providers can help with installation and commissioning. They are also on hand to support you throughout the operations and maintenance phases of the products life cycle, providing preventive maintenance programs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

ABB will ensure you are aware of any upgrades or retrofit opportunities. By registering your drives and motors ABB's engineers will proactively contact you and advise on your most effective replacement option.

All of which helps maximize performance, uptime and efficiency throughout the lifetime of your powertrain.



Replacements
Fast and efficient replacement services to minimize production downtime.



End-of-life services
Responsible dismantling, recycling and reusing of products, according to local laws and industrial standards.



Maintenance
Systematic and organized maintenance and support over the life cycle of your assets.





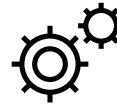
Advanced services
Gain the unique ABB Ability™ digital advantage through data collection and analytics with advanced services.



Extensions, upgrades & retrofits
Up-to-date systems and devices with the best possible performance level.



Engineering & consulting
Ways to identify and improve the reliability, usability, maintainability and safety of your production processes.



Spares & consumables
Authentic, high-quality ABB spares and consumables with quick delivery.



Technical support & repairs
Quick and accurate response during emergencies and efficient support during planned production breaks.



Installation & commissioning
Highly-trained and reliable installation and commissioning experts at your service.



Training
Comprehensive and professional training either at ABB premises or your own.



Agreements
Comprehensive bundling of relevant services into one contract to suit your needs.

Global service network 24/7

—
“I need operational excellence, rapid response, improved performance and life cycle management.”

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 authorized value providers 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 wastewater 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.





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For more information, please contact
your local ABB representative or visit

www.abb.com/drives

www.abb.com/drivespartners

www.abb.com/motors&generators

