



Desalination plants

Providing cost-effective solutions to water scarcity

Benefits of improving efficiency in desalination processes

Seawater is abundant, but converting it into potable water can be energy-intensive and costly. By using the latest technology, fresh drinking water can be brought efficiently to drier regions, creating a safe, secure and high quality water supply for future generations.



Plant and personnel safety



“We must maintain water quality and quantity requirements, while exceeding safety standards and complying with legislation.”

Safety manager

Tackling diverse safety demands...

- High pressure equipment, if not properly operated and maintained, has the potential to put plant operations and personnel at risk. Desalination utilizes hazardous chemicals which must be carefully managed, while contaminants in untreated source water can present health risks.

... 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.
- **Arc flash mitigation** protects staff by ensuring all panels undergo arc flash testing.
- **Tested, validated solutions** lower risk, save design time and secure implementation.
- **Remote monitoring** support for drives, motors, pumps and bearings using smart sensors and cloud-based technology.
- **Safe torque off** built into variable speed drives (VSDs), brings motor-driven applications to a safe, certified and efficient stop.
- **Globally certified drives and motors packages** protect plant and people and conform to worldwide regulations using tested and certified motors and VSDs.



Energy efficiency



“We must achieve the highest possible energy efficiency to ensure our process is profitable.”

Energy manager

Knowing where to look...

- Electrical energy is estimated to account for up to 50 percent of a desalination plant's running costs. Desalination processes are energy intensive, and so reducing usage wherever possible is key to increasing profitability and sustainability.

... helps to unlock the saving potential

- **Energy optimization** is a dynamic control within a VSD that adapts to changes in the motor load and reduces the energy needed to deliver the required torque. Adjusting the speed of the pump according to the need rather than throttling the flow typically saves 30 to 60% of energy, even up to 80% in some cases.
- **Energy monitor** is built within a VSD and works out energy savings in kWh, MWh, CO₂ emissions and money saved.
- **High efficiency VSD-motor package** lowers energy between 20 to 60 percent and reduces carbon dioxide emissions.
- **Up to IE5 efficiency level motors** are among the most efficient available, contributing to further energy reduction.
- **Synchronous reluctance motors (SynRMs)** reduce total losses by up to 40 percent, bringing optimal efficiency and reliability.
- **ABB Ability™ Smart Sensors** for either pumps and/or motors helps to spot energy saving opportunities.



Productivity and resilience



—
“We must achieve maximum productivity to address the challenge of water scarcity.”

Production Manager

Building in resilience...

- Desalination plants typically operate in areas where water supplies are already scarce. Maximizing productivity while reducing costs is crucial to meet increasing demand for clean water.

... with flexible motor-driven solutions

- Use of VSDs together with energy efficient motors reduces cost of running and risks of not running. End result is lower total cost of ownership.
- **Matched VSDs and motors packages** ensure correct dimensioning of the VSD and motor and guaranteed package efficiencies.
- **Harmonics** caused by poor power quality can be mitigated using an ultra-low harmonic (ULH) drive that reduces the losses in the mains supply, improves the mains quality and reduces the risk of disturbance to other equipment connected to the mains. Using ULH drives with generators will reduce the generator size required, compared to a similar standard VSD.
- **Cyber security** is paramount by ensuring that VSDs can be integrated into a system that meets IEC 62443 requirements.
- **Fieldbus communications** offers greater flexibility than point-to-point hardwiring, thereby improving the volume and speed of information sharing between the VSD and other connected devices.
- **Communications loss backup mode** enables the VSD to automatically switch to internal PID control, allowing for resilient operation of the system while maintaining accurate control of the process, rather than tripping the drive or even using fixed speed back-up modes, if available.



Operation and maintenance



—
“100 percent uptime is crucial for reliable supply of such a precious resource.”

Maintenance Manager

Lowering operational overheads...

- Reverse osmosis membranes are sensitive to pollutants in the intake stream. As well as effective pre-treatment, equipment must be robust, with effective visibility of maintenance requirements to ensure minimal downtime.

... by using smart functionality

- **Life cycle assessment** provides a clear understanding of the VSD/motor installed base, detailing how assets will evolve over the next few years.
- **Preventive maintenance plan** provides regular inspections and component replacements according to a product-specific maintenance schedule.
- **Genuine parts** are available locally and can be ordered online 24 hours a day, helping to maintain 100% uptime.
- **PC tools** provide optimal commissioning and monitoring software that stores VSD parameter sets and operation and maintenance documentation. Allows customization of the VSD, reducing the need for a PLC to control small systems.
- **Service agreements** are available that tackle proactive and reactive maintenance needs.
- **Digital services** like remote condition monitoring, automatically and continuously collects performance data from VSDs and motors and provides alerts and information to enable issues to be predicted before failure can occur.

Finding improvements every step of the way

Every stage of reverse osmosis (RO) desalination can be fine-tuned to vastly reduce operating costs.

1 SEAWATER INTAKE

Raw water is delivered by intake pump and sent into the desalination plant.

Applications:

- Centrifugal and submersible pumps.

Requirements:

- Pumps are required to raise seawater to level of facility.
- Raw seawater may have considerable variance in salinity, temperature, turbidity and organic matter depending on seasonal and geographic conditions.

2 PRE-TREATMENT

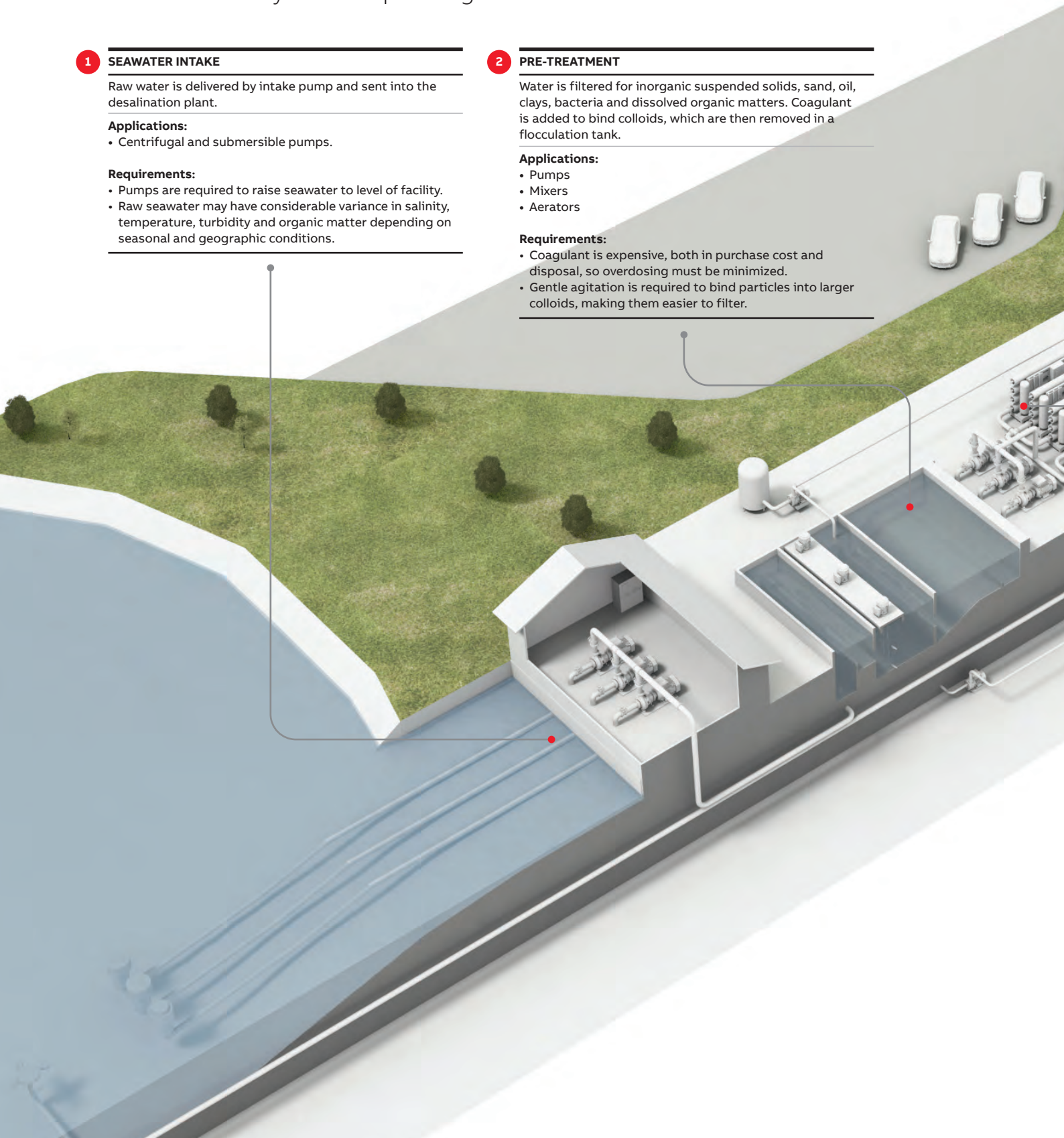
Water is filtered for inorganic suspended solids, sand, oil, clays, bacteria and dissolved organic matters. Coagulant is added to bind colloids, which are then removed in a flocculation tank.

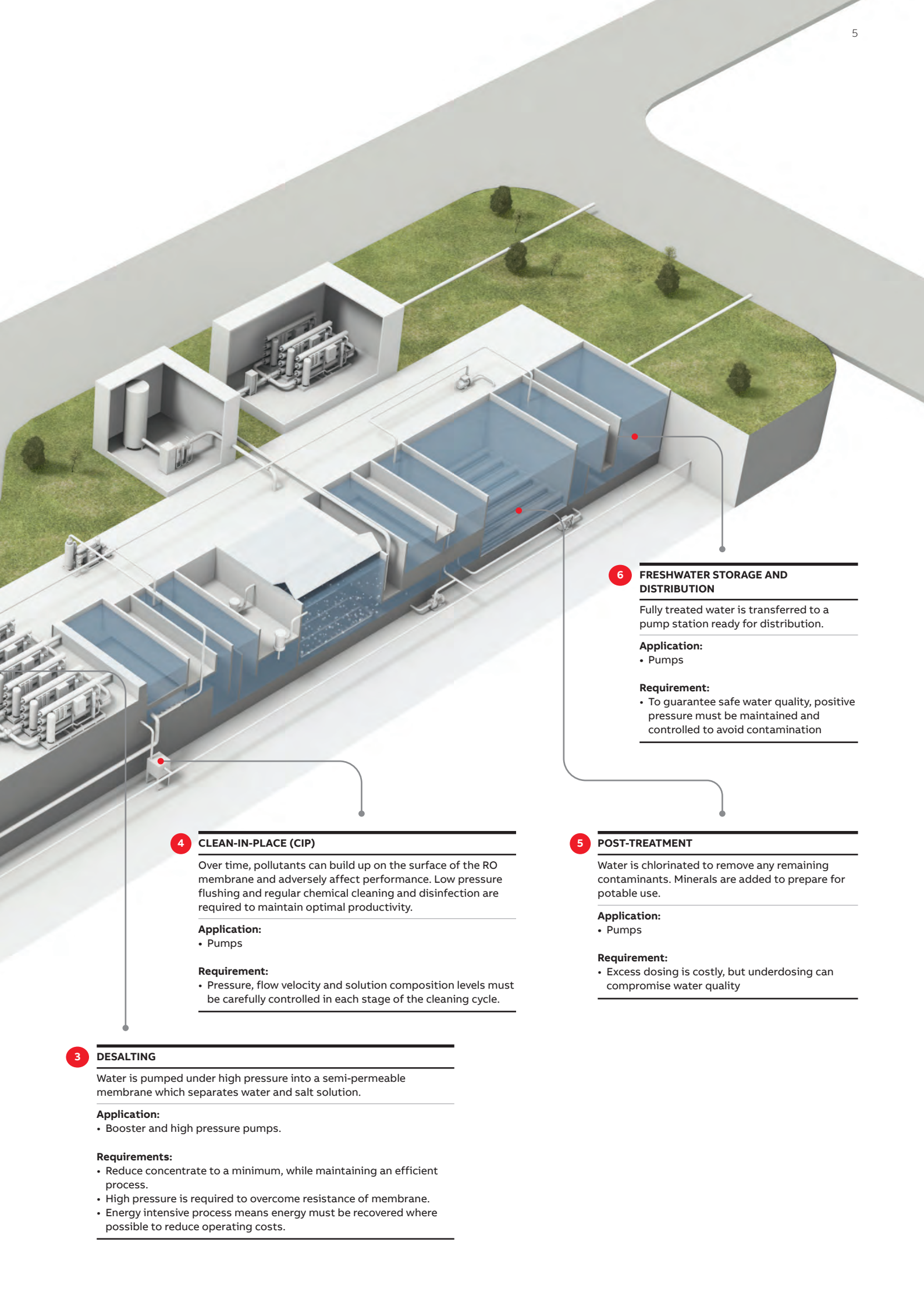
Applications:

- Pumps
- Mixers
- Aerators

Requirements:

- Coagulant is expensive, both in purchase cost and disposal, so overdosing must be minimized.
- Gentle agitation is required to bind particles into larger colloids, making them easier to filter.





3 DESALTING

Water is pumped under high pressure into a semi-permeable membrane which separates water and salt solution.

Application:

- Booster and high pressure pumps.

Requirements:

- Reduce concentrate to a minimum, while maintaining an efficient process.
- High pressure is required to overcome resistance of membrane.
- Energy intensive process means energy must be recovered where possible to reduce operating costs.

4 CLEAN-IN-PLACE (CIP)

Over time, pollutants can build up on the surface of the RO membrane and adversely affect performance. Low pressure flushing and regular chemical cleaning and disinfection are required to maintain optimal productivity.

Application:

- Pumps

Requirement:

- Pressure, flow velocity and solution composition levels must be carefully controlled in each stage of the cleaning cycle.

6 FRESHWATER STORAGE AND DISTRIBUTION

Fully treated water is transferred to a pump station ready for distribution.

Application:

- Pumps

Requirement:

- To guarantee safe water quality, positive pressure must be maintained and controlled to avoid contamination

5 POST-TREATMENT

Water is chlorinated to remove any remaining contaminants. Minerals are added to prepare for potable use.

Application:

- Pumps

Requirement:

- Excess dosing is costly, but underdosing can compromise water quality

Reverse osmosis process

1 SEAWATER STREAM

Pre treated seawater is pumped at high pressure through reverse osmosis membranes.

Application:

- Centrifugal or positive displacement pumps.

Requirements

- High pressure is required. When combining with high volume of water, high energy costs arises.

2 BRINE HANDLING

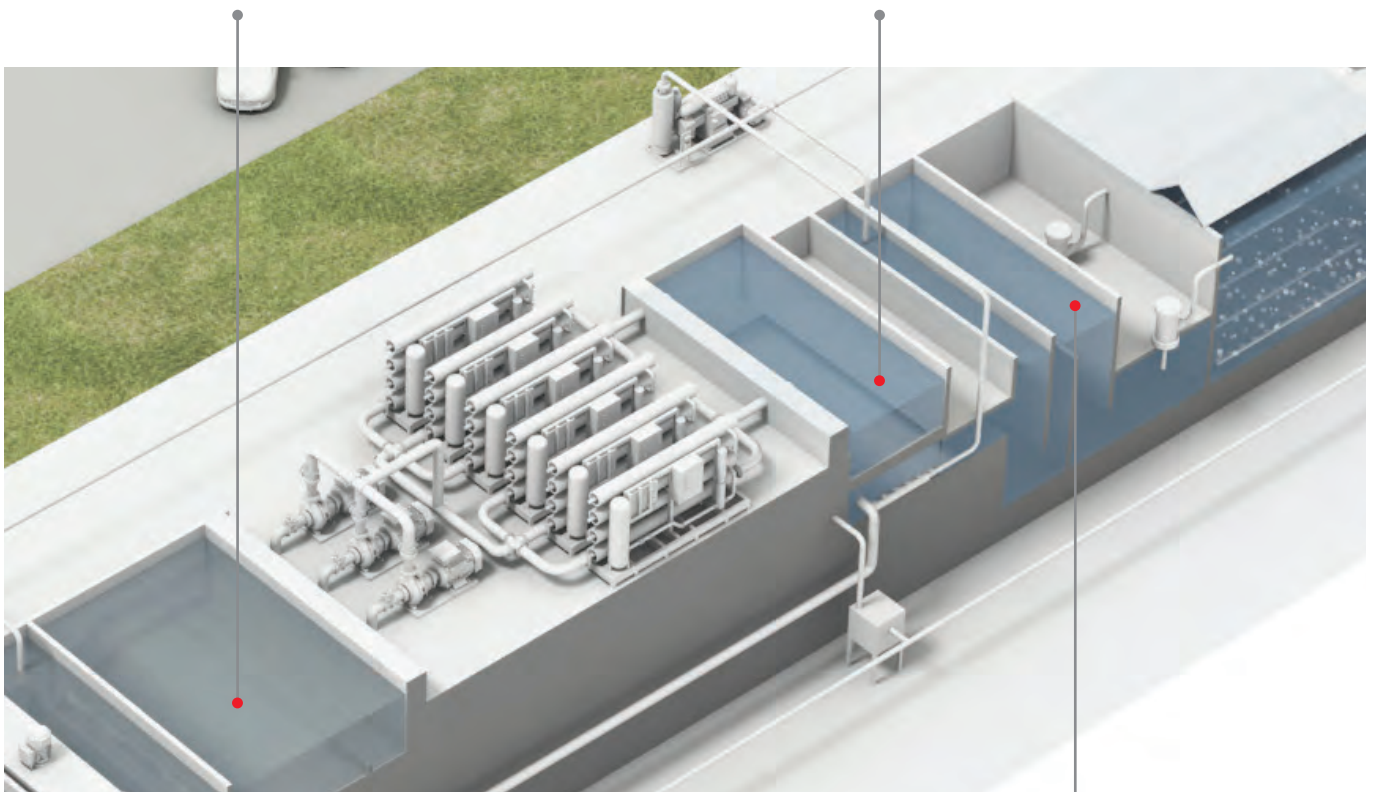
Salt and water is returned back to the sea after passing through the reverse osmosis process.

Applications:

- Centrifugal or positive displacement pumps

Requirements:

- Special pumps for brine handling require typically low power, when compared to main pumps.



3 ENERGY RECOVERY

Energy Recovery Device (ERD) captures hydraulic energy from the high pressure reject stream and transfers the energy back into the system.

Applications:

- Turbine

Requirements:

- A generator is required to convert the hydraulic energy back to the power supply.

Motor-driven applications help produce water efficiently

With electricity accounting for some 50 percent of the operational costs of a desalination plant, energy efficiency and life cycle cost optimization are critical challenges for utilities and developers. ABB variable speed drives and motors lie at the heart of maximizing plant efficiency and productivity levels.

In the last few decades, production costs in desalination plants have fallen fourfold thanks to the emergence of highly efficient electrical equipment. ABB variable speed drives (VSDs) and motors, for instance, are used to control the flow rate of pumps with a typical 30 to 60 percent savings in energy consumption. While improving the efficiency of the entire water cycle, VSDs and high efficiency motors reduce the mechanical and electrical stress on pumps and aeration equipment, significantly lowering maintenance costs.

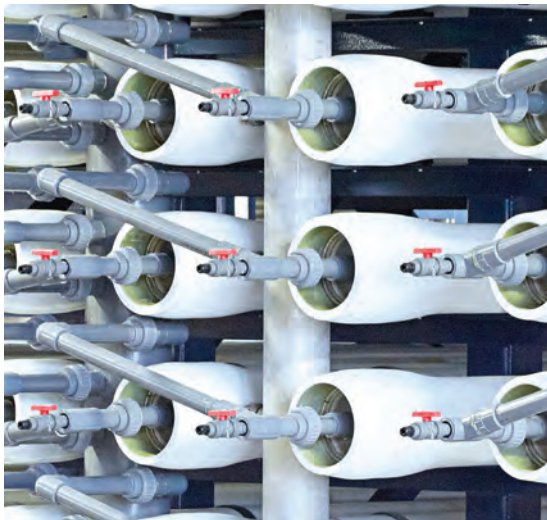
Algeria: one of the large desalination plants (500,000 m³/day)

The solution includes 33 medium voltage VSDs that reduce plant electrical losses from the benchmark target of 5 percent to only 3 percent. In addition, the VSDs speed up the long plant start-up process after maintenance or power-failure related shutdowns, reducing the length of plant downtime compared with the more traditional method of mechanical control.

Australia: Gold Coast 125.000 m³/day RO desalination plant

ABB supplied motors and VSDs and was selected for best compliance with the lowest harmonic distortion, fastest switching response, smallest footprint and highest motor efficiencies, lowest noise levels and fastest delivery.

01



02



Features and functions benefiting desalination plants

VSDs, soft starters, motors, gearing and mounted bearings all play a vital part in keeping desalination processes 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

- Control the process driven with drives by adjusting the speed and process setpoints. Monitor the system performance, flow rates, energy consumption, specific energy and other figures through fieldbus communication connecting the VSD to plant control systems.

Ingress protection

- Drive variants that offer up to IP55 for wet and corrosive environments.



Functional safety

- Safely stop pumps using built-in safe torque off (certified safety level SIL3 / PL e).

Low harmonics

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

Flow and pressure protection

- Protection solutions reducing stress on the RO process



Softstarters

Prolong pipe and pump life

- Use 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.





Motors

Designed for harsh environments

- Protection against external conditions.
- IP55-IP56 protection against wet and corrosive environments.
- Wide range of surface treatment and corrosion protection solutions available.

Energy efficiency

- High efficiency to support emissions reduction - up to IE5 efficiency levels for low voltage motors.
- Suitable for frequency converter operation.
- High power density and efficiency reduces cost of ownership.

High reliability and compact design

- Robust design.
- Bearing locked at D-end to avoid axial play.
- Bearings can be regreasable, fitted with grease relief systems.
- Optimal pump shaft speed.
- Compact design - same output power with a smaller frame size - less weight, a smaller installation footprint and lower costs.



Easy installation

- Oversized terminal box as standard for ease of installation.
- Flexible cabling solutions.
- Horizontal or vertical mounting.

Vertical Gearmotor

- Smaller footprint and lighter than traditional pump drive systems.
- Higher efficiency and power factor.
- Optimal pump shaft speed.



Drive and motor packages

Synchronous reluctance motor and drive (SynRM)

- Save energy across the water treatment process with IE5 synchronous reluctance low voltage motors.
- Better partial load efficiency and more precise process control.

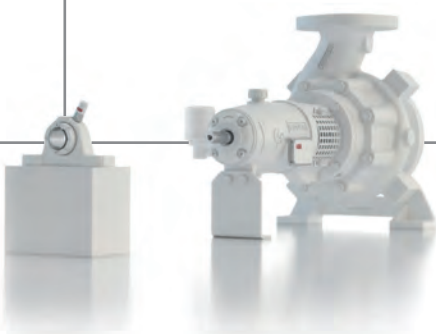
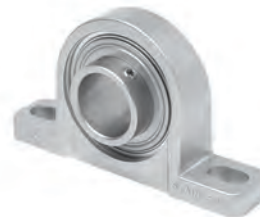
Globally certified drives and motors packages

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



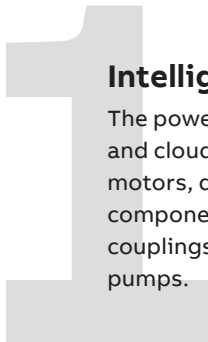
Gearings and bearings

- 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.
- 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.



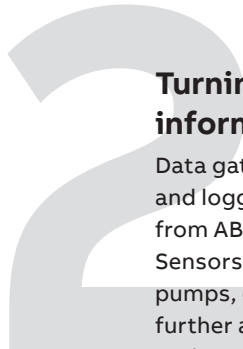
From the plant to the cloud and beyond

ABB Ability™ Condition Monitoring service for powertrains optimizes the performance and efficiency of rotating equipment. It enables full transparency on key parameters for drives, motors, mounted bearings and pumps, and can also be used in applications such as compressors, conveyors, mixers and extruder main shafts.



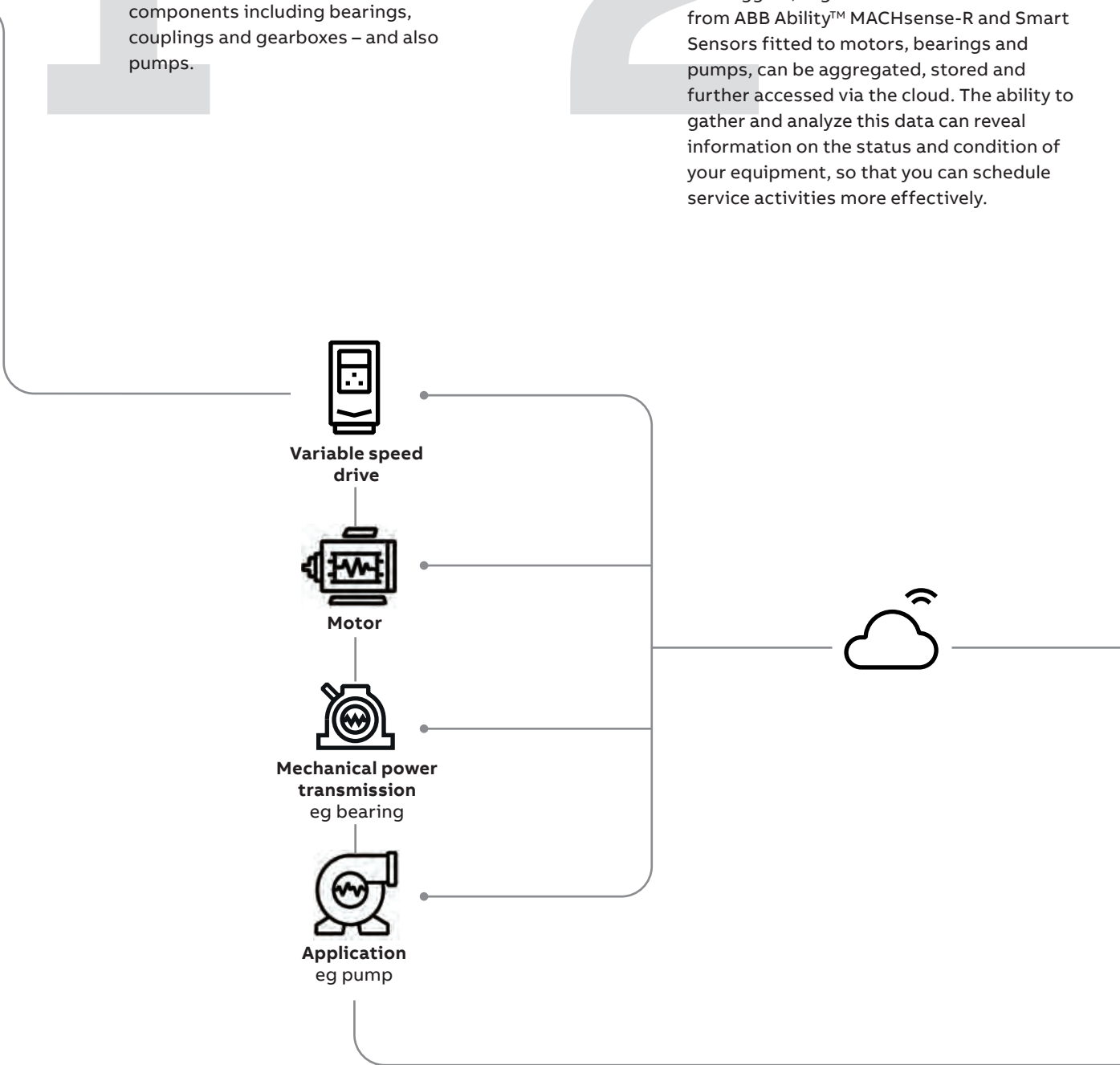
Intelligent powertrain

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' built-in 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

By accessing a monitoring portal it is possible to view key operational parameters of individual assets as one unified system. Detailed dashboards give full transparency so actions can be taken 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 has the right information at the right time brings:

- Appropriate response to production challenges, minimizing operating costs and water wastage.
- Greater insight into various aspects of your process, thereby improving quality and reducing variations, errors and waste.
- Lower risk of production downtime while maintenance is changed from reactive to predictive.

Maintenance Manager



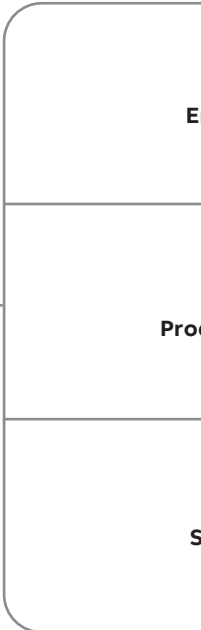
Energy Manager



Production Manager



Safety Manager



Keeping your desalination plants 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 ABB 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 VSD, motor or bearing, ABB's experts are on hand to offer technical advice from dimensioning through to potential energy saving.

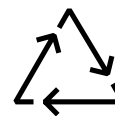
When you've decided on the right product, ABB and its global network of Value Providers can help with installation and commissioning. They are also on hand to support you throughout the operations and maintenance phases of the product's life cycle, providing preventive maintenance programs tailored to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

ABB will ensure you are aware of any upgrades or retrofit opportunities. By registering your VSDs 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

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“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

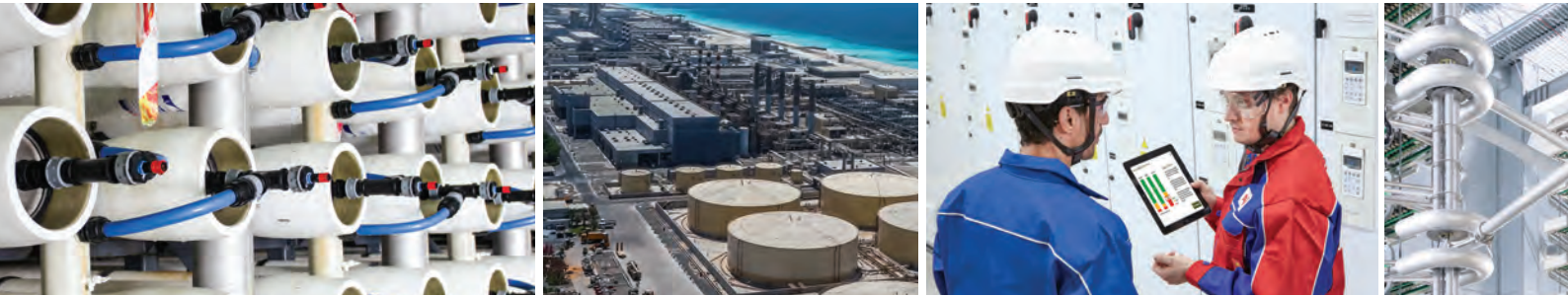
ABB operates in over 100 countries with its own manufacturing, logistics and sales operations together with a wide network of local Value Providers that can quickly respond to your needs. Stock availability is good, with short delivery times for many products backed by 24-hour spare parts delivery.

In addition, we work closely with the desalination industry 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, softstarters, 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, and 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 and flexibility.
- 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

