

HVAC and water supply in healthcare facilities

Taking patient wellbeing
and building performance
to new heights

Improving healthcare facility performance

Modern healthcare facilities require smart HVAC systems that create healthy, comfortable and safe environments for patients and medical workers, while minimizing energy consumption and sustainability impacts.



Hospital owner



“To make a hospital function as intended, it is critical to invest wisely in hospital systems, while

also choosing solutions that optimize capital and operating costs.”

Modern hospitals demand a comfortable, safe and healthy environment...

- A comfortable, safe and healthy environment is vital for personnel productivity and patient recovery.
- Smart hospitals react rapidly to ever-changing conditions, while running their systems in an optimal manner.
- Digitalization gives a higher level of environment control in confined areas like the infection department or operating theatre.

... at optimized costs...

- High capital costs can deter potential investors, while high operating costs make the healthcare facility less profitable for the owner.
- Modern HVAC control solutions for hospitals, particularly variable speed drives (VSDs), can significantly cut both capital and operating costs.

... ensured by innovative control solutions

- Digitally enabled VSDs for HVAC allow more optimal control of the hospital environment for better comfort and safety, while reducing energy consumption.
- Return on investment can be improved with ultra-low harmonic (ULH) HVAC drives, since they provide both power quality and network stability, while reducing the size of transformers and backup generators.



Consultant / healthcare inspector



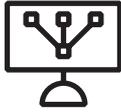
“We design and verify systems that ensure a proper hospital environment 24/7.”

Meet healthcare requirements for HVAC...

- Under normal conditions, hospital HVAC must precisely maintain comfort and asepsis.
- Zone pressure control is critical to contain infections, with no air leakage allowed.
- Contamination- and bacteria-free air is ensured by fine filters (ULPA and HEPA), cleaned regularly.
- In case of fire, hospital systems must respond accordingly – ensure smoke-free exit routes, help in fire suppression, and provide access for firefighters.
- Power quality affects the reliability of a hospital's electrical network and connected devices.
- Sustainability goals should be achieved in spite of HVAC initially high energy use.

... by utilizing best-in-class technologies

- VSDs accurately control HVAC to match hospital needs.
- Drives alert about dirty filters/ air leakage in ducting.
- VSD-based override mode helps reduce smoke spread while ensuring safe evacuation in case of fire.
- Smoke extraction fans with drive control are certified for Smoke and Heat Control Systems standard EN12101-3.
- VSD compliance with EMC standards eliminates radio-frequency interference with medical equipment.
- ULH drives prevent disturbances in the network, also ensuring smooth backup generator operation.
- Drive compliance with power-loss ride-through standards secures HVAC operation during short power outages.
- ABB's drives undergo factory acceptance testing.
- SynRM motors offer increased reliability thanks to lower winding and bearing temperatures.
- Use of drives and efficient IE5 motor technologies brings substantial energy savings.



System integrator



“Component compatibility with common standards and interfaces ensures smooth integration into

a hospital management system.”

From easy connection and integration...

- Connecting and integrating components into hospital HVAC systems should be straightforward.
- Digital capabilities of system components are a must for running smart hospital management systems.

... to high interoperability ...

- Efficient hospital building management requires detailed access to operational data and fault logs.
- Smart hospitals demand transparency, that can be ensured by digitalizing and interlinking all systems and their components.

... using world leading protocols and standards

- Support of all major communication protocols, such as BACnet and Modbus, easily makes VSD a part of a hospital building management system to realize central control.
- Drive-based Bluetooth and 5G connectivity enables remote commissioning, monitoring, and troubleshooting.



Facility manager



“Maximum uptime of my hospital’s technical systems is of the utmost importance.”

Eliminate malfunctioning of hospital HVAC...

- Failure of HVAC can make the hospital environment challenging for continued occupancy.
- Proper functioning of hospital systems directly impacts patients’ and personnel health.
- Comprehensive service offering for HVAC guarantees its 24/7 operation and rapid response in case of failure.

... via advanced functionality

- Protection features within VSDs help prevent failures in hospital HVAC system, e.g. load curve monitoring warns about upcoming fan or pump bearing damage.
- Drive-based real-time recording of trips and faults.
- VSD’ safe-torque-off allows to safely conduct maintenance on mechanical parts of HVAC equipment, without shutting down the whole system.
- Drives can be installed both inside and outside the air handler, for the best serviceability.
- VSD wireless connectivity allows remote access to hard-to-reach equipment, for effortless troubleshooting.
- Fast remote support possible through ABB Ability™ Mobile Connect service in Drivetune app.

“How can I optimize operating costs?”

Lower expenses...

- Costs can easily be reduced without compromising the healthy and safe environment.

...through cutting-edge solutions and services

- 20 to 60 percent of HVAC energy is saved with VSDs.
- Advanced IE5 SynRM motor has 40 percent less energy losses compared to IE3 induction motors.
- VSD use in HVAC eliminates both mechanical and electrical shocks, providing smooth control for pumps, fans and compressors, thus extending their lifetime.
- Remote ABB Ability™ Condition Monitoring enables targeted maintenance when needed, eliminating the need for regular inspections.
- Energy Efficiency appraisals on-site by ABB experts help identify further possibilities for improvement.

Demands on hospital HVAC systems

A hospital's HVAC system must ensure a comfortable and healthy environment for its personnel and patients, while also supporting fire suppression and evacuation systems for ultimate safety.



1 AIRBORNE INFECTION ROOMS

Designed for isolation of patients infected with organisms spreading by airborne droplets less than 5 μm .

Applications:

- Supply fans and exhaust fans, filter units, water supply

Requirements:

- High air exchange rate to prevent the spread of diseases
- Negative pressure to prevent the spread of contagions into adjacent areas
- Heavy filtering of the outgoing air might be needed to limit the spread of infection outside the area
- No air recirculation unless heavily filtered

2 INPATIENT ROOMS

Patients' comfort, safety and conditions for speedy recovery is priority.

Applications:

- Supply and return fans, filter units, water supply

Requirements:

- Required air exchange rate, pressure, temperature and humidity
- Filtering of the inflowing air to prevent the spread of pathogens in the environment
- Noise attenuation
- No air recirculation unless undergoing filtering

3 PROTECTIVE ENVIRONMENT ROOMS

Designed to protect the high-risk immunocompromised patients from airborne pathogens.

Applications:

- Supply fans and exhaust fans, filter units, water supply

Requirements:

- High air exchange rate to prevent the spread of diseases
- Positive pressure to prevent air from adjacent areas entering the space
- Heavy filtering of the inflowing air to prevent the spread of pathogens in the environment

4 CLINICAL LABORATORY

The environment in clinical laboratories is often a cleanroom environment, allowing between 293 and 29 300 particles of the size below 0.005 mm per cubic meter of the environment (ISO).

Applications:

- Supply and exhaust fans, filter units, water supply

Requirements:

- Highly variable air exchange rate with increased flow when e.g. chemicals are detected and decreased flow when contaminants are not detected in the environment
- Positive or negative differential pressures, depending on if the laboratory works with hazardous substances
- Heavy filtering of the inflowing or outflowing air depending on laboratory type
- No recirculation if the laboratory handles airborne hazardous material



5

LOBBY AND COMMON AREAS

In hospitals, HVAC in the lobby area is supposed to ensure the comfort of visitors and waiting patients while keeping the environment healthy and safe.

Applications:

- Air handler supply and return/exhaust fans, smoke extraction and pressurization fans

Requirements:

- High air exchange rate to prevent the spread of diseases, with no recirculation
- Pressurization in case of fire to ensure evacuation routes
- Smoke extraction in case of fire

7

DIAGNOSTICS CENTER

Diagnostics rooms do not require any specific air treatment, but the electromagnetic emissions of HVAC electronics should not exceed specified limits to avoid interference with sensitive medical equipment.

Applications:

- Supply and return fans

Requirements:

- Required air exchange rate, pressure, temperature and humidity

6

OPERATING THEATER

Operating theaters require a clean germ-free environment for safe surgical procedures.

Applications:

- Supply fans and return fans, filter units, water supply

Requirements:

- High air exchange rate to prevent the spread of diseases
- Positive pressure to prevent contamination of the sterile area via air leakage from non-sterile ones
- Efficient filtering of the inflowing air to prevent the spread of pathogens in the environment

8

MORGUE AND AUTOPSY ROOMS

Require continuous cooling and backup power source to ensure cooling if utility power fails.

Applications:

- Supply and return fans, chillers, cooling towers, circulation pumps, water supply

Requirements:

- Required air exchange rate, pressure, temperature and humidity
- Direct exhaust of the air to the outside, no recirculation
- Negative differential pressure between morgue and autopsy rooms and any adjacent spaces

Unlock greater potential for cost and efficiency gains in your hospital HVAC

Motors equipped with variable speed drives and controllers that run heating, ventilation and air conditioning contribute to a cleaner and more comfortable hospital environment, while also preventing the spread of disease. But there are also many other important benefits to be gained as well.

Application	Challenge	Solution	Benefit
 Air handling units / fans	Pressure drop over fine filters	<ul style="list-style-type: none"> EC fans have a limited pressure range while standard fans with drives can create significant pressure to overcome filters 	<ul style="list-style-type: none"> No need for filtering units with extra fans to overcome pressure drop More compact AHU design
	Clogged filter	<ul style="list-style-type: none"> Drives can alarm about clogged filters when drawn current starts being higher than normal 	<ul style="list-style-type: none"> No need for additional pressure sensors
	Air handler uptime	<ul style="list-style-type: none"> Less mechanical and electrical stress with VSD control, as opposed to direct-on-line start Smart sensors collect information on fan performance, enabling predictive maintenance SynRM motors offer better reliability thanks to lower winding and bearing temperatures 	<ul style="list-style-type: none"> Air conditioning runs continuously for greater hospital comfort and safety
	Air quality	<ul style="list-style-type: none"> VSD manages temperature, humidity and air exchange by adjusting fan speed, humidification and circulation in heating/cooling coil VSD maintains required air exchange to prevent disease spread 	<ul style="list-style-type: none"> Healthy and comfortable environment for personnel productivity and speedy patient recovery
	Fan acoustic noise	<ul style="list-style-type: none"> VSD-based resonance control VSD switching frequency adjustment 	<ul style="list-style-type: none"> Quiet environment for enhanced comfort
	High energy consumption	<ul style="list-style-type: none"> VSDs adjusting fan speed to the hospital load Motors with IE5 efficiency Filter monitoring via the VSD, with alarm if the filter is clogged and the pressure drop too high 	<ul style="list-style-type: none"> 20 to 60 percent energy savings with VSDs compared to damper control system Up to 10 percent improved efficiency at partial loads with ABB IE5 SynRM Cleaning a dirty filter can lower air conditioning energy consumption by 5% to 15%
	Control redundancy	<ul style="list-style-type: none"> In case of external communication loss, VSDs can take over the control 	<ul style="list-style-type: none"> Fan will continue running in a preset local control mode, until the external communication is back
	Hospital automation system overcomplexity	<ul style="list-style-type: none"> VSD-based control capabilities, for local control and to extend external controller tasks VSD-based fieldbuses without employing external gateways 	<ul style="list-style-type: none"> Decreased infrastructure complexity and costs, with lower risk for errors
	Electrical harmonics in the power network	<ul style="list-style-type: none"> ULH drives reduce harmonics content in the network to an absolute minimum 	<ul style="list-style-type: none"> Hospital network stability and elimination of costly active filters for harmonics mitigation Elimination of penalties from the utility
	Fire emergency	<ul style="list-style-type: none"> VSD-based fireman's override makes the regular ventilation fans a part of a fire suppression system – shuts them down, or turns them into smoke exhaust or pressurization units 	<ul style="list-style-type: none"> Safe evacuation for people Enabled access to the fire location for firemen No tripping of drives in extreme conditions Flexible evacuation/smoke extraction strategy
 Smoke exhaust fans	Escape route management in emergency	<ul style="list-style-type: none"> Override mode in VSDs allows maintain air pressure or fan speed to prevent smoke from entering evacuation spaces 	<ul style="list-style-type: none"> Eliminates door blockage or smoke propagation due to too high or low pressure
	Availability	<ul style="list-style-type: none"> VSDs and softstarters allow fans to start without power system overload VSD or softstarter-based motor phase loss monitoring, also during standby VSD or softstarter-based derate functionality in case of input phase loss 	<ul style="list-style-type: none"> Smoke extraction system is always available Occupants' safety
	High temperatures	<ul style="list-style-type: none"> VSDs are tested for operating 1 h at 70 °C Smoke extract motors are tested for operating at 200 °C / 120 min, 300 °C / 60 min, 400 °C / 120 min, 250 °C / 120 min 	<ul style="list-style-type: none"> Smoke extraction process continuity, even at high temperatures



Operating rooms require positive pressure inside, and drives can ensure it's maintained.



Air exchange rate in laboratories needs to be modular. Either negative or positive pressure needs to be ensured, depending on the specific situation.

Application	Challenge	Solution	Benefit
 Boilers	Heating/hot water temperature control	<ul style="list-style-type: none"> VSD's burner control ensures the hot water for heating or domestic use 	<ul style="list-style-type: none"> Hospital occupants' comfort and hygiene
	Heating/hot water supply reliability	<ul style="list-style-type: none"> VSD's sleep and boost feature to prevent boiler burner hunting, causing premature wear 	<ul style="list-style-type: none"> Comfort continuity
 Chillers	Cooling load control	<ul style="list-style-type: none"> Cooling load varies throughout the day and season, so VSDs adjust chiller compressor speed to hospital needs 	<ul style="list-style-type: none"> Substantial (usually up to 30%) energy savings
	Cooling reliability	<ul style="list-style-type: none"> VSDs prevent mechanical and electrical shocks in chillers thanks to smooth starts and stops VSD's sleep and boost feature to prevent compressor hunting, causing premature wear Smooth generator operation with ULH drives ensuring unity power factor and low harmonics 	<ul style="list-style-type: none"> Longer equipment lifetime, bigger maintenance intervals No interruptions in cooling due to power quality issues
 Circulation pumps and booster pumps in HVAC and water supply	Energy use	<ul style="list-style-type: none"> VSD adjusts pump speed to hospital water consumption VSD sleep mode for circulation pump control, to stop the pump during low demand, instead of running it slowly below its efficient operating range 	<ul style="list-style-type: none"> Energy savings
	Pump uptime	<ul style="list-style-type: none"> VSD supervisory functions indicate upcoming mechanical failures or events like a dry pump run Smart sensors measure pump motor health parameters like vibration and temperature Auto-restart after power failure Duty/standby pump auto changeover for balancing run hours 	<ul style="list-style-type: none"> Continuous comfort for hospital occupants Better maintenance time planning
	Pressure shocks	<ul style="list-style-type: none"> Soft pump start and stop thanks to VSD 	<ul style="list-style-type: none"> Pump and piping system increased lifetime and decreased maintenance costs
	Pipe leakage	<ul style="list-style-type: none"> Leak monitoring via VSD – when pressure in a pipe drops by a set value, drive sends an alarm 	<ul style="list-style-type: none"> No infrastructure damage and associated costs due to leakage
	Booster set lifetime	<ul style="list-style-type: none"> VSD-based intelligent pump control distributes the pump work hours equally over several pumps 	<ul style="list-style-type: none"> Optimized operation for extended equipment life
	Pressure maintenance	<ul style="list-style-type: none"> Jockey pump control via VSDs to eliminate: <ul style="list-style-type: none"> - overpressure in the sprinkler system causing component damage - underpressure in the sprinkler system causing false discharge 	<ul style="list-style-type: none"> Elimination of costly water damage in no-fire situation Elimination of sprinkler system component damage, which may not be apparent until ineffective in case of a fire
Availability	<ul style="list-style-type: none"> Pump start without causing power system overload, if using VSD or softstarter control VSD and softstarter-based phase loss monitoring 	<ul style="list-style-type: none"> Successful fire extinguishing, occupant safety 	
System cost	<ul style="list-style-type: none"> VSD use eliminates the need for pressure-reducing valves, break tanks, and reduces the generator size 	<ul style="list-style-type: none"> Optimized costs without compromising reliability and safety 	

Features and functions that give tangible benefits to HVAC systems in hospitals

ABB offers an extensive range of devices for heating, ventilation and air conditioning in hospitals, extending from motors and drives to full building management systems. It's easy to choose the right products and features for your specific needs, making hospital environment more healthy, comfortable, safe and energy efficient.



Variable speed drives

EMC

- Compliance with C2 and optionally C1 electromagnetic filtering levels for increased protection of sensitive medical equipment.

Low harmonics

- Built-in active front end and integrated line filters reduce harmonic disturbances in the building network to an absolute minimum.

Built-in redundancy

- External communication loss is handled seamlessly by a VSD taking control until the external communication is restored.

Fireman's override mode

- Makes ventilation part of a fire suppression system, protecting people and property.
- Disables non-critical warnings and faults, allowing the drive to run even in adverse conditions.

Power-loss ride-through

- Controlled process continuity during short power supply interruptions.

Robust design

- High protection classes against humidity and dust.
- Compliance with vibration/seismic standards.

High reliability

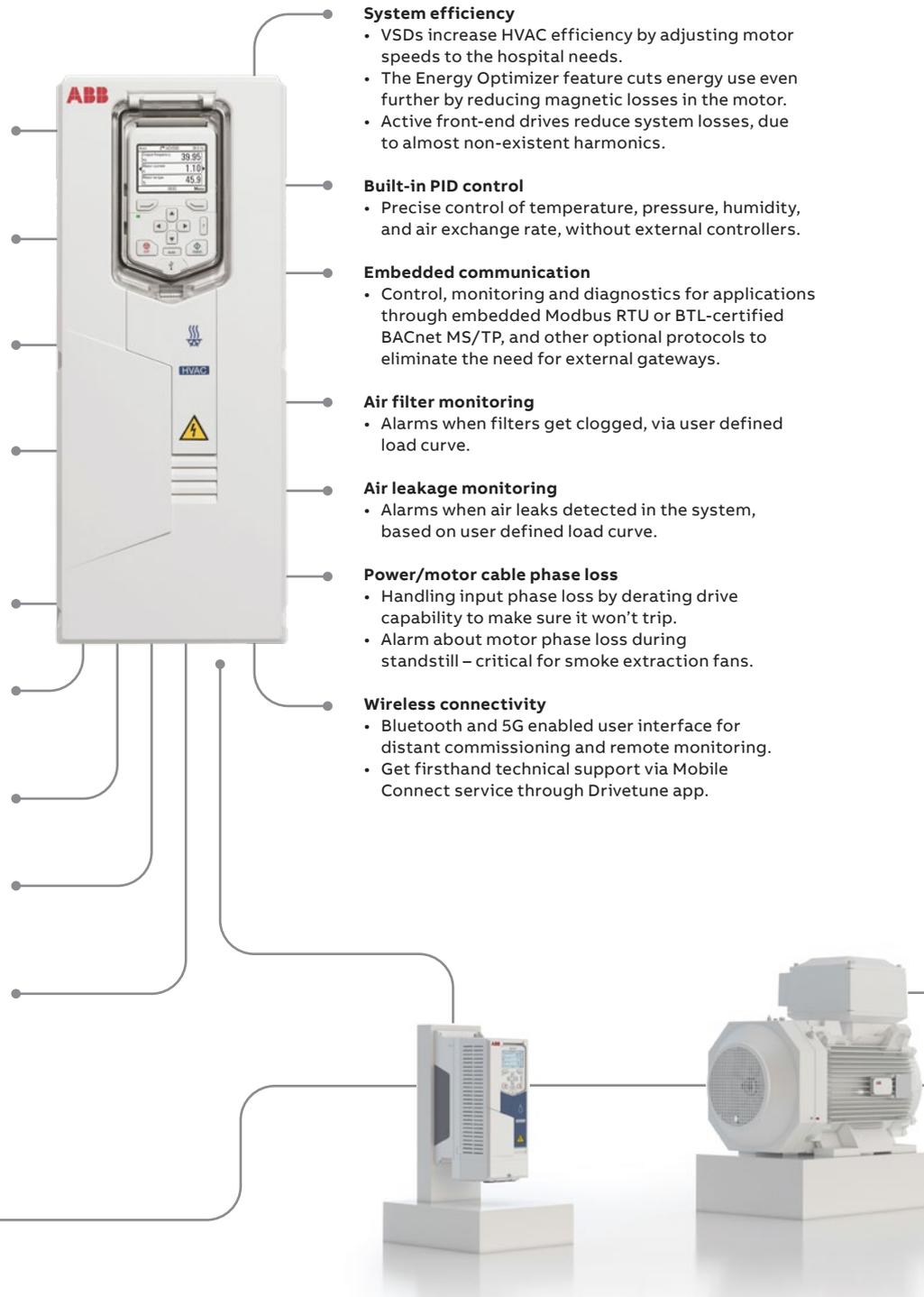
- Factory acceptance testing for every drive unit to ensure impeccable performance.

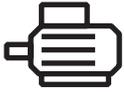
Real-time clock

- Trips and faults are date and time stamped, so the facility management knows what has happened and when.

Resonance control

- Helps avoid fan, pump or compressor resonance by skipping resonant frequencies, for quieter environment.





Motors

High reliability

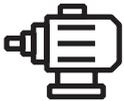
- Protection against external conditions with IP55 as standard
- Wide range of surface treatment and corrosion protection solutions available
- Protection against bearing currents with an extended portfolio of solutions including insulated bearings and shaft grounding
- Bearings locked at D-end to avoid axial play

Efficiency

- Up to IE5 efficiency level to reduce energy consumption and improve total cost of ownership

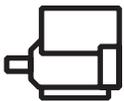
Easy installation

- Oversized terminal box as standard to ease installation
- Flexible cabling solutions
- Various mounting arrangements including direct drive, belt or transmission
- Horizontal and vertical mounting



Smoke extraction rated motors

- Operate reliably even at high temperatures of a fire zone
- Comply with smoke and heat control systems standard EN 12101-3, classes F200-120, F300-60, F400-120, T250-120
- Maximum performance in both normal and emergency conditions
- Designed for direct-on-line and VSD operation, both in normal and emergency situations



Integrated motor drive packages

- IE5 efficiency – highly efficient at full and partial loads
- Integrated design saves control cabinet space and reduces wiring costs
- Flexibility with multiple options including wired keypads and PC tools as well as Bluetooth communication
- Plug and play concept with the pre-programmed drive only requiring two inputs to run out of the box
- High power density with more power available from the same frame size



Building management solutions

Flexibility, scalability, ease of integration

- State-of-the-art BTL-certified BACnet IP and MS/TP controllers for hospital building mechanical and electrical systems control
- Integration support for Modbus TCP and Modbus RTU without external gateways
- Replace or extend I/O points quickly and easily
- Freely programmable controllers for enhanced building automation performance and reduced time on task
- Support of multi-protocol communications simultaneously
- Future-proof architecture with upgrade paths

Better and more cost-efficient energy use

- Cloud-based energy management can greatly increase a hospital building's energy efficiency
- Access energy monitoring via web enabled smart devices
- Optimize operational costs
- Reduce the building's CO2 footprint

Improved occupant comfort

- Embedded schedules and trend logs for tuning the hospital building environment
- Onsite user control via touch screen
- Access building controls, anytime, anywhere via web enabled smart devices



ABB Ability™ Smart Sensors for motors, pumps and bearings

Minimized unplanned downtime

- Upcoming failures can be detected well before equipment fails, avoiding unplanned downtime

Reduced maintenance costs

- By changing from scheduled to condition-based maintenance, service costs can be considerably reduced

Improved safety

- Eliminate the need for manual motor/pump/bearings check-ups in locations that are hard-to-reach or dangerous



From the facility to the cloud and beyond

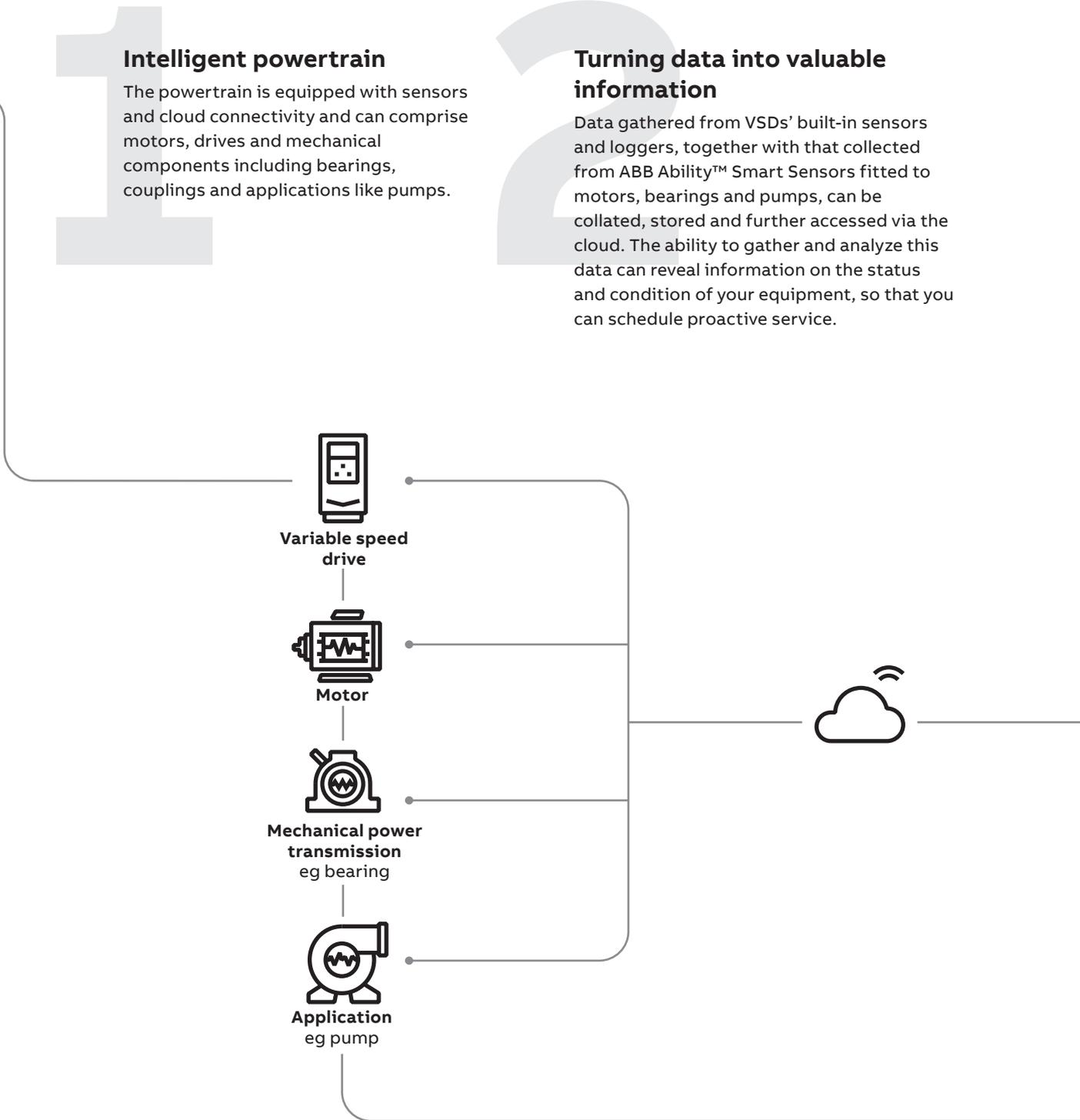
ABB Ability™ Condition Monitoring for powertrains optimizes the performance and efficiency of rotating equipment. It enables full transparency on all parameters for VSDs, motors, mounted bearings and applications like pumps.

1 Intelligent powertrain

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

2 Turning data into valuable information

Data gathered from VSDs' built-in 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 proactive service.



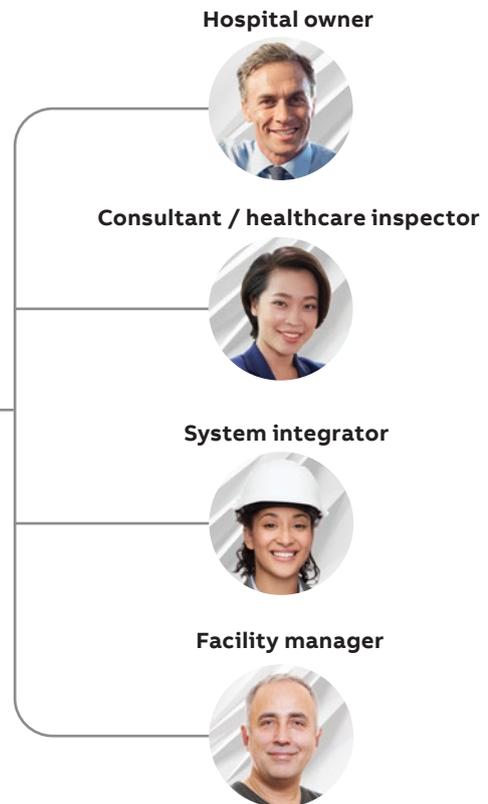
3 Accessing data for analytics

You have access to a monitoring portal to view key operational parameters of individual assets as one unified system. 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 has the right information at the right time brings:

- Appropriate response to process challenges, minimizing operating costs
- Greater insight into various aspects of the process, thereby improving system performance
- Lower risk of process failure, while changing your maintenance from reactive to predictive



Keep your facility 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 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 generator, 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 Value Providers can help with installation and commissioning. They are also on hand to support you throughout the operation and maintenance phases of the product's life cycle, providing preventive maintenance programs tailored to your facility's needs.

ABB will ensure you are notified of any upgrades or retrofit opportunities. If you've registered your drives and motors with ABB, then our engineers will proactively contact you to 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

Identify ways to improve the reliability, usability, maintainability and safety of your 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 breaks



Installation & commissioning

Highly-trained and reliable installation and commissioning experts



Training

Comprehensive and professional training either at ABB premises or your own facilities



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 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, ABB interacts closely with healthcare industry players including consultants, inspectors, engineering societies and dedicated organizations. This helps increase hospital safety and engineering systems reliability and

efficiency to an absolute maximum, while providing a healthy and comfortable environment for the patients and medical workers.

ABB has seven global R&D centers with more than 8,000 technologists and invests \$1.5 billion annually on innovation.

End-to-end product portfolio

Alongside its diverse portfolio of VSDs, motors and generators, ABB offers healthcare facilities:

- Medium voltage components and systems such as air- and gas-insulated switchgears, uninterruptible power supply units, relays,



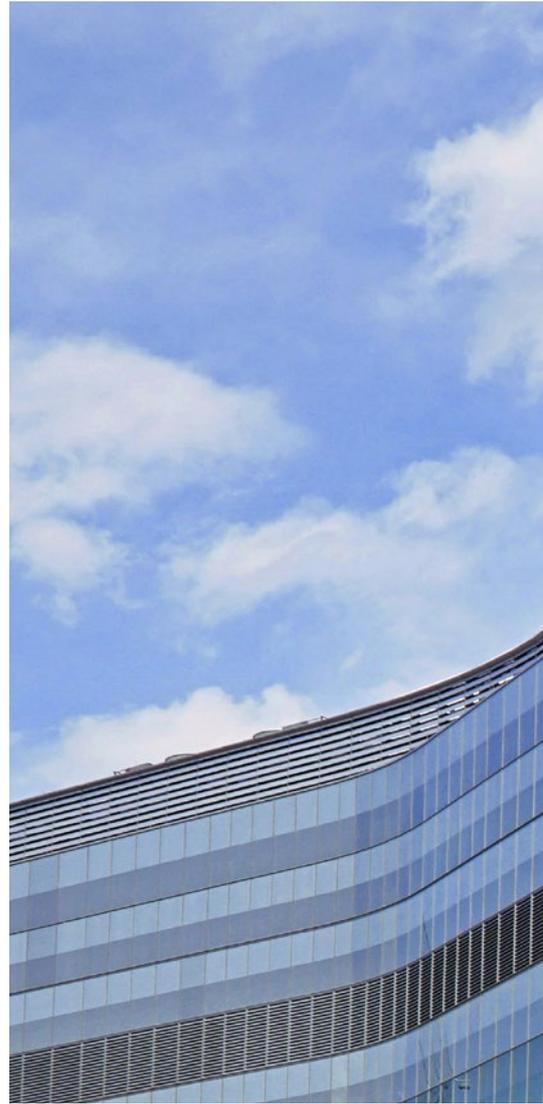
ultra-fast earthing switches, Is-limiters to reduce high short-circuit currents, and more.

- Low voltage components and systems such as switchgears, uninterruptible power supply units, breakers, industrial plugs and sockets, RCD blocks, power distribution units, remote power panels, a wide range of scalable PLCs and HMIs, and more.
- Digital solutions including ABB Ability™ digital cross-product and system offering providing intelligence all the way to the component level, improving overall visibility and making the system safe, reliable and efficient.

Streamline sourcing

ABB's end-to-end product and services portfolio streamlines your sourcing and purchasing activities and standardizes processes 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

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