

HVAC in healthcare facilities

Driving patient well-being
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 environmental impacts.



Hospital administrator



“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.
- Digitization gives a higher level of environment control in confined areas like the infection department or operating theater.

... 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 frequency drives (VFDs), can significantly cut both capital and operating costs.

... ensured by innovative control solutions

- Digitally enabled VFDs 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



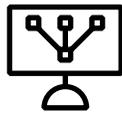
“We design and verify systems that ensure a proper hospital environment 24/7.”

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.
- Power quality affects the reliability of a hospital's electrical network and connected devices.
- OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT (OSHPD). OSHPD is a special seismic certification. Pre-approval ensures that your equipment will be safe after a seismic event.

... by utilizing best-in-class technologies

- VFD's accurately control HVAC to match hospital needs.
- Drives alert about dirty filters/ air leakage in ducting.
- VFD-based override mode helps reduce smoke spread while ensuring safe evacuation in case of fire.
- VFD compliance with EMC standards eliminates radio-frequency interference with medical equipment.
- ULH drives prevent disturbances in the network, while 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.
- EC Titanium motors offer increased reliability thanks to lower winding and bearing temperatures.
- Use of drives and efficient Ultra Preumiun (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 digitizing 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 VFD 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 up time 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 VFD's 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.
- VFD' 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.
- VFD 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 VFDs.
- EC Titanium motor has 40 percent less energy losses compared to premium efficiency induction motors.
- VFD 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 clean-room 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 inflowing or outflowing air depending on laboratory type
- No recirculation if airborne hazardous material is present



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 in your building systems

Motors equipped with variable frequency drives and controllers that run heating, ventilation and air conditioning applications are excellent at providing comfort and safety for the building's occupants. But there are many other important and profitable benefits to be gained as well.

Application	Challenge	Solution	Benefit
 Air handling units / fans	<ul style="list-style-type: none"> High energy consumption 	<ul style="list-style-type: none"> VFDs adjusting fan speed to the building load Motors with NEMA Premium® or IE5 (ultra premium) efficiency Filter monitoring via a VFD, with warning if the filter is clogged and the pressure drop too high 	<ul style="list-style-type: none"> 20 to 60 percent energy savings with VFDs compared to damper control system Up to 30 percent improved efficiency at partial loads with ABB synchronous reluctance ferrite assisted motors Reduced operation cost. Better air quality.
	<ul style="list-style-type: none"> Air handler uptime 	<ul style="list-style-type: none"> VFD protection includes overcurrent, overvoltage, motor overheating and under/overload control Lowest mechanical and electrical stress with VFD control, as opposed to direct-on-line start VFDs and smart sensors collect information on fan performance, enabling predictive maintenance 	<ul style="list-style-type: none"> Air conditioning runs correctly and continuously for greater occupant comfort Improved life cycle for the overall system Reduction in un-planned down time
	<ul style="list-style-type: none"> Air quality in the building 	<ul style="list-style-type: none"> Managing temperature, humidity and CO₂ levels by adjusting fan speed, humidification rate and circulation in heating/cooling coil via VFD 	<ul style="list-style-type: none"> Healthy and comfortable environment Increased productivity in hospitals Optimized energy use
	<ul style="list-style-type: none"> Building automation system overcomplexity 	<ul style="list-style-type: none"> VFD-based control capabilities to enhance external controller tasks and improve failure redundancy Most popular BAS protocols are embedded on the VFD controller 	<ul style="list-style-type: none"> Decreased infrastructure complexity and costs, low error risk Simplified hardware integration Industry standard protocols available as options
	<ul style="list-style-type: none"> Fan acoustic noise 	<ul style="list-style-type: none"> VFD-based resonance control VFD switching frequency adjustment for lower motor noise 	<ul style="list-style-type: none"> Quiet environment for enhanced comfort and productivity
	<ul style="list-style-type: none"> Electrical harmonics in the power network 	<ul style="list-style-type: none"> ULH drives reduce harmonics content in the network DC choke or line reactors are standard on ACH580 series drives to provide harmonic mitigation 	<ul style="list-style-type: none"> Building network stability and elimination of costly active filters for harmonics mitigation Elimination of non-wattage financial penalties from the utility
	<ul style="list-style-type: none"> Fire emergency 	<ul style="list-style-type: none"> VFD fireman's override allows making the regular ventilation fans a part of a fire/smoke control system – shut them down, or turn them into smoke exhaust or pressurization units to maintain a safe escape route 	<ul style="list-style-type: none"> Enables access to the fire location for firemen No undesired tripping of drives in extreme conditions Flexibility in evacuation / smoke control strategy
	<ul style="list-style-type: none"> Escape route management in case of emergency 	<ul style="list-style-type: none"> Override mode in VFDs is implemented in a way that required pressure or fan speed can be maintained to prevent smoke from entering the evacuation spaces 	<ul style="list-style-type: none"> Eliminate door blockage or smoke propagation due to too high or low pressure Safe evacuation for people Protected access routes for first responders



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
 Smoke exhaust fans	<ul style="list-style-type: none"> • Availability 	<ul style="list-style-type: none"> • VFDs allow fans to start without power system overload 	<ul style="list-style-type: none"> • Smoke extraction system is always available • Occupants' safety
	<ul style="list-style-type: none"> • High temperatures 	<ul style="list-style-type: none"> • VFDs are tested for operating 1 h at 158°F (70°C) • Smoke extract motors are tested for operating at 392°F (200°C) for 120 min, 572°F (300°C) for 60 min, 752°F (400°C) for 120 min, 482°F (250°C) for 120 min 	<ul style="list-style-type: none"> • Smoke extraction process continuity, even at high temperatures
	<ul style="list-style-type: none"> • Control reliability 	<ul style="list-style-type: none"> • Control backup in VFDs – in case of external communication loss, VFDs can take over the control 	<ul style="list-style-type: none"> • Fan will continue running in a preset for local control mode, until the external communication is recovered
 Circulation pumps and booster pumps	Heating / hot water temperature control	<ul style="list-style-type: none"> • Hot water recirculating pumps can control the flow based on BMS or instrument feedback 	<ul style="list-style-type: none"> • Building occupants comfort, hygiene and safety
	Pump uptime	<ul style="list-style-type: none"> • VFD 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 	<ul style="list-style-type: none"> • Continuous comfort for building occupants • Improved up-time and reliability
	Pressure shocks	<ul style="list-style-type: none"> • Soft pump start and stop thanks to a VFD helps avoid water hammer 	<ul style="list-style-type: none"> • Pump and piping system increased lifetime and decreased maintenance costs
	Pipe leakage	<ul style="list-style-type: none"> • Leakage monitoring via VFD indicating when the pressure in a pipe drops to a minimum, thus sending an alarm drops by a set value, drive sends an alarm 	<ul style="list-style-type: none"> • Helps avoid infrastructure damage and associated costs due to leakage
	Booster set lifetime	<ul style="list-style-type: none"> • VFD-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
Cooling tower pumps	Pump cavitation	<ul style="list-style-type: none"> • Dry pump protection allows you to set up a control point to trip or alarm based in the input source 	<ul style="list-style-type: none"> • Pumping and piping system increased lifetime and reduce maintenance cost
	Routine maintenance	<ul style="list-style-type: none"> • Using the Motor Disconnect Detection, safely open isolation switch without stopping the drive 	<ul style="list-style-type: none"> • Maintenance costs are reduced

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.

Harmonic mitigation

- The drive provides reduced harmonics with built-in, DC choke in a small and lightweight design.
- Input line reactors are included as standard on larger designs.

Ultra Low Harmonic (ULH) drive for a clean electrical network

- The revolutionary ACH580 Ultra-Low Harmonic drive is designed specifically for the HVAC market, minimizing the effect of harmonics on your system.
- This all-in-one solution is fully integrated within the ACH580 platform and leverages the same programming tools, user settings, options, and functions, while providing superior harmonic performance.

Real-time clock

- Events and faults are date and time stamped.

System efficiency

- VFDs increase the system's efficiency by adjusting motor speeds to the current needs
- Energy Optimizer improves energy use by reducing magnetic losses in the motor
- Active front end drives reduce system losses due to unity power factor

Built-in PID control

- Controls applications without employing external controllers, decreasing automation system complexity and costs

Fireman's override mode

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

Embedded communication

- Control, monitoring and diagnostics for applications through embedded Modbus RTU or BTL-listed BACnet MS/TP, and other optional protocols like BACnet IP using fieldbus adapters



HVAC user interface

- HVAC quick setup gets commissioning done quickly
- Enhanced screen and diagnostics
- Bluetooth for those hard to reach places
- Common user interface across all HVAC products

Intelligent pump control

- Control of multiple pumps in the set for higher efficiency – next pump steps in when the load increases
- Distribution of work hours equally between all pumps in the set for extended equipment lifetime
- Redundancy – in case one of the pumps fails, the others take over the load

Motor disconnect detection

- Simple one-step setup feature that eliminates the need to add an auxiliary contact for local disconnects

Advanced damper control

- Makes it easy to integrate single or dual damper controls into the VFD

Check sum

- Provides a level of security to ensure parameters haven't changed, the BMS monitors values for a mismatch

Flow calculation

- Reduce complexity of high end flow measurement instruments, for reduced system cost

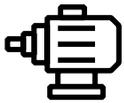




Baldor-Reliance® Motors

Key features

- Dynamically balanced rotor to reduce noise and increase bearing life
- Color coded and numbered leads for ease of connectivity
- Bar code spec number for easy identification
- Low noise vibration dampening bases
- Baldor-Reliance NEMA motors meet or exceed all efficiency requirements for US, Canada and Mexico regulations



EC Titanium™ Ultra-premium efficient inverter duty motor

- IE5/Ultra premium efficient motor
- FASR - Ferrite Assisted Synchronous Reluctance rotor
- Class F insulation with Class B motor temperature rise
- Internal grounding brush for bearing current mitigation
- For inverter use only per NEMA MG1 Part 31.4.4.2
- Designed for longevity with 3 year warranty



Building management solutions

Flexibility, scalability, ease of integration

- State-of-the-art BTL-certified BACnet IP and MS/TP controllers for building's mechanical and electrical systems control
- Support for simultaneous routing of communication protocols including BACnet MS/TP and Modbus RTU to IP layer without the use of external gateways
- Easily extend I/Os using the Field Level Extension modules to meet the most complex HVAC strategies
- Freely programmable controllers with available preengineered application libraries
- Future-proof architecture with upgrade paths

Better and more cost-efficient energy use

- Cloud-based energy management can greatly increase a building's energy efficiency
- Access energy monitoring, anytime, anywhere 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 building environment
- On-site operator control via touch screen display
- Receive alerts and alarms on mobile devices anywhere in the world



ABB Ability™ Smart Sensors for motors and pumps

Minimized unplanned downtime

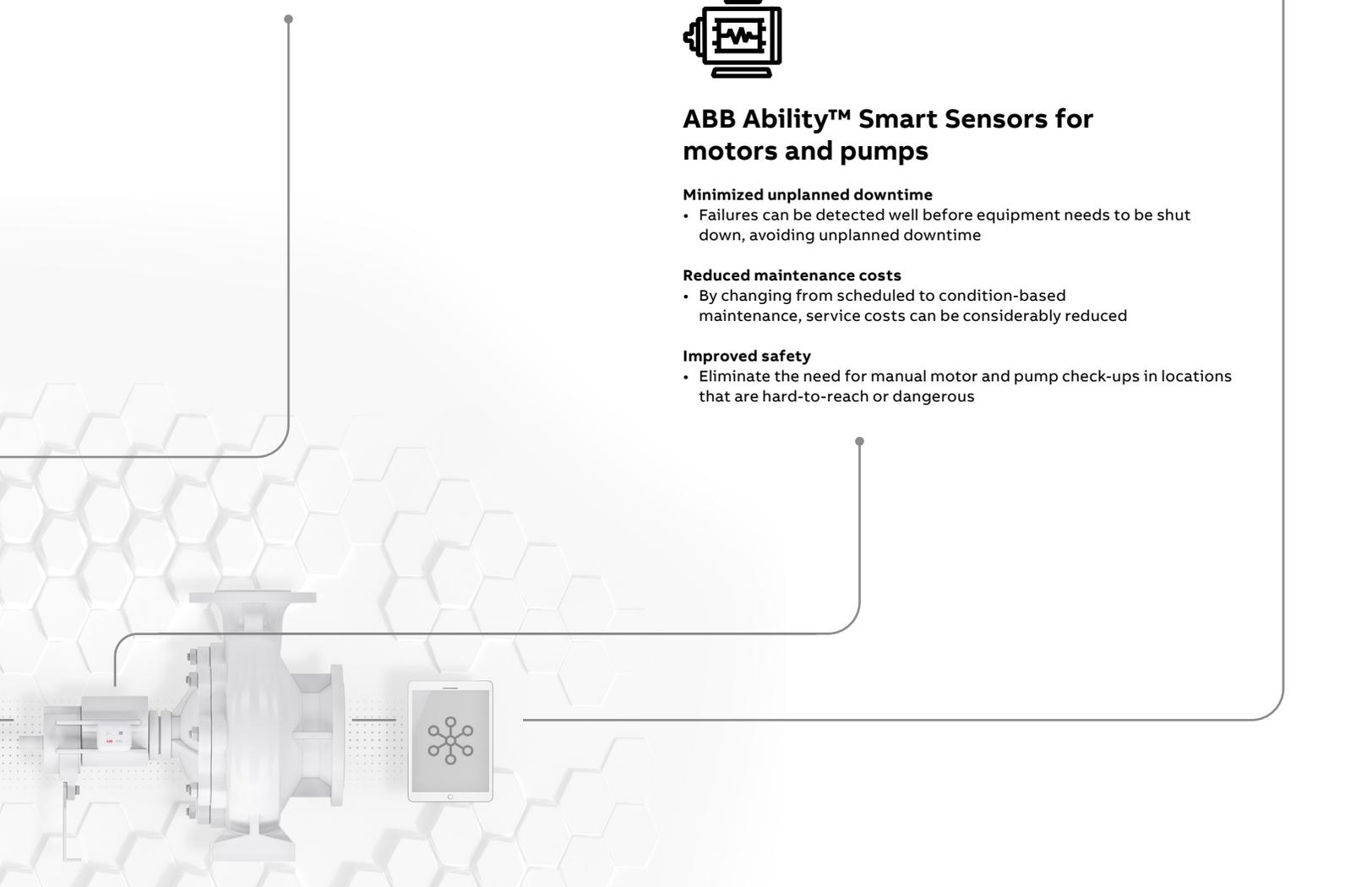
- Failures can be detected well before equipment needs to be shut down, avoiding unplanned downtime

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 and pump check-ups in locations that are hard-to-reach or dangerous



From the facility to the cloud and beyond

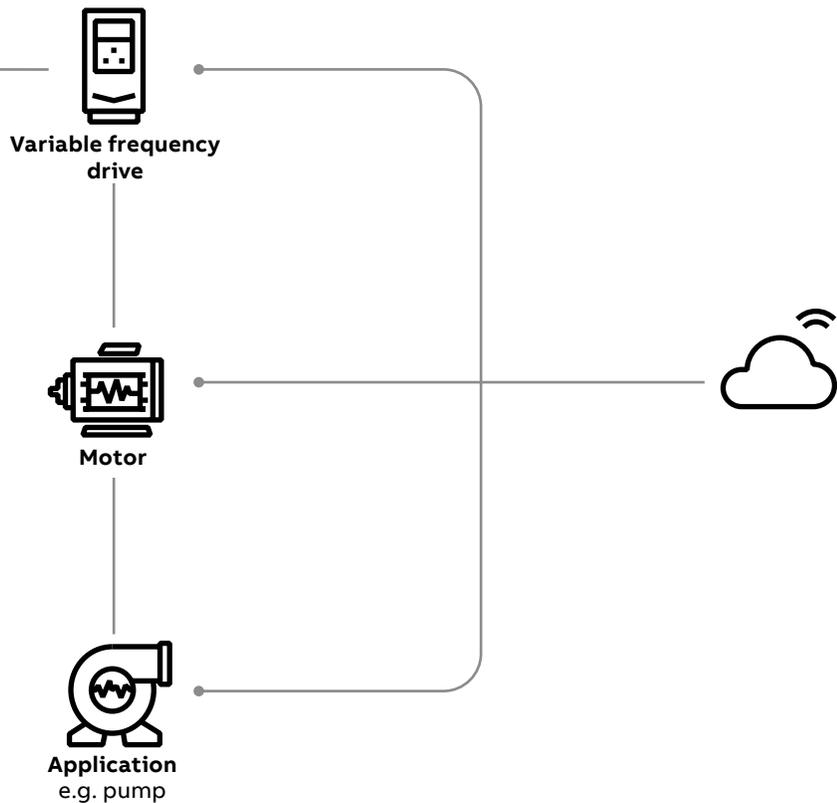
ABB Ability™ Condition Monitoring for powertrains optimizes the performance and efficiency of rotating equipment. It enables full transparency on all parameters for VFDs, motors, mounted bearings and applications like pumps.

Intelligent powertrain

The powertrain is equipped with sensors and cloud connectivity and can comprise motors, drives and driven equipment such as pumps.

Turning data into valuable

Data gathered from VFDs' built-in sensors and loggers, together with that collected from ABB Ability™ Smart Sensors fitted to motors 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.



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.



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

Hospital administrator



Consultant



System integrator



Facility manager



Keep your facility running

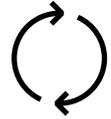
From spare parts and technical support to cloud-based remote monitoring solutions, ABB offers the most extensive service offering to fit your needs. The global ABB service units, complemented by external Value Providers, form a service network on your doorstep. Maximize performance, up time and efficiency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

With you every step of the way

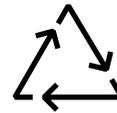
Even before you buy a generator, drive, motor, bearing or softstarter, ABB's experts are on hand to offer technical advice from dimensioning through to potential energy saving.

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



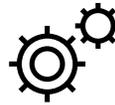
Extensions, upgrades & retrofits

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

—
“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 VFDs, 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

new.abb.com/drives

new.abb.com/drives/drivespartners

new.abb.com/motors-generators

new.abb.com/drives/segments/hvac

