

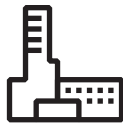


Heating, ventilation and air conditioning in buildings

Enhancing comfort, safety, and energy efficiency in commercial and residential environments

Taking building performance to a new level

Heating, ventilation and air conditioning (HVAC) systems have a significant impact on both comfort and costs in any building. Modern buildings require smart HVAC systems that create comfortable, healthy and safe environments for the occupants, while minimizing energy consumption and increasing sustainability.



Building owners / Developers



“To make a building attractive to leasers or buyers, it is critical to invest in comfort and safety”

Modern buildings demand a comfortable, safe and smart environment...

- Comfort inside residential and commercial buildings is vital for the occupants, since it has a major impact on productivity, health and quality of life.
- Digitalization of everyday life is increasing continuously, and buildings are no exception. Smart buildings can promptly react to ever-changing conditions and maintain a higher level of individual comfort, while running the systems in an optimal way.

... at optimized total cost of ownership...

- High initial investments increase the selling price of a building or apartment, while high operating costs make it less attractive for leasers or buyers.
- Control solutions for building HVAC can significantly influence both capital and operating costs. Specifically, more attention should be paid to variable speed drives (VSDs) selection, due to the cost benefits they deliver.

... ensured by innovative control solutions

- VSDs for HVAC provide optimal control of the building environment for better comfort and safety of the occupants, while perfectly matching energy consumption to the specific load.
- The return on investment can be improved with ultra-low harmonic drives – they ensure both power quality and building operation stability, while reducing the size of supply transformers and backup generators needed.



Consultant



“I am responsible for designing HVAC systems in compliance with the industry standards”

From occupant health and safety...

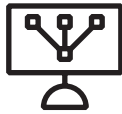
- In-building technical systems primarily aim to provide a healthy and safe environment.
- Under everyday conditions, HVAC systems maintain favorable air temperature, humidity and CO₂ levels for the occupants' comfort, resulting in better health and increased productivity.
- In case of a fire, the building systems must respond accordingly – ensure smoke-free exit routes, help suppress the fire, and provide access to the fire location for emergency services.

... to increased energy efficiency...

- HVAC systems have high operating costs, since they consume on average 30 to 70 percent of the building's energy. Making them energy efficient is a clear priority.
- Power quality influences the efficiency of a building's electrical network, so power equipment including VSDs should be carefully chosen.

... utilizing best-in-class technologies

- VSDs allow accurate control of CO₂ concentration, temperature and humidity of the air inside by automatically adjusting HVAC processes to match the needs.
- In an emergency like a fire, a VSD's override mode makes ventilation a part of the fire suppression system, mitigating the fire while providing safe evacuation for the occupants.
- Ultra-low harmonic (ULH) drives prevent disturbances on the power supply, maintaining an efficient and reliable electrical network.



System integrator



“Component compatibility with common standards and interfaces ensures smooth integration into a building management system”

From easy connection and integration...

- Connecting and integrating components into HVAC systems must be straightforward.

... to high interoperability...

- Efficient building management requires detailed access to fault logs and operational data for condition monitoring and troubleshooting.
- Smart buildings require transparency, that can be ensured through 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, makes VSDs an integral part of a building management system, helping contribute to the overall control strategy.
- BTL certification for BACnet components ensures that the product has passed rigorous independent testing, and there are no protocol implementation errors.

Facility manager



“Continuous operation of a building’s technical systems is of the utmost importance”

Eliminate malfunctioning of building HVAC...

- Depending on the building type and weather conditions, failure of HVAC can make the building environment challenging for continued occupancy.
- Proper functioning of the building systems goes beyond comfort, since it also can directly impact productivity and health.

... by utilizing smart functionality

- Monitoring of temperature, overload, overcurrent and other protection features within VSDs help prevent failures in HVAC equipment control and ensure its continuous operation.
- Drive-based safe-torque-off functionality allows safe conduct of maintenance work on mechanical parts of HVAC equipment, without shutting down the whole system.
- The real-time clock in drives keeps records of trips and faults, so the facility management knows what happened and when.
- VSD-enabled wireless capability secures remote access to hard-to-reach equipment, for effortless troubleshooting.

“How can I optimize my operating costs?”

Lower expenses...

- Costs can be optimized without compromising building comfort and safety.

... through advanced solutions and maintenance regimes

- On average, 20 to 60 percent of HVAC energy is saved upon implementing variable speed control.
- VSD usage in HVAC eliminates both mechanical and electrical shocks in the system, providing smooth control for pumps, fans and compressors and extending their lifetime.
- ABB Ability™ Condition Monitoring remotely delivers information on drive and motor events and proposes targeted maintenance actions, reducing the need for regular inspections.

Demands on HVAC systems during normal operation and emergencies

A building's HVAC system should ensure a comfortable and healthy everyday environment for its occupants, and also be able to support fire suppression and evacuation systems, should an emergency situation arise.

1 VENTILATION

In buildings, ventilation is an essential part of maintaining a good indoor air quality. In combination with air-conditioning, it manages temperature, humidity and CO₂ for the comfort and safety of the occupants.

Applications:

- Supply, return and exhaust fans

Requirements:

- Air quality maintenance in the building in accordance with an ever-changing environment
- Efficient energy use through adjusting fan speed to current needs
- Fan performance monitoring for predictive maintenance planning

2 SMOKE EXHAUST, ESCAPE ROUTE MAINTENANCE

Large buildings, like shopping malls and skyscrapers, often have dedicated smoke extraction and pressurization fans for smoke exhaust and escape route maintenance.

Applications:

- Smoke exhaust fans, stairway pressurization fans

Requirements:

- Monitoring of the fan availability, so it is always ready in case of need
- Prompt reaction to any emergency situation, so the fan can achieve full load speed in a short time
- Control redundancy in case of communication loss
- Override mode, which ignores faults and warnings, thus allowing extended runtime in adverse conditions
- Precise control of air flow rate and pressure for safe evacuation

3 FIRE SUPPRESSION

Water-based fire suppression systems must be ready to supply water to fire sprinklers in a building, should an emergency occur.

Applications:

- Pumps

Requirements:

- Prompt response in case of emergency
- Continuous monitoring of the pump availability
- Secure stable pressure on the sprinkler nozzles, both in standby and during a fire situation
- Easy integration into a building fire suppression system

4 HEATING

District heating often involves a heating substation installed in the basement of a building. It receives the heating carrier from a heat generating station and via a heat exchanger makes it available for the building heating system.

An individual heating system in many cases consists of a boiler heating water up to required temperature for further distribution in the building heating system.

Applications:

- Boiler burner, circulation pumps

Requirements:

- Burners with a variable fuel throughput require a corresponding volume of combustion air, so variable speed control of the blower is needed for efficient combustion
- Pumps should adjust the circulation rate in the heating system to the current heating need





5 AIR CONDITIONING

In buildings, cooling energy is often generated on site by chillers, and then distributed throughout the building.

Applications:

- Chiller compressor, circulation pumps, condenser and cooling tower fans

Requirements:

- Cooling load varies throughout the day and season, so using variable speed control for air conditioning equipment ensures substantial energy savings
- When using VSDs on chillers, it is recommended to apply ultra-low harmonic drives to also improve the building power network by lowering harmonics and maintaining unity power factor at all load points

6 DOMESTIC WATER SUPPLY

Domestic water is delivered mostly from clean water treatment plants. Cold water goes directly to the tap. Water for hot water supply is heated either in an individual boiler or using district heating energy. If extra pressure in hydraulic system is needed to deliver water to higher floors, booster pumps are used.

Applications:



- Circulation pumps and booster pumps

Requirements:

- Domestic water consumption is never uniform, often peaking in the mornings and evenings. Water supply needs to be adjusted according to a consumption rate, for increased energy efficiency
- Sleep mode for pump control, to stop the pump during low demand, instead of running it slowly below its efficient operating range
- Maintaining the required water pressure in the system
- Multi-pump support to reach the highest possible energy efficiency and handle demand variations over the day
- Pump performance monitoring, to support predictive maintenance planning




Unlock greater potential in your building systems

Motors equipped with variable speed 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.

	Challenge	Solution	Benefit
 Air handling units/fans	<ul style="list-style-type: none"> High energy consumption 	<ul style="list-style-type: none"> VSDs adjusting fan speed to the building load Motors with IE5 efficiency Filter monitoring via a VSD, 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 VSDs compared to damper control system Up to 30 percent improved efficiency at partial loads with ABB synchronous reluctance ferrite assisted motors
	<ul style="list-style-type: none"> Air handler uptime 	<ul style="list-style-type: none"> VSD protection includes overcurrent, overvoltage, motor overheating and under/overload control Lowest mechanical and electrical stress with VSD control, as opposed to direct-on-line start VSDs 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
	<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 VSD 	<ul style="list-style-type: none"> Healthy and comfortable environment Increased productivity in offices
	<ul style="list-style-type: none"> Building automation system overcomplexity 	<ul style="list-style-type: none"> VSD-based control capabilities to enhance external controller tasks and improve failure redundancy VSD-based fieldbuses without employing external gateways 	<ul style="list-style-type: none"> Decreased infrastructure complexity and costs, low error risk Simplified hardware integration
	<ul style="list-style-type: none"> Fan acoustic noise 	<ul style="list-style-type: none"> VSD-based resonance control VSD 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 to an absolute minimum 	<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"> VSD fireman's override allows making the regular ventilation fans a part of a fire/smoke suppression 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 suppression strategy
	<ul style="list-style-type: none"> Escape route management in case of emergency 	<ul style="list-style-type: none"> Override mode in VSDs 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
 Smoke exhaust fans	<ul style="list-style-type: none"> Availability 	<ul style="list-style-type: none"> VSDs and softstarters allow fans to start without power system overload VSD or softstarter-based phase loss monitoring 	<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"> VSDs are tested for operating 1 h at 70°C Smoke extract motors are tested for operating at 200°C for 120 min, 300°C for 60 min, 400°C for 120 min, 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 VSDs – 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 for local control mode, until the external communication is recovered



01

	Challenge	Solution	Benefit
 Boilers	<ul style="list-style-type: none"> • Heating/ hot water temperature control 	<ul style="list-style-type: none"> • VSD-based burner control ensures the hot water for heating or domestic use has the required temperature 	<ul style="list-style-type: none"> • Building occupants comfort, hygiene and safety
 Circulation pumps and booster pumps	<ul style="list-style-type: none"> • Pump uptime • Pressure shocks • Pipe leakage • Booster set lifetime 	<ul style="list-style-type: none"> • VSD supervisory functions indicate possible upcoming mechanical failures, such as bearing wear or events like a stalled impeller or dry pump run • Smart sensors measure pump motor health parameters like vibration and temperature • Auto-restart after power failure • Soft pump start and stop thanks to a VSD helps avoid water hammer • Leakage monitoring via a VSD indicating when the pressure in a pipe drops to a minimum, thus sending an alarm • VSD-based intelligent pump control distributes the pump work hours equally over several pumps 	<ul style="list-style-type: none"> • Continuous comfort for building occupants • Pump and piping system increased lifetime and decreased maintenance costs • No infrastructure damage and associated costs due to leakage • Optimized operation for extended equipment life
 Fire pump station	<ul style="list-style-type: none"> • Pressure maintenance • Availability • System cost 	<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 its components damage - underpressure in the sprinkler system due to e.g. incidental leakages • Pump start without causing power system overload, if using VSD or softstarter control • VSD and softstarter-based phase loss monitoring • VSD use eliminates the need for pressure-reducing valves and break tanks, and can reduce the generator size by up to 50 percent 	<ul style="list-style-type: none"> • Elimination of costly water damage in no-fire situation • Elimination of sprinkler system components' damage which is not realized until proven ineffective in case of a fire • Successful fire extinguishing, occupant safety • Optimized costs without compromising reliability and safety

02



01 VSDs control pumps and boilers in building heating systems, saving a considerable amount of energy.

02 Variable speed drives bring many economic and safety benefits to ventilation and air conditioning equipment.

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

ABB offers an extensive range of devices for heating, ventilation and air conditioning applications in buildings, 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 any building more comfortable, safe and energy efficient.



Variable speed drives

Low harmonics

- Built-in active front end and integrated line filter mitigate harmonic disturbances in the network to a minimum of 3 percent

Real-time clock

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

System efficiency

- VSDs increase the system's efficiency by adjusting motor speeds to the current needs
- Advanced feature, Energy Optimizer improves energy use further by reducing magnetic losses in the motor
- Active front end drives reduce system losses due to almost non-existent harmonics and unity power factor

Electromagnetic compatibility

- Compliance even with the strictest EMC standards requiring C1 filtering

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 suppression system, protecting people and property
- Disables warnings and faults, allowing the drive to run even in adverse conditions for as long as possible

Built-in redundancy

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

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



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

Safe torque off

- Built-in feature for safe maintenance of the mechanical parts of HVAC equipment

Resonance control

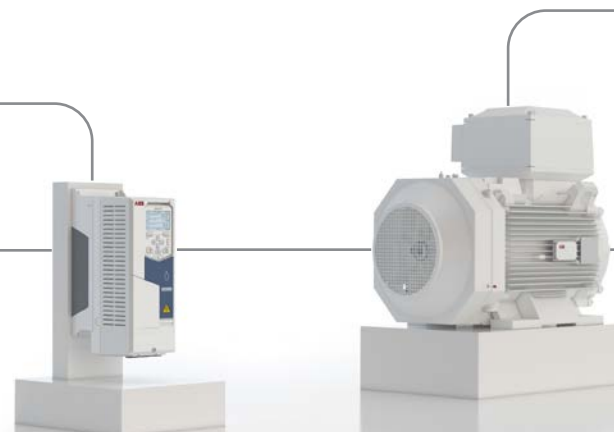
- Helps to avoid fan, pump or compressor resonance, by skipping resonant frequencies

Sleep function

- Saves energy by stopping the motor during low demand and starting it again when the demand increases by the set value

Sensorless flow calculation

- Eliminates the need for an external flow meter, for reduced system cost





Motors



High reliability

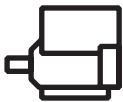
- Protection against external conditions with IP55 as standard
- Wide range of surface treatment and corrosion protection solutions available
- Protection against bearing currents with an extended portfolio of solutions including insulated bearings and shaft grounding
- Bearings locked at D-end to avoid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



Integrated motor drive packages



- IE5 efficiency – highly efficient at full load and partial load conditions
- Integrated design saves control cabinet space and reduces wiring costs
- Tune and control 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 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 pre-engineered 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, pumps and bearings

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



From the facility to the cloud and beyond

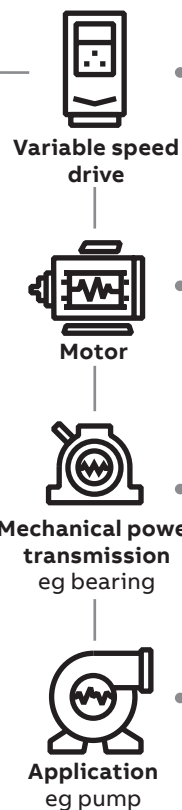
ABB Ability™ Condition Monitoring for powertrains optimizes the performance and efficiency of rotating equipment. It enables full transparency on all parameters for VSDs, motors, mounted bearings and applications like pumps.

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



Building owners / Developers



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, 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.

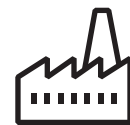
ABB will ensure you are notified of any upgrades or retrofit opportunities. If you've registered your drives and motors with ABB, then our engineers will proactively contact you to advise on your most effective replacement option. All of which helps maximize performance, uptime and efficiency throughout the lifetime of your powertrain.



Replacements
Fast and efficient replacement services to minimize production downtime

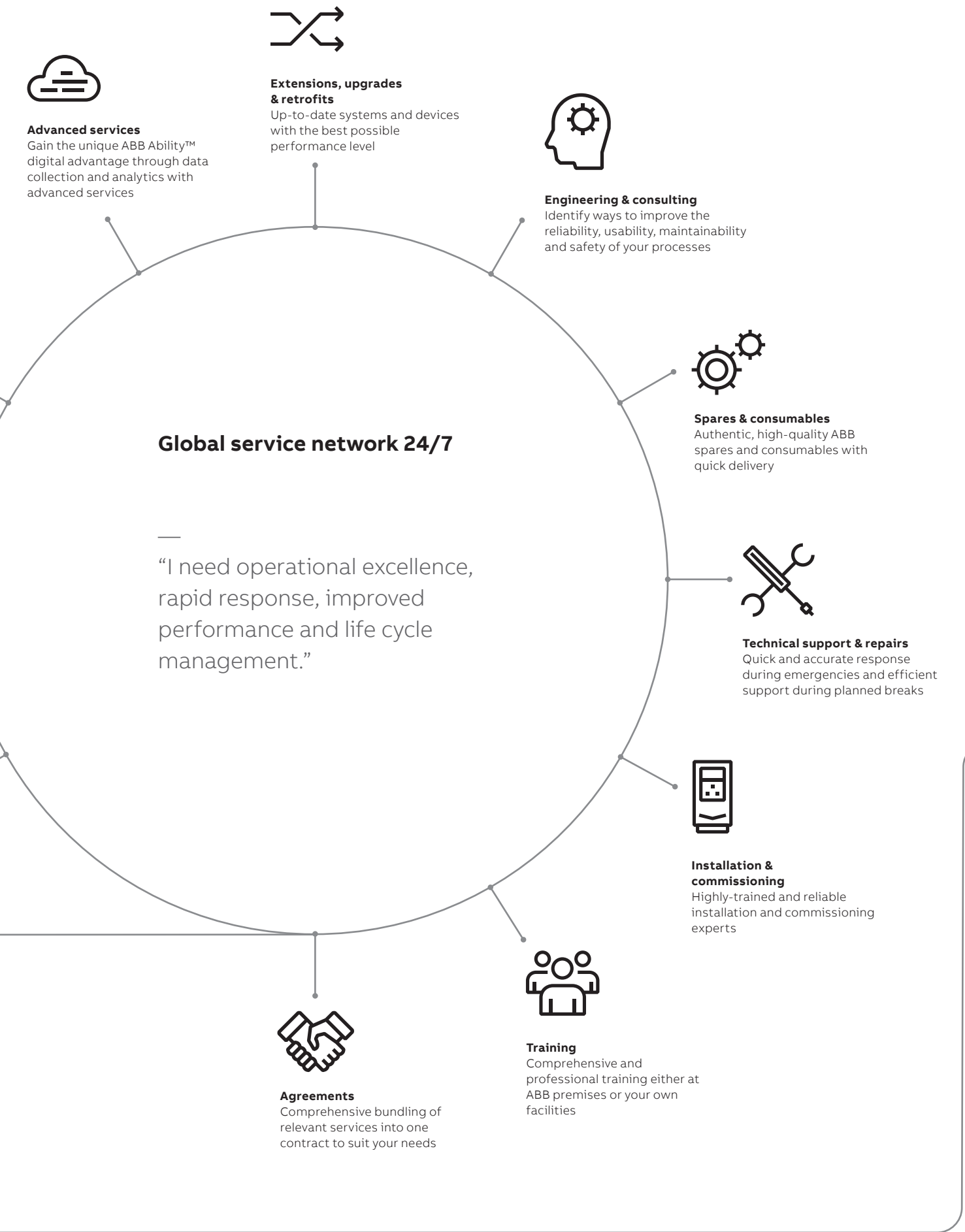


End-of-life services
Responsible dismantling, recycling and reusing of products, according to local laws and industrial standards



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





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 building and HVAC industry players including consultants, system integrators, safety inspectors and engineering societies and organizations. This helps increase building safety and engineering

systems reliability and efficiency to an absolute maximum, while providing healthy and comfortable environments for the occupants.

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, softstarters, motors and generators, ABB offers buildings:

- 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™ 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.





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

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