

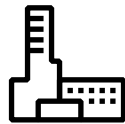


Heating, ventilation and air conditioning in buildings

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 and energy efficient manner.

... 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 Frequency Drive (VFD) selection, due to the cost benefits they deliver over their life cycle.

... ensured by innovative control solutions

- VFDs for HVAC provide optimal control of the building environment providing better comfort and safety of the occupants, while perfectly matching energy consumption to the specific load requirements.
- The return on investment can be improved with Ultra-Low Harmonic (ULH) 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...

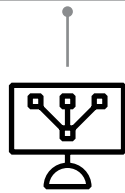
- In-building technical systems primarily aim to provide a healthy and safe environment.
- Under everyday conditions, HVAC systems maintain favorable air temperature, humidity and CO₂ levels for the occupants' comfort, resulting in better health and increased productivity.
- In case of a fire, the building systems must respond accordingly – Fireman's Override mode allows smoke-free exit routes, helps control the fire, and provides 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 VFDs should be carefully chosen in compliance with IEEE 519. Recommendations for harmonic distortion mitigation will help your facilities system be more efficient.

... utilizing best-in-class technologies

- VFDs allow accurate control of CO₂ concentration, temperature and humidity of the air in the occupied spaces by automatically adjusting HVAC processes to match the needs.
- In an emergency like a fire, a VFD'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

- BTL certified BACnet MS/TP, Modbus RTU, and Johnson Controls N2 are embedded in every ACH580.
- In addition, a wide range of optional fieldbus adapters, including DeviceNet, LonWorks, PROFIBUS DP, Ethernet, Modbus TCP, PROFINET IO and BTL certified BACnet/IP, are available to enable connectivity with all major building automation and control systems.
- Building Management system (BMS) is most effective when it works with reliable and accurate data. VFDs are strategically located at HVAC systems throughout the building infrastructure. Integrating VFD data into the Building management system enables informed decisions to support effective facility operation.
- Leading edge application of technologies (IOT) integrated with services like ABB Ability Condition Monitoring can monitor and report on key system data and events.



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.
- Up-time and reliability of HVAC systems is strategic to a business's critical infrastructure. VFDs play a key role in minimizing down time and improving overall reliability.

... by utilizing smart functionality

- Monitoring of temperature, overload, and other protection features within VFDs help prevent failures in HVAC equipment control and ensure its continuous operation.
- The real-time clock in drives keeps records of trips and faults, so the facility management knows what happened and when.
- Customized text for events, Warnings and Faults makes for safe and effective response to system events.
- ABB's HVAC Bluetooth control panel lets you commission the drive remotely, safely outside the arc flash boundary.
- The Drivetune smartphone app allows you to commission and tune the drive from a distance, giving you access to the same primary settings and other menus available on the drive's HVAC control panel.

“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 frequency control.
- VFD usage in HVAC applications eliminates both mechanical, electrical shocks and stresses 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 alarm control 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 levels for the comfort and safety of the occupants.

Applications:

- Supply and Return Air, Make-up Air and Exhaust Air systems

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, commercial office, hospitals, retail and education spaces have dedicated smoke extraction and pressurization fans for smoke exhaust and escape route maintenance.

Applications:

- Smoke exhaust fans, floor and space pressurization, stair well pressurization fans

Requirements:

- Fire Alarm system and smoke control using Fireman's Override Mode
- 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
- Customized text for events, Warnings and Faults makes for safe and effective response to system events.

4 HEATING

Building infrastructure for High rise commercial buildings often involves a dedicated mechanical equipment room to support Hot Water production.

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:

- circulation pumps
- Hot water pumps

Requirements:

- Pumps are controlled to adjust the circulation rate in the heating system to the current heating need





5

AIR HANDLING AND CONDITIONING

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

Applications:

- Chiller compressor, chilled water pumps, circulation pumps, condenser water 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 VFDs on chillers, it is recommended to apply ULH drives to also improve the building's power quality by lowering harmonics and maintaining unity power factor at all load points

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HYDRONIC CIRCUITS

Water is delivered in many different forms in a large commercial building. From domestic water for drinking, washing, and many other needs. All require the use of hydronic circuits to move water at the right pressure of flow. Circulation and booster pumps controlled by drives help with creating comfort in occupied spaces.

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
- Intelligent Pump Control (IPC) makes it easy to control the multi-pumps across the multiple VFDs using peer-to-peer control.


Unlock greater potential in your building systems

Inverter duty 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. 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"> 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 Baldor-Reliance® EC Titanium™ motors Reduced operation cost Improve 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 Reduces un-planned down time Fault resets without human intervention
	<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 office 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
	<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 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
 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



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	Challenge	Solution	Benefit
 Circulation pumps and booster pumps	<ul style="list-style-type: none"> 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
	<ul style="list-style-type: none"> Pump uptime 	<ul style="list-style-type: none"> VFD 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 	<ul style="list-style-type: none"> Continuous comfort for building occupants Improved up time and reliability
	<ul style="list-style-type: none"> 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
	<ul style="list-style-type: none"> Pipe leakage 	<ul style="list-style-type: none"> Leakage monitoring via a VFD indicating when the pressure in a pipe drops to a minimum, thus sending an alarm 	<ul style="list-style-type: none"> Helps avoid infrastructure damage and associated costs due to leakage
	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Pump cavitation 	<ul style="list-style-type: none"> Dry pump protection allows you to set up a control point to trip or alarm based on the input source 	<ul style="list-style-type: none"> Pump and piping system increased lifetime and reduced maintenance cost
	<ul style="list-style-type: none"> Routine maintenance 	<ul style="list-style-type: none"> Using the Motor Disconnect Detection, safely open service switch without stopping the drive 	<ul style="list-style-type: none"> Maintenance cost are reduced

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02



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

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02 Variable frequency 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. Choosing the right products and functions for your specific needs is easy, making any building more 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 for as long as possible

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

Advanced damper control

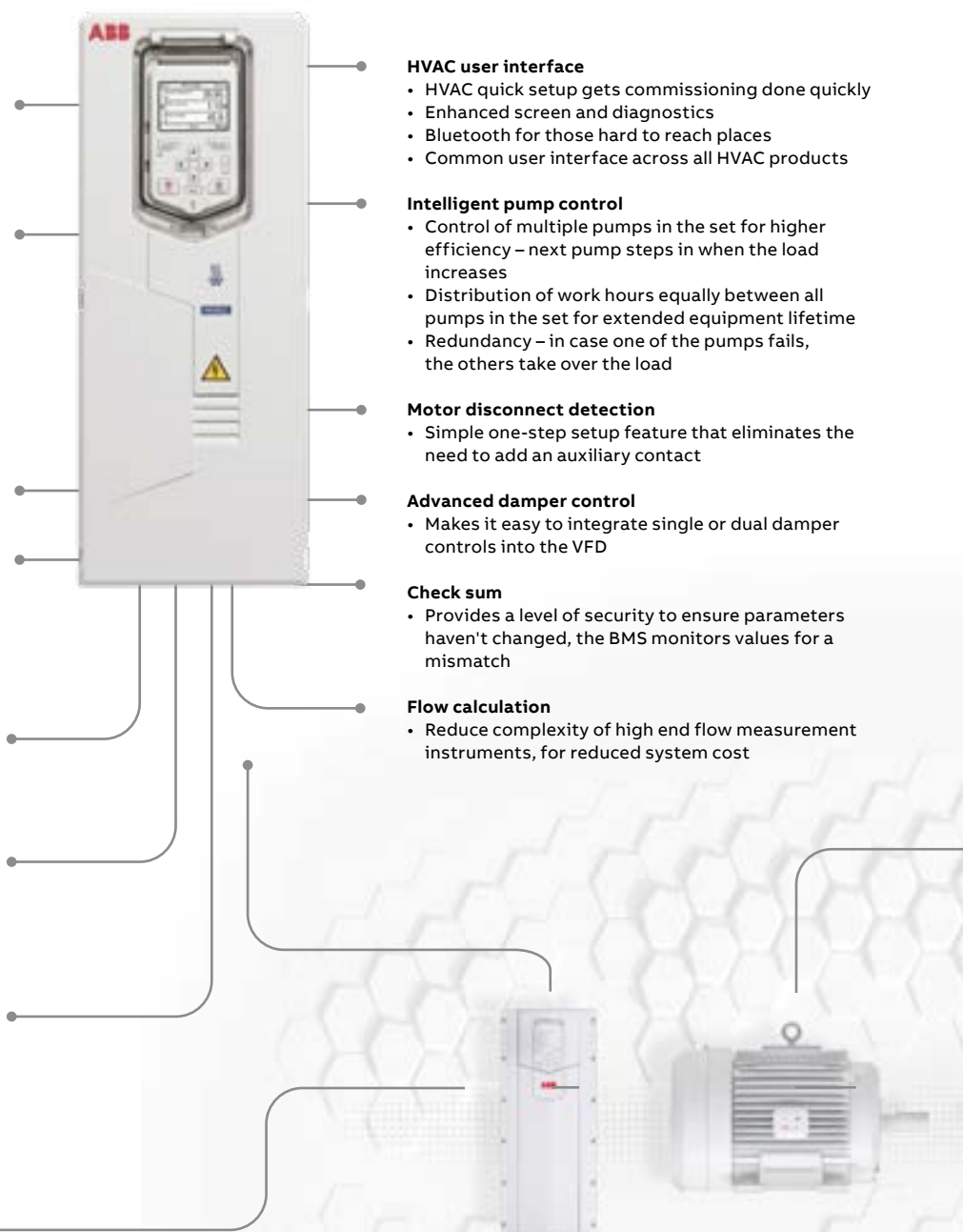
- Makes it easy to integrate single or dual damper controls into the VFD

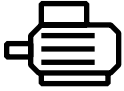
Check sum

- 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



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



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



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, and applications like pumps.

1 Intelligent powertrain

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

2 Turning data into valuable information

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.



Variable frequency drive



Motor



Application
eg pump



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, 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

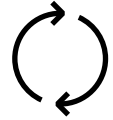
From spare parts and technical support to cloud-based remote monitoring solutions, ABB offers the most extensive service offering to fit your needs. The global ABB service units, complemented by external value providers, form a service network on your doorstep. Maximize performance, uptime and efficiency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

With you every step of the way

Even before you buy a generator, drive, motor, 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.



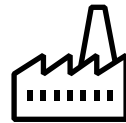
Replacements

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

This increases 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 VFDs, 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

solutions.abb/us-drives-hvac

new.abb.com/service/motion

www.baldor.com/brands/baldor-reliance/products/motors/ac-motors/hvac

new.abb.com/buildings/smarter-building