Simple to sophisticated
Products for pumping systems

Power and productivity
for a better world™

From simple to sophisticated

Our comprehensive global product and service offering helps pump system manufacturers find the right products and solutions to build reliable and energy efficient pumping solutions, all from a single supplier.

Contents

AC drives offer efficient and reliable solutions for increased pump efficiency and energy savings.

Doing more than meeting expectations

Our customers share similar concerns when they select product suppliers for their pumping systems:

- They want product solutions based on experience
- They demand reliability
- They demand quality
- They insist on performance
- And they want the best value

In addition, our customers are being asked to provide pumping solutions that:

- Provide the control to operate at the best efficiency point
- Help them develop engineering recommendations to improve pump performance and to extend pumping system equipment life cycles
- Are more energy efficient and reduce energy consumption and that increase their customer's return on investment
- Use the latest automation technology and application knowledge
- Reduce maintenance demands by using reliable, dependable high quality products backed by global warranties
- Provide condition-based predictive and preventive maintenance programs and schedules, backed by globally available service

Our product offering and global life cycle services help our customers address all of these concerns.

We have an extensive offering of automation, motor, and connectivity products and the application experience to put together the best product solutions for our customers. The offering includes premium efficiency low voltage AC motor and drive packages that reduce installation space and lower energy consumption by as much as 50 to 60 percent, to programmable logic controllers and measurement products that help ensure your pumping system operates reliably, 24/7.

ABB products are backed by our global manufacturing capacity where the same high quality materials and production processes ensure each product's quality. A global life cycle services network provides our customers with a wide range of services from in-classroom training to spare parts contracts.

Our offering includes:

- Pre-sales engineering
- Global life cycle services
- Connectivity and communication ready devices
- Low and high voltage AC motors
- Low and medium voltage AC drives
- Softstarters
- Programmable logic controllers (PLC)
- Measurement products
- Low voltage products

Change thinking on pump efficiency
More than the best efficiency point

Traditionally, pumping efficiency has focused on the best efficiency point (BEP) of the centrifugal pump. However, what does that mean when pumping systems are operated with variable speed output?

Pump efficiency and BEP

The BEP of a centrifugal pump is defined as the operating point of highest efficiency, but also the point where velocity, and therefore pressure, is equal around the impeller and volute. The corresponding BEP for variable speed follows the Affinity laws.

Centrifugal pumps should be selected and normally operated at or near the manufacturer's design specific speed for the rated conditions of head and flow best efficiency point.

In a fixed speed pumping application BEP is "fixed." When flow modulation is required, throttling or bypassing is used. This is not the most efficient way to operate, both in energy use and mechanical stress (reliability) of the system.

Fixed speed and reduced flow

When fixed speed pumping motors are operated at reduced capacity, ie, at a flow significantly less than BEP and at a higher head, the fixed vane angles will cause eddy flows within the impeller, casing, and between the wear rings. The radial thrust on the rotor will increase, causing higher shaft stresses, increased shaft deflection, and potential bearing and mechanical seal problems while radial vibration and shaft axial movement will also increase.

Fixed speed and excess flow

Any pump operated at excess capacity, ie, at a flow significantly greater than BEP and at a lower head, will surge and vibrate, creating potential bearing and shaft seal problems as well as requiring excessive power. Additionally, it may also infringe net positive suction head (NPSH) leading to cavitation and erosion of the impeller.

Many pump systems require variable flow to meet changing process demands. The most common methods for controlling a variable flow system is a control valve, bypass line or a variable speed drive.

Valve control

Controlling the pump with a valve forces the pump "back on the curve" away from the pump's BEP, resulting in wasted energy across the valve and at the pump. In addition the pump's reliability is reduced.

Bypass control

Bypassing the excess fluid allows the pump to operate at or near BEP, however the energy used to move the excess fluid is wasted.

Variable speed drive control

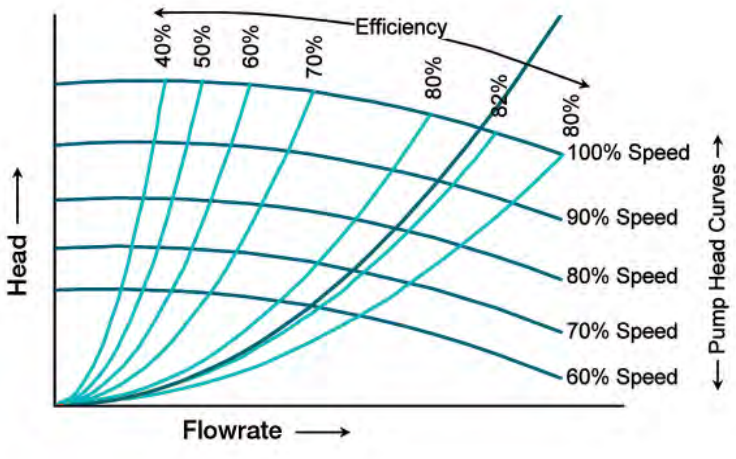
Variable speed drives are the most efficient method for controlling flow. Because the drives control the speed of the motor directly based on actual demand, a more efficient match to the actual system requirements is more easily achieved, increased energy savings are easily possible, and stress on the pumping system as a whole is reduced. Variable speed operation also changes the thinking about BEP, introducing instead the pumping system's best efficiency area, where the specific energy (kWh/m^3) can be kept at the minimum possible value.

BEA and variable speed drives

A pumping system's best efficiency area (BEA) considers variable speed operation and optimization of the pumping system as a whole. BEA helps to understand the benefits of running pumps at variable speeds. This is achieved by using drives to control the speed of the pumping system's motors. BEA takes hydraulic losses of the system into account, and is based on the specific energy use of the total pumping system (kWh/m^3). BEA realistically shows the advantages of operating the pump at lower rotational speeds. These advantages include:

- Lower total system mechanical stress
- Less stress on pump bearings, shaft and sealing system
- Longer pump life span
- Reduced cavitation
- Reduced risk of pump failure
- Good specific energy for a wide operational flow range with either single or multiple pumps

The most efficient method to control the system is a variable speed drive. The drive provides the best solution for optimum pump efficiency and reduced energy consumption.



Solutions for water hammer

The term water hammer comes from the pressure surge's hammering effect on a system. Water hammer is also known as liquid hammer since the phenomenon can occur in other liquids. This phenomenon is the result of a rapid increase in pressure (typically in a closed loop system) when the liquid velocity is suddenly changed.

The effect occurs due to a force applied to move and add pressure to a liquid (which is virtually incompressible) thereby creating dynamic energy that is transmitted instantly across the system. When liquid moves, stops, or changes velocity abruptly, the dynamic energy amplifies the normal system pressure creating a sudden pressure surge, or spike. When the pressure surge accelerates and approaches the speed of sound, the surge becomes an acoustic resonance with a sound wave. The pressure surge is amplified many times greater than the normal system pressure. This pressure surge can be extremely destructive to system components ie, pump, piping and valves.

In a centrifugal or roto-dynamic pumping system the sudden change may be the result of:

- Across-the-line starting
- Abrupt stop from base speed
- Rapid change in speed
- Sudden opening and closing of valves

All of these events can result in a change in the liquid velocity within the pumping system.

Actions for controlling water hammer:

- Protect the pump by installing non-return check valve on discharge piping to isolate the pump in the event of its sudden stoppage or reversal of its rotation in an upset condition. This device should be installed regardless.
- Open or close valves gradually (results in stress to system and wasted energy)
- Install surge suppressor, or pulsation dampener (highly engineered solution)
- Using a gradual, controlled start/stop of the pumping system prevents water hammer. This is the most effective method for controlling water hammer.

In order to provide the gradual deceleration of the pump, sufficient motor torque needs to be available. To address the motor torque/controlled stop ABB offers three solutions, AC drives, electro-mechanical controlled start (CST) and softstarters.

AC drives

In addition to the many pump specific features provided in our AC drives, reliable and precise torque control is a standard feature. Technology like ABB's direct torque control (DTC) ensures the needed torque is available in the motor while stopping the pump.

Electro-mechanical controlled start

Our Baldor/Dodge division has a unique electro-mechanical solution for high horsepower low speed pumping applications where a controlled start and stop is necessary, eg irrigation, circulating water and flood control pump systems.

Softstarters

ABB softstarters with torque control are designed for pumping applications. The PSE and PST range of softstarters with torque control have a stopping algorithm that provides full control over the pump's torque during the pump's deceleration ramp.

Solutions for pumping challenges, a spotlight on drives

Built-in technology in ABB AC drives does more than just control the speed and torque of AC motors. Pump specific functions provide solutions for many common pumping challenges while improving the pumping system's energy efficiency, mechanical reliability and availability.

PID control: Process feedback, rather than a set speed reference, lets the drive calculate the required motor speed or torque based on pre-configured process parameters like flow, pressure, level, etc.

Pump cleaning/anti-jam

Used to prevent solids from building up on pump impellers and piping, this function consists of a programmable sequence of forward and reverse runs of the pump to shake off any residue on the impeller or piping. This is especially useful with booster and wastewater pumps, and can be set to run automatically at scheduled intervals, at startup or when the drive detects the impeller needs cleaning.

Level control

Using a level or pressure sensor connected to the drive's analog or digital inputs, the drive varies the flow into the container ensuring the desired level is maintained. Level control also works with a series of drives connected in a master/follower configuration, known as multi-pump.

Sleep and boost

When demand falls and the motor speed is reduced, the drive detects the changes over time and starts the sleep mode. It stops unnecessary pumping but continues to monitor pressure. Pumping restarts when the pressure falls below the set level.

Pump auto change

In multi-pump systems, the drive alternates between available pumps ensuring each has an equal duty cycle.

Pump priority

Used in pumping systems where the flow rate varies based on a schedule or demand. For example, the drive can be configured to use larger pumps during high demand times and switches to smaller pumps when the demand is less, optimizing system efficiency.

Flow calculation

Drives with a built-in flow calculation function very accurately determine the process' flow rate without requiring an external flow meter. This calculation is suitable for applications where flow data is not used for invoicing.

Flow monitoring

When configured, the drive monitors the flow (calculated or actual) and generates an alarm or fault if the flow falls below or rises above defined limits. This function helps detect leaks in the system.

Pumping in water and wastewater systems
ABB's ACQ810 AC drive for water and wastewater applications is designed with many built-in pump specific functions to meet the demanding requirements found in the water industry.

- 0.37 to 400 kW
- 0.5 to 535 hp
- 200 to 480 V AC

Multi-pump control
Communicating together, ABB drives efficiently control parallel pumps to meet the required variable flow demands. Stable process conditions are maintained while optimizing the speed and number of pumps required.

Soft pipe filling
Pressure peaks damage pipe work and aggravate leaks. The drive ramps the pump speed slowly, avoiding pressure peaks when filling systems.

Energy savings calculator
Drives with energy savings calculators show used and saved energy by the motor, and can display this information in terms of kWh, currency or volume of saved CO_2 emissions.

Flow and pressure protection
Cavitation occurs when pumping pressure falls and the fluid being pumped is vaporized by the change in pressure at the impeller. This results in harmful gas bubbles that cause damage to the pumping system. The drives detect when the flow rate or the pressure in the pumping system changes, and can increase or decrease pumping to correct the flow or pressure, helping to prevent cavitation.

Energy optimization
The drive monitors the load on the motor shaft and optimizes the motor's flux to ensure the minimum amount of energy is used to satisfy the pump system needs.

Energy consumption monitoring
The drive monitors the energy consumption of both the drive and the pump's motor. The drive saves 12 months of data, and can be configured to generate alarms when the energy consumption rises significantly compared to past consumption.

Oil and gas pumping
Designed specifically for the unique demands of the oil and gas industry, dedicated control programs help improve the performance of:

- Electro submersible pumps (ESP)
- Progressive cavity pumps (PCP)
- Rod pumps
- Booster pumps

Harmonic reduction
Drives with built-in harmonic reduction ensure total harmonic distortion (THD) levels remain less than 5 percent.

Power loss ride through
Drives with this feature are able to remain in control during short periods of power loss. This also helps prevent mechanical shocks when power is restored.

Built-in motor protection
Along with pump specific functions, ABB drives also provide many built-in motor protection functions as well. These include:

- Motor thermal protection
- Motor stall protection
- Phase loss detection
- Motor ground fault protection

Pumping in HVAC systems
Pumps are used throughout heating, ventilation and air conditioning (HVAC) systems. And when these systems are used in commercial buildings, there are increased requirements that the system must meet. ABB drives for HVAC provide built-in solutions for these increased requirements.

- Meets HVAC EMC requirements
- Meets HVAC harmonics standards
- Native BACnet for integration with building management systems
- IP21 and IP54 protection
- Built-in timers
- Built-in calendar and clock

ACH550 drives for HVAC.

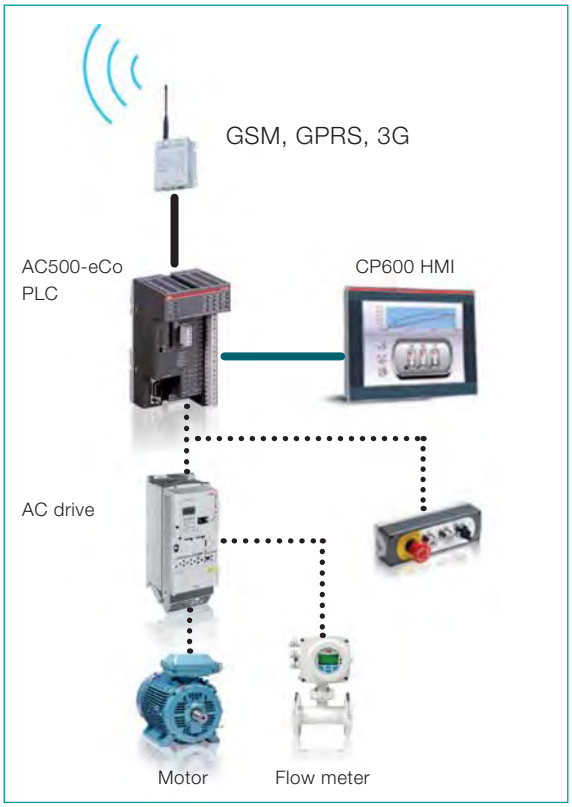
Pumping solutions, from simple to sophisticated

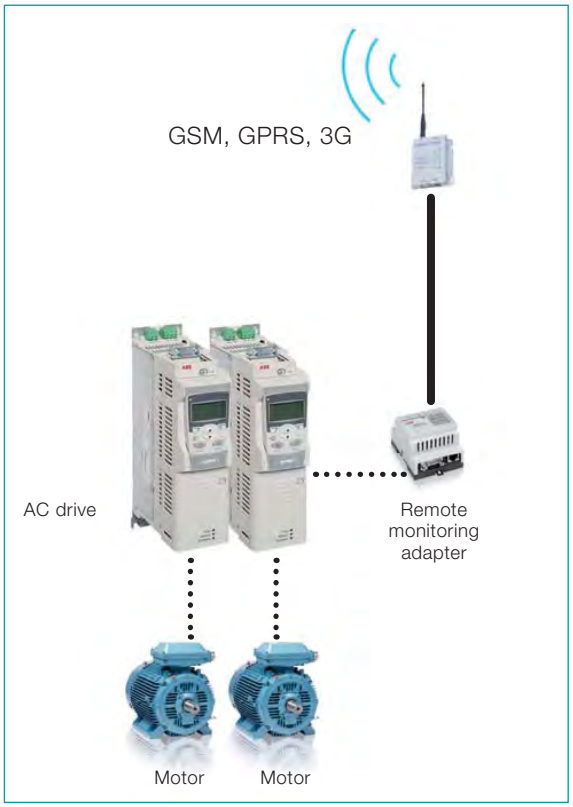
Manual motor starter and contactor

Softstarter

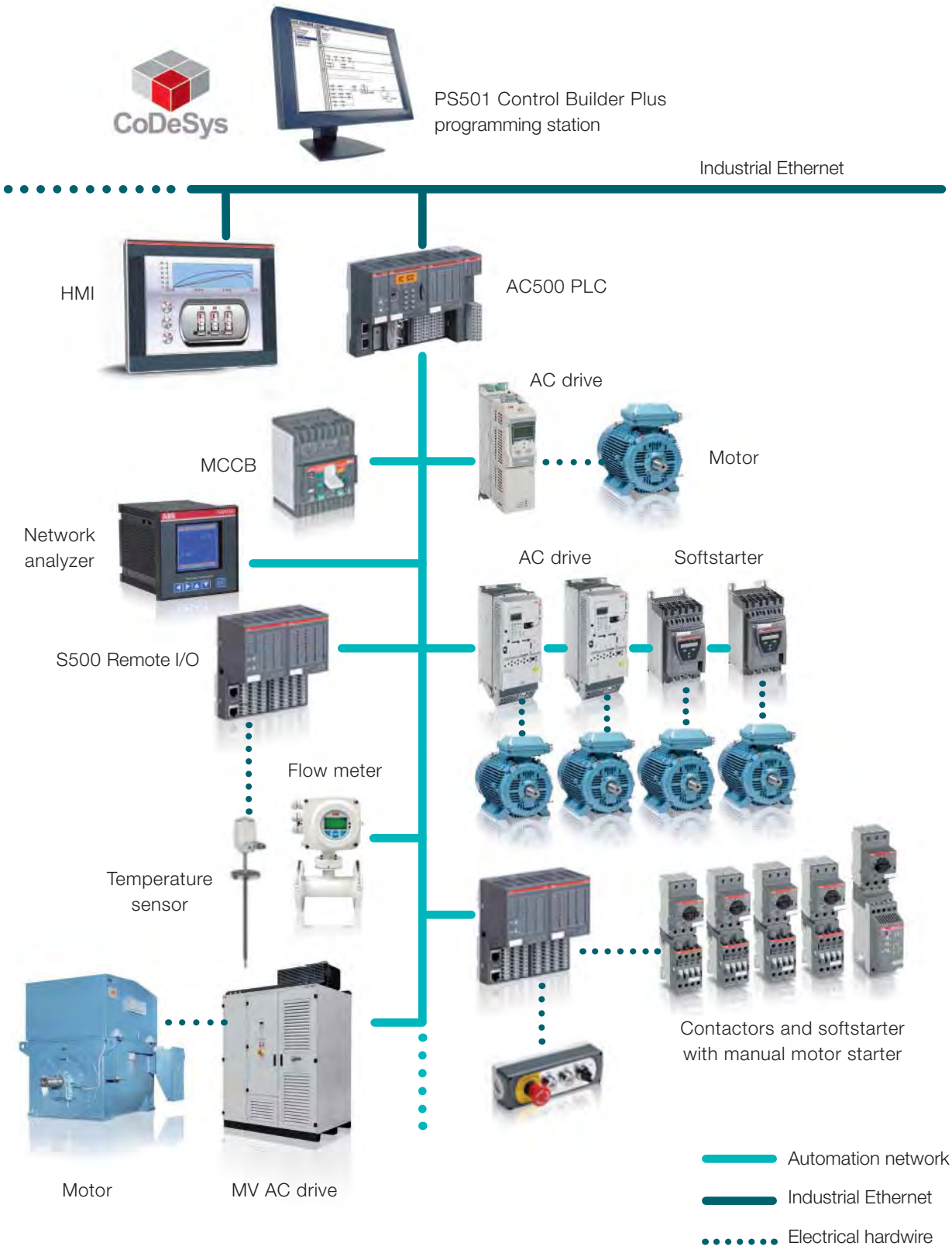
Low voltage AC drives

Remote monitoring options





Advanced solutions with PLC and measurement products



Low and medium voltage AC drives offer tremendous energy savings

Using ABB AC drives to control motor speed and torque in pumping systems not only helps greatly reduce lifetime energy costs, but also improves system reliability. The wide range of built-in pump control technology helps our customers build smarter pumping systems.

Pump specific applications built-in to the drives offer solutions for common challenges such as multi-pump control, flow and pressure monitoring, PID control, level control and cavitation protection. Energy use and saved CO_2 information let our customers easily keep track of their savings.

Single drives, 200 to 690 V
- 0.37 to 5,600 kW
- 0.5 to 7,500 hp

Multidrives, 380 to 690 V
- 1.5 to 5,600 kW
- 2 to 7,500 hp

The drives help you easily follow your return on investment and energy savings by calculating:

- Saved MWh
- Money saved (in local currency)
- CO_2 reduction

ABB medium voltage AC drives extend drive control and energy saving benefits to larger pumping systems. From reducing network voltage dips when starting pumps to soft starting and stopping, these features reduce mechanical stresses on the pumping system.

Single drives, 2.3 to 10 kV
- 250 kW to 72 MW (higher on request)
- 335 to 96,500 hp (higher on request)

Multidrives, 3.1 to 3.3 kV
- 3 to 36 MW
- 4,020 to 48,240 hp

Soft starting solutions, 2.3 to 10 kV
- 250 kW to 72 MW (higher on request)
- 335 to 96,500 hp (higher on request)

AC motors, demonstrated pumping dependability

Motors are the driving force for pumping systems. Reliability and efficiency are key factors in their choice. Our motors are designed with this in mind and are backed by global manufacturing and life cycle services.

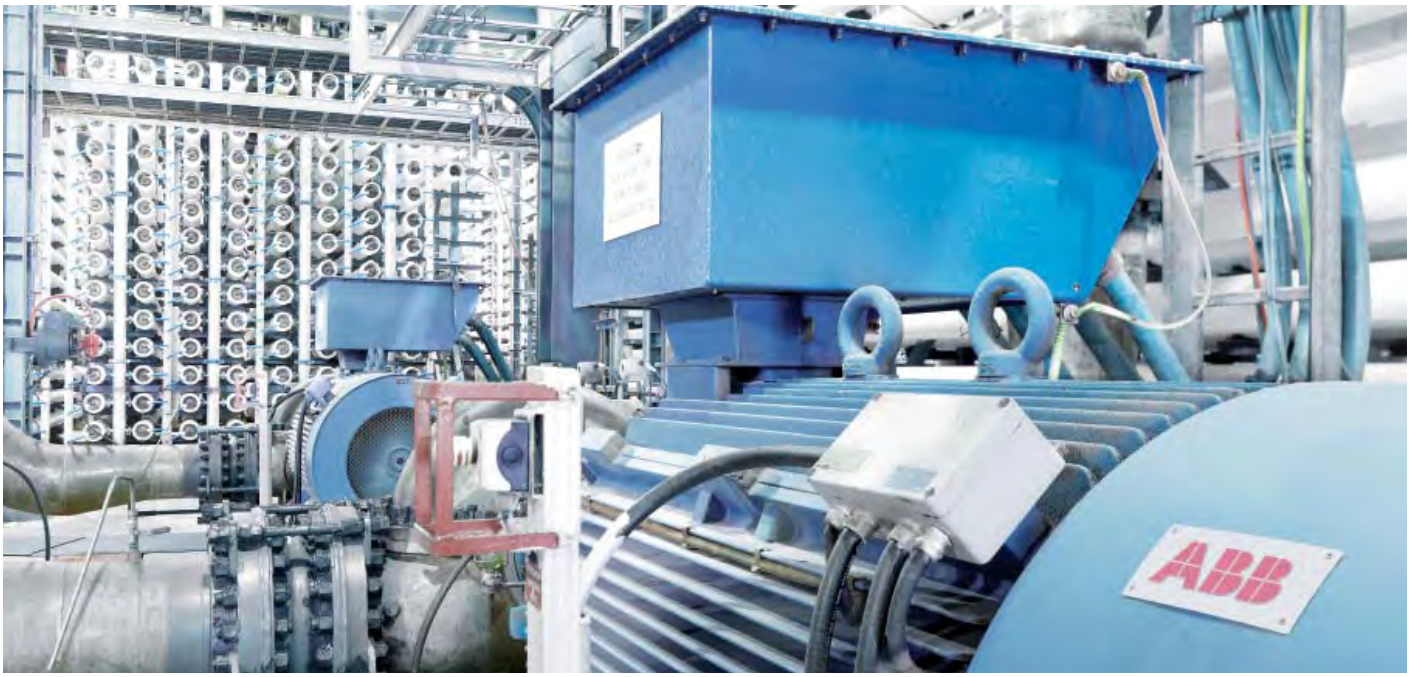


ABB low voltage IEC and Baldor Reliance NEMA AC motors offer robust and reliable performance for a wide variety of pumping applications. The motor selection includes induction motors, permanent magnet motors, synchronous reluctance motors, and motors for explosive atmospheres.

IEC Process performance motors
- IEC frame sizes 71 to 450, up to 1,000 kW
- Efficiency classes IE2, IE3 and IE4

General performance motors
- IEC frame sizes 56 to 355, up to 355 kW
- Efficiency class IE2

Explosion proof motors, all protection types
- IEC frame sizes 71 to 450, up to 1,000 kW
- NEMA frame sizes 48 to 5810, 0.25 to 800 hp

NEMA Severe duty motors
- NEMA frame sizes 42 to 6800, up to 5,000 hp
- NEMA Premium efficiency; Energy Efficient

The powerful range of ABB high voltage IEC and medium voltage Baldor Reliance NEMA AC induction and synchronous motors are designed to operate reliably no matter how challenging the pumping system. The standardized construction for horizontal and vertical motors feature innovative insulation and optimized rotor, stator and fan designs. This, along with over a century of electric motor design, helps ensure low life cycle operating costs and reliable operation.

Cast iron HXR motors
– IEC sizes 355 to 560, 100 to 2,250 kW

Modular induction motors
– IEC sizes 400 to 1,000, 140 to 23,000 kW

Process performance cast iron motors
– IEC sizes 315 to 450, 110 to 750 kW
– NEMA sizes 143T to 6800, 1 to 5,000 hp

Synchronous motors
– IEC sizes 0710 to 2500, 1 to 60 MW

Synchronous reluctance motor and drive packages, efficiently efficient

When motor bearings and windings heat up, energy is lost, and reliability is lowered. Our synchronous reluctance motor (SynRM) and drive packages offer a new rotor design that significantly increases efficiency and improves system reliability, all without the use of rare earth magnets.

High output SynRM motor and drive package

Induction motor

High output synchronous reluctance motor

The high output SynRM motor can be up to two IEC frame sizes smaller when compared to traditional induction motors. This space savings helps design more compact pumping systems.

Alternatively, replacing an induction motor with the same frame size high output SynRM motor is a convenient way to increase a pumping systems's power.

IE4 SynRM motor and drive package

IE2 Induction motor

IE4 Synchronous reluctance motor

Losses in the IE4 (super premium efficiency) SynRM motors are cut up to 40% compared to IE2 motors. This helps pump system designers to meet the ever increasing demands for more efficient pumping systems.

The IE4 SynRM motors are available with the same output size combinations compared to traditional induction motors. This allows existing pumping systems to be upgraded easily for increased system efficiency.

Synchronous reluctance motors require the use of an ABB drive, they cannot be run direct-on-line.

Low voltage products bring it all together

Sometimes, the small things make the biggest difference. In pumping systems, every switch, breaker, fuse or contactor needs to be just as reliable as any other part of the system. That's the driving idea behind every one of ABB's low voltage products.

Low voltage products connect the electrical system and provide protection for pumping systems. From circuit breakers, contactors, relays and switches to surge protection and residual current devices, the range of products helps our customers create the best solution for their pumping needs.

Circuit breakers
- Air circuit breakers
- High performance and miniature circuit breakers
- Moulded case circuit breakers

Control products
- Arc guard systems
- Contactors
- Manual motor starters
- Electronic relays

Fusegear
- Switch fuses
- Fuse switch disconnectors
- Fuse bases
- Fuse links
- Fuse monitors

Switches
- Switch-disconnectors
- Change-over switches
- Transfer switches

Enclosures
- Main distribution boards

Other modular DIN rail products
- Residual current devices
- Surge protective devices
- Electricity meters
- Socket outlets

Softstarters deliver controlled and cost effective motor startup and stopping

In pumping systems, it's not always the motor starting that can be challenging. Direct motor stops can quickly wear out valves, gaskets and pipe connections. ABB softstarters offer convenient and reliable solutions.

The wide range of softstarter solutions offers more than just controlled motor starting and stopping. With features such as fieldbus communication options, pump-stop torque control, built-in bypass and flexible output connections, they offer flexibility for pump system designers.

PSR range
- Compact
- Can be used with manual motor starter
- Up to 105 A, 600 V

PSE range
- Pump specific functionality
- Torque control
- Up to 370 A, 600 V

PST range
- Most advanced functionality
- Torque control with programmable functionality
- Up to 1,050 A, 690 V

Measurement products provide a look inside

Acquiring accurate data on what is actually happening inside a pumping system is critical for efficient and maximized flow. Our measurement products make this data easily available.

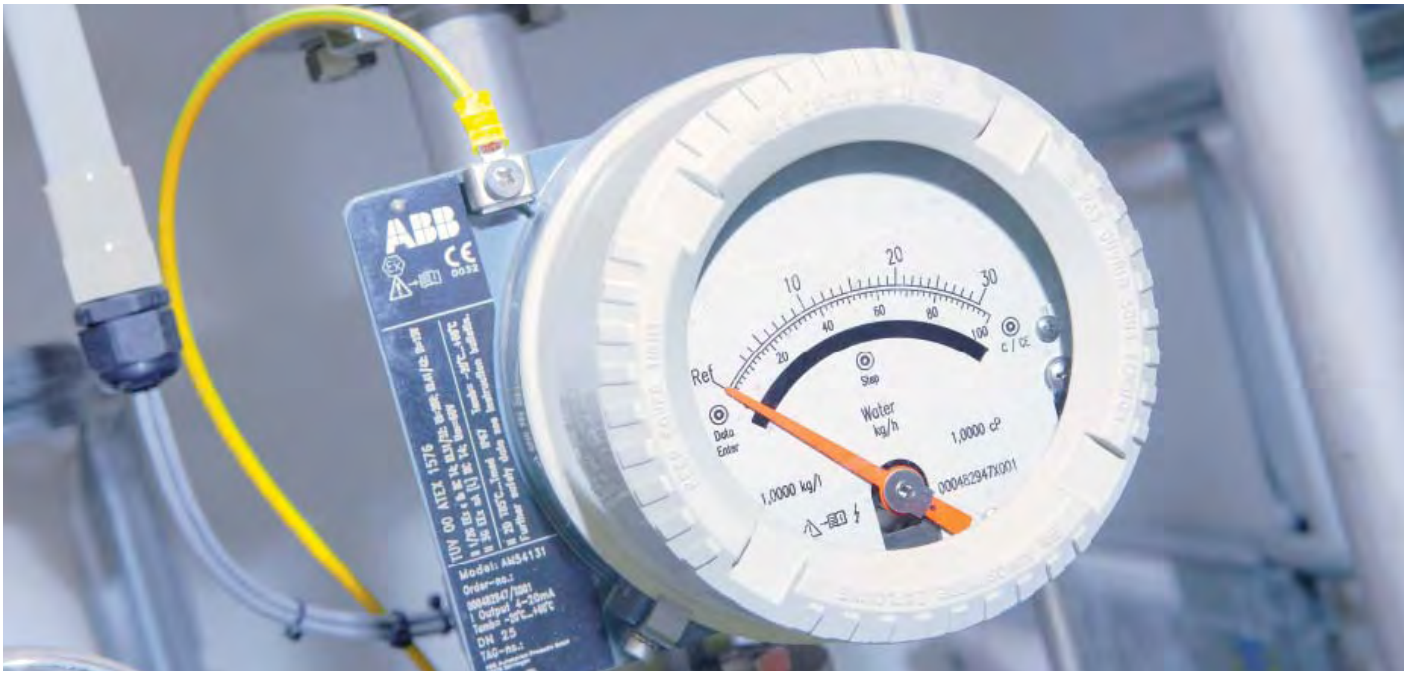


ABB flow, temperature, pressure and level sensors as well as analytical measurement products provide the reliable and accurate data needed to fine tune the performance of your pumping systems. With a wide range of input and outputs they easily integrate into pumping systems. Developed with over century of experience and backed by worldwide sales and service, our measurement products provide pump system designers with the right data for any pump system design.

Flow measurement products
- Self diagnostics
- High accuracy
- Quick and simple startup

Pressure, temperature and level measurement products
- Long term stable measurements
- Designed for demanding environmental and operational conditions

Analytical measurement products
- Simple setup
- Easy operation and maintenance
- Online diagnostics

PLCs enable flexible and scalable control

Pumping systems can have very unique control challenges. And when they do, our range of PLCs provides the flexibility to meet these challenges.

The scalable ABB AC500 range of PLCs, which also includes a safety PLC, provides pump system manufacturers with the flexibility and choices to meet the technical demands of pumping systems. A wide range of communication options provide connectivity to all common industrial networks. Design and build your pump control applications with our Control Builder Plus engineering tool.

AC500-eCo
- For small to medium applications
- CPUs come with onboard digital and analog I/Os
- Expandable

AC500
- For mid to high end solutions
- Wide connectivity and real time Ethernet
- Complete set of internet services
- Very fast algorithm execution
- Decentralized I/O
- Available for harsh ambient conditions

CP600 operator panels:
- Wide range of touch panels (from 4.3” up to 15”)
- Graphic and web panels created with Panel Builder 600 or the AC500 web server
- Completely integrated with AC500 PLC and Control Builder Plus
- Alarms, trending and graphics fully integrated
- USB, Ethernet and serial communication ports

Global life cycle services offer more than just spare parts

Our global service offering starts even before you decide to buy ABB products, and continues through installation, commissioning, and daily operation to the eventual recycling of the products. Our local and global technical support networks answer questions and solve problems quickly and efficiently.

Pre-sales services
Energy appraisals help you find out where and how you can save energy.

The appraisal, conducted on your site by trained ABB engineers, documents types and powers of motors, control methods used, and typical duty cycle characteristics. The information is used to produce a report showing possible energy savings, the estimated annual operational savings, and recommended products as well as payback period to achieve these savings.

Pre-sales engineering connects our technical engineers with your engineers. They work together to understand your unique product and integration requirements and together, determine and specify correctly dimensioned products.

ABB global manufacturing, central stocks and advanced logistics solutions ensure high availability and quick delivery, including spare parts.

Installation and commissioning
Time and cost efficient installation and commissioning helps get pumping systems up and running safely and quickly. We offer a wide range of installation and commissioning services to help you stay on schedule.

Preventive and predictive maintenance
Planned preventive maintenance helps you extend the return on your investment. Our preventive maintenance programs let you tailor the best service to meet your needs. From product-specific maintenance schedules to convenient preventive maintenance spare parts kits, these services help you keep your pumping systems running reliably.

Quite often, analysis of process data provides helpful information to pinpoint where unplanned maintenance actions may be required. From PLC's and drives monitoring process data, to our Life Expectancy Analysis Program (LEAP), predictive, or condition-based maintenance services help you identify, budget and plan for your maintenance.

Retrofit and upgrades

Sometimes, existing equipment can be retrofitted or upgraded with our latest products to help optimize your operation. This offers a cost efficient solution compared to replacing the whole system.

Ordering and tracking

Our eBusiness systems make routine tasks like checking stock availability, ordering and status tracking quick and easy. Product documentation and other information are quickly available.

Training, available at ABB Universities, online, and even at your site, makes sure your system engineers and maintenance staff have the technical understanding and familiarity to keep ABB products running reliably.

Services tailored to your needs

Our services are offered on a contract basis and are designed to meet your specific requirements. The contracts are flexible, allowing you to add or remove services as your business needs grow.

This is ABB

As one of the world's leading engineering companies, we help our customers to use electrical power efficiently, to increase industrial productivity and to lower environmental impact in a sustainable way.

Many of the benefits we take for granted in our daily life, from electricity at the touch of a switch to the consistent high quality of industrial goods, are made possible by technology that was pioneered, improved and adapted by ABB over more than a century of innovation.

Formed in 1988 by the merger of two long-established engineering groups, ABB has about 135,000 employees and operations in more than 100 countries in every region of the world.

Today, ABB is one of the world's leading engineering companies, helping customers to use electrical power effectively and to increase industrial productivity in a sustainable way.

Power Products Division
- High Voltage Products
- Medium Voltage Products
- Transformers

Power Systems Division
- Grid Systems
- Network Management
- Power Generation
- Substations

Discrete Automation and Motion Division
- Low Voltage Drives
- Motors and Generators
- PE and MV Drives
- Robotics
- Programmable Logic Controllers

Low Voltage Products Division
- Breakers and Switches
- Control Products
- Enclosures and DIN-Rail Products
- LV Systems
- Wiring Accessories

Process Automation Division
- Full Service
- Open Control Systems
- Measurement Products
- Marine and Cranes
- Metals
- Minerals
- Oil, Gas and Petrochemical
- Pulp and Paper
- Service
- Turbocharging

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www.abb.com

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