

ABB drives

Low voltage AC drives for cement

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ABB

Profile



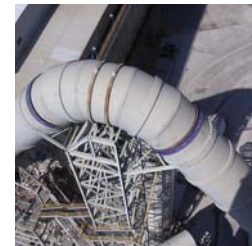
More than 2,000 million tonnes of cement are used every year, with different types manufactured to meet various chemical and physical requirements. Producing this cement requires a clear understanding and careful control of the manufacturing processes. With over 100 years experience in the cement industry, ABB brings an unrivalled clarity of vision to the specific needs of the cement making process.

Automating the future

Recent years have seen a dramatic increase in the level of automation and, in particular, the use of variable speed AC drives within the cement industry. Automation leads to less man power, therefore less errors in production, while optimizing the process and making control easier and faster.

ABB drives – highly reliable, energy and cost efficient

AC drives are primarily used to adjust the speed and/or torque of standard AC motors. AC drives, together with induction motors, replace DC motors and slip-ring motors along with their control systems. AC drives also replace the need for starters, cascade drives, hydraulic speed control, mechanical gears, fan inlet vane control, fan damper control and many



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other techniques of regulating the speed of electric motors used throughout the cement making process.

AC drives bring substantial energy savings, reduced installation, operation and maintenance costs. The high reliability and reduced mechanical stress on electric motors leads to maximized up-time and greater productivity.





Profile

For over 30 years ABB has been supplying low voltage AC drives to the cement sector. Today, AC drives are used in a wide range of applications, some of which involve much more than just rotating the motor. The benefits include:

- Lower energy consumption, gas emissions and pollution levels
- Less investment in electrical network compensation devices, such as filters
- Reduced harmonic distortion to the electricity supply network
- Minimized mechanical wear of the equipment
- Higher process quality and reliability
- Better process equipment efficiency
- Increased productivity and throughput



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How ABB can help

Throughout all stages of cement production ABB offers:

- Wide product range from pushbuttons to complete automation systems
- Versatile services from technical support to plant engineering
- Global presence and local support in over 100 countries





ABB drives - highly reliable, energy and cost efficient

ABB drives bring together a world leading and recognized brand which has carved a niche as a global number one supplier for variable speed AC drives together with a product range from 0.18 kW up to 100 MW that is simply the widest available from any manufacturer.

ABB drives is a reference for drives users the world over and signifies reliability, simplicity, flexibility and ingenuity, throughout the lifecycle of an AC drive.

For the cement industry, ABB manufactures motors and drive systems, from sub-kilowatt to megawatt ratings in low voltage and medium voltage ranges.

Flexible customer interface

- Easy connection to automation systems:
 - several fieldbus protocols available
 - same application program for the entire power range
- Drive's input and output signals can be used as they are, or modified depending on customer application
- Parameter setting is extremely easy to use and understand



Superior control accuracy and high dynamics

- The world leading motor control method, Direct Torque Control (DTC), ensures extremely high control accuracy
- DTC behavior in abnormal situations is excellent, i.e.
 - short supply voltage breakdown
 - heavy variations of torque
 - motor already rotating
 - cable short-circuits



Unrivalled energy efficiency

- Lower reactive power consumption
- High efficiency of 98 per cent
- Minimized need for air conditioning in electrical rooms



Maximized uptime

- Preventive maintenance to avoid unplanned down-time
- Short repair time to minimize production losses
- Alarms before malfunction
- Drive diagnostics to help personnel to locate any faults





Products

ABB industrial drives - single drives, 0.55 to 5600 kW, 230 to 690 V

ABB industrial drives are highly flexible AC drives that can be customized to meet the precise needs of all demanding cement industry applications.

Programmability is a key feature of these drives. Here we highlight just a sample of benefits offered by an ABB industrial drive.

Inbuilt redundancy

With parallel-connected modules, drives can be run without faulty modules.

Network friendly

High power factor (nearly unity) and low harmonic feedback into the line supply cause less losses in supply cables, transformers and switchgear.

Advanced motor control

Direct Torque Control brings unprecedented control accuracy and the best tolerance on voltage dips. The control has excellent dynamic performance.

Modular construction

Drive modules are interchangeable across the entire power range. Spare modules are easy to stock and handle. Repair procedure is fast.



Industrial design

The drives are designed to meet the requirements of various industrial environments:

- Protection classes up to IP54
- Varnished boards
- Cabinet heaters
- Temperature protection with warning functions
- Changing dust filters without stopping drive
- Inbuilt EMC filter

Multilingual control panel with start-up assistant

Parameters, fault messages, alarms and instructions are shown in 14 languages. The desirable language is easily selected.

Flexible control interface

Extensive fieldbus communication possibilities including Ethernet, are available.



ABB industrial drives - regenerative drives, 5.5 to 2500 kW, 230 to 690 V

Regenerative drives - also known as 4-quadrant drives - belong to the ABB industrial drive range. Thus, the same features and benefits of ABB industrial drives are available with the regenerative drives. The inbuilt active supply unit allows full power in motoring and generating modes. Transition between modes is quick due to the ultra-fast DTC method.

An active supply unit also provides control of the network power factor and if rated appropriately the active supply unit can compensate for the reactive power consumption of other loads such as fixed speed motors, transformers and rectifiers.

Network friendly

Thanks to the active supply unit, the drive has excellent tolerance against network voltage fluctuations compared with traditional regenerative drives with a thyristor supply unit. In addition, the harmonic currents generated into the network by the active supply unit with DTC and the LCL filter are very low, thus resulting in lower power losses in the supply transformer and cabling.

Compact size

Everything required in an AC drive can be mounted inside the cabinet, including integrated RFI filters, chokes, brake choppers, I/O extensions, fieldbuses and pulse encoder modules, delivering further space savings. No space is needed for additional enclosures or cabinets, while the reduced cabling requirement further lowers costs.

Dynamic braking

It only takes a few milliseconds for the load torque to change from its nominal value in the motoring mode to its nominal value in the generating mode. These kinds of torque changes are easily managed, enabling dynamic braking and superior speed and torque control.

Nominal motor voltage even at fluctuating network voltages

The drive compensates for network fluctuation, thereby guaranteeing nominal motor voltage even at low network voltages. The IGBT supply unit keeps the DC link voltage and consequently the motor voltage at nominal value, even if the network voltage drops down. This makes it possible to save in motor dimensioning as low network conditions do not need to be considered when selecting the motor.

Easy to install

Available in either a standard cabinet or as a kit with mounting frames. Commissioning is equally simple, with ABB's start-up assistant giving effective menu-driven help with parameter setting for fast plug-and-perform operation.



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It pays to have an active supply unit

ABB AC drives feature active supply units manufactured using power semiconductor technology known as insulated gate bi-polar transistor (IGBT). With these components, both normal rectifier and the regenerative functions are achieved. Also, the DC voltage level can be

controlled to increase the voltage level in the DC circuit. This ensures the optimum voltage to the motor during network fluctuations.

With an active supply unit, the drive not only controls the speed but also carries out other tasks, unlike those drives with passive supply units.



Products

ABB industrial drives - low harmonic drives, 5.5 to 2700 kw, 230 to 690 V

Effective harmonic mitigation, combined with unrivalled motor control functionality, is now available in the latest low harmonic drives. These drives are compact in size and do not require any multi-pulse transformer, filters or other additional

equipment for harmonics reduction. This results in better harmonic performance compared with 12-pulse or 18-pulse solutions.

Low harmonic distortion emissions

Eliminates low and high-order harmonics resulting in low harmonic content in the network.
With total current distortion reduced to less than 5 per cent, the drives meet the requirements of stringent harmonics guidelines such as IEEE519 and G5/4.

Simpler cabling

Thanks to low harmonic emissions, no dedicated multi-pulse transformer is needed. This simplifies cabling arrangements and reduces the floor space required.

Reduced need for reactive power compensation

The power factor can be controlled by the active supply unit. The power factor can be unity or controlled to compensate for the reactive power.

Easy maintenance

Smart module concept enables easy maintenance and redundancy in high power range.



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During the mains voltage breakdown, the stopping of the active supply unit is controlled and no fault situations occur. This is in contrast to switch-off of thyristors, which are no longer controlled during a network voltage breakdown. This may result in a short circuit in the bridge and the blowing of the protective fuses.

ABB industrial drives feature two types of active supply units, one for fully regenerative 4-quadrant operation and minimized harmonic emissions and the other for minimized harmonic emissions only. Both supply units provide control of the input power factor and if rated appropriately they can compensate for the reactive power demand of other loads such as fixed speed motors.



ABB industrial drives - liquid-cooled single drives, 200 to 5600 kW and multidrives, 1.1 to 5600 kW, 380 to 690 V

Thanks to direct liquid cooling, the drives are extremely compact and silent. Liquid cooling is efficient with 98 per cent of losses transferred to the liquid and only 2 per cent of losses radiated. The liquid is either tap water or a mixture of water and propylene glycol, to counter freezing conditions.

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Totally enclosed

The drive is designed into a totally enclosed cabinet to class IP54 or IP42 and without any cooling openings. This avoids harmful dust, suspended in the air, being circulated within the drive, which could lead to malfunction or shorter lifetime of critical components.

Minimized air conditioning

Being liquid-cooled and totally enclosed means that no additional air conditioning is needed - heat losses are transferred through the pipe work to the outside of the electrical room.

Compact size

The overall size of the drive is up to 50 per cent smaller, compared to previous generations and its air-cooled counterpart.

Low noise

Direct liquid cooling offers low noise and easy heat transfer without air filtering. Having no additional air conditioning or cooling fans means minimal noise levels in electrical rooms.

Inbuilt redundancy

The drives have inbuilt redundancy through parallel-connected modules - each module is a complete three-phase inverter. The motor can still run with a partial load even when one of the modules is not operating. This enables higher drive availability and greater process up-time.



Products

ABB industrial drives - multidrives, 1.1 to 5600 kW, 380 to 690 V

Designed for simultaneous control of multiple motors, this highly modular AC drive range uses multiple drive modules (inverters) connected to a common DC busbar. This busbar supplies the modules with DC power coming from a single inbuilt rectifier unit. This construction simplifies the total drive installation, reduces cabling, installation

and maintenance costs and brings substantial space savings. In addition, thanks to the common DC busbar, the energy of a braking motor is used by other, non-braking motors without the need for a braking chopper or regenerative supply.



Lower costs and space savings

The common DC busbar means less cabling, reduced installation costs, reduced line currents, simpler braking arrangements, reduced component count, increased reliability and space saving.

Modular construction

The drive modules can be connected in parallel for higher output current. In case of failure, modules are easy and quick to change, which minimizes down-time. Maintenance costs are further reduced thanks to lower component count, i.e. optimized need for spare parts.

Inbuilt redundancy

The ABB multidrive comes with inbuilt redundancy through parallel-connected modules. Each drive module is a complete three-phase inverter. Should a module fail, other modules can continue running at partial loads. This ensures greater process up-time in critical applications.

Compact size

Recent technology developments have seen the inverter modules dramatically decrease in size, reducing the average length of the multidrive to half of its previous size. Small modules are tilted inside the drive cabinet to further economize space. With fewer power devices than the equivalent number of individual drives, reliability is improved and spare part costs are reduced.



ABB standard drives - 0.75 to 355 kW, 230 to 480 V

The ABB standard drives are simple to buy, install, configure and use, saving considerable time. The drives are available through ABB's worldwide distributor network. The ABB standard drives are

ready-to-play products suitable for applications where customizing or special product engineering is not required.

Assistant control panel

An extremely easy to use keypad featuring two special soft keys, the function of which changes according to the state of the panel. An inbuilt HELP button ensures fast set-up without the need to refer to manuals.

Real-time clock

The real-time clock allows timed tracing of faults so you know what happened and when. It also allows setting of parameters to activate at various times of the day, thus eliminating the need for an external timer.

Wide range of interactive assistants

- Start-up assistant with help:
The start-up assistant guides the user through all essential settings without going into the parameter list. The rapid speed of set-up and simplicity is unrivalled among drives.
- Interactive maintenance assistant:
The drive raises alarms to alert the user of imminent maintenance programs that need to be carried out on the drive, the motor or the driven machine.
- Guiding diagnostic assistant:
Should a fault occur, the display shows, in plain language, possible causes and potential solutions.
- A number of other assistants are available, such as serial communications assistant and PID control assistant.

Inbuilt EMC filters

EMC filters for the C2 class (1st environment) are inbuilt as standard and eliminate the need for any external filtering.

Swinging choke

ABB's swinging choke lets the drive deliver up to 25 per cent less harmonics at partial loads, compared to a conventional choke of equal size.

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Products

ABB machinery drives - 0.18 to 160 kW, 100 to 480 V

Machinery builders can now choose from component drives through to high performance machinery drives. Global support and service guarantees lifelong satisfaction. ABB machinery drives provide speed control of diverse applications.

ABB high performance machinery drives - 0.75 to 160 kW, 380 to 480 V

ABB high performance machinery drives provide excellent speed, torque and motion control for demanding applications. They can control induction, synchronous and asynchronous servo and high torque motors with various feedback devices.

The compact hardware and programming flexibility ensure the optimum solution. The innovative memory unit concept enables flexible drive configurations.

ABB general machinery drives - 0.37 to 22 kW, 230 to 480 V

ABB general machinery drives meet the requirements of machine manufacturers, system

integrators and panel builders by supporting a wide range of machinery applications, such as those demanding high repeatability.

The drives are easy and economical to install and integrate. The basic product is user-friendly, yet provides high intelligence. The drives are available through ABB's worldwide distributor network.

ABB component drives - 0.18 to 4 kW, 100 to 480 V

ABB component drives meet the requirements of machine builders, installation companies and system integrators.

These drives are similar to other installation and electrical components bought from a logistical distributor and are available from stock. The number of options and variants is optimized for logistical distribution and these drives are highly suitable for cabinet installations.



Applications



Stone crushers

Uninterrupted throughput with minimal maintenance

Crushing large limestone rocks causes considerable mechanical stress on the crusher and the motor. Prolonging the lifetime of the equipment and maximizing the up-time is easily achieved by controlling the speed and torque of the crusher motor by means of a variable speed AC drive.



ABB drives help relieve the enormous stress placed on stone crusher motors.

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Reasons to select an ABB drive

Feature	Advantage	Benefit
Soft starting and reversing of motor	Lower starting currents and reduced mechanical stress during starting. Minimized wear and tear of mechanics, means improved reliability and prolonged crusher lifetime. Smooth reversing in case of blocked crusher.	Savings thanks to smaller sized cables and supply switchgear. Considerable maintenance savings and increased productivity. High up-time of crusher and consistent production.
Accurate speed regulation	Optimization of crusher speed and smooth change of direction of rotation.	Reduced operational and maintenance costs compared to slip-ring motor solutions.
Dynamic torque regulation	Reduced mechanical stress caused by high torque peaks. High torque during start and operation if required.	Less maintenance and lower costs. High up-time and increased throughput.
Synchronizing of double motors	Equal distribution of load between both motors and elimination of undesirable dynamic effects.	Reduced maintenance costs. Elimination of unequal torque distribution and undesirable dynamic effects.
High power factor	Lower reactive power consumption and reduced need for compensation equipment compared to other control methods.	Lower installation costs and substantial energy savings.

Drives in action

ABB major partner in Vietnam cement plant

ABB has partnered Polysius in the construction of a 6,000 tonnes per day cement clinker production line in Vietnam. The plant, for the Thang Long Cement Joint Stock Company, a joint venture of the Vietnamese companies Lilama and Geleximco, is in the province of Quang Ninh, near Halong Bay about 150 km north-east of Hanoi.

As well as supplying the variable speed drives for the grinding mills, kiln and cooler fans, ABB supplied the high voltage and medium voltage power distribution equipment, motor control centers (MCCs), low and medium voltage motors, cables and engineering, installation material, lighting and earthing equipment.

ABB was chosen for the contract for its reputation as a well known supplier

of electrical and control equipment. Polysius supplied the main machines as well as the engineering for civil construction and structural steelwork; is supervising the manufacturing and the assembly; and is performing the commissioning. The company was also responsible for customer personnel training and technical assistance.



Applications

Conveyors

Prolonged belt lifetime and high up-time

Throughout cement making, numerous conveyors are used in demanding conditions, with the risk of belts stretching, slipping or breaking. Using variable speed AC drives protects the belts and other mechanical equipment by offering smooth and accurate control of the motor speed and torque.

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ABB drives help protect conveyor belts from stretching, slipping or breaking.

Reasons to select an ABB drive

Feature	Advantage	Benefit
Soft starting and stopping	No belt stretching, slipping or breaking.	Prolonged conveyor lifetime, reduced maintenance costs.
Smooth reversing of direction of rotation	Easy maintenance in case of belt failure.	Minimized down-time, cost savings.
Accurate speed regulation	Optimization of conveyor speed. Reduced power consumption.	Prolonged conveyor lifetime, lower operational and maintenance costs.
Synchronizing of multiple motors	Equal distribution of load between the motors and elimination of undesirable dynamic effects.	Less wear and tear, resulting in less maintenance and smaller costs.
Regenerative braking	Braking energy is fed back into the plant electrical network.	Reduced utility bills.
Dynamic torque regulation	Enables high starting torque which can be precisely controlled at any time, yet preventing stretching and slipping of the belt.	Less maintenance and lower costs.

■ Challenge

With a difference in height of 273.8 meters at an inclination of up to 28 degrees to be overcome, Ciment Vigier, Switzerland, uses a two-conveyor system to transport limestone from its new deposit some 2,642 meters from the crusher on the hill top to its factory in the valley below. The aim is to save energy while using as few conveyors and transfer stations as possible.

■ Solution

The tubular belt conveyor is equipped with one drive pulley, two 160 kW squirrel cage induction motors and two ABB industrial drives. The second, the trough belt, is equipped with three, 160 kW squirrel cage induction motors and three ABB industrial drives. All

five drives are coupled to the same supply unit in a common DC busbar arrangement. This construction simplifies the total installation and saves cabling, reduces line currents, simplifies the braking arrangements and enables energy circulation over the common DC busbar. The 350 kW of braking power that is generated, is transferred to the mains by means of an energy recovery unit, significantly reducing the energy consumption of the complete system.

■ Benefits

- The drive system harnesses the energy produced by the descending continuous conveyor system and feeds this back into the supply, saving energy.

- To reduce the spare parts stock, identical motors and drive systems are used.
- Using an ABB multidrive common DC bus ensures optimal load distribution on the individual drive units for different operating conditions. This enabled ABB to minimize the resulting belt tensile forces, while at the same time maintaining the belt forces necessary to transmit the required drive power in both driven (generator) as well as driving (motoring) operation.

Drives in action



Feeders

Required cement quality through accurate dosage of materials

Accurate and controlled dosage of raw materials and additives is crucial to the quality of the cement. It is also important to avoid stretching, slipping and breaking of feeder belts.

Controlling the speed and/or torque of feeder motors with variable speed AC drives guarantees precise material dosage which is under continuous control. AC drives enable precise information on the dosed amounts of materials. Using AC drives also protects the feeder belts and other mechanical equipment by offering smooth and accurate control of the motor speed and torque.



Precise raw material dosage, with the help of ABB drives, guarantees required cement quality.



Reasons to select an ABB drive

Feature	Advantage	Benefit
Accurate speed and torque regulation	Precise dosage of materials. Detailed information on the dosing process. Elimination of mechanical dosing systems.	Desired cement quality, consistent process quality. Optimized consumption of fuel, raw materials and additives - minimized gas emissions. Low operational and maintenance costs, high process up-time.
Flexible user interface	Easy connection to any automation system through multiple fieldbus adapters and a high number of inputs and outputs.	Reduced installation costs, minimal need for programming.
Soft starting and stopping	No belt stretching, slipping or breaking.	Prolonged feeder lifetime, reduced maintenance costs.

Applications



Grinders

Less wear and higher reliability for increased efficiency

Grinding raw material and clinker causes considerable wear to the grinding mill. Starting the grinder, direct-on-line, stresses the grinder and the gearbox, increasing the risk of gearbox failure as well as shortening the lifetime of mechanical equipment. The use of AC drives helps optimize the grinder speed to match the material flow, thus minimizing the wear of the grinder. Furthermore, the mechanical stresses during starting are eliminated.

Grinding is an area where energy use is high. In addition, the efficiency of grinding mills is low. Optimizing the grinder speed by using AC drives ensures efficient use of energy and an improvement in the overall efficiency of the grinding process.

ABB drives can be used to control the speed of permanent magnet motors in applications running at low speeds. This enables using gearboxes with simple and robust construction.



Vertical and horizontal grinders can both benefit from the use of ABB drives.

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Reasons to select an ABB drive

Feature	Advantage	Benefit
Soft starting	Low starting currents and eliminated mechanical stress during starting.	Prolonged grinder lifetime. Reduced maintenance costs.
Speed regulation	Optimized grinder speed, minimized wear of the grinder.	Considerable savings in maintenance costs. Improved energy efficiency. Reduced reactive power consumption.
Permanent magnet motor speed control	Ability to use simple and robust gearboxes.	Savings in investment, installation, operational and maintenance costs.
Grinder measurements: various grinder operational values measured and relayed to plant automation systems	No need for external measuring devices.	Savings in investment and maintenance costs.



Separators

High quality cement through consistent separation

Separators are crucial elements of the cement making process, having a major impact on the quality of cement as well as energy consumption. Adapting the separation to the overall process characteristics, such as material and gas flows and size of particles, requires precise and rapid speed control of the separator motors. The high inertia of the separators requires braking in order to achieve rapid speed reductions or to stop the separators.

AC drives enable fast and accurate separator speed control, which ensures a consistent separation, resulting in high quality cement.

ABB drives offer both resistor braking and regenerative braking, where braking energy is fed back into the mains, thus lowering the consumption of energy. The main source of energy savings, when compared to traditional control methods, are AC drives.

A more accurate separator control also improves the efficiency of the grinding process.



ABB drives contribute massively to energy savings of separators.

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Reasons to select an ABB drive

Feature	Advantage	Benefit
Accurate speed regulation	Optimization of separator speed. Reduced energy consumption.	Consistent cement quality. Lower operational costs.
Regenerative braking	Braking energy is fed back into the mains.	Lower energy bill.
Flying start	Separator can be started when spinning.	Time savings through immediate starting and no need for braking.



Kilns

Continuous operation and superior process control with minimized energy consumption

Kilns, being at the heart of the cement making process, require reliable and high performance motors and drives in order to guarantee continuous operation in varying conditions. This is the area where capital costs are highest, fuel demands are largest and process control is crucial.

ABB drives, with Direct Torque Control (DTC), offer proven reliability as well as state-of-the-art torque control and superior speed control accuracy, ensuring uninterrupted and stable running, irrespective of the kiln speed or the kiln load.

Power supply failures and other special occasions result in the need to restart the kiln. Restarts, requiring a very high starting torque, are easily achieved with DTC.

The multitude of different fieldbus adapters available for ABB drives, together with the drives superior control characteristics, enables accurate control of the kiln, thus optimizing the fuel consumption and the production flow.



ABB drives' DTC plays an important role in the efficient running of kilns.

Reasons to select an ABB drive

Feature	Advantage	Benefit
Accurate speed regulation	Optimization of kiln speed and production flow. Reduced mechanical wear of the kiln and other equipment.	Minimized cost of fuel and electricity, maximized production volume. Minimized maintenance costs.
Dynamic torque regulation	Reduced mechanical stress caused by high torque peaks. High torque during start and operation if required.	Less maintenance and lower costs. High up-time and increased throughput.
Eliminate motor maintenance	AC is preferable to DC because of the dusty outdoor motor/tachometer environment. Cement dust greatly increases DC brush wear. The totally enclosed frame of the AC motor is much more suited to cement environment. Lower reactive power consumption and reduced need for compensation equipment compared to other control methods.	Maintenance costs substantially reduced. High power factor. Lower installation costs and substantial energy savings.
Master-follower software	Equal distribution of load between two kiln motors.	Reduced maintenance costs.
Multitude of fieldbus adapters available	Easy connection to various automation systems, thus no need for extra adapters or other devices.	Savings in installation and minimal need for programming.



Fans

Precise gas flow with minimized energy consumption

Irrespective of the fan application, there is always a need for precise control of the gas flow. This is valid for both the cooling air and the gases produced by the cement making process itself. Accurate control of the gas flow has a key role in securing a consistent cement quality. As to energy consumption, fans are the biggest source of energy saving, provided that they are efficiently controlled.

The most accurate control of the gas flow is achieved by controlling the speed of the fan motors by AC drives. ABB drives incorporating Direct Torque Control (DTC), provide excellent speed control plus have a wide variety of features suited to fan applications. Controlling the fan speed with AC drives is the most energy efficient control method, ensuring significant energy savings compared to any other control method.



ABB drives can provide the biggest energy saving potential for fans.

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Reasons to select an ABB drive

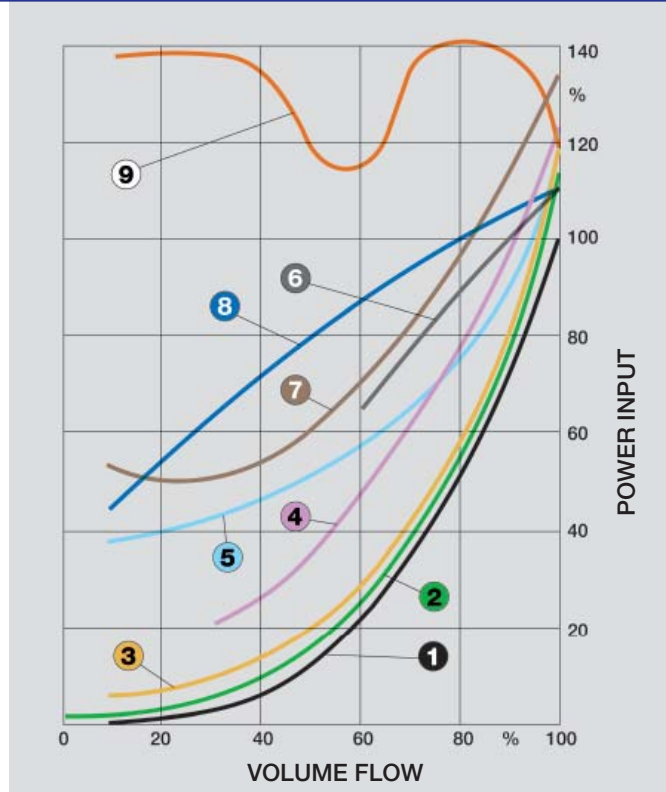
Feature	Advantage	Benefit
Accurate speed control of the fan motor	Can vary air flow according to process conditions Prolonged fan lifetime. Reduced consumption of raw material and smaller amount of waste. Lower noise level of the fan.	Consistent cement quality, improved customer satisfaction. Savings in maintenance costs. Substantial cost savings and minimized emissions. Safer and a more comfortable working environment.
Soft starting	Avoids too high or low gas pressures, minimizing mechanical stresses. Prolonged fan lifetime.	Maximized process up-time and savings in maintenance costs. Savings in maintenance costs.
High efficiency	Efficient use of electrical energy, i.e. low power losses.	Reduced energy costs, improved environmental friendliness.
Flying start	Fans can be started when spinning.	Time savings through immediate starting and no need for braking.
Power loss ride-through	Uninterrupted operation of drive and motor in power failure situations, with no need to restart the drive when the supply voltage is restored.	Time savings.
Jump-over of critical frequencies	Speeds causing mechanical resonance are automatically skipped.	Prolonged fan lifetime, considerable cost savings.
High power factor	Lower reactive power consumption and reduced need for compensation equipment compared to other control methods.	Lower installation costs and substantial energy savings.



Fans

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- 1 Required fan power
- 2 Speed control by AC drive (both for centrifugal and axial-flow fans)
- 3 Variable pitch angle (for axial fans only)
- 4 Fluid coupling (slip control)
- 5 Inlet vane control (for centrifugal fans with backward-curved impeller)
- 6 By-pass control (for axial fans)
- 7 Damper control (for centrifugal fans with forward-curved impeller)
- 8 Damper control (for centrifugal fans with backward-curved impeller)
- 9 Damper control (for axial fans)



Power consumption of fan installations with different control methods.

■ Challenge

A series of surveys at Castle Cement's Ribblesdale cement works in the UK discovered local weather and topographical conditions occasionally caused the plumes of chimney gases from kiln seven to fall to ground prematurely, resulting in sulphur dioxide odours at ground level.

■ Solution

Two fans are being controlled by an ABB AC drive, comprising two inverter units fed by a common DC bus from a single rectifier, together with two AC motors and a 2000 kVA phase-shift transformer.

Each motor powers an ABB fan by means of one 1,700 kW ABB drive,

which is housed in the scrubber plant's switch room. The drive solution allows a single transformer from the plant's supply to provide a common DC bus for the control of both the scrubber fans.

The first fan is located at the end of the scrubber unit and is turned by a 1,100 kW ABB AC motor.

The speed of the 4m-diameter fan is governed by the ABB drive, which in turn is connected to a PLC in the main plant control room. The PLC monitors a pressure control loop and maintains a negative inlet pressure of two millibars. This ensures that the exhaust gases are drawn through the scrubber unit from the main stack at a rate of around 296,000 m³/hour.

The second fan, driven by a 395 kW ABB AC motor, reclaims heat from the kiln-cooling grate by drawing in atmospheric air. This hot air is then mixed with the saturated gas exiting the scrubber prior to it being released to the chimney.

The hot gas, delivered at 240,000 m³/hour and 250°C, ensures better plume dispersion and reduces the chances of water condensation inside the stack.

■ Benefits

Accurate speed control of two fans within a chimney gas scrubber, has helped to virtually eliminate sulphur dioxide emissions and reduce overall emissions by 45 per cent.



As the premier company for low voltage AC drive technology, ABB has amassed a wealth of knowledge and expertise on all aspects of drive systems throughout the cement and other industrial sectors. ABB has dedicated experts who understand all details of cement industry applications; talk your language; and can offer the quickest route to a profitable solution, without forgetting personnel safety and environmental responsibility. Here's how:

Leading technology in design and production

For over 100 years, ABB has consistently invested a large proportion of its turnover in research and development, working closely with some of the world's leading universities and institutions. The result is the most advanced range of variable speed drives in the market, designed to meet the specific

needs of various cement industry applications. This has also led to several patents for leading edge technology within ABB drives.

ABB's reputation is further enhanced through its work with world leading authorities and legislative bodies. This cooperation contributes to the safety of ABB's products and thus the personal safety of the users.

Cooperating with its sub-suppliers, ABB can exploit the latest component technology when designing its drive products. This results in improved quality of ABB's drive products and in enhanced component quality.

ABB's drive manufacturing facilities are equipped with the most modern production lines using the latest production techniques and advanced software. Precision robots combined with fully automated



Expertise

material flow and testing routines guarantee high quality of products and short throughput times.

As part of its supply chain management, ABB is the first company in Europe using radio frequency identification (RFID) of components which considerably improves product quality and traceability.

Product reliability is further enhanced through stringent quality control procedures with all manufacturing facilities operating to ISO 9001. Identical manufacturing facilities are located in Finland, the USA, China and India.

Complete technical advice from selection to installation and use

ABB constantly monitors all legislation, regulations, directives and standards, not only ensuring that its products comply but by offering sound advice to customers. Examples of directives guiding the design and use of AC drives are the European EMC (electromagnetic compatibility) directive and the low voltage directive.



Another example is ATEX, which became mandatory in July 2003. ATEX is the European regulation covering equipment intended for use in potentially explosive atmospheres. ABB is one of the first companies to gain blanket ATEX certification for its ABB industrial drives and flameproof and non-sparking motors, for use in hazardous areas. By gaining the blanket certification, ABB can provide combined ATEX-approved drives and motors packages that do not need further testing on site.

ABB's expertise extends throughout a cement plant's entire electrical installation. ABB's engineers can advise on the correct selection, dimensioning, installation, operation and maintenance of drives, motors, transformers, relays, switches, contactors through to transducers and meters. Advice is available on long cabling, weak networks, protection functions, harmonics, EMC, power factor correction, mounting options and air flow requirements.

Using harmonic filters developed by ABB eliminates the severe plant disruptions caused by harmonic disturbances in electrical equipment. ABB offers





proven ways to assess your vulnerability to harmonic problems and your need for filters.

In cement plants, the consumption of inductive reactive power is significant. Reactive power compensation equipment offered by ABB helps minimize the amount of reactive power.

In many applications there is a need to interface the drives with external systems. ABB has the expertise in all high performance communication protocols including PROFIBUS DP, Devicenet, CANopen and Modbus fieldbus.

ABB offers knowledge-based publications which include a series of detailed technical guides covering harmonics, EMC, bearing currents and motor control platforms, through to single page FactFiles, offering the latest thinking on topical subjects. These, and much more, can be downloaded from www.abb.com/motors&drives.

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Thorough process know-how for improved competitiveness

Not only is ABB the leading supplier of low voltage AC drives, but it has also built a formidable knowledge databank of all applications from stone crushers and kilns through to grinders and conveyors.

This know-how has been honed in tackling many unusual applications across a variety of industries. As such, ABB boasts that no application is beyond its experts. Today, ABB has created an enviable team of dedicated industry specialists whose focus is on their chosen industry but who share the knowledge from other sectors to their benefit.

This pioneering spirit has its roots in the 1970s when ABB developed the very first AC drive. In subsequent decades ABB has led a technology revolution which has been driven by the needs of its customers. ABB is recognized as the world's leading application engineering organization.

Its advice covers all aspects of process control and focuses on increasing production capacity, improving end product quality, reducing waste and reducing maintenance costs.

Sustainable development for people and the environment

With around one per cent of the world's electrical energy used in crushing and grinding cement, all cement producers experience financial and environmental pressures to reduce energy consumption.

One of the biggest benefits of using AC drives is the energy saving opportunity over fixed speed motors. As such, ABB is a world leader in assessing the energy saving potential within all industries.

A structured process that includes an energy audit, coupled with a series of energy saving tools, have been devised to ensure that customers see the



Expertise

benefits of changing to AC drives. Greenhouse gases are also reduced thanks to AC drives.

ABB has devised a replacement drive scheme for upgrading older, inefficient drives for new, space saving and highly efficient drives. Following an assessment of a plant, ABB helps select a replacement drive with improved efficiency and features for the application.

In some countries, ABB is able to remove the redundant drives, regardless of the original manufacturer and ensure that they are disposed of in accordance with the latest world standards. ABB's commitment to the environment means that old drives are recycled whenever possible. All new products, even the packaging, are designed for recycling.

The ISO 14001, international environmental management standard, has been implemented and the Finland factory is certified since 1996. LifeCycle Assessment (LCA) is applied continually to all product development. All certificates and declarations relating to environmental issues can be found at www.abb.com/motors&drives.

Health and personnel safety is a fundamental part of ABB's commitment to sustainability. ABB cares deeply about how its operations and products



affect its employees, customers, contractors and neighbours.

Many of the industries in which ABB works – often on customer sites – are by their nature very challenging and accordingly ABB operates to the highest standard of occupational health and safety excellence and remain constantly vigilant in carrying out its duty of care.

ABB's ultimate aim is to prevent all accidents, injuries and occupational illness through the active participation of its customers, contractors and employees.

The successful management of safety starts with the involvement of everyone, from the CEO to ABB's front line workers in a systematic and continual focus on hazard recognition and mitigation.

ABB's combined efforts and commitment allows it to achieve a continuing improvement in its safety record.





Partner network

ABB has developed a global channel partner network that brings its products, service and support straight to your front door.

These channel partners include technical distributors, system integrators as well as electrical wholesalers. Each brings its own set of skills and services and collectively they can tackle all your diverse drives needs.

Maximized process up-time

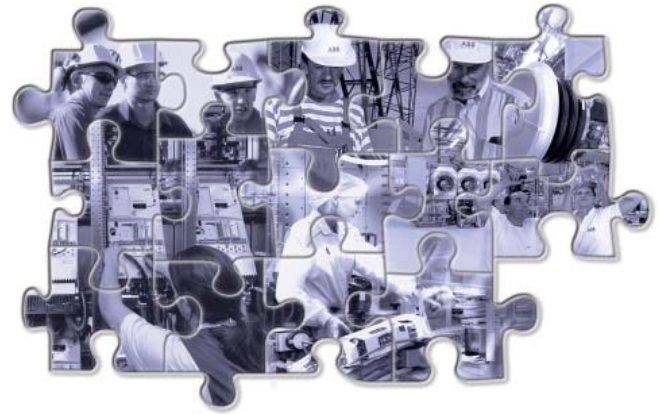
The partners are fully conversant with ABB's drives and many have thorough application knowledge. The partners can help with all kinds of drives and motors related issues and offer support wherever and whenever it is needed.

Benefits of using an authorized technical partner network

The members of ABB drives Technical Partner network provide consistent quality in sales, support and services supported by ABB. This authorized Technical Partner network is able to provide:

- Dedicated sales engineers who understand your application
- Trained and authorized technical personnel
- Accurate drives dimensioning and selection
- Extensive stock of ABB drives and spare parts
- Ability to install, commission and maintain drive systems
- Customized product training
- Off-site technical support
- On-site service
- Spare part services
- Warranty repair

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A customer driven network structure

All ABB Technical Partners are authorized according to a global program, to provide support and services, ensuring the availability and quality of operation, world-class consistency while maintaining a local presence. The Technical Partner categories are:

- ABB drives - Authorized Sales
- ABB drives alliance - Sales and Support
- ABB drives alliance - Sales, Support and Service
- ABB drives alliance - Technical Service and Support
- ABB drives alliance - System Integration

Partner companies are regularly audited and together with ABB they strive for continuous quality improvement and consistency in the services and support provided.

Find the members of the network at www.abb.com/drivespartners



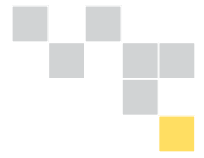


ABB has the largest service team of all drives suppliers. Field service engineers with experience within the cement industry are located worldwide.

The service team works to the ABB drive lifecycle management model. This model offers maximum profit for your investment by maintaining high availability, eliminating unplanned repair costs and extending drive lifetime.

The lifecycle management model comprises a palette of dedicated services for the entire lifecycle of ABB low voltage AC drives. Services include:

Energy audit

The increasing interest in AC drives in the cement sector is partly due to a greater awareness of energy issues and rising energy prices. In many countries, ABB offers energy audits that can rapidly determine just where and how much energy can be saved.

Power savings up to 50 per cent can be reached by reducing the motor speed by just 20 per cent, with payback as short as six months.

Harmonic survey

ABB collects data on harmonic currents and voltages interfering with the electricity supply network and details actions to minimize them.

Selection and dimensioning

Whatever the cement application, ABB's vast experience will help in the correct selection and dimensioning of the drive. This ensures the correct drive installation, powerful enough for your motor requirements.





Installation and commissioning

ABB's professional start-up service uses certified engineers to install and adjust the drive according to the application requirements as well as to instruct the user on how to operate the drive. All start-up information and the production parameters are saved, should the engineer need to restore any information at a later date.

Training and learning

ABB offers dedicated drives training for service and operating personnel to acquire the skills to use ABB drives correctly and safely.

Technical support services

Technical support services provide accurate, consistent and responsive information and support to all ABB customers.

Maintenance and repair

ABB recommends regular preventive maintenance throughout the lifetime of variable speed AC drives.

Maintaining drives in accordance with the maintenance schedules, ensures maximum availability, minimum repair costs, optimized performance and extended lifetime of the drive.

Maintenance can be performed on a contract basis.

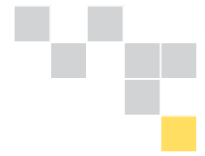
Drive preventive maintenance (PM) consists of annual drive inspections and component replacements according to the product specific maintenance schedules using PM kits which contain all the service parts and materials defined for a certain preventive maintenance.

ABB's certified engineers provide maintenance and repair services on site and in authorized ABB drive service workshops.

Workshop services include:

- Module maintenance and repair service - instead of performing maintenance or repair on site, modules can be sent to an ABB drive service workshop. It is often practical to perform preventive maintenance at the same time.
- Exchange unit service - a convenient and fast way to fix a problem with a drive is to order an exchange module. A reconditioned drive is immediately shipped to the customer (subject to availability). The defective but repairable unit will be returned to ABB.





Spare part services

Genuine ABB factory-certified drive parts are delivered quickly worldwide. They guarantee full compatibility and are available throughout the drive lifetime following the drive lifecycle model.

Spare part services include:

- Parts OnLine - a web based spare part information and ordering system for quick and easy ordering from your PC around the clock. Address: www.abb.com/partsonline
- Conventional spare part service - contact your local ABB representative for spare part orders.
- 24-hour emergency spare parts service - provides spare parts 365 days a year.
- Preventive maintenance kits - contain all the replacement parts for a scheduled maintenance.
- Inventory Access - an ABB owned and maintained spare part inventory at the disposal of a customer. This spare part inventory is usually

located at the customer's site or at an ABB location. This service provides the customer with up-to-date spare parts with no capital investment for a fee that is based on the inventory value and duration of the contract commitment.

Upgrade and retrofits

Drives upgrade and retrofit offerings are designed for improved performance and extending the lifecycle, resulting in the best possible return on your drive assets.

Replacement and recycling

ABB's replacement drive scheme provides a correctly dimensioned drive, while disposing of old equipment. The scheme covers any drive or motor, regardless of the original manufacturer.

ABB drive lifecycle management model

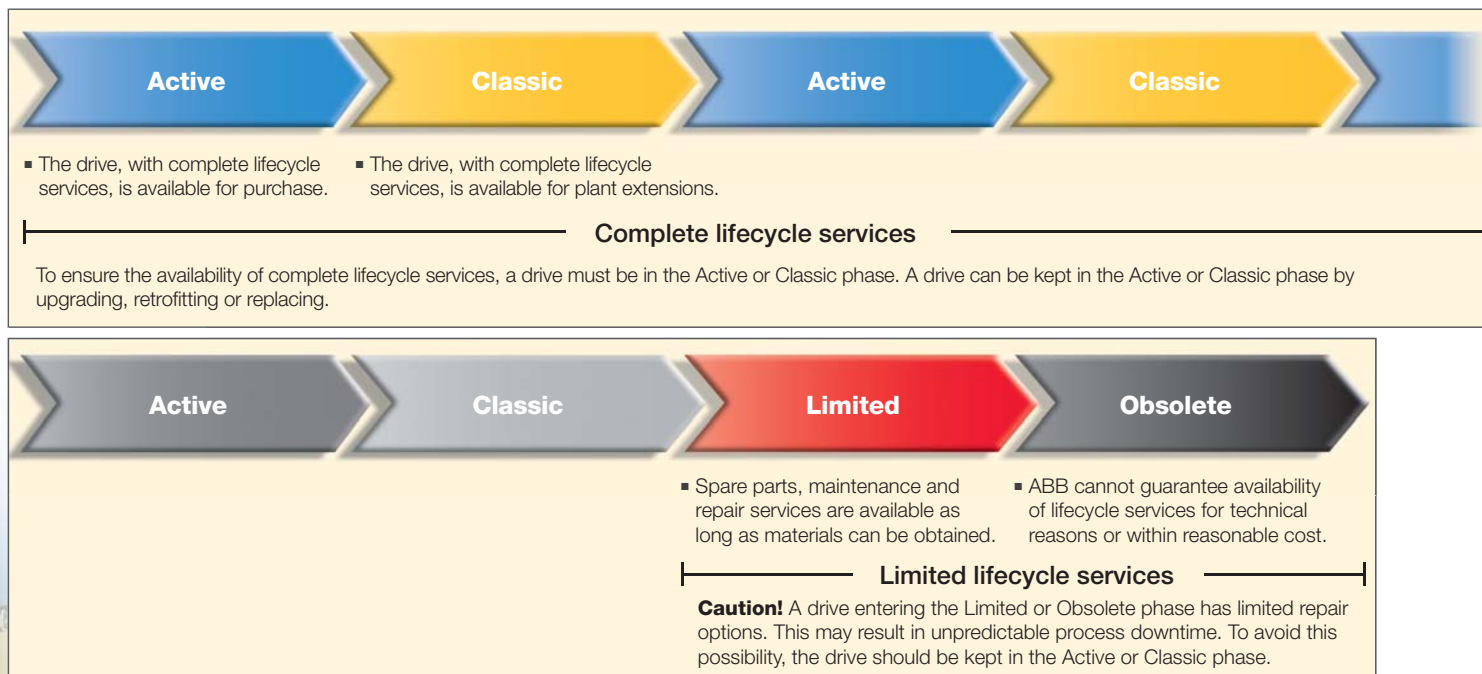


ABB follows a four-phase model for managing drive lifecycles, which brings enhanced customer support and improved efficiency.

Examples of lifecycle services are: selection and dimensioning, installation and commissioning, preventive and corrective maintenance, remote services, spare part services, training and learning, technical support, upgrade and retrofit, replacement and recycling.

Low voltage AC drives for cement

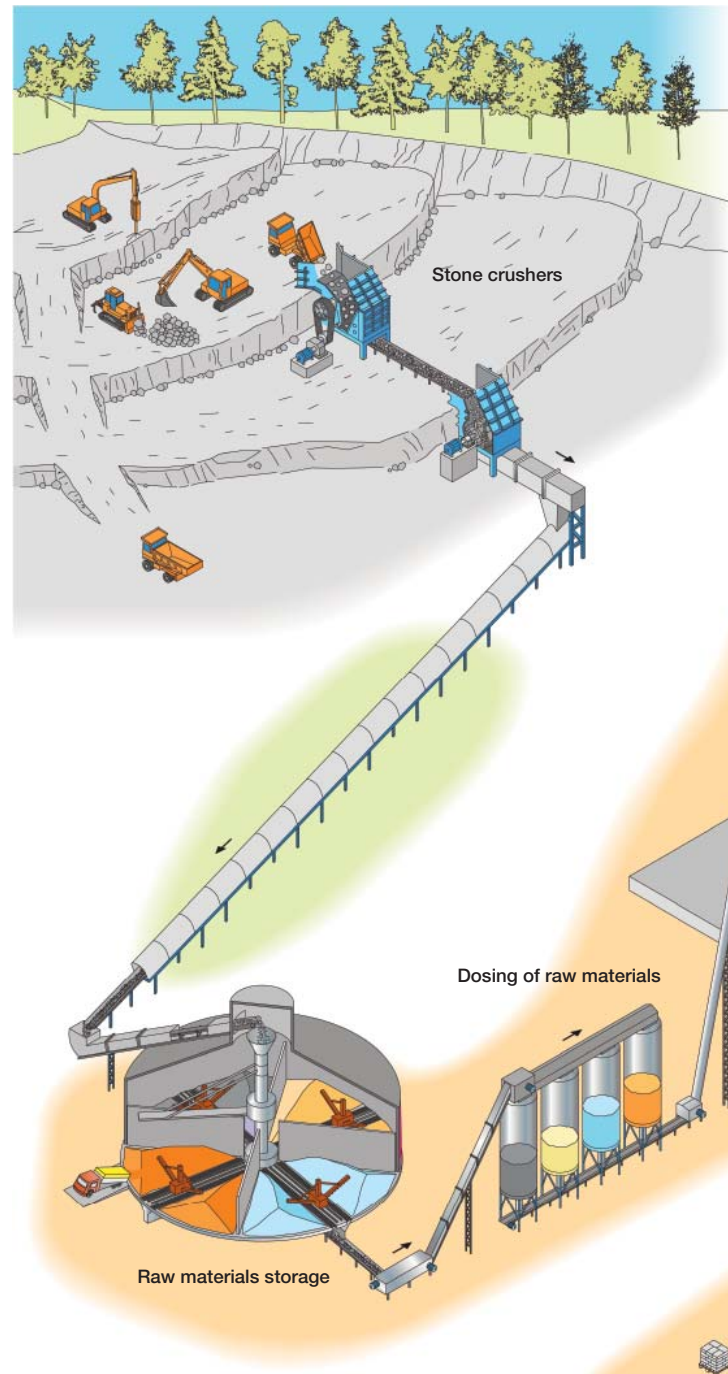


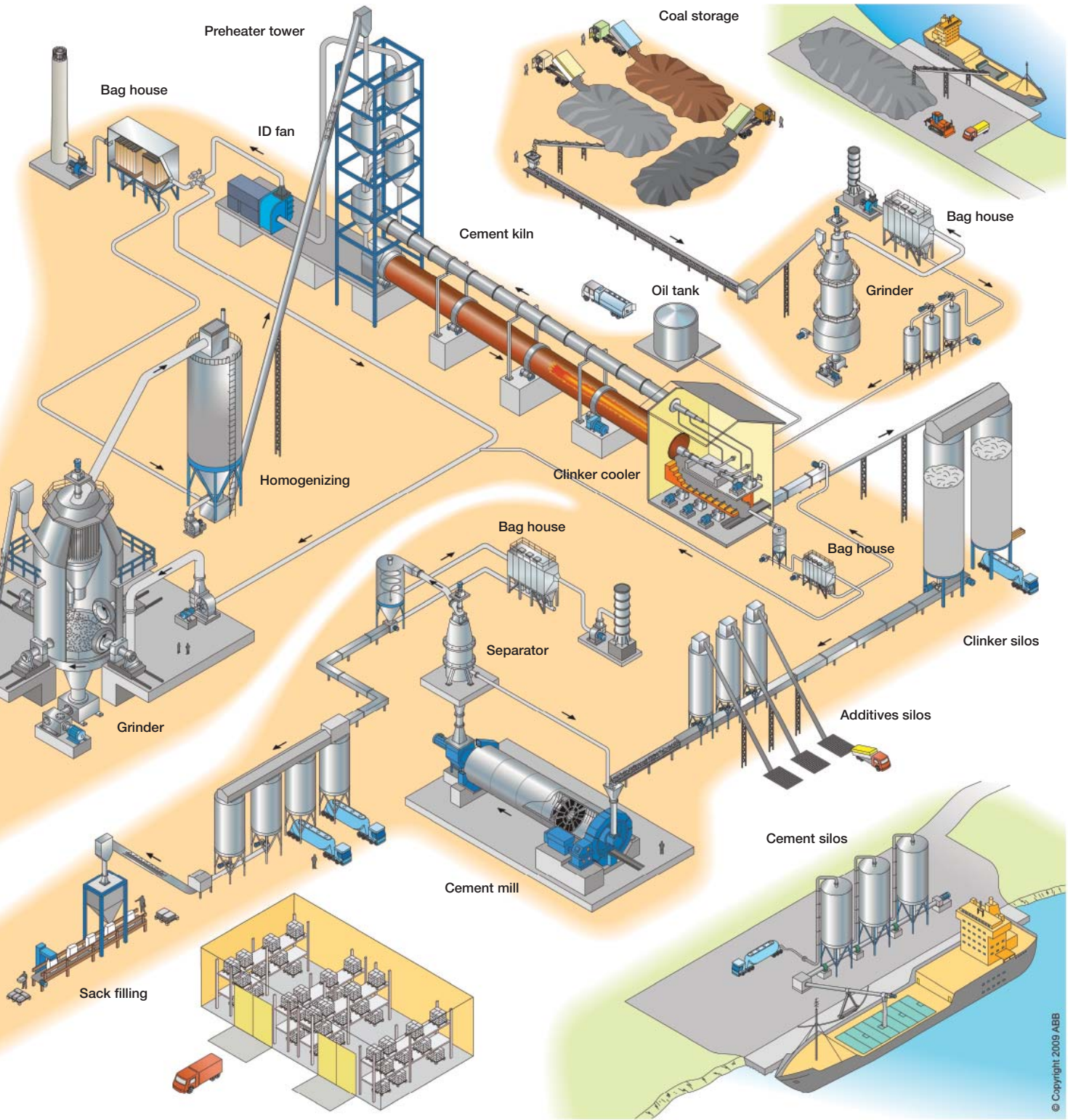
ABB drives – when tough environments need tough control

While ABB drives are used extensively in pump and fan applications, the cement industry has a whole array of more demanding challenges from the crushing of heavy limestone, and the high stresses this places on motors, to the continuous operation and superior process control demanded by kilns. In between lies a host of other strict application demands from grinders and separators to conveyors. For ABB drives these are simply every day challenges.

One thing all these applications have in common is the opportunity for substantial energy savings. Here the highly reliable ABB drives do not disappoint, and they also reduce installation, operation and maintenance costs. All of which leads to maximized up-time and greater productivity.

ABB drives are backed by unprecedented application know-how and the assurance that the drive installation will be looked after throughout its lifecycle with ABB's comprehensive services offering.







Your partner throughout the cement production process

From a critical component to a complete electrification project, ABB is the single source for automation systems and solutions, electrical equipment and a vast variety of services, including engineering and plant maintenance services.

Power transmission and distribution systems

ABB offers a complete portfolio of solutions, systems and equipment for the efficient transmission and distribution of electricity. Also available is a wide variety of services for network management. Furthermore, ABB can optimize your energy asset utilization and contribute to the profitable operation of your business.

Equipment for high quality of power

To eliminate the severe plant disruptions caused by harmonic disturbances in electrical equipment, ABB delivers modern filters.

Reactive power consumption can be minimized by using ABB power factor compensation equipment. This results in significant savings.

Motors and machines

As a leading supplier, ABB offers a wide range of motors and machines for every application.

Thanks to their high efficiency and robustness, the efficiency of the cement making process is maximized.

Automation systems, solutions and services

In addition to world-class electrical equipment, ABB offers leading solutions, such as control and knowledge systems for economic process optimization. ABB ensures results for its clients by offering a range of services, including engineering and plant maintenance.

Engineering

ABB uses an integrated team approach to produce professional engineering documentation, designing the electrical interfaces with its client's appointed consultants, engineers and mechanical and civil partners.

Electrification

ABB provides the planning and supervision of the site staff to ensure short, effective and standardized procedures. Stores are organized for incoming goods. Insurance, safety and transport matters are settled before they become issues.

Process control

Scalable automation solutions provide easy entry to benefit from next-generation automation products. A small, basic system can be rapidly extended into a fully integrated and optimized automation solution, to deliver even greater value.

Existing ABB customers have access to a range of migration plans, designed to modernize existing plants in structured steps. Customers, who want to switch to added value ABB solutions, can easily migrate to modern, integrated process automation, thanks to ABB's standardized product ranges that can be tailored to their needs. Communication protocols such as OPC, PROFIBUS, Foundation





Fieldbus, HART and Modbus bring easy, economical interfacing with a wide range of third-party products.

Knowledge systems

ABB's knowledge systems provide the best-in-class manufacturing operation through to efficient dispatch of final product.

Using ABB's extensive solutions portfolio, the data from the customer's process control system is collected and converted to production information. Together with extensive process knowledge and

proven advanced control techniques, this information is used to monitor and optimize the process to improve process efficiency and product quality.

Optimization systems

ABB's suite of optimization solutions, allow cement customers to reach new levels of plant performance.





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