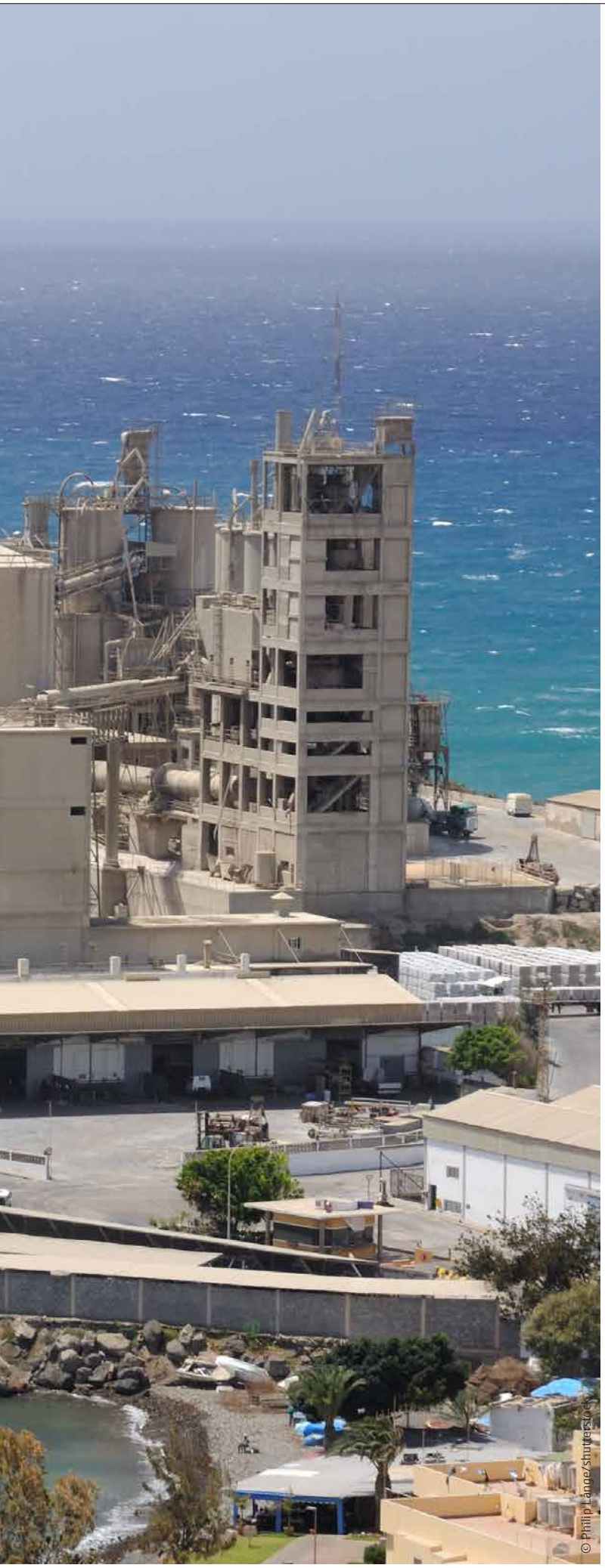
Cement Industry

Focus on what really counts – cement production

Easily meet the specific and complex demands of your customers

Endress+Hauser
People for Process Automation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Additional documentation

- Keep your mining process running smoothly (SO403B11)
- Water is our life (SO01014X)
- Simply reliable: Process safety from Endress+Hauser (CP01073Z24)
- Services - by your side (FA00018H)

You can download all Endress+Hauser brochures in our media library:

www.endress.com/media-library

At the **Search for** area you can enter the documentation code *(e.g. SO403B11)* and download the brochures you are interested in.

Your challenge is our inspiration

Measuring technology for the cement industry

Whether you need to prepare and meter a fuel mix, clean up your gas and liquid emissions to comply with local environmental standards or simply need a professional technician to set up level instruments in your cement silo, you can be confident that Endress+Hauser will serve your needs and support your ambitions.

Run your cement plant safely The best solution in order to achieve high-quality cement and consistently high production levels can be realized by installing industry-optimized, field-proven instrument technology backed by 60 years of cement process know-how.

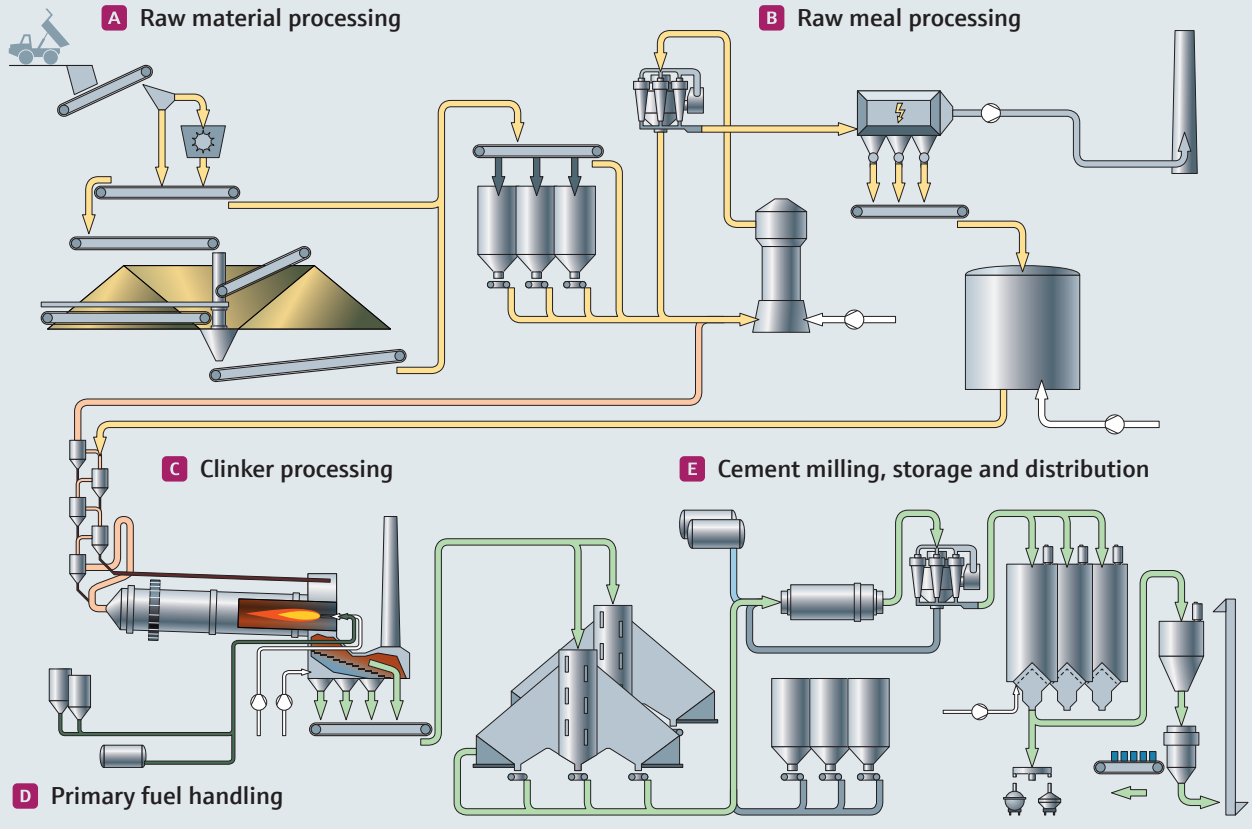
Trust the People for Process Automation Whether you are managing a project, automating a fuel handling system, selecting instruments for your clinker process or packaging a NOx gas cleaning solution for your environmental compliance program, our experienced process automation consultants can handle all measurement and control requirements of fully-integrated cement plants.

Solutions for your process

- Clinker burner measurement and control
- Automation, storage and control systems for alternative fuels
- Cyclone preheater blockage control instrumentation
- Crusher and feeder optimization
- Wireless monitoring and data transmission – from remote bunkers, stock piles and crushers
- Maintenance optimization and local support
- Comprehensive web-based tools for instrument selection
- Local and competent sales and service support

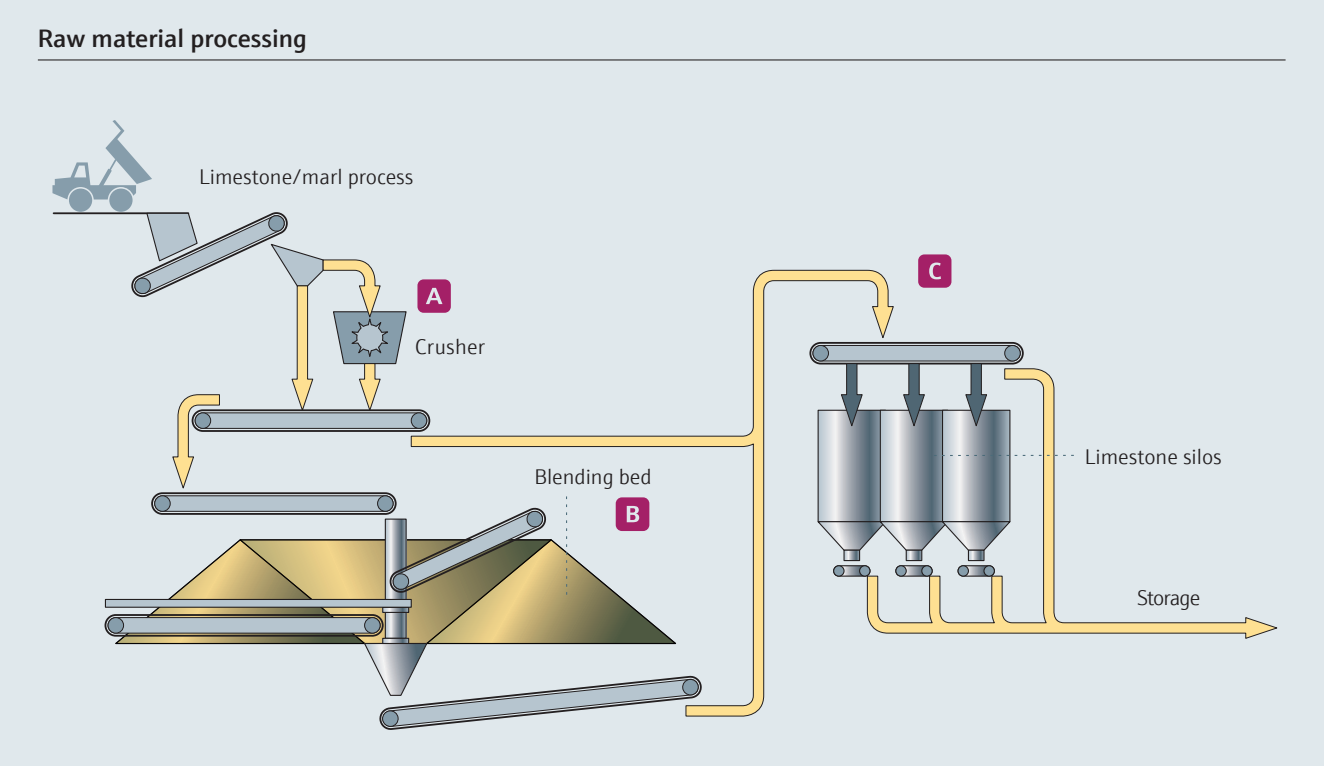
www.endress.com/cement-process

Cement process



Raw material processing and preparation

Reliable measuring technology for your applications



A **Feed bin and crusher monitoring** A crusher is an expensive piece of equipment and to avoid damage to the liner and optimize energy consumption, a certain level must always be maintained.

You can rely on Prosonic S, ultrasonic level measurement solution to monitor crushers. Ten sensors can be linked into the Prosonic S transmitter saving you cost and setup time in the field.

Feed bin and crusher control with Prosonic S ultrasonic sensor to avoid damage.

Prosonic FDU9x ultrasonic sensor monitoring crusher feed bin levels prevents overspills and expensive clean up costs.

B **Blending bed** Operators of blending silos are challenged with preventing the raw meal mix from compacting and at the same time avoiding dust cloud formation.

- Monitoring the discharge height of the stacker to control machine movement and reduce dust formation by using the Prosonic S ultrasonic or Micropilot M radar measuring system.
- The level sensor diagnostic software can monitor dust build up and be used to initiate dust suppression spray systems.
- A non-contact Prosonic S level system offers highly reliable measurement of stock piles or blending beds and the ultrasonic sensor has a self-cleaning effect to keep the system running in dusty environments without much maintenance.
- Conveyor belt emergency switch-off with Solicap M capacitance rope probe as a compact or separate version with Nivotester FTC switching unit.

Using Prosonic S ultrasonic or Micropilot radar in the raw material blending bed to protect the enviroment.

Continuous level measurement of bulk solids with Prosonic S reduces your production costs.

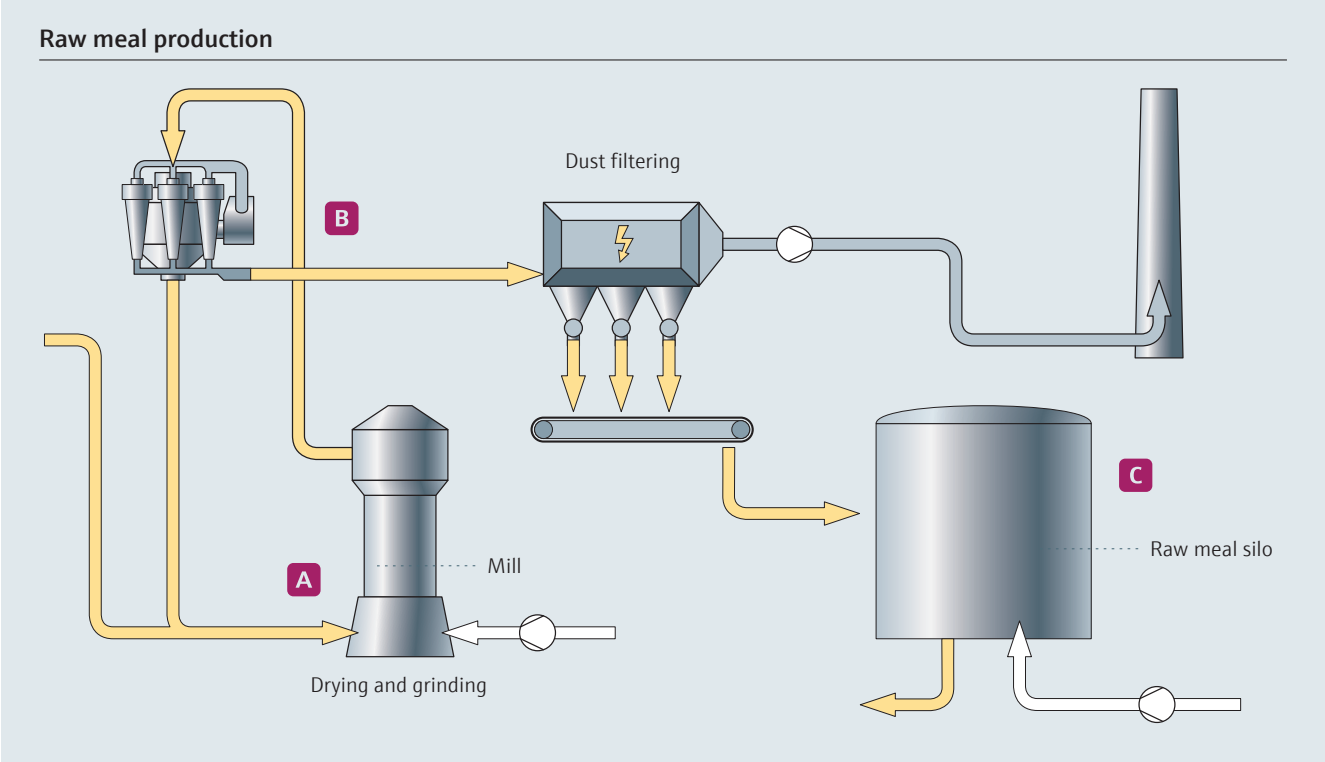
C **Silos and bunkers for raw material** Holding the right amounts of all the key ingredients for the production process is important and storage vessels come in many shapes and sizes including concrete bunkers and steel blending silos. Each vessel is fitted with mechanical or pneumatic discharge and filling points, and an effective level measurement must be easy to install and simple to maintain.

- A Solicap M capacitance point level rope probe is used to prevent overflow of bunkers and a robust rod probe to indicate low levels in blending silos.
- Ropes and probes are protected with an active build up compensation, for bulk solids with a caking tendency and a 2-stage overvoltage protection against static discharges from metal silos.

Stock piles of raw material in a quarry.

Production and transportation of raw meal

Always the best solution for your process



A **Vertical roller mill** Vertical mill process optimization and grind effectiveness is a balance of air flow, optimum pressure and temperature control.

- Mill product load measurement with Deltabar S differential pressure transmitters. Deltabar S offers extensive diagnostic messaging so that troubleshooting any problem is easy.
- Air quantity measurement with a Deltabar S differential pressure transmitter optimizes the drying process.
- Water metering is used to cool the mill components with Promag W electromagnetic flowmeters.
- Oil is used on mills for lubrication to prevent damage to bearings and shafts. Various measurements are needed to ensure the correct and trouble free operation of the mill.
- A Liquiphant vibration level switch is used to measure the oil level in the reservoir. This switch is not affected by any contaminants, such as metal filings, in the oil.
- A Ceraphant T pressure switch is used to ensure that the system pressure is maintained and should the pressure drop, the crusher can be stopped before any damage is caused.
- Mass flow is measured by means of a Promass E coriolis flow meter to ensure that any blockages in the piping are quickly noticed. Should the oil flow rate to the mill be interrupted it can be stopped and an alarm can be given to the maintenance crew.

Proline t-mass A150 metering air to the clinker cooler.

B **Dust filtering with electrostatic precipitator**
Hoppers are typically filled with clinker dust, fly ash and other powdery materials.

- Along with the effects of humidity and high temperature, fly ash tends to stick to the sides of the hopper which can cause material build-ups and clogging of the hopper which can damage the ESP plates.
- Automatic triggering of hammer and rapper systems can be directly initiated by installing a Solicap S or Gammapilot radiometric measurement system.
- Solicap S FTI77 is a compact and rugged limit switch for min/max detection for bulk solids.
- Extremely robust design for harsh and high temperature process conditions.
- Easy and fast commissioning as calibration is performed at the press of a button.

www.endress.com/fti77

Robust Solicap point level switch prevents blockage in an electrostatic precipitator.

C **Raw meal silo** In order to keep the kiln in operation it is necessary to continuously monitor stock levels in the raw meal silos.

- Micropilot FMR57 is the level sensor for the highest demands in bulk solids and best suited for measurements in high silos or bunkers. For extremely narrow or multi-chamber silos select the parabolic antenna with a 3.5° microwave beam angle, which enables measurement to the bottom of the silos.
- Reliable Silopilot FMM50 electromechanical level measurement system with umbrella weight is a good choice.
- Maximum level detection with the Soliphant M vibration limit switches to safely avoid overspills.
- Air intake and fluidization monitoring with Cerabar M pressure transmitters help you to fluidize your cement.
- Air injection to fluidize the blending silo can be metered using Proline t-mass thermal mass flowmeter. The t-mass B 150 insertion probe is suitable for large pipelines or rectangular ventilation ducts.

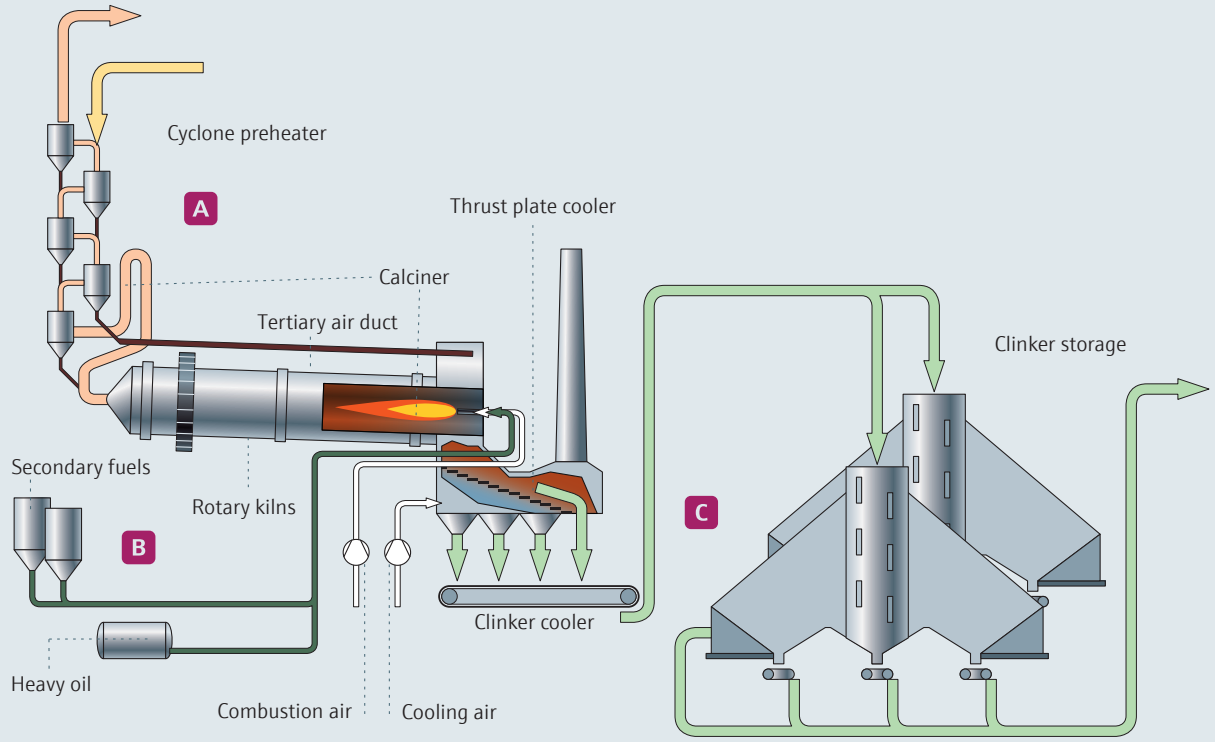
www.endress.com/fmr57

Micropilot FMR5x radar family is used for continuous, non-contact level measurement in powdery to granular bulk solids. Dust, filling noises, temperature layers and gas layers do not affect the measurement.

Clinker burning process

Consistently creating the perfect clinker recipe

Clinker burning process



A Pyroprocessing Pyroprocessing is generally regarded as the heart of the cement-making process. It is the stage in which most of the operating costs of cement manufacture appear, and is also therefore the area where most of the opportunities for process improvement exist.

Cyclone preheater Significant maintenance time can be saved by automating air cleaning cycles in the preheater cyclones. Clogging in the cyclones happens due to chemistry of the raw meal and the hot exhaust gases. Monitoring is important to avoid down time and hazardous situations.

- Gammapilot FMG60 offers non-invasive point level or continuous measurement to monitor build up before complete blockage occurs. Trigger points can be easily configured to proactively schedule maintenance.
- Pressure can be monitored and blockages in the cyclone are detected using a combination of Ermeto piping and Cerabar S pressure sensors with high purity ceramic (99.9 % Al2O3) measurement cells, which are overload-resistant.
- Accurately control the blending of raw meal as it passes through each cyclone and ensure instrument accuracy is not affected by plant vibration by selecting a remote sensor and housing combination.

www.endress.com/clinker-burning

- Carefully monitor the adverse effects of alternative fuels on the clinker process chemical reactions and process conditions in the cyclones with a combination of Gammapilot FMG60 scintillators and high accuracy Cerabar S gauges.
- Petcoke build up monitoring, clogging detection from high chlorine fuels like PVC and animal waste. In addition, Cerabar S sensors offer integrated overvoltage protection of electronics against lightning strike and power surges.

www.endress.com/fmg60

Gammapilot FMG60 and separate FHX display mounted on a cyclones to avoid down lime.

B **Fuels management** Substituting fossil fuel with another energy sources can help reduce your carbon footprint. Alternative fuels such as biomass, tires and industrial waste can be used to replace coal in cement kilns, this allows not only a reduction in consumption of fossil fuels but also the safe disposal of waste that would otherwise be incinerated or land filled.

Fluid management solutions Whether it is custody transfer during fuel loading into your storage area or feeding fuel to your burner systems, we meet your requirements with the highest accuracy during these processes. You can rely on our fuel management solutions allowing you to gain greater cost-efficiency.

- The straight, single-tube design of the Promass I provides measurement information on mass flow, density, temperature and in-line viscosity. These parameters are important to optimize the metering of waste oil to the kiln burner. The oil is heated and conditioned to optimize burner efficiency.
- Heartbeat Technology is embedded in Endress+Hauser flow meters and many other measurement devices. Gradual degradation of the performance of a flowmeter due to abrasion, corrosion or sticky build-up can be tracked easily with Hearbeat Technology.

www.endress.com/fms

Coal storage at a cement plant.

Alternative fuels such as old tyres, solvents and waste oil are burnt as secondary fuels.

C **Clinker cooler and storage** Clinker cooling is an essential part of the clinker production process. All measurement parameters have to be carefully controlled to achieve the best clinker qualitiy – every time.

Calicination and Cooling The basic cement kiln system comprises a preheater in which feed material is prepared by heat exchange with hot exhaust gases from the rotary kiln. The challenge in installing a robust temperature measurement system includes the selection of cost effective sensors and transmitters requiring minimum maintenance over the plant lifetime.

- For temperature measurement in the upper cyclones of the preheater, where sensor erosion is a major maintenance challenge, use Omnigard TAF11 with an advanced ceramic thermowell made of Silicon Nitride. This material has been successfully tested with up to 5 times longer lifespan compared to AISI310.
- For the bottom cyclones, we recommend Omnigrad TAF16 thermometers with a bar stock thermowell made from a Nickel Cobalt which offers unparalleled resistance against aggressive gases, stress cracking and high tensile strength against material impact.
- For milling applications we recommend the Omnigrad M TR15 thermowell and TS111 vibration proof ammonia treated sensor for faster measurement response time and better creep and corrosion resistance.

Temperature measurement with Omnigrad S thermocouple.

Cerabar M pressure sensor for blockage detection.

www.endress.com/temperature
www.endress.com/pressure

Clinker cooler The rate of cooling can be critical to the clinker quality and performance of cement. A clinker cooler package includes:

- Differential pressure flow sensors for metering and monitoring cooling air consumption
- Soliwave non-intrusive microwave blockage barriers to detect material backup in silos under the clinker cooler grate
- Non-invasive Gammapilot radiometric scale for mass flow on clinker screw conveyors or belt feeders (indicates clinker density and infers free lime levels)
- Omnigrad TAF11 and TAF16 temperature sensors and transmitters which last on average 10 times longer than regular stainless steel thermocouples
- The Solicap S high temperature point level switch for fine-grained and coarse solids (designed with a sword probe which prevents build ups and associated alarm conditions)
- The robust sensor Solicap S design is unique in the market as it permits a maximum lateral loading of up to 800Nm

High temperature Micropilot level radar

As microwaves are not affected by process temperature, the Micropilot M FMR57 with integrated air cooling and temperature monitoring is ideal to monitor clinker bed levels. The radar features integrated cooling software algorithms to detect failures in the antenna cooling system and spikes in process temperature. In addition the Micropilot M FMR57 uses a dual chamber high temperature thermoplastic emitter which unlike a ceramic emitter will not be damaged by splinters of hot clinker.

www.endress.com/fmr57

Solutions for your cyclone preheater

- Solution packages for energy monitoring and management
- Precise measurement and control of raw ingredients passing through the cyclone preheater
- Air cleaning of cyclones initiated by accurate monitoring of buildup and blockage
- Precise kiln burner regulation and optimized fuels mix controls for storage, blending and dosing
- Accurate online measurement to optimize the clinker cooler
- On average, our temperature thermocouples last 10 times longer than regular sensors

Point level detection in clinker cooler outlet funnels with Solicap S.

Clinker Storage Clinker is stored in large storage silos, domes and buildings and the total capacity should amount to at least 14 days kiln production to ensure a continuous cement supply. Endress+Hauser level solutions can assist you maintain supply to the mills and prevent overspills of clinker dust which may be hazardous to air quality.

- Continuous level measurement in clinker silos with the non-contact Micropilot M radar measuring device (max. 400 °C/752 °F at antenna); for greater distances, use the version with parabolic antenna.
- Point level detection with capacitance high-temperature rope probe (max. 400 °C/752 °F)

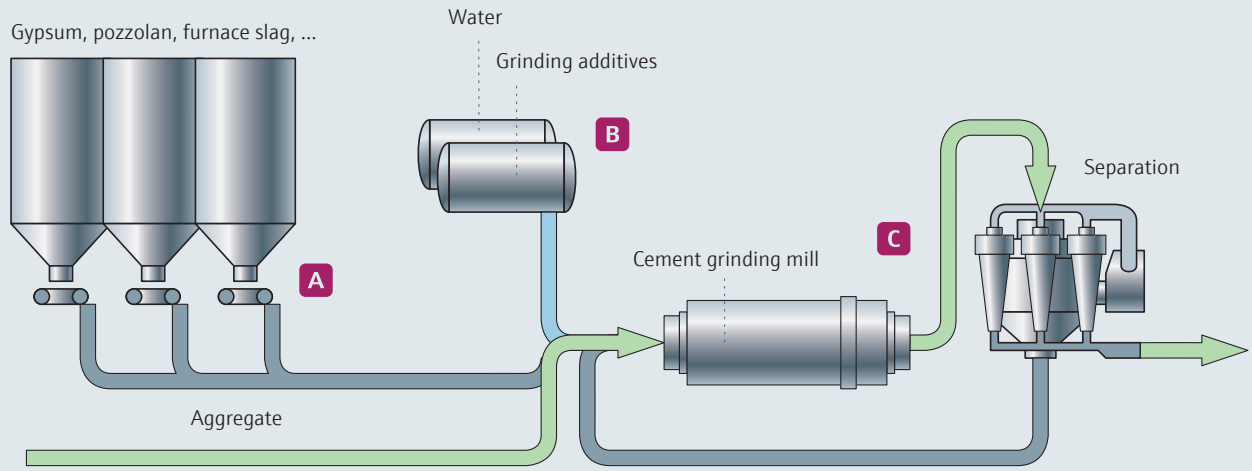
www.endress.com/level

Effective level control in clinker storage silos.

Cement production

Accurate measurement and control are the basis

Cement production



A **Aggregate and cement additive bins** Level measurement in compact aggregate bins is a challenge for free space radar or ultrasonic level systems. Install a Levelflex FMP57 guided wave radar with integrated cable health monitoring to achieve the best measuring results.

Levelflex FMP57 is the sensor for the highest demands in bulk solids and best suited for measurements in narrow storage bins, bunkers or stockpiles. An integrated overvoltage protection module is available for two-wire HART as well as PROFIBUS and FOUNDATION fieldbus devices.

www.endress.com/fmp57

A Levelflex guided wave radar measures the levels of grinding aggregates in storage tanks.

Levelflex FMP57 is the sensor for bulk solids and best suited for tight spaces.

B **Grinding aggregates storage tanks** Liquid grinding aggregates storage tanks can be monitored with Liquicap continuous capacitance level transmitters. Liquicap is a reliable rod or cable probe for continuous level monitoring in liquids, particularly in build-up forming media. You can adapt the length of the cable with a probe shortening tool.

Liquicap level probes for conductive liquids.

www.endress.com/fmi52

Chemical additive dosing in the ball mill make your recipe right.

C **Cement grinding plant** Cement additives amplify grinding efficiency, resulting in a higher mill throughput and lower the clinker factor, with an overall reduction in CO^2 emissions. For accurate metering of grinding additive use a Promass E coriolis flowmeter to identify grams of additive per ton of cement.

OEM's manufacturing skids to dose cement liquid additives can easily integrate the ultra-compact Proline Cubemass C sensor for even the smallest quantities with seamless system integration. Volume measurement of grinding additives and injected water for cooling is done by means of Promag W electromagnetic flowmeter.

Proline Cubemass coriolis meter for easy integration to additive metering skids.

Transfer and control of solids on conveyor belts and screw conveyors The Gammapilot radiometric belt scale is an easy to install weighing system which does not require removal and adjustment of the conveyor belt idlers as is the case with conventional belt weighing systems. The belt scale and weigh screw system is easy to install and comes complete with weigh frame, FQG6x secure radiometric source container and FMG 60 scintillator and Memograph RSG40 integrator with speed sensor and other inputs like belt slippage and breakage alarms. The Memograph RSG40 includes an OPC server and offers limitless integration into your existing control system and can be used by maintenance as a central collection point for conveyor condition data.

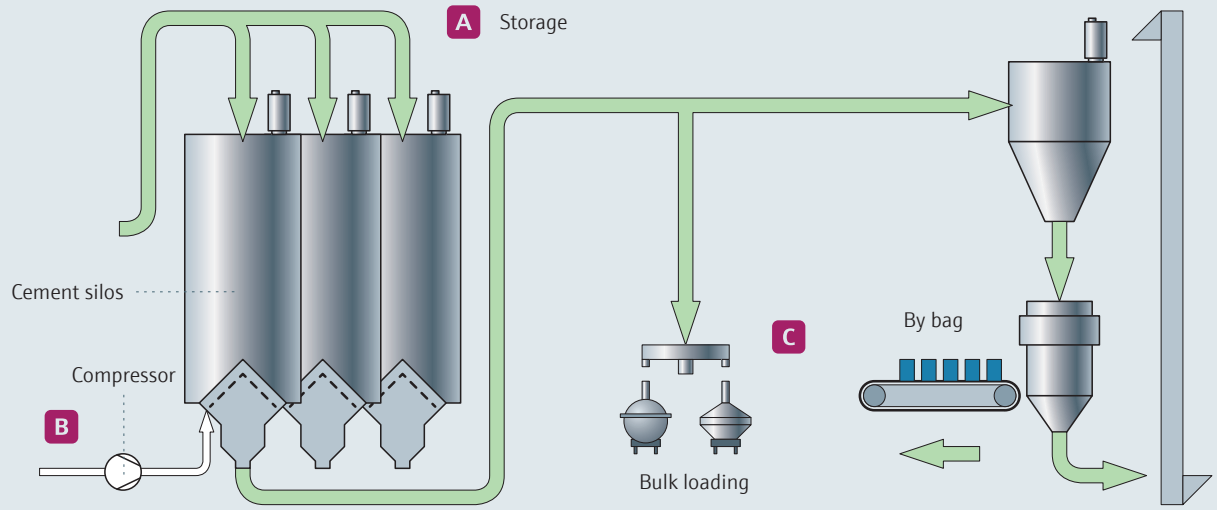
Wet cement processing

The Gammapilot radiometric system is used to calculate the concentration of solids in slurry. The Gammapilot M source container and the transmitter are often clamped directly to the slurry pipe and combined with a Promag 55S electromagnetic slurry flow meter to calculate mass flow and solids concentration.

Cement storage and loading

Keep your cement flowing

Cement storage and loading



A **Cement Storage** Level measurement in cement silos is challenging and a continuous sensor health check is key in improving reliability and availability of measurements.

- Micropilot FMR57 is the radar level sensor best suited for measurements in high silos. The parabolic antenna facilitates very small emitting angles and used for narrow multi chamber silos. Dust, filling noises, temperature layers and gas layers do not affect the measurement.
- Use the Micropilot FMR57 health check diagnostics to monitor for deteriorations in measurement integrity caused by cement build up, steep angles of repose and rat holing. The dual output module with HART digital communications can automate radar cleaning cycles, activate silo air fluidization and make reliable stock level measurements.
- The HistoROM data management chip records measurement and setup data in each radar. Plug in touch screen displays copy and transfer setup data to new or replacement radars.
- You can reach the highest reliability even in the presence of obstructions in the silos due to Multi-Echo Tracking evaluation algorithms.
- Solicap FTI77 capacitance high temperature point level switch for fine-grained and coarse solids is available with a robust steel rope to a maximum measuring range of 20 m/65 ft. It offers active build-up compensation which extends periods between maintenance clean-up of the rope.
- Soliphant FTM5x vibrating fork is recommend for bulk solids for low bulk density and highly fluidized cement silos.

Reliable measurement for your cement storage silos.

B **Compressed air generation** Aeration monitoring in cement silos is important for an effective cement storage and loading.

- Many large storage silos are equipped with an aeration grid at the silo bottom to fluidize cement flow. A t-mass A150 thermal mass flowmeter is ideal for this application. There are no moving parts and sensor cleaning periods are reduced to a minimum by activating the Heartbeat sensor health check diagnostics.
- The t-mass A150 features an integrated totalizer which not only gives energy consumption data, but also infers the flowability of cement in silos.

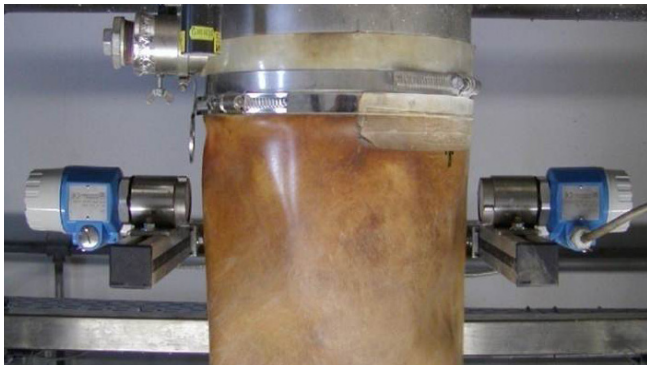
www.endress.com/t-mass-a150

Compressed air mass metering with Proline t-mass for an effective cement flow.

C **Cement packaging and loading** The Soliwave FQR56 and FDR56 is the ideal solution for monitoring cement flow in the bagging fill line.

- In addition a Soliwave sensor system can be used to avoid cement spillage by correctly positioning your cement truck or ship. The system signals the driver when it has reached the correct parking position.
- The Soliphant FTL5x with separated electronic housing is designed for installation in telescopic cement loading funnels to prevent truck overloading.

www.endress.com/fqr56



Soliwave M microwave level limit switch for cement bag loading.

Environmental sustainability

Solutions helping you comply with local standards

The environmental legislative situation is becoming in-creasingly stringent. Endress+Hauser packaged measurement and control solutions help you to meet dust, NOx and many more air emission regulations.

Early blockage detection Bag house and filter monitoring with Deltabar S electronic differential pressure transmitter FMD71/72 offers a reliable, safe and cost effective pressure measurement solution.

The electronic Deltabar FMD71 is a differential pressure system compromising two sensor modules with ceramic diaphragms and one transmitter used to measure differential pressure across fabric filters to detect blockage and automate cleaning routines. It eliminates traditional mechanical issues associated with oil filled capillaries resulting in greater bag house availability and reliability.

DeNOx / SNCR systems Nitrogen oxide in the flue gas can be reduced by installing in a DeNOx system. Endress+Hauser will supply the complete gas cleaning and urea preparation solution package. Highlights are:

- Safe monitoring of the storage of hazardous chemicals with Levelflex FMP5x.
- Liquiphant FTL70 featuring housings with welded gastight feed through which prevents ammonia gas leaks. This increases safety to personnel and to the electronics of the devices.
- Deltatop DP62D Pitot tube waste gas flow measurement in chimneys with DA62P automatic dust purge system reduces maintenance cleaning cost.
- On line gas composition analysis with the latest in Raman spectrometry analysis.

Analyzing the quality of mine water discharged to water bodies is key to developing an effective environmental policy.

Clean air solutions for enviromental sustainability.

The wireless cement plant

Reduce project life cycle costs and go wireless

WirelessHART is a technology specifically conceived for process automation. It adds digital wireless capabilities to any 4...20mA HART field device and brings a host of benefits to plant maintenance when combined with instrument health check diagnostics.

Go wireless Simply select an SWG70 gateway and SWA70 adapter and plug this in to any 4...20mA HART device existing in the plant. The SWA70 can power any two-wired sensor. Alternatively you can use existing power lines or select a solar power option from Endress+Hauser. In addition to the well-proven battery pack, the SWA70 is now available with a power supply that allows connection to line voltages of 24...230 VAC/DC, with the added advantage that the adaptor can be used to power up to four HART devices in multi-drop mode. The result is simpler installation and a saving in additional power supplies.

Wireless temperature sensors installed on a three stage rotary kiln.

WirelessHART

www.endress.com/wirelesshart

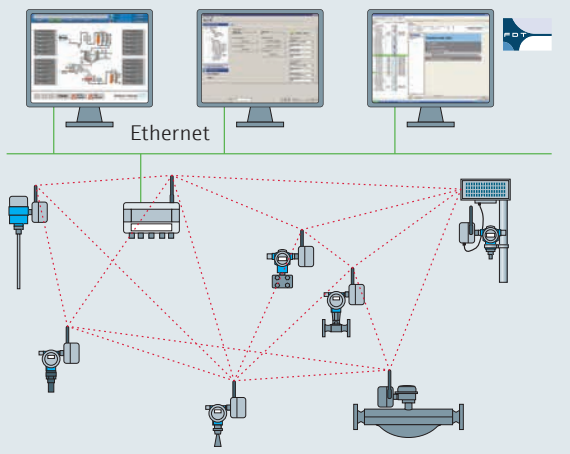
SupplyCare hosted software Cloud based inventory management and supply chain platform is the solution. From simple fuel tank or cement silo visualization to just in time deliveries to your concrete plant clients. Endress+Hauser will link you to the right software tool to run your process at its full potential.

www.endress.com/supplycare

Benefits

- Improves demand planning and lowers your inventories
- Enables business processes such as Vendor and Supplier Managed Inventory (VMI, SMI)
- Complete solution from inventory measurement and data acquisition to integration in your business processes
- Worldwide service and support network
- Faster reaction to supply chain volatilities
- IT infrastructure within the Endress+Hauser network with full support
- Complete inventory visibility 24 hours a day, 7 days a week, anywhere around the world, even on mobile devices

Get the most information out of your field device



Services – by your side

Committed to your business, for improved plant performance

Partnership: From consulation and commissioning through to operation Our commitment to you is to support, to service and to optimize your process. Whatever your location or your industry, our global service force of over 1,000 experts is strategically located worldwide ensuring active local presence to help you reach your goals. Based on our process knowledge and technical expertise, a uniform approach through clear procedures ensures that the work we conduct for you is done properly. Customized responses can also be adapted to your needs, contact us today.

Endress+Hauser is with you during the whole process as your partner in industrial instrumentation and plant asset management. The responsibility of Endress+Hauser does not end with instruments. Be it fieldbus installation, remote instrument visualization, automation of processes or the realization of asset management installations – all of this is engineered by a partner you know well.

www.endress.com/services

Our consultation services provide the following:

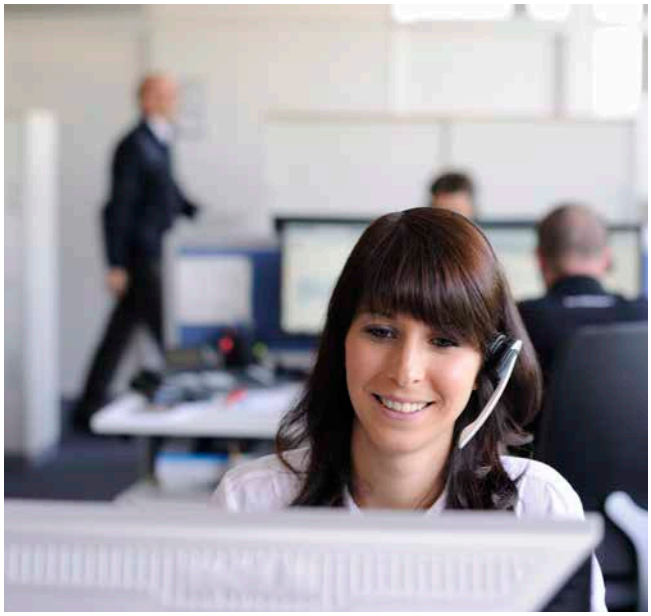
- Optimization solutions to improve plant efficiency
- Cost reduction solutions by decreasing energy consumption
- Optimize your maintenance work flow with simple tools for calibration, trouble shooting and diagnosis
- Use of advanced diagnostics to improve asset performance
- Sharing of best practices in waste handling and treatment
- Increased safety and reduced plant availability
- Higher availability of your fieldbus network
- Reduction in spares stock holding by offering modular sensor platforms

Co-operation and partnership are important.

Support services Keep your critical applications up and running and minimize the risk of process interruption. Endress+Hauser's technical support experts ensure your installed base of instruments, software, and/or automated solutions are kept running smoothly over time. The support is tailored to meet your needs and is available worldwide and around the clock to guarantee a fast response time.

- Support technicians are available to guide you through installation/set up, configuration and maintenance of your field instrumentation products
- Customized training at your site or online, at your local Endress+Hauser training facility, at specialized training centers
- Telephone help-line and email support (optional: remote access to your devices)
- Calibration services for density and flowmeters

www.endress.com/supporting



We offer a variety of services to efficiently support you.

Engineering services Solutions to meet your plant's process requirements while ensuring optimal performance.

- Project specification: Our consultants and design teams will work with you to generate the URS (User Requirement Specification) and the FDS (Functional Design Specification) for your project – from products to automation solutions
- Generation of Engineering Documentation package containing: Instrument list, component list, automation components list, CAD drawings, electrical drawings, installation charts, cable schedules and calculation notes for design compliance
- Our complete quality management covers testing such as Factory Acceptance Test (FAT) and the Site Acceptance Test (SAT)
- With our standardized or customized documentation services you receive data on your measurement devices or automation solution for its entire life cycle, this documentation is also the basis for our training offering

www.endress.com/engineering-services

Benefit from engineering services to complement the capabilities of your staff.

Additional solutions to optimize your cement process

Innovative temperature engineering for a long life

A basic cement kiln system comprises a pre-heater in which feed material is prepared by heat exchange with hot exhaust gases from the rotary kiln. The challenge in installing a robust temperature measurement system includes the selection of cost effective sensors and transmitters requiring minimum maintenance over the plant lifetime.

Temperature engineering Endress+Hauser offers a complete assortment of compact and modular thermometers, long life material for thermowells, digital communication modules, field, rack mount, integrated and wireless transmitters and displays for cyclone pre-heater, kiln, mills and flue gas processes.

For temperature measurement in the upper cyclones of the preheater, where sensor errosion is a major maintenance challenge, use Omnigard TAF11 with an advanced ceramic thermowell made of Silicon Nitride. This material has been successfully tested with up to 5 times longer lifespan compared to AISI310.

For the bottom cyclones, use Omnigrad TAF16 thermometer with a bar stock thermowell made from a Nickel Cobalt alloy which offers unparalleled resistance against aggressive sulfide gases, stress cracking and high tensile strength against clinker material impact.

Thermophant T compact sensor for lubrication oil and cooling water line monitoring

To effectively measure temperature in the kiln hood and inlet and in the rotating kiln itself ask for an Endress+Hauser temperature specialist for more information on optical and other temperature measurement solutions.

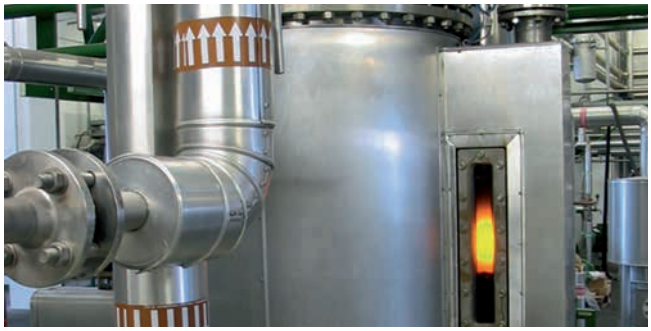
www.endress.com/temperature

Modular TAF11 ceramic thermocouple with retractable assembly, replacement thermowell and transmitter options .

Reducing cement costs with tailor-made energy solutions

Constant monitoring of the heat system cools down energy costs There are a huge range of industry specific heating processes and technologies which require individual approach and measures to evaluate and improve system performance. Boilers and fired heaters are typically large sources of energy loss due to inefficient combustion, improper operation, and poor maintenance. The simplest way of evaluating such losses is efficiency measurement.

www.endress.com/heating-efficiency



Heating system with a burner boiler for steam generation.

Keep your power plant chemistry in balance Water quality control within power plants maintains the operational efficiency and minimizes plant downtime caused by corrosion or preventative maintenance. It also allows turbine supplier warranties to remain applicable. The integrity of the components is affected by the constant contact of the water and steam with metal surfaces, which creates corrosion and scaling. You need smart instrumentation for analysis, allowing you to prevent such situations and avoid expensive repairs.

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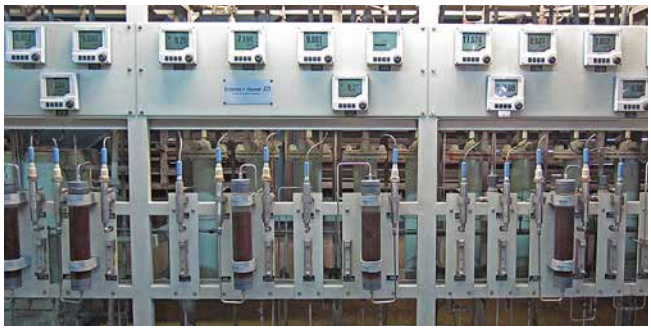

The modular Steam and Water Analysis System (SWAS) provides all necessary measuring signals for process control.

Reduce costs with improved system performance Compressed air systems are complex systems and often "grow over time". With constant system monitoring using meaningful KPIs, operators, supervisors and management are kept informed and constructive energy management is possible. As up to 85% of total costs of a compressed air system are energy costs, investment in measurement and system equipment pays off.

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Define the right KPIs which help you to evaluate the compressor efficiency.

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