FLSMIDTH CEMENT

ECS/ProcessExpert®

Advanced process control for vertical roller mills

ECS/ProcessExpert SOLUTIONS FOR VERTICAL ROLLER MILLS

Expert process control of your vertical roller mill delivers improved operating conditions, increased grinding efficiency, and simplified mill start-up.

KEY BENEFITS

Up to 7% increase in production.

Up to 7% reduction in specific power consumption.

Up to 40% reduction in quality variation.

Tighter control of mill vibration.

Minimal change-over time between product recipes.

WHY ADVANCED PROCESS CONTROL?

Vertical roller mills (VRMs) have established a reputation in cement applications for their high efficiency. However, the come with a range of operating challenges, among which are the fast dynamics of the process. Compared to ball mills, where conditions change over the course of 15-20 minutes, conditions in a VRM can change in just 2-4 minutes. This makes it even more important to monitor process conditions, so any necessary corrective action can be taken in time.

Other challenges include changes in material grindability and excessive mill vibration, which may result in mill shutdown.

The latest ECS/ProcessExpert software utilises a multi-input multi-output (MIMO) model of the process to overcome these challenges. This predictive model allows the software to plan and implement optimum setpoints. These setpoints are continuously updated according to the difference between predicted and measured values, using the so-called 'optimisation cost function over the receding prediction horizon', which seeks to minimise deviation from production targets.

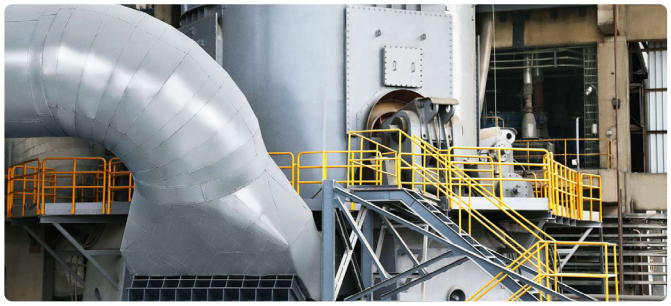
The result is a more stable and productive mill that delivers consistent product quality, tighter control of mill vibrations, and efficient change-over between product recipes, all while reducing energy consumption for lower carbon intensity and costs of cement production.

FLSmidth: the process knowledge experts

We are a global leader in the construction, maintenance, and optimization of cement plants. We also have more than 50 years' experience of plant automation, installing thousands of control systems and laboratory systems worldwide. So, when it comes to designing and implementing advanced control automation solutions in the cement industry, there's no more expert a partner.

Designed by our team of cement process experts specifically for cement applications, our ECS/ProcessExpert software brings all this knowledge and experience together to deliver a solution that reliably enhances the capabilities of our customers' plants. Whether that's on cost, sustainability, productivity, quality – or all the above.

DELIVERING THE BENEFITS OF VERTICAL MILLING



Stabilize, then optimise

The ECS/ProcessExpert mill controller continuously monitors and adjusts the mill to comply with operational targets – and does so far more frequently and accurately than a human operator ever could. When the mill reaches operational stability, a high-level target optimisation procedure regularly calculates a new set of optimum targets for mill Dp based on process conditions, keeping product fineness close to target, while maximising production within allowed operational limits. The optimisation process also ensure that initial recipe targets are adjusted according to actual conditions, such as raw material grindability.

The typical VRM setpoints are separator speed, fresh feed, and mill fan speed; however, the selection of process measurements, control variables, and setpoints is customised to the given process configuration of the mill.

Upset conditions

In the event that excessive mill vibrations are detected, ECS/ProcessExpert software takes immediate corrective action by adjusting the grinding pressure and further reducing mill feed, resulting in optimum bed thickness. If a process measurement is declared invalid (due to hardware failure, for example), the controller automatically replaces it with second priority signals or estimated values to continue operations. Temporary measurements can also be selected manually by the operator when a device is taken down for maintenance.

Mill ramp up

Another feature of ECS/ProcessControl for vertical roller mills is the ramp up function. This ensures a smooth and controlled mill start-up: essential for mills to quickly achieve process stability and minimise equipment wear.

Key controlled variables, such as feed rate, separator speed, and fan speed/damper position, are manipulated and stabilised. Once the mill is stabilised, automatic ramp up finishes, and the normal control strategy takes over.

The result is a simplified and consistent mill start-up that is not reliant on operator input; mill start-up time is also reduced, improving mill productivity as normal production conditions are achieved as quickly as possible.

Controlled parameters

- Fresh feed and separator speed
- Feeder ratio control
- Mill fan speed
- Water injection
- On-line process state estimation
- Grinding pressure
- Recirculation damper

Monitored parameters

- Product quality, such as Blaine/residue, SO3, LOI.
- Mill vibration
- Mill Dp and power
- Mill bed level thickness
- Draft and temperature
- Feeder response to a given setpoint
- Fan speed/damper position

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