After the journey from the quarry to grinders and the kiln, the final step in the process of making Portland cement is the finish mill. Clinker, along with a proportional amount of gypsum, is fed into the mill to be ground into finished cement ready for storage or transportation.

The design of a finish mill most commonly consists of a very large diameter steel tube filled with a designated quantity of steel grinding balls. As the mill is rotated at an optimum rpm (revolutions per minute), the grinding balls crush the clinker/gypsum mixture into a fine powder [Figure 1, next page].

A high efficiency cyclone separator controls the particle size. Other additives may be added during the finish grinding process to produce specific types of cement. The drum is generally divided into two or three chambers with differently sized grinding media. As the clinker particles are ground down, smaller media are more efficient at further reducing the particle size.

In a closed circuit system, coarse particles are separated from the finer product and returned to the start of the process for further grinding. This is called a recirculating load.

A current of air is passed through the mill, which helps keep the mill cool and removes evaporated moisture that would otherwise cause hydration and disrupt material flow. The dusty exhaust air is cleaned, usually with a filter bag system.
These filter systems can be monitored by acoustic sensors to detect broken bags or perforations in the filtration system. For example, SITRANS AS100 acoustic sensor from Siemens will alarm if filters become torn or inefficient and begin allowing exhaust dust particles into the process. The AS100 works in combination with Siemens SITRANS CU02 alarm control unit to operate an alarm or control device and also to display readings locally on the unit’s LCD.

For peak efficiency, the mill should run with an optimum load. Sensors may be used to measure the frequency of noise coming from the mill, as there is a relationship between the frequency and amplitude of the sound generated and the loading of the mill.

Load cell systems have also been used to weigh the entire mass of the mill and provide loading readings by weight. It is also important to measure the rate of materials being fed into the mill, which is usually done with a belt scale monitoring feed rates, but there is also a need to measure the rate of flow of the coarse rejects being returned to the mill from the separator system. This reading from the recirculating load, or regrind circuit, must be instantaneous and not disrupt the material flow.

The most common application for a solids flowmeter in a cement finish mill is the coarse returns downstream from the cyclone separator. It is important that this reading be instantaneous since the load of the mill needs to be kept at a desired level for the most efficient grinding.

With this rate feedback the system controller can vary the input of clinker and additive feeds to quickly adjust for best grinding control. The flow rate in the coarse return process varies with systems, but rates of up to 800 t/h (880 STPH) are possible.

SITRANS WF200 and SITRANS WF250 solids flowmeters from Siemens can measure the flow of material up to 900 t/h (990 STPH). Their design features two parallelogram load cells mounted externally to the process to ensure ease of maintenance and reliability. The external mounting of the load cells also allows for product temperatures up to 150 °C (300 °F). The designs are completely dust tight to ensure the product does not become contaminated and to keep the area around the unit clean and clear.

Siemens solids flowmeters only detect horizontal movement from the material impact. This ensures that material buildup on the sensing plate has no negative effect on accuracy. Along with the coarse returns process, impact flowmeters can be used in other applications in the grinding circuit.

In Figure 2 (next page), flowmeter A provides rate indication of oversized product being loaded to a bucket elevator, which again feeds into the main separator. Flowmeter B helps control the fine rejects from the static separator that are added back into the system. Flowmeters C and D provide instantaneous indication of the amount of finished cement that is being conveyed to storage or load out to a truck or ship. Finally, flowmeter E measures and helps control the amount of kiln dust being added to the finished cement. A small amount can be added to the finished product, but this limit cannot exceed a certain percentage.

With these flowmeters from Siemens, plant operators receive precise rate-of-flow measurements instantly without having to interrupt the flow of material. Siemens has been supplying solids flowmeters for over 40 years. Our field-proven designs are in thousands of applications worldwide, contributing to the optimization of cement-making processes every day.
With these flowmeters from Siemens, plant operators receive precise rate-of-flow measurements instantly.

Figure 2: The mill process features a number of different applications where solids flowmeters can be installed for instantaneous flow indication.

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