

Adapting to the market

The selection of suitable grinding systems is an important part of ensuring the competitiveness of a cement producer and its ability to rapidly respond to market requirements. This article examines some of the key requirements of such grinding equipment and shows how the FCB Horomill® can meet such needs.

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Grinding equipment must be able to provide the cement producer with the right product at the right time, in volumes required by the cement market. In today's fast-developing markets, the ability to switch between the production of different types of cement becomes an issue of market competitiveness.

Continuity of delivery of much-demanded cement types as well as the ability to supply smaller market segments is helped by the correct selection of grinding equipment.

This includes cement plants producing cements with low clinker factors, therefore reducing carbon footprint and production costs in one go. The ability to efficiently grind additives such as pozzolana, limestone or fly ash is also important, but due to their higher moisture content, the grinding operation is often carried out in tandem with a drying arrangement.

Furthermore, grinding systems must meet several other requirements. As the process accounts for up to 60 per cent of power demand in the cement plant, electricity consumption is a key issue, both in terms of capital expenditure (plant grid adaptation or captive power plant) and operational expenses (electrical energy cost).

In addition, reliability and easy of use are further key factors as cement producers rely on high uptime, reduced manual interventions in day-to-day operations and low maintenance costs.

Rapid change of recipe

With a relative low quantity of material circulating in the circuit (there are about 10t of material for an FCB Horomill 3800 standard workshop), rapid and frequent changes of product types are possible within very short time periods (5min) and without need of any purge bin to deal with intermediate production grades.

Various cement types meeting all

Fives FCB supplied the Teresa grinding plant in the Philippines to Republic Cement



quality targets are produced reliably thanks to the FCB Horomill process stability and the FCB TSV™ Classifier's proven efficiency. In fact, many plants process different types of products with the same FCB Horomill, taking advantage of its flexibility and versatility, with 3-4 daily changes of recipe, depending on production and sales needs (eg Opterra/CRH-owned Karsdorf plant, Germany).

As for standard daily operation, modifications of cement compositions, and adjustment of process parameters, as well as selection of cement silo, can be fully automated (eg Buzzi Unicem's Trino plant, Italy).

Easy management of moist materials

As the FCB Horomill is not an air-swept mill, the drying function is ensured in the separator gas circuit and the moist materials are fed below the FCB TSV Classifier. With drying taking place

separately, low moisture content is also ensured inside the mill. Thanks to this efficient drying process and without the need for water spraying, high venting speed and material moisture are reduced, achieving the lowest operating wear rate (typically from 0.1-0.7g/t).

The specific design and equipment required for the mill's drying arrangements are selected by Fives according to the material type to be dried, its grain size and moisture content.

The grinding flowsheet can be adapted depending on the application. For wet and fine additives/products, there is a dedicated feed to the dryer section. Examples include:

- pozzolana in the Teresa and Norzagaray plants of Republic Cement/CRH in the Philippines, with 29 per cent of pozzolana, up to 25 per cent moisture in wet season
- pozzolana in Cementos Moctezuma's Tepetzingo plant, Mexico, representing

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15 per cent of the composition with up to 24 per cent moisture during wet season

- blast furnace slag in Opterra/CRH’s Karsdorf plant, Germany: up to 100 per cent of pure slag feeding at 10 per cent moisture.

In raw mix grinding, part or full circulating load passes through the dryer. Tepetzingo’s raw mix grinding facilities operate with a feed moisture of up to nine per cent, which is dried at a minimum rate of 270tph. Between 20-50 per cent of the circulating load is fed to the flash dryer.

Fine particles are dried during their gas lifting to the classifier, whereas the coarsest particles are mechanically fed back to the FCB Horomill via the classifier reject belt.

A further improved drying efficiency can be achieved using the FCB Aerodecantor, installed below the classifier. With this arrangement, coarse products with total moisture of up to 10 per cent can be successfully processed in industrial plants.

No water injection

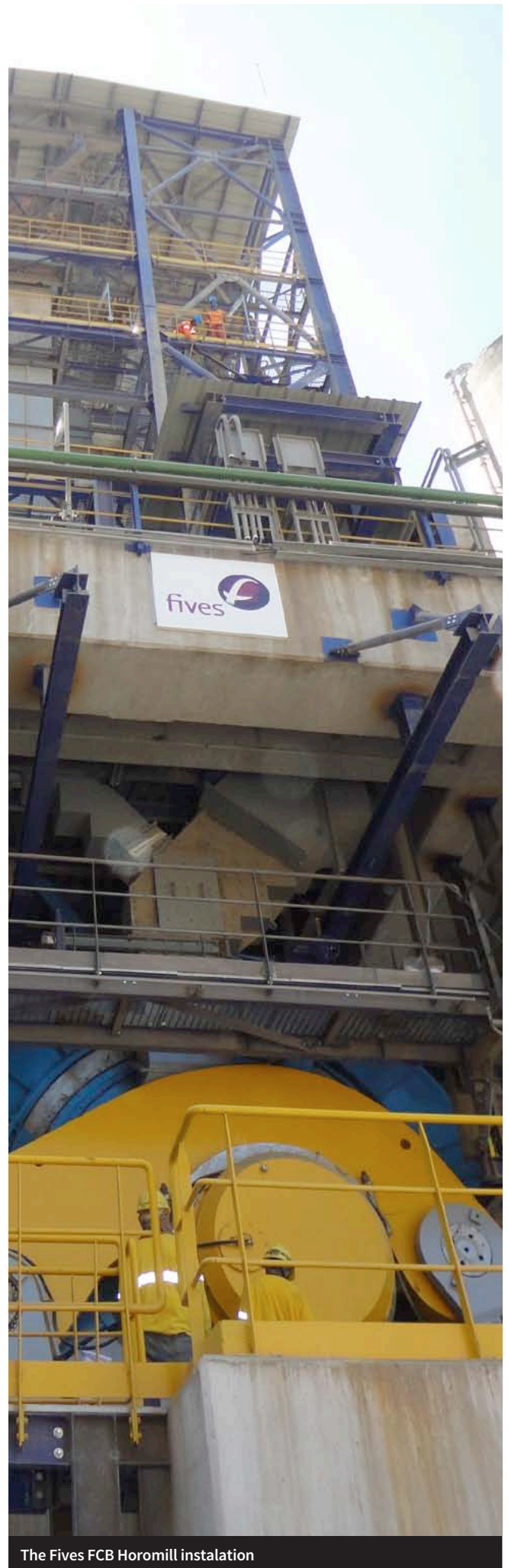
Water injection is not required when grinding cement or any other mineral in the FCB Horomill. The special concept of the mill features a fully-controlled material/recirculation loop that ensures optimal operation of the mill. This feature allows the FCB Horomill to avoid waste of process water and the related heat consumption increase for evaporation while it prevents cement hydration in the mill, effectively combining the need of sustainable production with cement quality.

Low energy consumption and stable high-quality product

As a roller mill, FCB Horomill benefits from the material bed compression which is a source of significant energy saving compared to more traditional technologies. Compared with a ball mill, the FCB Horomill saves up to 50 per cent in energy.

Moreover, as it is not an air swept mill the gas circuit is only dedicated to classification and drying (if required). Therefore, there is no extra gas flow or pressure drop by material handling to the classifier. This is carried out by a bucket elevator, resulting in up to 20 per cent of energy savings compared with vertical mills. For example, at Republic Cement’s Teresa plant in the Philippines, the overall energy consumption for the whole grinding plant is limited to 25.2kWh/t (cement type 1P), while at LafargeHolcim’s Barroso plant in Brazil, the overall (raw mix) grinding circuit consumption comes down to 10.8kWh/t.

Thanks to this arrangement, the mill settings can be fully optimised for grinding efficiency, while the aeraulic loop is itself adapted to classification and drying optimisation, without compromises.



The Fives FCB Horomill installation



The high moisture content of the pozzolana used in Republic Cement's Norzagaray plant required a drying process, carried out by an FCB Aerodecator with hot gas from the clinker cooler exhaust used to reduce the moisture content of the pozzolana

As a result, the concrete/mortar strength developments achieved are similar or even better than those obtained with a ball mill cement circuit at a said fineness. This allows the best production rate vs fineness target compromise for a given type of cement, optimising the cost efficiency of the cement grinding system.

Operation stability combined with a high-efficiency classifier

The stability of the FCB Horomill combined with the highly-efficient FCB TSV Classifier is also a major advantage for the production of even finer cement, a target which seems today to be shared by all cement producers. While vertical mills need significant water addition to stabilise the mill, the FCB Horomill keeps the finished product dry. In trials carried out in Fives FCB's Research & Testing Center and under adequate classifying conditions, a very high fineness level at more than 7000 cm^2/g was reached with CEM I.

Automatic operation

By pushing the start button, the FCB Horomill operation is fully automated, without intervention of the CCR operator.

Therefore, automatic changes of cement composition, adjustment of plant parameters and selection of target silo for the end product have been successfully implemented in many plants such as Buzzi Unicem's Trino works in Italy, allowing

Case study: Republic Cement, the Philippines

FCB Horomill® has recently been implemented and successfully commissioned for Republic Cement in the Philippines at the cement producer's Teresa and Norzagaray plants. To meet market demand at optimal cost, both plants, which had similar production targets, needed to increase production of blended cement (ie 1P type). This type of cement uses a high percentage of additives such as limestone, pozzolana and fly ash to optimise the C/K ratio. Therefore, a low content of clinker (55 per cent) had to be taken into account when designing the plant.

Furthermore, the pozzolana available in the vicinity of the plants in the Philippines has high moisture content, especially in the wet season when it can reach 25 per cent. Therefore drying was a key issue to ensure the success of the project. This was addressed by incorporating a drying facility (FCB Aerodecator) in the process flow sheet and physically integrating it in the workshop.

While at the Teresa works the heat source was a pulverised coal-fired 12MW hot gas generator (supplied by Fives Pillard), in the Norzagaray plant hot gas from the clinker cooler exhaust was tapped. In addition, a 4.8MW diesel oil-fired hot gas generator supplied by Fives Pillard was installed for use during kiln stoppage periods.

The Norzagaray production facility started operation mid-February 2016. The plant has already achieved an extra production capacity of 400,000t of cement (of which 90 per cent 1P grade) with a high C/K ratio in excess of 1.8. All cement produced from the initial run has been within quality expectations of the customer and sold to the market. Thanks to FCB Horomill® technology, both plants are able to increase their cement production by 850,000tpa each.

Moreover, as the new mill is able to use carbon-neutral additives and reduce CO_2 emissions by 94,000tpa, it meets Republic Cement's drive for sustainable production. In addition, the power required by the grinding facility is 40 per cent lower when compared to existing cement mills operated by the company.

The new grinding facility is enabling Republic Cement to meet present and future market requirements in an effective and flexible way.

overnight and weekend operation without supervision.

Conclusion

In a more challenging market where efficiency, reliability and sustainability are key drivers for any new investment project, the FCB Horomill system offers an optimised grinding plant, benefitting from the following key advantages:

- maximisation of C/K ratio, irrespective of the additives type
- high flexibility of the plant in processing various cement types
- energy savings and a lower installed power
- higher product quality thanks to zero water injection
- fully-automatic mode for start/stop and change of recipe

- same nominal capacity during the whole operation (insensitive to wear)
- very low wear rate leading to low maintenance cost
- high and proven system reliability
- low noise level.

FCB Horomill® provides a compact installation footprint with flexible, automatic, reliable and stable production, and best process conditions to achieve sustainability targets.

With more than 60 units in operation for the comminution of a wide range of materials including cement, slag, raw materials and minerals, the FCB Horomill grinding system achieves the production and sustainability targets of 34 different cement companies worldwide, maximising their benefits to meet the market challenges of today and tomorrow. ■