

# Establishing a Latin fan base

Latin America is a key market for the Boldrocchi Group. Recent projects include the supply of a range of fans for the Cementos Fortaleza plant in Tula, Mexico, and for the Oruro plant of Empresa Pública Productiva Cementos de Bolivia (ECEBOL). Over the years, the Italy-based equipment supplier has built a presence in most Latin American countries.

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In the last few decades, Boldrocchi Group has delivered numerous projects in Latin America, with references in about 90 per cent of these countries. Among Boldrocchi's recent activities in the region are projects to supply all process fans and some dampers for two new cement plants: the Cementos Fortaleza works in Tula, Mexico, and the new production facility by Empresa Pública Productiva Cementos de Bolivia (ECEBOL) in Oruro, Bolivia.

Headquartered in Italy, Boldrocchi is an international engineering and manufacturing firm with products in over 140 countries and offices operating in 13. With a strong focus on problem solving, it is among the few companies in the world that offers a wide-ranging portfolio of solutions that include fans, blowers and compressors, air pollution control, cooling systems/heat exchangers, noise protection, heavy-duty dampers and power generation/gas turbine ancillaries, among other equipment. Boldrocchi not only engineers and manufactures products and systems in its own workshops, it also offers an array of on-site services, providing turnkey projects.



Raw mill fan

Installing the new equipment at the Tula works of Cementos Fortaleza, Mexico



## Cementos Fortaleza – Tula, Mexico

The project in Tula, in Mexico's Hidalgo state, saw the addition of a 3300tpd production line at Cementos Fortaleza's plant. Completed in 2006, the works had previously been supplied with 12 clinker cooler fans by Boldrocchi. For Fortaleza's expansion project, Fives FCB was awarded the EPC contract and in 2015 the company contacted Boldrocchi to supply the design and manufacturing of the line's eight main process fans, inlet multi-louvre dampers and actuators.

The equipment was delivered in 2016 and the fans are expected to be commissioned this summer.

Despite all cement lines being similar, Boldrocchi believes it is crucial to tailor the exact design and materials to the process conditions of each line to ensure optimal effectiveness and reliability as well as longevity of the line.

For the Tula plant, Boldrocchi supplied:

- raw mill fan
- kiln and raw mill baghouse fan
- kiln ID fan
- clinker cooler fan

- two cement mill fans
- clinker cooler hot gases booster fan
- coal mill fan
- multi-louvre dampers (2) for each double-inlet fan
- multi-louvre damper (1) for each single-inlet fan
- actuator for each fan.

## Raw mill fan

This raw mill fan was designed for a flow rate of 580,000m<sup>3</sup>/h and static pressure of 70mbar. The fan's impeller is fully covered with wear liners in chromium carbide to protect against abrasion. The wear liners are crafted using a double layer for a full 10mm (25/64in) of protection. The first layer (6mm or 15/64in) is in a material similar to the base as this makes it easier to weld it to the baseplate. The second layer (4mm or 5/32in) is made of chromium carbide. This design offers an optimal balance between cost and protection. Although cheaper materials are available, they do not guarantee the same longevity. Boldrocchi has installed fans with a chromium carbide wear liner in the USA and Mexico that have been running

continuously for 10 years and still protect the impeller.

The engineering team decided on a special blade design to accommodate the dusty operating environment. The blades were designed to be more vertical than is often the case to optimise the fluid dynamics and efficiency in such an environment. The increase in the slope allows the dust to drop more easily, which is important to ensure the fan runs effectively and over a significant lifetime.

The impeller's centre disc was designed with a scalloped, star-like shape. This technique is often used when the fan is very large or operates in a dust-laden environment. In this case, the impeller has a diameter of 2.9m (5.5ft). The cut-outs reduce the weight and therefore, lower energy consumption and improve resistance to erosion. The reduced surface area further lowers the risk of erosion from abrasion.

The raw mill fan has a double-inlet with gas entering the impeller from both sides. Fives FCB also required a double regulation system for both flow and speed. Therefore, the fan has a variable frequency drive (VFD) and two inlet dampers, which is not very common in this type of application. One actuator regulates both dampers. The multi-louvre dampers are coated in wear-resistant material to protect them from dust, extending their lifetime.

The fan's shaft was forged with an integral flange and consumes 1.4MW of power, equipped with a 1.6MW motor. The bearings are anti-friction type, as for the other seven fans, and the couplings in all fans are flexible pin and bush type, widely used in these applications.

#### **Kiln and raw mill fabric filter fan**

The kiln and raw mill fabric filter fan is located just downstream from the fabric filter but before the stack. This type of fan, which pushes clean gas, typically has a high flow rate and relatively low pressure. As it collects the gases from different applications, this particular fan has a high flow rate of 1,280,000m<sup>3</sup>/h. Because it deals with clean gas at a relatively low temperature (200-250 °C or 392-482 °F), the material chosen was standard carbon steel, as a more expensive material was not necessary. The airfoil design reinforces the impeller and as a result increases efficiency by around 3-4 per cent in addition to improving mechanical resistance. Airfoil fans are usually a little more expensive than single-thickness



Kiln and raw mill filter fan

centrifugal fans due to the extra welding and workshop activities required, but the efficiency and mechanical resistance gained are significant.

#### **Kiln ID fan**

The materials of the kiln ID fan's impeller and shaft were selected to resist the high operating temperature, which usually reaches 300-400 °C (572-752 °F) but can spike to 500 °C (932 °F). Turning gear with an auxiliary motor was provided in case of sudden fan stoppage. This is important as there are definite risks to having such hot gases remain in the fan during a stoppage. If the main power goes offline, the auxiliary motor starts up automatically and turns the impeller. The design of the kiln ID fan resembles that of the raw mill, although the wear protection is installed in the location where dust hits the impeller.

For the raw mill fan, kiln and raw mill fabric filter fan and kiln ID fan, Boldrocchi used shafts with a special design that employ only nuts and bolts to connect the shaft to the impeller. As this makes it very easy to disassemble the shaft from the impeller, maintenance is simplified.

#### **Clinker cooler fan**

Since it is not located downstream from the fabric filter, the clinker cooler fan is of a similar design to the raw mill fan but is much smaller (designed for a 0.72MW motor with a power consumption at nominal conditions of 0.3MW). Due to the abrasive dust, a double layer of wear protection was added, including 3mm of chromium carbide for 8mm of wear protection in all.

As this fan also has a double inlet, Boldrocchi designed two multi-louvre dampers and one actuator for this fan.

#### **On-site installation**

Boldrocchi is able to supply complete on-site services, from installation to commissioning and training. At the Tula plant, the company was tasked with supervising erection activities and commissioning. A technician specialised in vibration analysis, with experience both in mounting fans in a workshop as well as installation and commissioning, spent a month at the plant in May 2017. He supervised installation and performed the fan alignments and final balancing.

#### **ECEBOL – Oruro, Bolivia**

State-run ECEBOL announced the construction of a new 1.3Mta cement plant in Oruro, Bolivia, as part of an ongoing policy to develop the country. The company aims to guarantee the supply of cement for domestic development projects without the help of imported product.

To this effect, a consortium of thyssenkrupp Industrial Solutions Spain, Imasa and Sacyr is building Bolivia's largest cement plant, which is expected to meet more than 20 per cent of domestic demand. As part of this project, thyssenkrupp Industrial Solutions contracted Boldrocchi to supply the process fans for the new works, which will have a clinker capacity of 3000tpd. The facility will have access to 85.7Mt of limestone from a 200Mt limestone reserve in the region, according to Bolivia's President Evo Morales.

The project is particularly interesting due to the plant's location at 4000m (12,123ft) above sea level, possibly making it the world's highest cement plant. The altitude is not only a challenge in terms of logistics and transportation, but also in terms of plant design. Boldrocchi designed all the fan equipment a little larger in diameter and size to achieve the desired operating objectives at the high altitude. Airfoil blades were also used, where feasible, to increase the fans' efficiency at the high altitude.

Boldrocchi was awarded the contract to supply all five main process fans with VFDs in 2015. To meet the government target of increasing local employment as well as for cost-saving reasons, static parts were manufactured locally while complex parts (ie the rotor, bearings, couplings and inlet bells) were produced at its workshops near Milan, Italy, where it has crucial expertise.

Boldrocchi's scope of supply includes:

- raw mill fan
- kiln and raw mill fabric filter fan

- kiln ID fan
- clinker cooler fabric filter fan
- cement mill fabric filter fan.

#### Raw mill fan

The raw mill fan, with a flow rate of 630,000m<sup>3</sup>/h and a static differential pressure of 95mbar, was once again designed with impellers fully covered with wear liners in chromium carbide for maximum abrasion protection (6mm material similar to the impeller + 4mm of chromium carbide). At 3.4m in diameter, Boldrocchi's engineers used a scalloped centre disc to reduce the impeller's weight and dimensions.

#### Kiln and raw mill baghouse fan

The kiln and raw mill baghouse fan was designed for a flow rate of 1,080,000m<sup>3</sup>/h with static pressure of 35mbar. Engineers used an airfoil blade design to achieve maximum efficiency and forged the shaft with an integral flange.

#### Kiln ID fan

The kiln ID fan was engineered with materials to withstand temperatures as

Shaft with integral flange



high as 450 °C (842 °F). Its shaft is forged with an integral flange. Boldrocchi's delivery took place in 2016 and the plant is expected to start up in 2018.

#### An increasing presence in Latin America

Following its success in projects such as the Tula and Oruro plants, Boldrocchi has set its sights on increasing its presence in Latin America in the coming years.

The company's ability to design, manufacture, install and commission a wide variety of key equipment for cement plants such as fans, complete air pollution control solutions (air filtration and flue gas

treatment), heavy-duty dampers, cooling systems/heat exchangers, noise protection and power generation ancillaries, offers significant advantages to those building greenfield plants.

Boldrocchi also carries out revamp or retrofit solutions to improve the performance of plants that have been operating for some time. The company has been able to increase performance by 40 per cent while reducing budget expenditures by 30 per cent.

The most recent of its hundreds of revamps around the world includes last year's Cementos Moctezuma project at Tepetzingo, Mexico. ■

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