A LEGO MOVIE

Giuliamaria Meriggi, Boldrocchi North America, discusses a building block inspired installation.

Coordinating major onsite work when several sub-contractors are working in close proximity, space is at a premium, and when the plant is functioning is always complex. Sometimes it means changing onsite tactics.

Boldrocchi recently faced such a challenge at Buzzi Unicem USA's Cape Girardeau plant in Missouri, US. The Italian company, which has North American offices in Atlanta, US, had been awarded a turnkey flange-to-flange contract to replace the fabric filter on the kiln and raw mill, along with the filter's ID fan, emergency/fresh air damper, and dust transport system. The fabric filter was designed to surpass all environmental emissions requirements and was built using a special stainless steel that offered several advantages. In this contract, however, it was the onsite installation strategy that particularly stood out.

Onsite in late 2017 to early 2018, several other sub-contractors were working in close quarters; space to pre-assemble the equipment was very limited, and crews had to work through freezing temperatures (as low as -18°C/0°F). The team reassessed its original installation plan and found

a better one. The inspiration: Lego. The team assembled the entire filter on the ground and hoisted the mega building block module up as one. The idea was to speed-up installation, do much of the work away from other sub-contractors, and make installation safer.

Engineering Cape Girardeau's new baghouse

The Cape Girardeau plant uses a variety of fuels to heat the kiln system. The fabric filter was therefore designed to operate effectively in all possible plant process conditions, ensuring minimal wear to the components.

The team at Buzzi Unicem USA aims to not only meet, but surpass, environmental legislation, so it asked Boldrocchi to provide a solution that would exceed all of the US Environmental Protection Agency's regulations for National Emission Standards for Hazardous Air Pollutants.

Boldrocchi's team opted for a prefabricated modular-type installation method, completely assembling and welding the fabric filter casing modules on the ground.

A 400 t crane was required to lift the mega-module into place in one big lift.

The fabric filter is a Boldrocchi pulse-jet high dust model, which is ideal for applications with high amounts of dust at the inlet (up to 1000 g/Nm^3 or 0.44 g/ft^3) and high flow rates (above 1.5 million m^3/hour or 883 000 alternating current field measurement). It includes a dust pre-separation section to reduce the amount of dust reaching the 8 m (26 ft) long bags. The baghouse is designed to reduce dust emissions to a mere 0.01 lb/t of clinker (2 mg/Nm^3). The high dust concentration in the mill is able to absorb enough HCl and SO_x in the flue gas to fall well within emission requirements (dust has a natural capacity to absorb some pollutants).

The dirty side of a baghouse and the hoppers are protected to a large extent from corrosion, as condensation is absorbed by the presence of dust. However, the clean side (plenum) has no inherent protection from corrosion. Due to the composition of this flue gas, special attention was required. Liners could have been used, but Boldrocchi and the customer opted for a special type of stainless steel for corrosive environments, which was deemed to be highly effective over a longer lifetime.

This stainless steel has a high content of alloys, giving it good resistance to uniform corrosion. This is because its protection is ingrained throughout the material, rather than simply as a layer on top. Alloys include chromium (which ensures the passivity of stainless steels), nickel (which reduces the corrosion rate of depassivated steel), molybdenum (which enhances passivity), and copper (which has a positive effect in the presence of reducing acids, such as dilute sulphuric acid). It also resists pitting and crevice corrosion well, due to its higher contents of chromium, molybdenum, and nitrogen.

This material choice offered an added advantage when it came to one of the key challenges in the structural design of the filter. Often, the 'dirty' side is made in carbon steel and the 'clean' side in stainless steel, offering design teams a challenge: the thermal expansion of the two materials is not the same. The use of this special stainless steel for the clean side meant a more comparable thermal expansion between the materials for the dirty and clean sides of the filter.

The building block plan

The original assembly and installation plan had been a common one: to assemble the filter into several medium-sized modules on the ground and then weld them together once they were installed on the supporting structure. This job would have seen 12 lifts by a crane to get all the modules up.

However, due to the lack of space, with other work occurring in parallel close-by, and to make the installation safer and quicker, the team changed the assembly method. It opted for a pre-fabricated modular-type installation method,

Boldrocchi's previous experience with a 'big lift', such as this one weighing 135 metric t, helped considerably.

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completely assembling and welding all the fabric filter casing modules on the ground. This created one giant module to be lifted into place as one huge mega-module. Assembling a baghouse on the ground using a modular design concept is faster. It means teams are not assembling between 23 m and 24 m (75 ft – 80 ft) in the air and on scaffolding. It is also much better from a worker's health and safety perspective.

Instead of renting the planned 50 t crane, the team rented a 400 t crane to allow the big lift. The welds were improved so that joints could withstand the heavy lift. While the original plan was to lift modules weighing approximately 30 t, this plan saw one mega module lift of 135 t. Boldrocchi had experience of mounting a baghouse this way (a 'big lift'), as prefabricated modular design is one of the options that Boldrocchi offers its customers. This experience helped immensely.

Boldrocchi's team moved to an extremely small area on plant grounds to assemble the fabric filter, its hoppers, penthouse, stairways, walkways, etc. "We had 15 to 21 guys onsite with a mere 3 m (10 ft) of space around the filter. It was tight," said the site supervisor. The move to a small space allowed the duct sub-contractor to get its work done.

Site organisation is often a team effort and Boldrocchi's installation strategy change was made much easier thanks to the assistance of Buzzi's Cape Girardeau plant managers and engineers. They provided continuous collaboration for which the company is grateful.

Conclusion

Openness to change remains key in the industry. Onsite installations can be planned one way, but when situations change it is important to have teams that can turn on a dime and find new solutions. The installation and commissioning team gave considerable effort, managing to find creative ways of coordinating the job using a different work method. It coordinated with other sub-contractors, moved to a small, awkward space, and decided to lift the immense building block piece in one 'big lift', due to limited space in a crowded area, and to improve worker safety in freezing temperatures.

Since commissioning over a year ago, Boldrocchi's 'one lift' baghouse is working well, achieving all expectations. ■

About the author

Giuliamaria Meriggi is Managing Director at Boldrocchi North America and Executive Director of International Operations at Boldrocchi. She began working in air pollution control shortly after finishing her engineering degree in 2001 and has since amassed expertise in a wide array of industrial processes and systems within the cement and lime industries. Over the past 17 years, she has held various engineering, commercial, and operational roles.