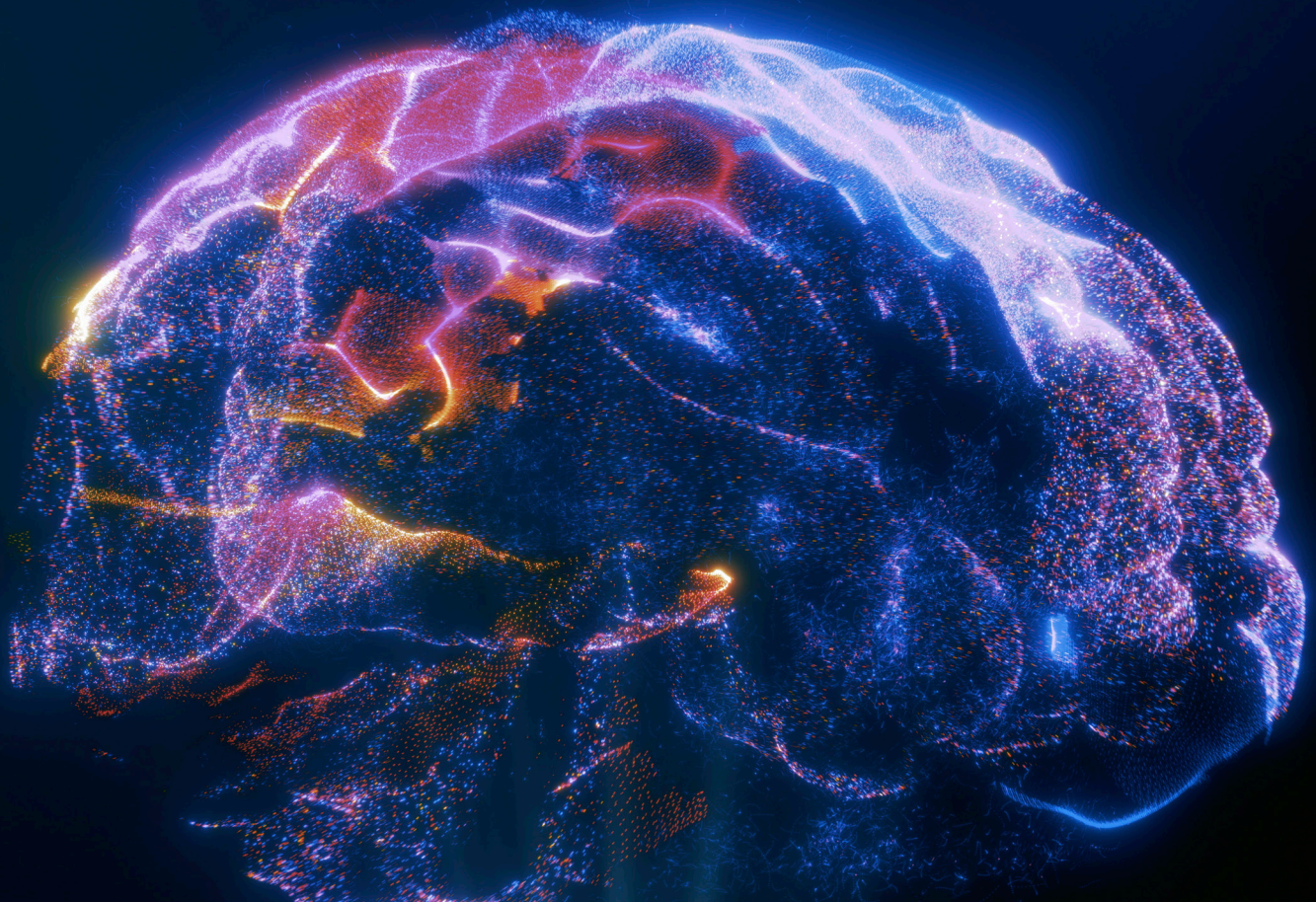
REIMAGINING THE REVERSE AIR BAGHOUSE

Edgar Isla Tapia and Luis Arévalo, Unacem Perú, Oscar Lijap, Parker, introduce a kiln venting upgrade which saves both downtime and dollars for cement producers.

While not the design of choice for venting newer cement kilns, plenty of reverse air baghouses are still operating today. Plant operators may wish to convert, but the downtime and cost often prohibit moving to a more efficient and reliable pulse jet cleaning process.

Instead, teams continue to face constant headaches in the form of corrosion on tubesheet thimble welding, the inability to completely remove dust accumulation on the tubesheet, and constant clamp and bag breakage along with leaks due to poor tensioning. All of these problems drive further costs into the operation.

Aware of these challenges, engineers at Parker took a fresh look at the traditional reverse air baghouse design. They developed a modification concept featuring a bag filter with a snapband fastener, improved fabric, and a custom tubesheet. Switching to snapbands eliminated the need for tubesheet thimbles, one of the most problematic cleaning system components in a reverse air baghouse.



Parker partnered with a 20-year customer, Mecánico Atocongo, Unacem Perú in South America, and custom-built a baghouse cleaning system for four compartments in one of its 14-compartment FLS reverse air baghouses. Each of the compartments has 120 bags with a 12 in. diameter and 428 in. length.

The new cleaning system significantly cut labour, downtime, and emissions. By designing and creating the system, a precision fit was ensured through design and pre-installation testing.

Replacing user-adjusted clamps and thimbles with pre-fitted snapbands cuts bag install time and ensures accurate pressure.

Conical stainless-steel springs at the top end absorb shock and help manage tension during the cleaning cycle.

The trouble with thimbles

In standard reverse air baghouses, the bags are installed at the tubesheet level with 12 in. high thimbles and clamps.

All thimbles are welded to the tubesheet individually during the fabrication. A high quality precision weld between thimbles and the tubesheet is essential yet difficult to accomplish as the thimbles are close together. The welding areas are the weakest points and most susceptible to corrosion attacks. Pounds of dust accumulates on the tubesheet around the thimble welds and must be shovelled out, which is challenging and time-consuming.

Most kiln gas streams are corrosive and eat through welding, frequently resulting in leaks.

Taking a new approach

The new approach ditches thimbles, welding, and clamps. This reliable solution applies bag filters directly to the tubesheet with snapbands precision fitted to the tubesheet hole diameters. The snapbands are pre-fitted to the bags and installed without tools, eliminating the user error inherent to adjustable clamps and time spent fitting bags on thimbles. Additionally, the extra filtration cloth from the new bags helps optimise the operating differential pressure.

Previously, clamps had to be manually placed between the core of the bag and a bead on the thimble, without leaving any space. An improper placement could leave slack in the bag and cause tension changes that may not be obvious for several days.

Thimbles and adjustable clamps leave room for error. See the correct installation location on the thimble (left) and incorrect installation point (right) that can quickly lead to loose, damaged or detached bags. Snapbands eliminate this user error.

By then, loose filter bags can form holes and begin rubbing against neighbouring filters, causing abrasion and premature bag failure. They can also disconnect at start-up.

Tensioning filter bags with the right components is key to low differential pressure and extending bag life. If the tension is lower, the bags will hit each other during the cleaning cycle and prematurely fail, which can cause emissions at the stack. If tensioning is too high, the bags will not flex enough to remove the dust cake and the differential pressure will not be reduced.

Clamping is seemingly simple, but the margin of error is small. Clamps that are not installed precisely on each bag can lead to problems, such as bag leaks and emissions, downtime, and safety issues with operators entering hot compartments to re-clamp bags.

A weaker tension on the clamps will ultimately cause them to break as well. This is a very common mistake. Snapbands are automatically calibrated to the correct tension. Snapbands can tolerate up to 1000 lb of tensioning, well beyond the maximum bag pressure of 100 lb typical in kiln applications.

Aside from removing variability in tensioning, clean-up is also much more efficient with the new filtration system. Without thimbles, accumulated dust on the tubesheet is easily and quickly swept into the flush hole openings with a broom.

Precision fit to tubesheet

The snapband works very well when accurately fitted to the tubesheet hole. If the diameter is off by 0.008 in. with a snapband, the bag can pop off or leak.

To ensure an accurate fit after years of wear on the tubesheet with thimbles, Parker custom fabricated new tubesheets, rather than retrofitting them to existing hole openings or customer-provided measurements. Next, the bags were tested for fit and tension before shipping filters to the customer for installation.

Customising the tubesheet also allowed a 0.25 in. thickness, rather than the typical 3/16 in., allowing a greater surface area to be in contact with the snapband in order to hold the necessary standard 70 – 80 lb of pressure.

The compartment tubesheet design featured four tubesheet sections to fit through the access

Pulse jets versus reverse air baghouses

Cement plant operators must constantly vent their kilns with steady suction to keep production running. They typically rely on one of two types of baghouse cleaning systems in these hot, dusty environments: pulse jet or reverse air.

A pulse jet baghouse cleaning system consists of a tubesheet with bags and wire cages. The wire cages support the bags internally, with dust collected on the exterior. Each row of bags is aligned with a blowpipe that creates an instant pulse to dislodge the dust collected around the bags. An intelligent cleaning system will pulse only when differential pressure is needed to extend bag life.

A reverse air cleaning system consists of a tubesheet with thimbles and tensioned bags. Dust collects inside the bags. To clean the bags, the system isolates one bag compartment from the flow with a set of dampers and a reverse fan assembly hits the bags to dislodge dust.

While the reverse air baghouse does not need wire cages, it requires a more conservative air-to-cloth ratio and an extra compartment to clean the bags offline.

Pulse jet equipment is the dominant baghouse choice for new kilns, due to its more efficient performance, but there are still plenty of traditional reverse air baghouses in operation. Both cleaning systems typically use fibreglass bags with membrane laminate.

Parker precision-fit snapband bags with high-durability membrane applied to a custom fabricated tubesheet now provide an affordable modification option with significant performance benefits for the many cement plants with reverse air baghouses still in operation.

The custom tubesheet's flush surface allows quick broom clean-up.

Thimbles welded to the tubesheet invite dust collection and corrosion.

door easily. This design also helps minimise the amount of welding required.

Tension at both ends

While the snapband secures the bottom of the bag, a conical stainless-steel spring at the top acts as a shock absorber and helps maintain proper tension during the cleaning cycle. When a compartment is isolated or cleaning off-line, a reverse flow applied to the bags' exterior dislodges dust inside the bags. The calibrated conical springs let the bags flex more initially. This prevents the bags from rubbing against each other unnecessarily, extending bag life.

The compact spring assembly provides a greater tension capability with a lower height requirement, allowing increased bag length for more filtration area. The spring assembly can also be installed more quickly than most threaded bolt assemblies. A cup washer centres the spring and has guide holes that prevent spring and drawbar misalignment and abrasion. It also features hitch-pin design that simplifies re-tensioning.

Durable bag material

The new cleaning system incorporated a new-to-market fibreglass bag with a high-durability membrane to improve bag strength and extend filter life. The calcined process creates fine particulates in the sub-micron range, and the membrane on fibreglass is a suitable solution to filter the small size particles and keep the differential pressure across the baghouse constant.

Finally, before the installation was considered complete, the team needed to ensure the filtration system was leak-free around the filter bags and the welded areas. The installers injected BHA® Visolite®, a lightweight fluorescent powder, into the baghouse. The powder follows the path of least resistance, accumulating around the source of leakage. Monochromatic light then pinpoints the exact location and severity of air leakage. This is a quick and easy means of ensuring the baghouse is ready to go to work.

Substantial Savings

- For each compartment with 120 bags, Unacem Atocongo achieved the following savings with this modification:
- Labour hours for bag installation were reduced by 55%.
- The cost of both the thimbles and clamps was eliminated.
- With a total of 28 compartments in two baghouses, the potential labour and component savings could reach US$87 360.
- Dust emission shutdowns are nearly eliminated, for a plant running 7500 t/clinker per day.
- Reducing substantially the emission from 350 mg/m^3 to less than 30 mg/m^3. ■