Particulate matter in the bag

With air emissions regulations becoming stricter in many parts of the world and policy makers considering the adoption of increasingly tighter legislation, cement producers need to re-evaluate their air pollution control systems to ensure compliance. The latest generation baghouses have proven to limit harmful particulate matter (PM) emissions and seek to address such pollution control concerns.

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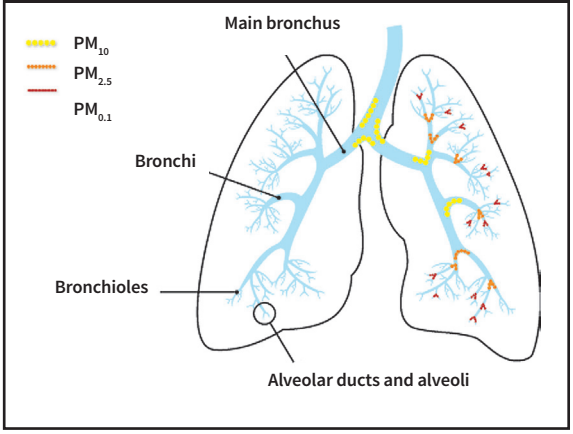
As the environmental and health effects of air pollution from particulate matter (PM) become more intensely researched and widely documented, an increasing number of governments are introducing and/or tightening limits on such emissions. For instance, limits on PM_{10} and $PM_{2.5}$ emissions have been imposed in Australia, Canada, China, Hong Kong, Japan, South Korea and the USA and EU. Going forward, United Nations Economic Commission for Europe (UNECE) Member States will have to meet stricter emission cuts, including the further reduction of $PM_{2.5}$ by 2020 and beyond. Even stricter limits are also being discussed in other countries.

In terms of health effects, studies by the World Health Organization (WHO), the US Environmental Protection Agency (EPA) and the EU have cautioned that short- or long-term exposure to $PM_{2.5}$ could result in the increased risk of lung cancer, development of chronic respiratory disease, aggravated respiratory and cardiovascular diseases and premature death.

Regulating $PM_{0.1}$ emissions could be the next step as research suggests these ultrafine particles, (not usually filtered out of emissions) are highly dangerous as they are capable of entering the noncillated alveolar parts of the body and be deposited deep within the lungs, causing further damage to the cardiovascular system. Moreover, as they are able to pass through cell membranes and migrate into other organs, including the brain, they may also lead to neurological damage.

The latest-generation baghouses contain filter bags designed with a small pore structure to capture submicron PM

Figure 1: impact of particulate matter on the lung



Limiting PM emissions

To limit harmful PM emissions, Italy-based Redecam has developed a bag filter that combines its proprietary $_{SPS}$ bag fixation system and Bi-Jet Bag Cleaning System with specially-designed cages and filter bags made of a fibreglass carrier medium on which an expanded polytetrafluorethylene (ePTFE) membrane has been laminated.

Designed with a small pore structure, the ePTFE bags are able to capture submicron particulate matter. A special weave allows high air permeability while blocking more particles of every size.

Bag characteristics include:

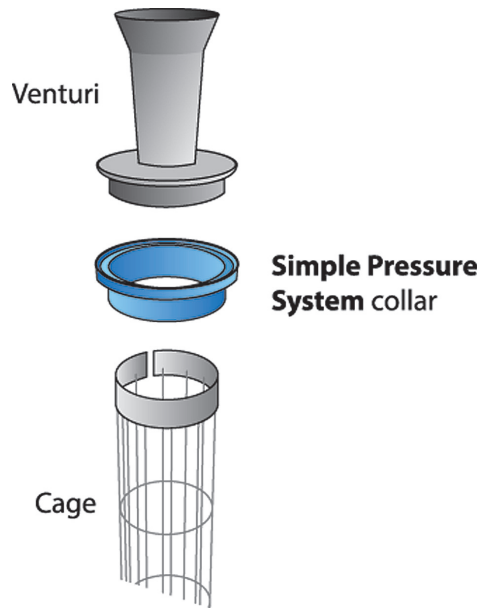
- microporous structure
- low surface tension
- peak temperature resistance of up to 288˚C (550˚F)
- water-repellent
- chemically-resistant
- extended service life.

Redecam ensures the ePTFE filter bags are designed to operate with the Simple Pressure System (SPS), the company's own bag fixation system (see Figure 2). The SPS is the result of continuous laboratory tests and on-site work experience. It guarantees that the tightness of the casing between the dusty and clean sides is 100 per cent effective.

Long life expectancy

When combined with Redecam's Bi-Jet Bag Cleaning System and the right cage

Figure 2: Simple Pressure System



design, the ePTFE bags have an average service life of five years, but some have been known to last eight years.

The ePTFE impregnation ensures an extended service life of the filter medium as it reduces additional mechanical stress that occurs during the cleaning process. Cleaning properties include a smooth, anti-adhesive surface.

The Bi-Jet Bag Cleaning System further extends the filter bags' service life by keeping the filter bags clog-free.

Correctly-designed filter bag cages are also key to maximising the lifespan of the bags. It is crucial that the bags fit perfectly within the support cage: too big and it will rub on the cage during cleaning, causing premature wear and tear. Once the engineers have calculated the exact dimensions required for both the filter bags and cages, physical samples are inspected to test tolerances, measure the pinch and calibrate the two together.

Temperature and acid resistance

The ePTFE bags can withstand a constant operating temperature of up to 260˚C (500˚F) and peak temperatures of up to 288˚C (550˚F). They also have excellent resistance to key acids.

The membrane has been designed to withstand the most aggressive chemicals and harsh environments (except for HF and HCl). It therefore does not age and maintains its physical and chemical structure during its entire service life.

Dual Venturi arrangement

Redecam's Bi-Jet Bag Cleaning System increases the volume of air forced into the bag inlet, while reducing the consumption of compressed air. A dual Venturi arrangement is used: one pipe is located downstream of the nozzle and the other above the bag inlet. This system minimises the dispersion of compressed air during the injection phase, thus increasing the volume of air forced into the bag. This reduces the volume of air needed to pulsate the bag and achieves a higher flow velocity than in systems equipped with one Venturi.

"Correctly-designed filter bag cages are also key to maximising the lifespan of the filter bags."

Addressing air pollution control concerns

The ePTFE filter bags combined with the correct cage design and the Bi-Jet Bag Cleaning System produce a low ΔP, reducing overall energy costs for three main reasons:

1. The Bi-Jet Bag Cleaning System increases the volume of air forced into the bag inlet. This reduces compressed air consumption and increases flow velocity.
2. The bags' coating resists cracking and therefore consistently lowers differential pressure while increasing throughput and decreasing energy costs.
3. The bag's anti-adhesive surface resists sticky dustcake. This results in lower differential pressure and compressed air consumption, as well as increased air flow and higher production. In addition, it also ensures a constant gas volumetric flow.

Additional benefits

Redecam's recommended system with fibreglass ePTFE–coated bags, unique cage design, SPS fixation system and the proprietary Bi-Jet Bag Cleaning System has not only proven to filter out PM_{10} and $PM_{2.5}$ particles but also more $PM_{0.1}$ particles than other filter bags. It offers lower operating costs, increased lifetime and a resistance to higher temperatures and acids. ■

Figure 3: bag filter pressure drop

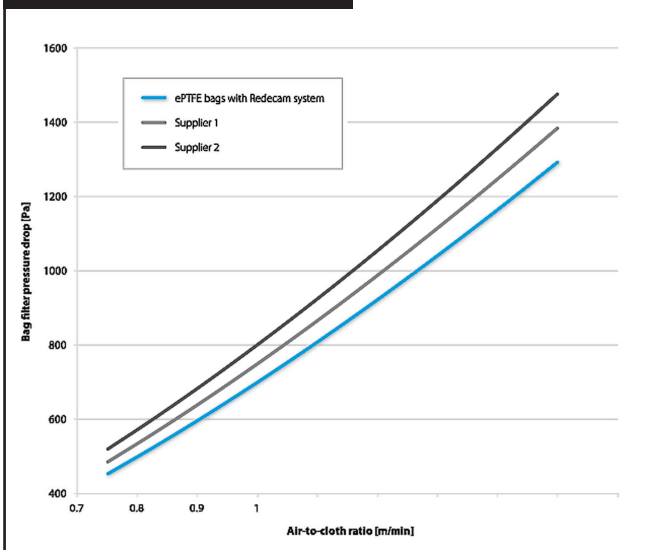


Figure 4: bag filter compressed air consumption