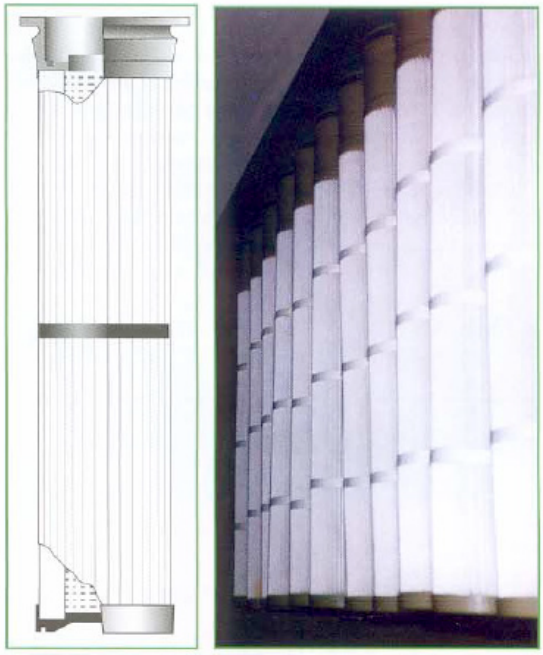
Smart Brief

Changing Your Dust Collection System?

Introduction

Dust collection in the cement industry is more important than ever. As plant output continues to increase globally, the physical size of existing and new plants also has increased. But the opposite is happening in today's air pollution control systems. Modern dust collectors are actually sized smaller, while continually proving to be more productive than the collectors of the past. New filtration technology continues to challenge and improve air pollution control theory and practice. One of the most successful technologies in recent years is the application of spun bonded polyester pleated filter elements to cement dust collection systems. Pleated filter elements have allowed dust collector housing requirements to be reduced by as much as 33% compared with the traditional bag and cage pulse-jet dust collectors. New collectors can now be constructed smaller than ever, and with the use of pleated filtration, can reduce capital and maintenance costs, as well as expensive downtime. Conversion of existing collectors to pleated filtration has also become an effective solution for undersized collectors, especially with the increase for production capacity.



Topload pleated filter installed PulsePleat® filter elements

Spunbond media

Spunbond media is unlike felt or woven fabrics traditionally used in filter bags. It features a tight pore structure and rigid physical properties that allow it to hold a pleat without the need for supporting backing material or a cage. Because of this, as much as three times more filtration area can be installed in the same tubesheet hole as a traditional bag and cage construction. Pleated filter elements offer extremely high efficiency (99.9%) and operate at lower pressure drops and higher airflow due to the surface filtration properties of spunbond polyester.

In controlled independent laboratory testing, spunbond media was tested against traditional 16 oz. (500 g) polyester felt media and 16 oz. (500 g) polyester felt laminated with expanded PTFE membrane. The samples were subjected to dust with a mean particulate of 0.5 micron with simulated pulse cleaning intervals for 50 hrs. Grain loading was established at 30 grain/acf (69 grams/m^3).

The spunbond polyester media reached a 99.9992% filtering efficiency allowing just 0.0025 grains of emissions while maintaining a pressure drop of only 2.8 in. (70 mm) w.g.

Dust collector sizing

For example, a 6.5 ft. (2 m) pleated filter element with a 6.25 in (159 mm) diameter has 58 ft^2 (5.4 m^2) of filtration area. Compare this to traditional filter bags that have a 6.25 in (159 mm) diameter are 10ft (3 m) long, and have only 16.4 ft^2 (1.5 m^2) of filtration area. The 6.5 ft (2 m) element at a 3.5:1 air-to-cloth ratio can filter 203 cfm (345 m^3/hr) while the 10 ft. (3 m) filter bag at a 6:1 air-to-cloth ratio can only handle 98 cfm (166 m^3/hr).

A dust collector designed to handle 10,000 cfm (16,990 m3/hr) would need only 64, 6.5 ft. (2 m) filter elements as opposed to 121, 10 ft. (3 m) filter bags and cages. The footprint for the bag and cage unit would be 96 in x 100 in (2488 mm x 2540 mm). The footprint for the pleated element collector would be 81 in x 83 in (2057 mm x 2108 mm). The pleated element collector footprint is 30% smaller than the filter bag unit. As you can see this translates to a smaller housing, less valves and blowpipes, and reduced installation cost.

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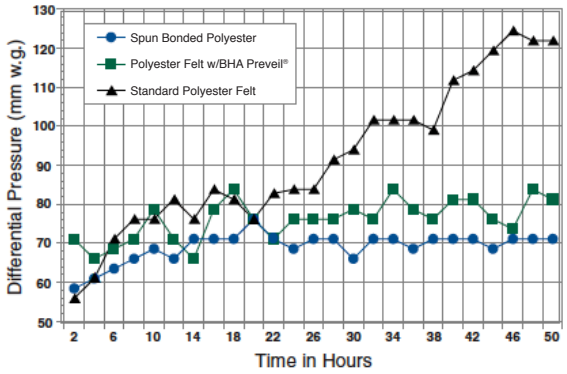
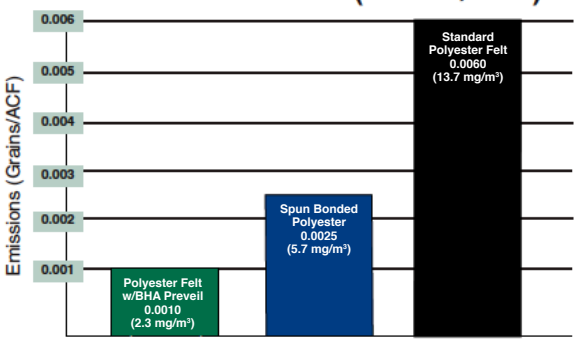
Differential Pressure Comparison



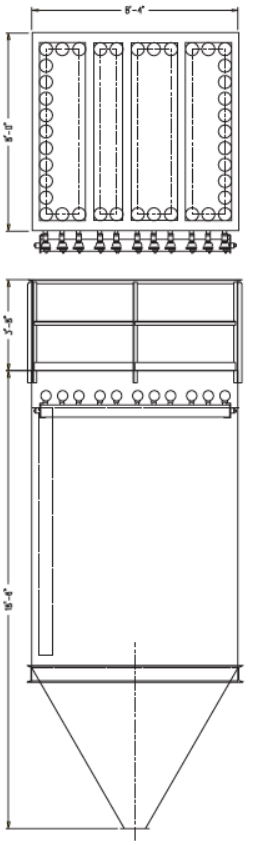
Outlet Emissions (Grains/ACF)



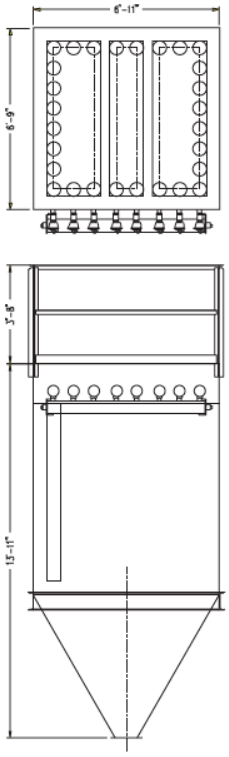
CRITERIA: *Air-to-cloth ratio: 5:1 ft/min. (1.5m/min.); Mean particle size: 0.5 micron; Inlet dust loading 30 grains/ACF (69g/m³); Pulse cleaning: 80 PSI (5.5 bar); Frequency and duration: 15 min. intervals for 50 hours.*
VESA TESTING: *In a controlled VESA (Variable Environmental Simulation Analysis) test, the spun bonded media was tested against traditional 16 ounce (500 g) polyester felt media and 16 ounce (500 g) polyester felt laminated with BHA Preveil.*

The footprint would be greater for shorter filter bags because more filter bags would be needed to achieve the same cloth area. For example, when comparing the 10 ft (3 m) bag above to an 8 ft (2.5 m) bag, the housing size would increase to 104 in x 110 in (2642 mm x 2794 mm). The installation of pleated filter elements in the collector would reduce the number of filters needed and decrease the footprint of the collector.

It is important to remember, the smaller the housing, the shorter the hopper. Not only is the footprint smaller, but the overall height of the unit is reduced to an average of 1 to 1.5 m (from 3.5 to 5 ft). the 10,000 cfm unit using 10 ft (3 m) would be 222 in (5839 mm) tall. The unit with 6.5 ft (2 m) pleated elements would only be 167 in (4242 mm) tall. This allows for easier installment of new dust collectors in tight spots, such as clinker tunnels and truck loading applications. In addition, reducing the height allows for walk-in plenums at the tops of silos allowing maintenance to be carried out in the clean side of the collector.



DESIGN SPECIFICATIONS	6.25" Dia. x 120" LG Bag
AIR VOLUMES:	10,000 ACFM
FILTER AREA:	1980 FT²
AIR-TO-CLOTH RATIO	5.05 CFM/FT²
NO. OF FILTERS	121
NO. OF PULSE VALVES	11
APPROX. WEIGHT OF HOUSING	8500#



DESIGN SPECIFICATIONS	6.125" Dia. x 79" LG PULSE-PLEAT
AIR VOLUMES:	10,000 ACFM
FILTER AREA:	2835 FT²
AIR-TO-CLOTH RATIO	3.53 CFM/FT²
NO. OF FILTERS	164
NO. OF PULSE VALVES	8
APPROX. WEIGHT OF HOUSING	5700#

Original unit with 121, 10 ft fabric filter bags and cages. Air Volume = 10,000 acfm (left). Smaller is better. Unit with 64, 6.5 ft pleated filter elements. Air Volume = 10,000 acfm

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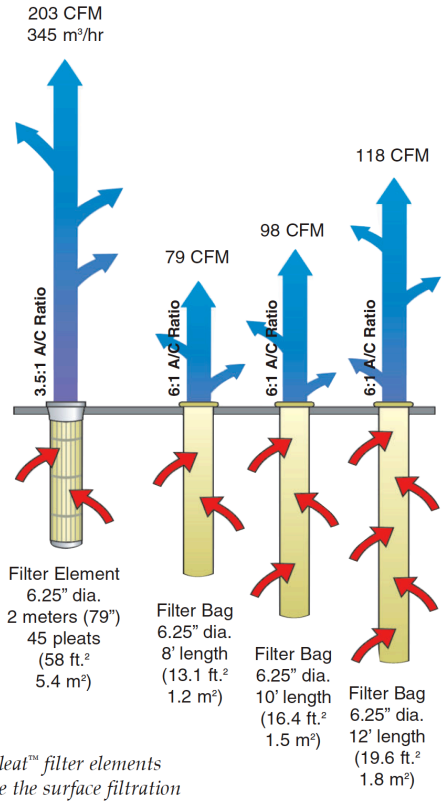
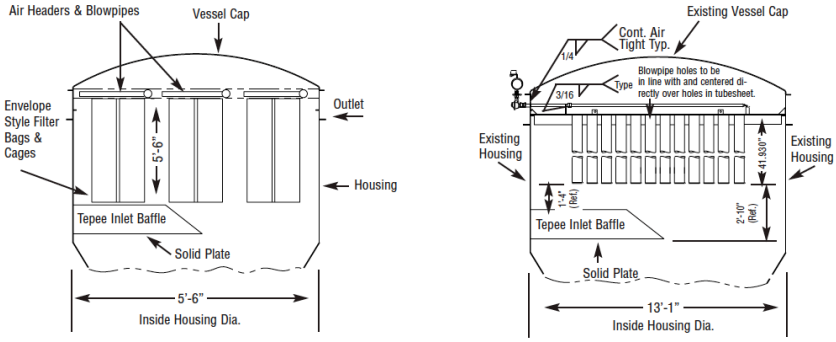


PulsePleat™ filter elements increase the surface filtration area available in existing equipment and help reduce abrasion failures by moving the filter elements above the incoming gas stream.

Typical air handling capacities. BHA PulsePleat filter elements vs. filter bags.



Barge unloading applications. Before (left). With filter bags and cages. After (right). With BHA PulsePleat filter elements.

Additional benefits

Filter bag changeouts are labor intensive and costly. This is especially a problem when frequent bag changes are necessary due to premature bag failure. Pleated filter elements are easier to install and remove because of their smaller size and one-piece design (no cage to handle). On average, using pleated filter elements instead of traditional bags and cages can reduce installation time by more than 60%!

Because of their superior collection efficiency and ability to operate at a lower pressure drop, pleated filter elements require less fan energy to move the same volume of air. In addition, the elements require 40% less air pressure to clean compared to filter bags. This computes to a substantial savings of compressed air and in turn, energy usage.

Pulse jet dust collectors with pleated filter elements have successfully been applied in the cement industry for crushings, finish grinding, packing machines, truck loading, material handling, silos, and clinker coolers. Whether one is planning to convert an existing dust collector, install new collectors, or even build a new plant, upgrading to pleated filter technology should be considered. There is a real potential to save thousands of US$ on the cost of dust collectors, installation time, and maintenance.

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Case Study

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Cement Terminal, Florida

Barge Unloading Application

Problem

This Portland cement terminal had consistent maintenance problems with its envelope style, reverse pulse dust collector vented the cement barge unloading operation. The original unit was a domed pressure vessel containing 140 polyester envelope style filter bags laminated with PTFE membrane divided into seven sections. The envelope bag used a heavy elastic cord around the top to create the tubesheet seal.

This style of filter bag is not only difficult to install to ensure a leak-free seal, but all pulse valves and timer cards, etc. were located inside the bolted domed clean air plenum. This required a crane to remove the plenum every time a normal preventive maintenance or corrective maintenance items occured such as changing a failed bag, adjusting a timer card, or changing a failed pulse valve diaphragm. This not only caused costly downtime (it took an entire shift or more to remove the bolted clean air plenum), but an excessive amount of man-hours were incurred to accomplish the smallest of repair work on the collector.

Solution

After a review of the unloading collector situation with BHA, a decision was made to convert the unit to a standard 6.25 in tubesheet with 144 x 3 ft 3 in (1 m) PulsePleat pleated filter elements. Each filter element contains 27.4 ft^2 filtration area which reduced the air-to-cloth ratio to a conservative 2.6:1.

Results

Not only has the unloading operation vastly improved due to the increased filtration area and lower operating differential pressures across the dust collector (a barge is now unloaded in approximately 60% of the former time), but the downtime incurred if a problem on the collector arises during an unloading operation is eliminated altogether. The single tubesheet/pleated filter element conversion features all pulse valves, timer boards, etc. to be located on the outside shell of the pressure vessel, allowing maintenance on these components to be completed while the unit in on-line.

With the elimination of this downtime, the barge can be unloaded faster than before, while the demurrage charges when the barge is in port have been significantly reduced.

Conclusion

Pleated filter elements can make a significant improvement in the operation of material loading/unloading dust collectors and bin vent systems through:

- Increased filtration area that allows lower operating differential pressures across the dust collector or bin vent.
- Increased air volumes that allow for faster loading and offloading of ships and barges.
- Reduction of emissions due to improved filtering efficiencies and through elimination of inadvertent emissions at pressure relief vents (PRVs).
- Energy savings on fans and blowers through a reduction in system pressure (fewer amps required to pull same volume at lower static pressures).
- Decreased maintenance requirements due to the reduced time required to install/remove elements versus filter bags and cages.
- Energy savings due to reduced compress air usage (lower pressure and overall reduction in volume requirements).
- Longer filter life through less frequent and more gentle pulse-jet cleaning.

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