

Baghouse Conversion to Pleated Filter Elements From Standard Bag and Cage Setup - Cost Benefit Analysis

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Summery

This report will outline how **NAME WITHHELD** can see substantial savings associated with the operation and maintenance of their dust collection systems by switching from their current filter bag and cage technology to newer pleated filter elements in their pulse jet baghouse dust collection systems.

Primarily, **NAME WITHHELD** would benefit in two main areas: reductions in purchases made on replacement filters every maintenance cycle and a reduction in total man-hours needed to replace the filters in each of the main collectors. Additionally, operations of the various units will be improved and capacity for the entire system could easily be increased to meet demand for greater production at the plant.

In total, **NAME WITHHELD** would begin to see returns on this investment within 3 - 6 months. Furthermore, savings will only continue to increase over time as maintenance costs decrease and filter life, performance and capacity increase.

Introduction

What is a Pleated Baghouse Filter Element?

Pleated filter elements are the latest and most advanced industrial dust collection technology on the market today. A great number of industries are switching en masse to pleated technology from traditional bag and cage technology. Pleated filter elements are essentially filter bags that are arranged to have many different folds of fabric in a smaller area than a traditional bag. Pleated elements also combine the bag and cage into a one-piece construction that removes the need for separate cages.

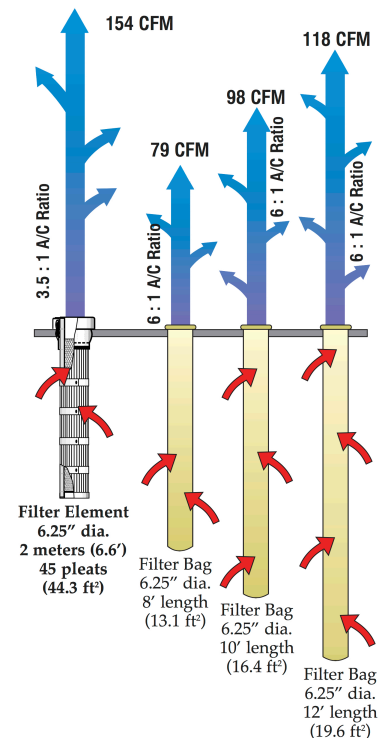
What are The Advantages of Pleated Elements Vs. Standard Filter Bags and Cages?

The main advantage of pleated elements carry over traditional bags and cages is that they offer on average 2 - 3 times the filter cloth area of a standard bag at half the average length of a standard bag and cage. Example: you have a **standard 6.25" diameter x 10' long pulse jet bag** (a very common size). If cut open and laid flat the bag would have approximately **16.4 sq/ft of filter area**. A pleated element of the same diameter and only 2 meters long (approx. 78-3/4") would have approximately **44.3' sq/ft of filter area**. Thus, a pleated filter with the same diameter but about half the length has 270% more filter area than a standard filter bag!

This has dramatic implications for operating and maintaining these dust collection systems. Consider just some of the following:

Improve Operation - Increase Capacity, Decrease Emissions, Decrease Electricity Usage, Combine Multiple Systems

Pleated elements greatly improve baghouse operation. Pleated elements can effectively increase the capacity of a baghouse by as much as 200%. This allows for the combining several dust collection systems into one large unit (more economical in many cases). Further, production can increase online without having to incur the large capital expenditure of a new baghouse to avoid production bottlenecks by simply increasing the airflow with a larger fan or increasing the existing fan's speed. Or, use less filters to improve performance and reduce energy usage by turning the



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system fan to a lower setting. Further, pleated filters on average have better emissions than traditional dust collector bags, an ever-increasing need with tougher Federal and State environmental regulations newly in force.

Use Less Compressed Air To Clean Filters

With more filter area the elements also load dust better and are easier to clean. This equals less cleaning cycles, which uses less expensive compressed air to run the baghouse. **Reductions of 30% - 50% in compressed air use** are common when converting to pleated elements.

Pleated Filters Last Longer Than Bags

Since the pleated filters are cleaned less they experience less wear and tear during operation. Pleated elements commonly last from **25% - 75% longer than filter bags** in the same application, sometimes as much as 2 to 3 times as long! This means you replace your filters less often than traditional filter bags.

Reduce Total Number of Filters

With more filter area you need less pleated elements to do the same work as bags. You can often replace bags with elements at a 2:1 ratio of bags to elements. This means less filters to replace. This is not possible in all cases, as interstitial velocity (air velocity between filters) and can velocity (air velocity coming up out of filters) will rise when removing filters. High interstitial velocity causes dust reentrainment (dust pulsed off backs in unable to fall down to due to high air speeds pushing it back on to the filters)

Easier Installation - Faster Changeouts, Less Downtime, Lower Labor Costs

Changing dust collector filters is very expensive for most facilities. Many need to hire outside contractors due to the manpower required. Replacing filters also leads to shutdowns and system downtime that costs much in lost production and maintenance.

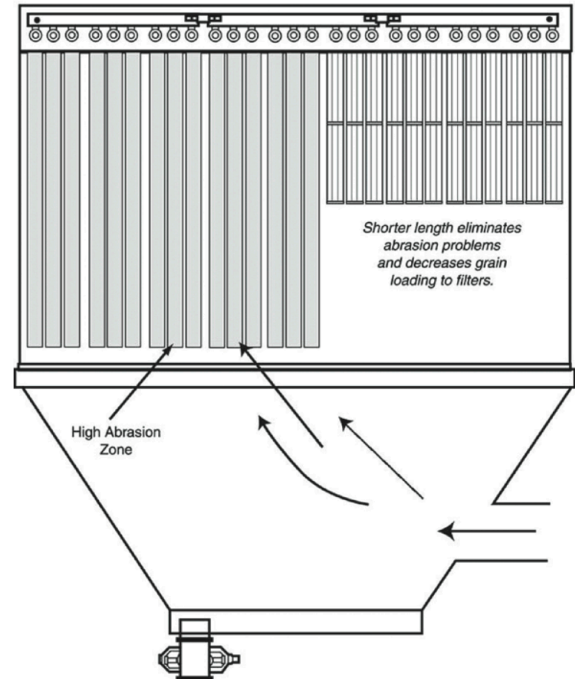
One of the greatest cost saving benefits of pleated elements is the ease of replacing them compared to traditional filter bags and cages. With traditional bags and cages, much effort is needed to remove the cage and bag assembly from the baghouse, and then replace the long cumbersome assembly back into the baghouse, and down into the tubesheet hole. With pleated elements all of this is eliminated. Compared to the complicated bag and cage assembly, the one-piece element is easy to handle and takes approximately 50% of the time to change compared to a traditional filter bag. Additionally, if the total number of filters has been reduced (See above) then less filters will need to be changed in total.

Reduce Filter Abrasion and Lower Grain Loading

Many applications with abrasive compounds (sand, metal dusts, silica, asphalt, cement, etc.) have problems with incoming dust-laden air wearing out the bottoms of the filters. Switching to pleated filters will help prevent filter abrasion., Pleated filter elements are shorter than the bags they replace, this means they sit higher in the dust collector, out of the way of high speed, incoming air laden with abrasive dusts. In addition to moving the filters out of the way of incoming abrasive air, pleated filters also create a larger knockout chamber beneath the filters that slows the air down, allowing for larger particles to drop out of the air before even making contact with the filters. Less dust will reach the filters (i.e. lower grain loading) leading to lower pressure drop, fewer cleaning cycles, lower emissions, and longer filter service life.

Reduce Inventory - Consolidate Several Different Filters Into One Style

Pleated filters can also replace several different types of filter bags with only one pleated element for use in several collectors. For example, imagine four collectors that all use a 5.75" diameter filter bag, but each one is a different length. This means the plant needs to keep on hand four different bag types for these collectors, and must have different pricing for all four. With a pleated element, you could easily replace all four filter styles with one pleated element. This would mean only needing to stock enough to replace one collector at any time (emergency requirement for many plants) and that avoiding bottlenecking the system an entire set of filters needed replacement. This also frees up warehouse space at the facility and reduces the work when ordering replacement filters.



Potential Barriers To Use

Pleated filter elements cannot be used in every dust collection application. They are sensitive to very high temperatures and certain corrosive gases. Additionally, certain applications require special construction materials that can end up making pleated elements much more expensive than comparable bag technology. Further, the reduction of the total number of filters in a dust collector using pleated filters will raise the can and interstitial velocities. These must be kept under certain thresholds in order for the system to function correctly.

The good news is that for applications like those found at **NAME WITHHELD**, these issues are not an issue. With relatively lower temperatures throughout the process and no difficult to collect dusts or corrosive gases, pleated filter elements can be deployed comparatively easy into these applications.

Potential Cost - Benefit Comparison For NAME WITHHELD

I recommend the plant to look to convert to pleated filters in two stages. The first involves all "low temperature" baghouse units. These are the main systems in the plant and are vital to running the production line. Converting to pleated elements on these would be relatively simple and the elements would not be much more expensive than the current filter bag and cage setup currently in place. The second would be the three "high temperature" kettle units. These would require a little bit more engineering to get the right filter element. Further, the high cost of high temperature elements would place the return on investment for these units further out into the future. For the this report I will only analyze the low temp units.

Plant Dust Collectors

#Low Temp Filters & Cages	1,277
# High Temp Filters & Cages	432
# Pleated Elements Needed To Replace Low Temp Filters	639
# Pleated Elements Needed To Replace High Temp Filters	216
Labor Per Man Hour - Estimated	\$30
Compressed Air Costs	\$0.14467 per 1,000 cubic feet
Average Cost Per Filter & Cage	\$50
Estimated Cost Per Pleated Element (Low Temp)	\$65
Estimated Cost Per Pleated Element (High Temp)	\$125

Low Temp Units Only

Operating Costs	Bag & Cage	Pleated Elements
Replacement - New Bags	Every 2 years - 1,277 x \$50 = \$63,850	Every 3 years - 639 x \$65 = \$41,535
Replacement - Labor	4 bags per man hour x 1,277 = 319.25 man hours = \$9,577.50	8 bags per man hour x 639 = 79.875 man hours - \$2,396.25
Cost Over 6 Years	\$191,550.00 + \$28,732.50	\$83,070.00 + \$4,792.50
	Total: \$220,282.50	Total: \$87,862.50

Additional Benefits	
Additional Operational Benefits	
Air Usage	Between 30% - 100% reduction
Warehousing	200 elements on hand vs. 770 bags and cages
System Capacity	If replaced at 1:2 ratio capacity could increase by 15% Additional savings to be had by expanding capacity at certain units and consolidating others systems into less units.
Emissions	Along with system repairs reductions of PM 2.5 emissions by 10% or more are possible

Conclusion

By converting to pleated filter elements, **NAME WITHHELD** potentially could see a cost savings of an estimated \$132,420.00 every 6 years. These estimates do not include the potential savings from decreased compressed air use, less system downtime due to less frequent changeouts, reduced energy costs associated with operating the baghouses, or the benefits of increasing production levels and lower emissions. When these are included the benefits could potentially reach \$1 million or more.

The estimated time it would take to recoup the initial investment to convert to pleated elements would be essentially immediately as the cost of replacing the filters and cages is likely greater than the cost of the pleated elements.

Baghouse.com already has the needed technical information to begin work on this conversion. Similar conversions are likely possible in many of **NAME WITHHELD** plants. The potential savings from all of these conversions likely would compound the benefits seen at **NAME WITHHELD**.

Sincerely,
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