

## 4 Potential Dangers to Collectors! How Cyclone Pre-Filters Can Help!

With government regulations tightening on solid emissions, baghouses and cartridge collectors have become status quo in the past 40 years. The fabric filters (bags or cartridges) remove dust below 1 micron in size. The high removal efficiency of the filters, have been considered best available removal technology. This means most processes requiring dust collectors will use a baghouse or cartridge collector. However, not all processes work well with baghouses and dust collectors.

Baghouses and cartridge collectors use fabric filters to separate particulates from the airstream. Since fabrics are used, they can have some operational issues in certain processes.

- High dust loading can plug up the filters.
- Abrasive, sticky and wet dust can plug up the filters.
- High temperature or sparks can degrade the filter or cause them to burn.
- Low temperatures in high humidity airstreams can cause operational issues.
- Cleaning of the filters will cause holes to develop over time.
- Changing of filters can be a costly and time consuming process.
- Dusts collected in the filter could be contaminated or be lost for particulate that is being recovered and reused.

Using a cyclone pre-filter can help the operation of a baghouse or cartridge collector with all of these challenges.



*GPC pre-filter before a cartridge collector*

The cyclone removes a portion of the particulate before it reaches the filters. The lower particulate concentration will

- Cause less dust to come in contact with the filter, thereby requiring less cleaning.
- Decrease the amount of abrasive, sticky, and wet particulates contacting the filters.
- The air temperature can be increased or lowered (as required) by adding a secondary airflow.
- Less dust concentration means less cleaning and longer filter life.
- Longer filter life means that filters will not require changing as often, thereby saving time and money.
- Particles collected in the cyclone pre-filter will not be contaminated and can be recovered and reused in the process or used in another process.

## **High Particulate Loading**

High particulate loading in a baghouse or cartridge collector can cause premature wear of the filters, increased pressure drop across the collector, and decreased airflow or increased power usage. The filters work by building up a layer of dust. This layer prevents particulates from passing through it, and making it to the filters. The thickness of the layer grows as more particulate joins it, thereby making it harder and harder for air to pass through.



*Cartridge filter plugged up with dust*

The pressure drop across the filters increase as the layer increases. The system fan, which is designed for a specific airflow (ACFM) and static pressure (inches of water column) decreases the airflow being sent through the system as the pressure drop in the dust collector increases.

Decreasing the airflow in the system causes multiple issues. Less airflow at the hoods will capture less particulate from the process equipment. A hood designed that normally works well can become inadequate. The system ductwork is usually designed to keep the speed through the ductwork over 4,000 feet per minute. Air speeds greater than 4,000 FPM keeps the particulate from building up in the ductwork. When the pressure drop in the dust collector goes up, the airflow goes down which means the air speed goes down. Particulate can now buildup in the ductwork.

A Variable Frequency Drive (VFD) can be used to control the fan. This allows the fan to be over sped as the pressure drop increases. However, this increases the power required, which increases the operational costs of the system. Operating the motor above normal speed regularly could cause premature failure of the motor.

To prevent the filter from plugging, baghouses and cartridge collectors have a cleaning cycle. The cleaning cycle is usually a pulse of compressed air or a shaking of the filters. The compressed air causes the filter to expand a slight amount, which causes the top layers of the particulate layer to fall off, thereby decreasing the pressure drop across the filter. Often times, the collector is equipped with a gage measuring the pressure drop and controlling the cleaning. So as the filters get older, the cleaning cycle is on more often.



*Cartridge collector plugged up with feathers*

Applications that have abrasive, sticky and/or wet particulate are even more troublesome for the dust collector. Abrasive dust will wear holes in the filters faster, and creating a path to bypass the cleaning of the filters. Sticky and wet particulate will not release as quickly during the cleaning cycle. They can also fill up the fabric spacing, thereby not letting air through.

For all these reasons, decreasing the particulate loading in the collector helps keep the dust collector working longer.

As a rule of thumb, a baghouse should have a dust loading less than 7 grains/ft<sup>3</sup> and a cartridge collector should have a dust loading under 2 grains/ft<sup>3</sup>.

## **Temperature Change**

The filters used in baghouses and cartridge collectors have maximum temperatures available. The filters are made up of fabrics and plastics. Cartridges also have glues. This means that too high of a temperature going into the collector can cause the filters to fail or fall apart. Higher temperature filters are available, but they are more expensive.

Cooling down the airflow can cause water vapor to condense in airflows that have high humidity. The condensed water droplets can cause operational issues (as described above) in the filters. Some cyclones use a secondary air that can be used to heat up or cool down the airflow.

This will allow the best possible temperature to be maintained in the baghouse or cartridge collector.

Cyclones pre-filters also provide two other benefits.

- 1) The cyclone acts as a spark arrester. When hot embers come in contact with the cyclone walls, it causes the spark to cool down. This helps prevent sparks from coming into contact with the filter. A spark in the filter can cause a fire, thereby damaging the dust collector.



*Horizontal GPC pre-filter*

- 2) The cyclone will remove a large amount of the particulate before it reaches the filters. So even if the airflow isn't in the ideal range, the amount of particulate that can cause issues with the filters are significantly decreased, thereby decreasing the chances of an issue developing, and increasing the operational life of the unit.

## **Maintenance**



*Dust collector wear from corrosion / abrasion*

As stated above, baghouses and cartridge collectors use fabric filters to separate the particulate from the airstream. The filters will wear out over time. Holes will develop, thereby allowing dust to pass through the dust collector and into the atmosphere. The filters can also plug up, causing the airflow through the system to decrease overtime. During cleaning, holes can develop and if there is a high cleaning rate, filter life will be decreased significantly. Bags usually have metal frames installed to support their shape.

Frames can break and bend, requiring replacement. The tube sheet (metal sheet separating clean air from dirty air) can develop holes, requiring patching or rebuilding of the dust collector.

Since most dust collectors with fabric filters use compressed air for cleaning, compressed air is required. Solenoid valves are used to control the cleaning air. Frequent opening and closing of the solenoid valve could cause shorter operational life. Compressed air also requires a compressor. Increased compressed air usage (increased cleaning) causes the compressor to operate harder, more often. This causes greater maintenance on the compressor and greater cost.

Installing a cyclone pre-filter will decrease the wear on the filters as the particulate loading will decrease. Lower dust loadings will allow greater time between cleaning, thereby decreasing wear on the bag and usage of compressed air. The decreased particulate loading will also increase the life of the tube sheet and cages.

## Particulate Recovery



*Vertical GPC*

A pre-filter cyclone captures the larger particulate before it reaches the filters. This decreases the loading on the filters and allows them to deal primarily with the smaller particulate. The cyclone captures the dust with minimum contamination from prior particulate. Since filters use a dust layer to increase their removal efficiency, the particulate being captured could be contaminated from previous materials.

If the particulate is product being used later in your process, recycled, or used in another process, then retaining particulate could cause contamination. Cyclones don't retain particulate and can easily be cleaned or washed down.

If the particulate collected is highly valuable, (gold, silver, platinum, etc.), collecting it in the filters could lead to loss in products or expensive recovery expenses. The cyclone pre-filter minimizes the dust in contact with the filter, thereby extending filter life and decreasing expenses.

Baghouses and cartridge collectors are highly efficient dust collectors and are considered the best available technology. This however doesn't mean that using them will be without a challenge. By installing a cyclone pre-filter before the baghouse or cartridge collector you can provide a better, more highly efficient system with less maintenance.

So, whether you are planning a new system, or are experiencing operational issues with your current baghouse or cartridge collector, installing a cyclone pre-filter can be an effective way to boost your performance, decrease maintenance costs, and make your operation less of a hassle.



*Vertical GPC*