Precoating new filters for better airflow, longer filter life

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After explaining why it's a good idea to precoat new bag and cartridge filters that will handle extremely fine dust particles, this article provides step-by-step instructions on how to do it.

Why consume expensive downtime to precoat (or *seed*) your dust collector's new filters? One good reason: Dust and fine particles 0.5 microns or smaller can leak right through a new bag or cartridge filter's pores, working their way deep into the media to the point of *blinding,* or clogging, the filter and slowing or stopping airflow through your collector. So if your dust particles are smaller than 10 microns, taking the time to pretreat your new filters' media surface with a dry precoating material — such as agricultural lime or diatomaceous earth — is smart.

When your dust stream contains a significant percentage (by weight) of submicron particles, precoating can reduce or prevent the premature failure of your new filter media. Figure 1 shows the effect of precoating a filter that handles extremely fine particles. In the figure, you can see how the precoating material has built up an initial dust cake on the media, preventing dust particles from flowing into and blinding the media. Precoating ensures that air flows freely through the collector, improving filtering performance while extending the filter life. Typical service life for bag filters without precoating is 1 to 3 years and for cartridge filters is 3 to 12 months. Depending on the application, precoating can extend the filter life, potentially providing enormous cost savings in replacement filters and changeout labor. (See the related sidebar "Some guidelines: When is it time to change your filters?")

Precoating new filters provides other benefits, too. By keeping particles on the filter surface, precoating improves the dust collector's initial filtering efficiency at startup. Precoated filters are easier to clean and provide better dust cake release for applications with process air that contains moisture, hydrocarbons (oil), or both. Precoating materials, which don't burn, can be applied to filters made of fire-retardant media to help reduce explosion risks in spark-producing processes, such as milling.

Before outlining the steps in the precoating process, let's take a look at how two factors — your filters' pore opening size and your dust's particle size — can make the case for precoating.

Precoating and pore opening size

Precoating is appropriate for bag or cartridge filters in applications handling particles smaller than 10 microns and particularly those 0.5 microns or smaller. (Precoating isn't typically required for filters with Teflon, polytetrafluoroethylene [PTFE], GORE-TEX, and similar treatments because of their ability to resist blinding by small particles.) The pore openings in bag filter media are usually larger than in cartridge filter media, so precoating is required more commonly for bag filters than for cartridge filters. For instance, the mean pore openings in a 16-ounce polyester bag filter are 19.675 microns, significantly larger than the 10.253-micron mean pore openings in a comparable 80-20 polyester blend (80 percent cellulose, 20 percent polyester) cartridge filter.

Precoating and particle size

The smaller your dust particles are, the more important it is to consider precoating your filters. And depending on the kind of size analysis used for determining your dust's size distribution, the particles may be smaller than you think.

Consider the results of different sizing methods for a sample of pulverized coal dust containing submicron particles. To determine the particle size distribution of a sample of this dust, the sample was analyzed first by count (population) and then by weight (volume).[1] Here are the results showing the particle size distribution *by count:*

- 0.1 percent of the count (that is, of the entire population of particles in the sample) is below 0.197 microns.
- 1.0 percent of the count is below 0.203 microns.
- 6.0 percent of the count is below 0.223 microns.
- 22.0 percent of the count is below 0.320 microns.
- 50.0 percent of the count is below 0.506 microns.
- 78.0 percent of the count is below 0.794 microns.
- 94.0 percent of the count is below 1.330 microns.
- 99.0 percent of the count is below 2.587 microns.
- 99.9 percent of the count is below 9.837 microns.

And the size distribution of the same sample *by weight* is:

- 0.1 percent of the weight (that is, of the total sample) is below 0.381 microns.
- 1.0 percent of the weight is below 0.734 microns.
- 6.0 percent of the weight is below 2.246 microns.
- 22.0 percent of the weight is below 11.33 microns.
- 78.0 percent of the weight is below 39.63 microns.
- 94.0 percent of the weight is below 62.60 microns.
- 99.0 percent of the weight is below 65.31 microns.
- 99.9 percent of the weight is below 65.80 microns.

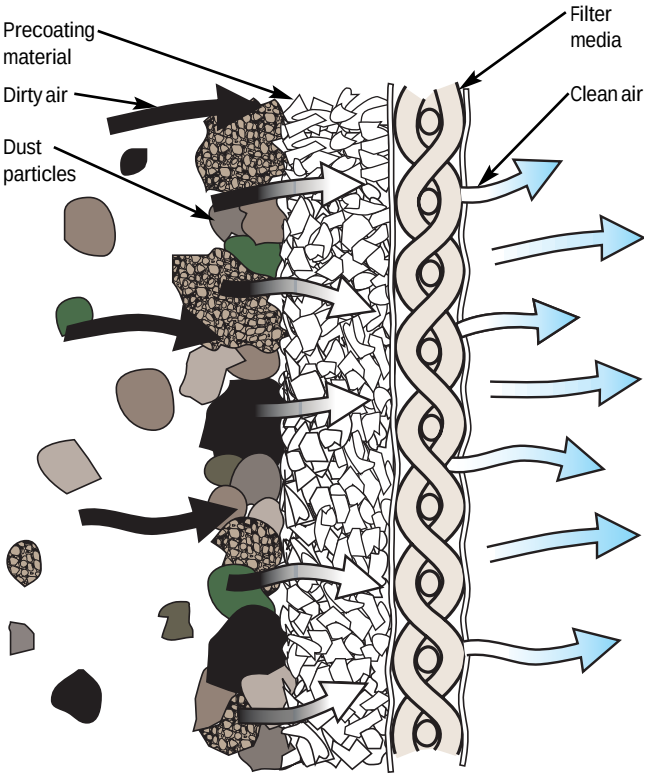
As you can see, the coal dust's particle size distribution flip-flops depending on whether it's by count or weight. By count, over *90 percent* of the particles are submicron. Yet by weight, only slightly over 1 percent of them are submicron. So which distribution is right?

They both are. Why? Very small particles have virtually no weight compared with larger particles. In fact, it takes 1 million 0.5-micron particles to equal the weight of one 50-micron particle of the same density.

In many bulk solids plants, particle size distributions are measured by weight, and when plants contract independent labs to do the analysis, the labs also usually measure the distribution by weight. If your dust's size distribution was determined by weight, be aware that even when the results indicate that only about 1 percent of your dust particles are submicron, the dust really contains a *significant* number of submicron particles. To handle particles this small, you not only must select filter media specially designed for capturing submicron particles, but most likely you'll need to precoat the filters to prevent blinding and extend the filter life.

Figure 1

Precoating's effect on a filter



Precoating step-by-step

The method for precoating new bag or cartridge filters is relatively simple and doesn't require any special equipment. After installing the new filters in your dust collector, you simply run the collector fan at a low volume to draw precoating material into the collector and onto the filters. For a baghouse or large cartridge collector, this process typically takes 3 to 4 hours; for a small cartridge collector, it can take just 30 to 60 minutes.

Precoating materials. Several precoating materials (also called *seeding materials*) are available. They're characterized by their porosity, which allows air to flow through them, and their very consistent particle size. All of them are nontoxic and nonflammable, and all are chemically inert so they won't damage your filter media. Most come in 25- to 50-pound bags for easy handling. The most com-

Some guidelines:

When is it time to change your filters?

The key to knowing when to change your bag or cartridge filters is measuring the pressure drop (also called *differential pressure*). A pressure drop reading measures the difference (in inches water gauge) between the static pressures upstream (on the dirty side) and downstream (on the clean side) of the filters.

Taking the reading. A pressure drop reading is typically taken with a differential pressure gauge or pressure gauge switch. The differential pressure gauge (known as a Magnehelic gauge) measures pressure drop by transmitting the effects of air pressure changes on a diaphragm to an indicating pointer. The pressure gauge switch (known as a Photohelic gauge) combines the differential pressure gauge's capability with two switches, one activated by a specified high pressure and the other by a low pressure. The pressure gauge switch has adjustable setpoint indicators for the high and low pressures. So when the pressure exceeds the high setpoint, it triggers a switch that activates the collector's filter cleaning system, and when the pressure falls below the low setpoint, the switch deactivates the cleaning system. By activating a cleaning cycle only when necessary, the pressure gauge switch conserves compressed air and extends the filter life because the filter isn't pulsed as often.

When the pressure drop rises 1 to 2 inches water gauge above the normal static pressure, it's probably time to change your filters.

When to change your filters. Consider changing your filters when the pressure drop rises 1 to 2 inches water gauge above the normal static pressure on the collector's dirty side. For instance, if the normal static pressure is 4 inches water gauge and the pressure drop continuously reaches 6 inches water gauge and won't drop significantly, even after "offline" cleaning (that is, cleaning when no air is entering the collector), it's probably time to change your filters. ***—E. Ravert***

mon and least expensive precoating materials are agricultural lime and diatomaceous earth, which are suitable for virtually any precoating application and are available from retail garden centers and home-improvement stores. Other materials developed specifically for precoating contain blends of materials such as agricultural lime, pearlite, and powdered cellulose and are available from filter suppliers. Be aware that you'll need more precoating material for bag filters, which require up to five times as much material per filter as cartridge filters — from 2 to 5 pounds of material per bag filter compared with from 0.5 to 1 pound per cartridge filter.

Precoating steps. Whether you're precoating bag or cartridge filters, the procedure is the same. After installing your new filters in your baghouse or cartridge collector, follow these steps:

1. Turn off and lock out the dust collector fan.

2. Remove any afterfilters downstream from the collector. (This will prevent the small amount of precoating material that initially passes through the bag or cartridge filters from entering the afterfilters.)

3. Turn off the collector's filter cleaning system.

4. If the dust collector has a pressure gauge switch (Photohelic gauge), disable the gauge by turning both setpoint indicators to the far right.

5. If the fan has a damper, close it down until the air volume is two-thirds to three-quarters of the normal flow

capacity, as shown in Figure 2a. (If the fan has no damper, close down enough dampers in the ductwork upstream of the collector to reduce the air volume to two-thirds to three-quarters of the normal flow capacity.)

6. If the collector's dust hopper discharge has a slide gate rather than a rotary airlock valve, open the slide gate and remove the dust cover connecting the hopper discharge to the dust storage container (typically a drum), as shown in Figure 2b. Move the container aside and place an open bag of precoating material under — but a few inches away from — the dust cover. (If the hopper discharge has a rotary airlock valve, find a capture hood or duct cleanout door as close to the fan as possible, and place the bag of precoating material near this spot.)

7. Turn on the fan, which will now be at reduced volume. (The reason for reducing the fan volume below its normal flow capacity during precoating is to prevent blinding of the new media by the precoating material. The new media's pores are virtually wide open, giving the media very low resistance, usually 1 inch water gauge or less. Operating the fan at its normal capacity would pull more air through the new media than through media in a seasoned filter that has been operating for some time.)

8. As the fan draws the precoating material into the dust collector, the material will form a continuous cloud. You can avoid creating an excessively heavy dust cloud in the collector by continuing to keep the bag a few inches away from the dust cover while gently shaking the bag, as shown in Figure 2c. Keep the fan running until the differential pressure gauge (Magnehelic gauge) indicates that the pressure drop has increased by 1 inch water gauge. (For bag filters, this typically occurs after 2 to 5 pounds of precoating material per filter has been added, and for cartridge filters, after 0.5 to 1 pound of material per filter has been added.)

9. As the fan continues to run, remove the precoating material bag, close the slide gate (or stop the rotary airlock valve), move the dust storage container back in place (or close the cleanout access door), and replace the dust cover. Reinstall any afterfilters and then reopen the slide gate (or restart the rotary airlock valve).

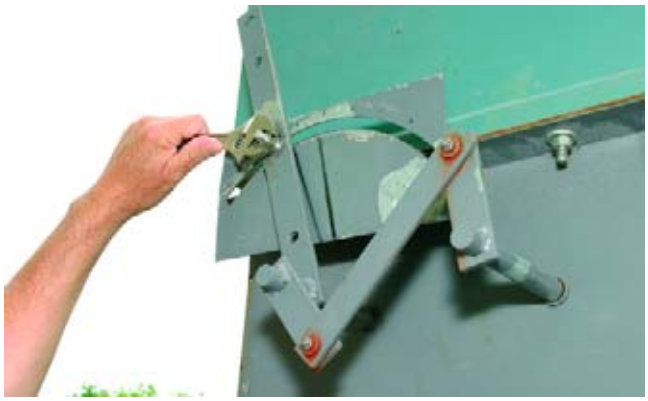
10. Start up the normal dust collection process.

11. Wait until the differential pressure gauge indicates an additional pressure drop increase of 1 inch water gauge before restarting the filter cleaning system. Then, if the collector has a pressure gauge switch, bring only the left (low-pressure) setpoint indicator down to its normal position (typically 2.5 inches water gauge).

Figure 2

Precoating steps

a. Closing fan damper



b. Removing dust storage container

c. Feeding precoating material in a continuous cloud

12. If you closed down the fan damper, gradually reopen it as the pressure drop increases to within the normal operating range for your collector. (If you closed down other upstream dampers, gradually reopen them until the pressure drop increases to within the normal operating range.) Then, if the collector has a pressure gauge switch, reset the right (high-pressure) setpoint indicator to its normal position.

Your filters are now successfully precoated, and your dust collector is ready for normal operation. **PBE**

Reference

1. More information about the tests (including instruments, procedures, and results) is available from the author.

For further reading

Find more information on filter media and dust collectors in articles listed under "Dust collection and dust control" in *Powder and Bulk Engineering*'s comprehensive article index at www.powderbulk.com and in the December 2005 issue.

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