SIMPLE INSTALLATION TIPS AND TROUBLESHOOTING BASICS FOR PULSE-JET DUST COLLECTION SYSTEMS

This article explains design, maintenance, and installation basics for pulse-jet dust collectors.

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For a dust collection system to operate efficiently and economically, it must be designed, installed, and maintained properly. The following installation and troubleshooting basics are intended to help newcomers to the industry and to dust collection avoid common pitfalls. (Note: While these tips can help, a scheduled preventative maintenance program is always the best plan to help eliminate the need to troubleshoot problems in your dust collection system.)

In most cases, dust collectors and their associated systems are installed by a contractor. Look for one who has experience with dust collection equipment and understands the special requirements of these systems. Properly set up, dust collection systems can run for many years with little or no maintenance, but a contractor's oversight — or even a maintenance crew's mistakes — can lead to expensive problems. Here are tips on handling some common oversights and troubleshooting your equipment.

Installation tips

Top-loading filter bags. Proper installation of the filter media is imperative, but too frequently the installation is substandard. Filter bags loaded from the top seem especially prone to incorrect fitting. Often, they're simply dropped into the tubesheet hole with the cage already inserted. But that won't provide the desired seal between the dirty and clean sides of the filter. To install the filter correctly, as shown in Figures 1a.-d., the snap-band within its top cuff must be seated snugly within the tubesheet hole. Begin by inserting the bag — just the bag, not the cage — into the tubesheet hole from the clean air side of the dust collector. As you reach the top cuff, form the snap-band into a U-shape and place its groove within the tubesheet hole and allow it to expand. There should be an audible "pop!" To check for proper fit, grip the snap-band with both hands and try rotating it. It shouldn't move. If it does, retract the bag and try setting the snap-band again.

Once the bag is properly installed, insert the cage into it. When the cage top meets the snap-band, gently press on the cage with your foot until the top fully seats on the bag. If the snap-band doesn't fit properly (so loose that it can rotate or so large that it can't fully open), work with your supplier to determine the source of the problem and take corrective action. In addition, ask the dust collector manufacturer to place installation instructions on the units to prevent further mistakes.

Compressed air and air piping. If your dust collector pulse-cleans its filter media using jets of high- or medium-pressure air, make sure the air is clean and dry. Standard high-pressure cleaning systems require 80 to 100 psi of pressure. Medium-pressure cleaning systems operate at about 15 psi, and the compressed air is usually supplied by the positive-displacement (PD) blower.

In both systems, the piping for the compressed air must be installed clean and kept clean. Beware of old piping that could be dirty inside. It can shed rust or other contaminants that cause diaphragm and solenoid valves to get stuck open. Avoid the problem by mounting a compressed-air filter and regulator upstream of the high-pressure cleaning headers. Also, install a pressure gauge so you can monitor the compressed-air pressure at the header. With medium-pressure cleaning, the pressure gauge is usually installed on the PD blower.

Dust collector field assembly. Large dust collectors are shipped in sections and assembled on-site. For the dust collector to work properly, these sections must be sealed airtight during assembly. Any gaps can cause problems. A leak in an outdoor system operating under vacuum will pull in moisture when weather is rainy. In a system under positive pressure, gaps will leak

dust. Where a joint requires a gasket seal, make sure the gasket lies flat and doesn't tear during assembly. At joints sealed with silicone, ensure that the installer applies a heavy bead and completely encircles any bolt holes. Inside seams might require a final bead of silicone to ensure an airtight seal. Take the same care when sealing ductwork.

Troubleshooting tips

Once a dust collector has been installed, problems can occur. Dust collectors and their system components are durable, but they need proper maintenance. If a dust collection system that's been operating effectively over time suddenly develops a problem, seek the cause by asking yourself "what has changed?" Maybe a component has worn out or perhaps the operating environment is different. In a dust collection system that controls nuisance dust via multiple pickup points, adding just a pickup point or two can have a serious impact on the overall system.

The first step in troubleshooting a dust collection system is to check the differential pressure (dP). This variable is typically measured using a magnehelic gauge and expressed as inches water gauge. It's a good indicator of the condition of the filter media.

If you sense the gauge isn't reading correctly, you can troubleshoot it. Begin by removing the piping, or lines, from both of the gauge's connections. Verify that the indicating needle is at zero. If it's not, adjust it using the set screw on the front of the gauge. Blow air through both lines to ensure that neither has an obstruction and then reconnect them. If the lines are old, worn, or damaged by the elements, replace them to prevent leaks from developing. Also check the connection fittings to ensure they're airtight. With an accurate dP gauge, you can chart the dust collector's performance, creating a historical log that's extremely helpful for future troubleshooting.

Pulse-jet cleaning basics

Before discussing troubleshooting, let's review the basic operation of high-pressure and medium-pressure pulse-jet cleaning systems. Figure 2 shows a typical pulse-jet cleaning system cutaway.

FIGURE 2

Cutaway of a typical pulse-jet cleaning system.

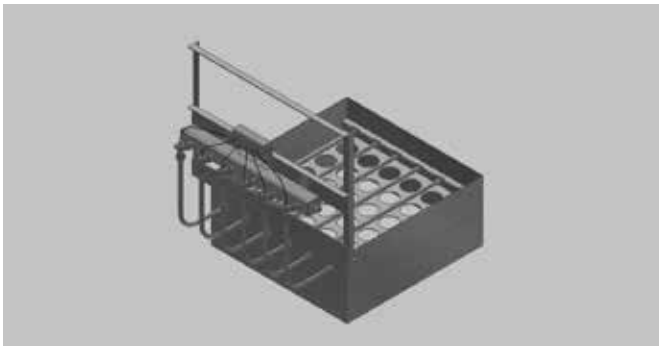
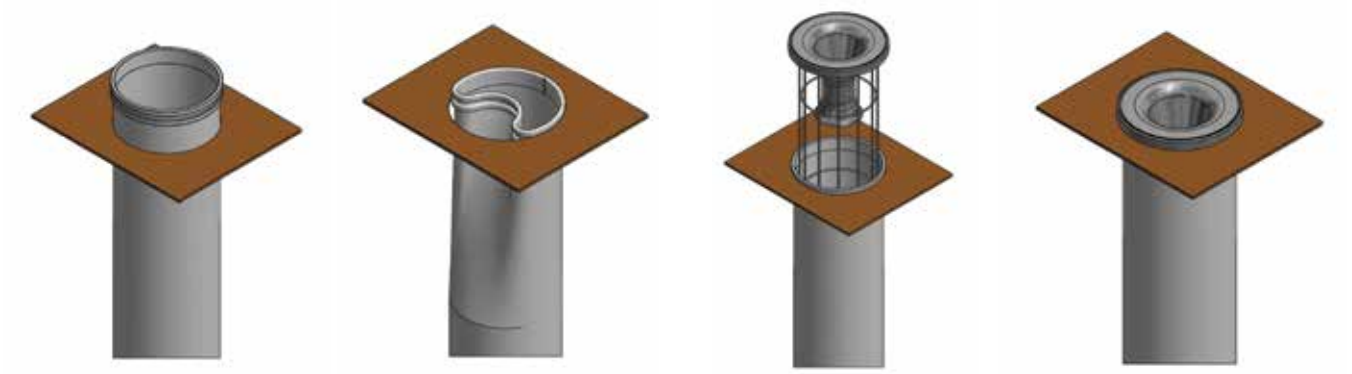


FIGURE 1

Top-loading filter bag and cage installation



a.
Carefully lower the closed end of the filter bag through the tubesheet hole.

b.
Form the top of the bag into a U-shaped bend, insert the rounded half groove of the snap-band into the tubesheet (seam should be opposite bend) and let the "U" shape snap back to fill the hole.

c.
Check the fit of the snap-band in the tubesheet hole. Bag's entire circumference should be at an even height above the tubesheet.

d.
Carefully lower the cage into the filter bag and firmly press down on the top of the cage over the filter snap-band.

Both types of systems operate the same way: An electronic timer sends a signal that energizes a solenoid, which opens the plunger (valve) and releases compressed air through the diaphragm valve. This compressed air travels through blow pipes or nozzles and blasts the filter media from the clean side, knocking dust buildup from the filter and into a hopper or collection vessel. The pulse duration is very short, typically 100 to 150 milliseconds, and the interval between pulses can vary from 5 to 20 seconds. The exact timing depends on the style of cleaning system, the dust type, and the dust load. Check the installation, operation, and maintenance (IOM) manual to see what settings the manufacturer recommends.

The two cleaning systems use different sizes of diaphragm valves. In high-pressure systems, the diameter of the diaphragm valve ranges from 0.75 to 1.5 inches, which corresponds to the number of filters in a row. The more filters there are, the larger the valve must be to accommodate the large piping needed for the compressed air. In medium-pressure cleaning systems, the diaphragm valve is larger, typically 2 or 2.5 inches in diameter. That's because those systems use high-volume, low-pressure compressed air, while high-pressure systems use low-volume, high-pressure air. With either type, there could be one diaphragm valve in a single system or more than 50.

Troubleshooting: Common pulse-cleaning system problem sources

1. Low compressed-air pressure
2. Solenoid stuck open due to dust, rust, debris, or ice
3. Air leaks in remote solenoid tubing and connection fittings
4. Loose or disconnected wiring
5. Defective solenoid valve
6. Defective timer
7. Damaged diaphragm or spring (if required)

When to troubleshoot

If the dP is high (exceeds 6 inches water gauge) and the filter media haven't reached the end of their service life, it might indicate a cleaning system malfunction. Troubleshooting the cleaning system typically can be done while the unit is in operation so this is one of the first items to check. The first step is to check the compressed-air pressure. If it's low, see whether the compressor is operating normally. Next, check for a defective diaphragm or solenoid valve. A leak in either can deplete the reservoir of compressed air to the point where effective pulsing becomes impossible. On a high-pressure cleaning system, you can locate a defective diaphragm valve by listening for air rushing out of it. If you identify one, determine which solenoid valve is upstream of it and see whether it's stuck open. (Sometimes the solenoid is mounted on the diaphragm valve.) If the valve is stuck open, use a small screwdriver to overcome the solenoid's spring tension and work the plunger in and out until it closes. If the plunger still doesn't travel freely, replace the solenoid. If the solenoid is working properly (not venting compressed air), then the diaphragm valve is defective and must be repaired or replaced.

If a medium-pressure cleaning system can't reach the typical pressure needed for a pulse, lengthen the interval between pulses by adjusting the timer. This will extend the time available to fill the reservoir. If this has no effect, you might need to replace the diaphragm, spring, or solenoid. Before doing so, check all the threaded fittings for leaks and the wire terminals for loose connections.

On both high- and medium-pressure systems, if the diaphragm valves aren't pulsing, check the electronic pulse timer, which controls the electrical power that opens the solenoid and allows the diaphragm valve(s) to release pulses of air. Typically, an indicator light will illuminate on a terminal when it's energized.

To see how well a high-pressure cleaning system is operating, reduce the interval between pulses to 3 or 4 seconds, then check whether each terminal lights up and whether the compressed air is adequate to operate all the diaphragm valves. If any valve still doesn't pulse, check for loose wiring connections. If none of the valves work, replace the timer.

Beyond the cleaning system

If the cleaning system is fully functional, the problem is likely elsewhere. Here are some potential problem causes and trouble spots to check.

Filter inspection. Remove some filters and assess their condition. If you find wet or moist product caked on the filter, as shown in Figure 3, determine whether this stems from a process issue or a leak in the system that's pulling in moisture. Or perhaps warm process air is condensing in the dirty-air plenum. If the filters are dry and look normal, as shown in Figure 4, have they reached the end of their service life or are they blinded? If so, replace them. Tracking the timing of when filters are replaced will help you determine when future filter changes should occur.

Impact of environmental conditions. Many dust collectors, filter-receivers, and bin vents are located inside a building, where environmental conditions vary much less than outdoors. This is true even when the building's air isn't conditioned. Under these con-

ditions, filters will generally have fewer problems and last longer. Dust collectors operating in the northern regions where winters are colder may require more attention. Frozen solenoid valves and condensation within the dust collector are just two possible results of environmental variation. Always consider environmental conditions when troubleshooting dust collectors.

Impact of wear and corrosion. As a dust collection system ages, wear and corrosion become a greater concern, especially if the material being processed is abrasive or corrosive. Likewise, if a dust collector serves as a product receiver and/or handles high volumes of such products 24 hours per day, be vigilant. Wear is more likely than in dust collectors that control a nuisance dust. Those units operate at much lower volumes and often only 8 hours per day. Keep in mind that ductwork is also subject to wear and corrosion, especially elbows.

The human factor. There are times when a problem can be traced to an unwitting human action. A worker exposed to the constant din of pulsing valves might decide to shut off the compressed air at the dust collector. In short order, the dP rises and airflow at the pickup points plummets, causing dusting. Or a worker seeking to improve dust pickup opens the fan damper completely. As a result, the dP increases and the cleaning system seems not to work properly. A review of the system reveals no issues, but here's what happened: The wide-open fan damper has increased airflow through the system, causing the velocity of the dust-laden air entering the dust collector to increase. This is known as the can velocity. The velocity between the filter bags, known as interstitial velocity, also increased. These higher velocities prevent the dust from falling into the hopper.

Long-term monitoring. If the source of the problem isn't found in a snapshot assessment, monitor the system over a longer period. That could be a day, week, or longer. At one site, several filter-receivers operating in the same room performed normally in the afternoon and at night. But in the morning and early afternoon, the dP increased. In this case, the source of the problem wasn't the dust collection system, but rather process equipment that consumed large amounts of compressed air between 8 a.m. and 2 p.m. As a result, the pressure of the compressed air dropped from 85 to 90 psi to 60 psi or less. The solution was to dedicate a compressed-air source to the filter-receivers. **PBE**

FIGURE 3

Wet and moist material caked on filter bags.

FIGURE 4

Dry, normal-looking filter bags.

For further reading

Find more information on this topic in articles listed under "Dust collection and dust control" and "Compressed air" in *Powder and Bulk Engineering*'s comprehensive article index in the December 2018 issue or the Article Archive on *PBE*'s website, www.powderbulk.com (All articles listed in the archive are available for free download to registered users.)

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