The low-pressure reverse-air dust collector has a mechanically simple design that provides efficient, reliable performance over the long term in a range of bulk solids applications. Like any dust collection equipment, this unit can develop operating problems over time, especially when the system air volume, dust load, or dust characteristics change from the original design conditions. The troubleshooting advice in this article provides a quick reference to help you diagnose and fix five common operating problems with your reverse-air dust collector.

The reverse-air dust collector (also called a reverse-air filter) is a common fixture outside bulk solids plants that process grain, agricultural products, coal and other minerals, wood products, and other materials. This versatile large-volume unit can handle light-dust-loading applications, such as filtering dust in a dust collection system, and high-dust-loading applications, such as serving as a filter-receiver to separate material from air in a pneumatic conveying system. The reverse-air collector’s filter elements are continuously, gently cleaned using low-pressure air that flows through a slowly rotating cleaning arm. This filter-cleaning method doesn’t use plant compressed air, doesn’t require a timer board or other controls, and minimizes wear on seals and other parts.

Despite its mechanical simplicity, the reverse-air dust collector can eventually develop various operating problems. Before we discuss how to troubleshoot the problems, let’s take a closer look at the collector’s components and operation.

How the reverse-air dust collector works

Components. Available from multiple manufacturers, the reverse-air dust collector commonly has a vertical, cylindrical housing from 6 to 20 feet or more in diameter. The collector is typically between 30 and 50 feet tall. Inside the housing, as shown in Figure 1, a tubesheet with holes for attaching filter elements divides the collector into an upper clean-air compartment and a lower dirty-air compartment. The tubesheet suspends multiple 4.5- or 6-inch-diameter filter elements arranged in a series of rows radiating from the tubesheet center. The filter elements, which can be constructed of various media types, typically are bag filters and pleated bag filters; occasionally, pleated cartridge filters are used. The bag filters are mounted on wire cages and extend down into the dirty-air compartment. Holes in the tubesheet not fitted with filters are blocked with blank-out plugs. Two lines run from the collector to a pressure differential gauge, with one line connected just above the tubesheet in the clean-air compartment and one connected just below the tubesheet in the dirty-air compartment.

With a reverse-air dust collector, you can often troubleshoot common operating problems on your own, saving time and money.
A rotating cleaning arm is mounted on a shaft at the tubesheet’s center, and typically nozzles or similar devices along the rotating arm align with the top of each filter element in one row. A gear motor to power the cleaning arm’s rotation and a centrifugal fan to supply low-pressure air to the cleaning arm are mounted above the arm. A dust-laden-air inlet, typically in the form of an involute (inwardly curved) cyclone-style inlet, is located near the bottom of the dirty-air compartment. A clean-air outlet is located near the clean-air compartment’s top. A dust hopper with an outlet for discharging the collected dust is located below the dirty-air compartment; the outlet is typically fitted with a slave-driven rotary-airlock-valve/discharge-screw combination.

**Operation.** Dust-laden air is drawn into the reverse-air dust collector’s involute inlet by a system exhaust fan downstream from the collector. The involute inlet’s shape causes the air to follow a spiral pattern as it flows into the round collector housing, creating centrifugal force that quickly separates particles from the airstream. (In some low-velocity applications, the collector instead has a high-entry inlet located near the dirty-air compartment’s top; as the air enters the inlet, dust is knocked out of the airstream by a series of baffles inside the inlet.) Large dust particles drop into the hopper, while finer particles remain entrained in the upward-flowing air and are deposited on the filters as the air flows through them.

The cleaning arm continuously rotates at low speed (1 to 2 rpm) from one row of filters to the next, and low-pressure air supplied by the arm’s centrifugal fan flows through the arm and is directed through the nozzles down into each filter in the row. Each filter row is cleaned once per arm rotation. This low-pressure cleaning air, flowing counter to the collector’s exhaust air, gently cleans each filter. Some dust dislodged from the filter falls into the hopper, and some — especially when the filter is long — redeposits on the filter.

Even though the reverse-air dust collector has a simple mechanical design and its cleaning arm’s slow rotation minimizes wear on parts, over time the collector can develop operating problems, especially when operating conditions change. You can often troubleshoot and fix these problems on your own without calling the manufacturer’s service department, saving your company time and money. The following information can serve as a quick reference tool for troubleshooting your collector: It explains what problems can affect operation, what potential causes are behind the problems, and how you can fix them. **Note:** The order of causes under each problem is typically from the easiest to hardest to diagnose, and the same cause may be the source of more than one problem.

### Problem 1: High differential pressure across the tubesheet

**Cause:** The differential pressure gauge is bad. **Solution:** Check the gauge by gently blowing into it. (Don’t use compressed air, which will damage the gauge.) If the needle doesn’t move, replace the gauge.

**Cause:** A differential pressure gauge line is leaking or clogged. **Solution:** Check the full length of both lines into the gauge for cracks, splits, breaks, or clogs. If you find any damage, replace both lines with new tubing. For a harsh environment, you may need to use copper tubing. If you find a clog, check the inline filter commonly placed in the dirty-air line and, if necessary, replace the filter. Try cleaning the line by disconnecting it from the gauge and blowing compressed air through the line; if this doesn’t remove the clog, replace the line.

**Cause:** The cleaning arm isn’t rotating. **Solution:** Inspect the arm’s drive components and check the gear motor’s operation and lubrication. Check the bearings on the arm’s shaft. Lubricate, repair, or replace the drive components, gear motor, and bearings as required.

**Cause:** The cleaning arm fan is malfunctioning. **Solution:** Check that the fan is running and rotating in the correct direction. (Most fan housings or motors have a
rotation-direction arrow.) Check the fan motor’s wiring and the circuit breaker at the electrical box to make sure the motor is receiving power. If the fan is rotating incorrectly, switch the lead wires. Check the fan motor’s nameplate to verify that the motor is operating at the correct speed to deliver the correct airflow for filter cleaning. (The nameplate will typically list a nominal speed of 3,600 rpm, which produces 3,450 actual rpm.) If you aren’t sure, check the speed with a tachometer. If the motor is running at the incorrect speed, you’ll probably need to replace it.

**Cause:** The filter media is blinded. **Solution:** Since excessive moisture in the collector is the most common cause of filter media blinding, look for high humidity, condensation, and leaks in the ductwork leading to the collector. In a high-humidity climate, you should operate the collector under no dust load (with the dust capture hoods closed) until the air temperature inside the collector stabilizes. Condensation results when high humidity in the ambient air or moisture from the process causes the collector’s airstream temperature to cross the dewpoint. To prevent dewpoint-related condensation, you may need to preheat and insulate the collector. Inspecting the ductwork for leaks should be part of your preventive maintenance program; if you find leaks, seal them with silicone caulking.

**Cause:** The interstitial velocity is too high. **Solution:** If the interstitial velocity (or can velocity) — that is, the velocity of upward airflow through the collector’s cross-section — is too high, check the dust collection system’s airflow to see if it has increased from the original design value. Such an airflow increase can result from an increase in the system exhaust fan’s speed, a change in the ductwork layout, or other dust collection system changes that reduce the system’s static pressure. Any airflow increase will increase the interstitial velocity and tend to cause dust particles to “float” in the collector rather than fall into the hopper after filter cleaning. A process change that reduces the dust’s particle size can also increase the interstitial velocity. In either case, to reduce the interstitial velocity you may need to reduce the collector’s airflow to the original design value or replace the collector and its ductwork with larger equipment.

**Cause:** The bag filters don’t fit properly on their cages. **Solution:** Check one bag filter’s fit on its cage by pinching the media at several points around the filter. You should be able to pinch at least 1⁄2 inch of media at any position on the bag filter. If the media fits too tightly on the cage, the media won’t be able to “pop” during cleaning and knock the dust cake loose. If the bag filters are too tight, replace them.

**Cause:** The rotary airlock valve leaks air. **Solution:** Check the rotary airlock valve at the hopper discharge for wear. Wear typically occurs at the valve’s rotor tips, creating an excessive rotor-tip-to-housing clearance. Air can leak upward through the worn-out valve into the hopper and cause dust from the hopper to redeposit on the bag filters. Air leaking through the valve can also keep the collected dust from discharging properly from the hopper, potentially plugging the collector. Repair or replace the leaking valve.

**Cause:** The collector is handling an excessively high dust load. **Solution:** When properly sized and operated under normal conditions, the reverse-air collector can handle very high dust loads. Compare the collector’s current operating conditions, including the process design, the dust load, and the dust’s particle size, to its original design conditions. If the dust load has increased or the dust’s particle size is smaller, something has changed in your process. Unfortunately, solving this problem will require replacing the collector and its ductwork with larger equipment.

**Problem 2: Low differential pressure across the tubesheet**

**Cause:** The differential pressure gauge is bad. **Solution:** Check the gauge by gently blowing into it. (Don’t use compressed air, which will damage the gauge.) If the needle doesn’t move, replace the gauge.

**Cause:** A differential pressure gauge line is leaking or clogged. **Solution:** Check the full length of both lines into the gauge for cracks, splits, breaks, or clogs. If you find any damage, replace both lines with new tubing. For a harsh environment, you may need to use copper tubing. If you find a clog, check the inline filter commonly placed in the dirty-air line and, if necessary, replace the filter. Try cleaning the line by disconnecting it from the gauge and blowing compressed air through the line; if this doesn’t remove the clog, replace the line.

**Cause:** The bag filters have holes. **Solution:** Replace all the bag filters. See the later section, “Problem 4: Short bag filter life,” for potential causes.

**Cause:** The dust collection system air volume is too low. **Solution:** Check the ductwork for plugs or closed blast gates. Check the system exhaust fan to be sure it’s operating at the correct speed and that its damper (which may be located at either the fan inlet or outlet) is closed. Clean out any plugged ducts, open closed blast gates, correct the fan speed, and open the fan damper as needed.

**Cause:** The bag filters and cages are incorrectly installed. **Solution:** Look for dust in the clean-air compartment or in the air discharging from the system exhaust fan, which can indicate that some bag filters are missing or are installed incorrectly in the tubesheet. Replace missing filters, and refer to the collector manufacturer’s operations and maintenance manual to determine how to correctly install the filters.
Problem 3: Dust in the exhaust air

Cause: The startup period isn’t long enough. Solution: At the collector’s initial startup and after installing new bag filters, run the dust collector continuously for 48 to 96 hours to establish a dust cake on the filters. In some cases, such as to capture a very fine or corrosive dust, you may need to precoat the bag filters (called seeding) with an appropriate material to establish the dust cake.

Cause: The bag filters have holes. Solution: Replace all the bag filters.

Cause: The bag filters and cages are incorrectly installed. Solution: Look for dust in the clean-air compartment or in the air discharging from the system exhaust fan, which can indicate that some bag filters are missing or are installed incorrectly in the tubesheet. Replace missing filters, and refer to the collector manufacturer’s operations and maintenance manual to determine how to correctly install the filters.

Cause: Blank-out plugs are missing or incorrectly installed in the tubesheet. Solution: Replace missing plugs and check the collector manufacturer’s operations and maintenance manual to determine how to correctly install the plugs.

Cause: Air is leaking across the panelized collector’s tubesheet. Solution: This applies only to a 14-foot- or larger-diameter reverse-air dust collector (called a panelized collector) that has been shipped in sections and bolted together at your site. Look carefully for gaps or uncaulked areas between the collector’s multiple tubesheet sections. Use silicone caulking to seal any gaps.

Problem 4: Short bag filter life

Cause: Abrasion from high-velocity airflow has damaged the filter media. Solution: Use an involute dust-laden-air inlet, which serves as a transition to the inlet, so that the incoming air flows across the inlet’s full cross-sectional area to reduce the airflow velocity. Avoid using an inlet duct that’s stubbed onto a flat plate on the inlet, and avoid mounting an inlet duct elbow directly onto the inlet. Either will result in a high inlet airflow velocity and eccentric loading on the bag filters.

Cause: The bag filter cages are damaged. Solution: Inspect the bag filter cages for bent, broken, or corroded wires that can cause the bag filters to fail prematurely. Replace damaged cages as soon as possible. If the wires have corroded, replace the cages with coated or stainless steel cages.

Cause: The collector’s air volume is too high. Solution: Compare the collector’s current operating conditions with its original design conditions. If the air volume through the collector is now higher than the design level, it creates a higher air-to-cloth ratio than the collector was designed to handle and can shorten the bag filter life. Unfortunately, you’ll need to replace the collector and its ductwork with larger equipment to solve this problem.

Cause: The filter media is blinded. Solution: Since excessive moisture in the collector is the most common cause of filter media blinding, look for high humidity, condensation, and leaks in the ductwork leading to the collector. In a high-humidity climate, you should operate the collector under no dust load (with the dust capture hoods closed) until the air temperature inside the collector stabilizes. Condensation results when high humidity in the ambient air or moisture from the process causes the collector’s airstream temperature to cross the dewpoint. To prevent dewpoint-related condensation, you may need to preheat and insulate the collector. Inspecting the ductwork for leaks should be part of your preventive maintenance program; if you find leaks, seal them with silicone caulking.

Cause: The filter media is failing. Solution: Consult the collector manufacturer for alternative media choices if high temperatures, the chemical content of your air or dust, or the dust’s particle size or other characteristics are causing the bag filter media to fail prematurely.

Problem 5: Hopper plugging

Cause: The cleaning arm isn’t rotating. Solution: Inspect the arm’s drive components and check the gear motor’s operation and lubrication. Check the bearings on the arm’s shaft. Lubricate, repair, or replace the drive components, gear motor, and bearings as required.

Cause: The cleaning arm fan is malfunctioning. Solution: Check that the fan is running and rotating in the correct direction. (Most fan housings or motors have a rotation-direction arrow.) If it’s rotating incorrectly, switch the lead wires. Check the fan motor’s nameplate to verify that the motor is operating at the correct speed to deliver the correct airflow for filter cleaning. (The nameplate will typically list a nominal speed of 3,600 rpm, which produces 3,450 actual rpm.) If you aren’t sure, check the speed with a tachometer.
**Cause: The rotary airlock valve leaks air. Solution:** Check the rotary airlock valve at the hopper discharge for wear. Wear typically occurs at the valve’s rotor tips, creating an excessive rotor-tip-to-housing clearance. Air can leak upward through the worn-out valve into the hopper and cause dust from the hopper to redeposit on the bag filters. Air leaking through the valve can also keep the collected dust from discharging properly from the hopper, potentially plugging the collector. Repair or replace the leaking valve.

**Cause: The rotary-airlock-valve/discharge-screw speed has dropped. Solution:** If your reverse-air collector has a slave-driven combination rotary-airlock-valve/discharge-screw and your operating conditions have changed, you may need to increase the drive speed.

**When to call the manufacturer**
When troubleshooting a reverse-air dust collector problem on your own doesn’t lead to a solution, or when you can’t determine which of several causes is at fault, it’s time to call the collector manufacturer’s service department. You can simplify this troubleshooting process by having the following basic information about your collector on hand when you call:

1. Your company’s name and location, as well as the name, phone numbers, and e-mail address for a contact person at your company.

2. The reverse-air dust collector’s model number and serial number.

3. How long the collector has been in service and when the problem started; if possible, have complete descriptions of the problem and the system layout.

4. The size, manufacturer, and model number of the rotary airlock valve at the hopper discharge, and an indication of whether the airlock valve and discharge screw operate correctly and rotate in the correct direction.

5. Whether the cleaning arm is rotating.

6. Whether the cleaning arm fan is running and, if so, whether it’s rotating in the correct direction.

7. The cleaning arm fan’s motor nameplate data (including nominal motor speed, which should be 3,600 rpm).

8. Whether any filter elements or blank-out plugs are missing; on a large panelized collector, also whether there are leaks between the tubesheet sections.

**An ounce of prevention**
Many operating problems with reverse-air dust collectors and other dust collection equipment can be prevented. The first step in preventing problems is to make sure that all system operators and maintenance workers become familiar with the collector’s operations and maintenance manual at the time your collector is installed. They should also receive thorough training in running and maintaining the collector.

Once the dust collector is operating in your plant, the operators should monitor the unit’s performance, such as by regularly checking the pressure differential gauge to ensure that the filters are being cleaned adequately. Maintenance workers should provide routine preventive maintenance as outlined in the manual and keep key spare parts on hand — often the best insurance against a costly production shutdown. Consult your reverse-air dust collector manufacturer if you have questions about the collector’s operation or maintenance or how to prevent or solve collector operating problems.

**For further reading**
Find more information on dust collector operation and troubleshooting 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 2007 issue.

*Ron Krebs* is president of AIRLANCO, 312 South Highway 73, PO Box 398, Falls City, NE 68355-0398; 402-245-2325, fax 402-245-5196 (rkrebs@airlanco.com, www.airlanco.com). He has 30 years of experience in filtration technologies for bulk solids processing and handling.