In past “Pneumatic points to ponder…” columns I’ve discussed pneumatic conveying system components, troubleshooting, optimization, and design approaches. I’ve often focused on the beginning of the system, where the conveying air first meets the material to be conveyed, and how to optimize the air velocity and material loading to ensure that the material becomes adequately entrained in the airstream. In this column, I’ll focus on the conditions at the end of the system, specifically on how adding a bin vent fan affects system costs and operation.

A basic pressure pneumatic conveying system, as shown in Figure 1, includes an air mover (typically a positive-displacement blower or fan), a line charger (such as a rotary airlock), a conveying line, a silo (or other receiving vessel), and an air-material separator (typically a bin vent dust collector). In operation, the air mover forces air through the conveying line as the line charger feeds the material to be conveyed into the airstream. The material is carried through the conveying line and deposited in the silo. The airstream then passes through the bin vent to filter out any fines or dust before venting back to the atmosphere.

As shown in the figure, a system may convey material from a single source to multiple silos. In such cases, the typical end-of-line configuration is for each silo to have its own bin vent. To determine the required bin vent size, you should increase the conveying system air volume by a multiplier, as shown in Table 1, before calculating the required filter media surface area. This ensures that the bin vent’s air-to-cloth ratio is sufficient to handle the surging conditions of the different pneumatic conveying modes listed in the table. [Editor’s note: For more information about the different pneumatic conveying modes, see “For further reading.”]

Some systems also have a fan mounted on the discharge side of the bin vent. A bin vent fan will move the conveying system’s zero point into the silo or bin vent housing, depending on the fan’s pressure output and whether the fan discharge uses an exhaust duct. Zero point refers to the zone where the “push” of the air mover diminishes and the “pull” of the bin vent fan takes over.

Without a bin vent fan, the silo and the bin vent are pressurized during operation and may leak dust into the surrounding area if sealing points become compromised. With a bin vent fan, any leakage at the end of the system will be inward, which is advantageous for hazardous materials or applications where

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**Figure 1**

Pressur pneumatic conveying system

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**Table 1**

<table>
<thead>
<tr>
<th>Conveying mode</th>
<th>Multiplier</th>
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</thead>
<tbody>
<tr>
<td>Dilute-phase flow</td>
<td>1.0</td>
</tr>
<tr>
<td>Two-phase flow</td>
<td>2.0</td>
</tr>
<tr>
<td>Dense-phase flow</td>
<td>3.0</td>
</tr>
<tr>
<td>PD truck unloading</td>
<td>3.0</td>
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</tbody>
</table>
escaping dust could create a safety hazard. On the other hand, if leakage into the system from outside could cause problems with the material (such as moisture issues with a hygroscopic material), a bin vent fan is not recommended.

For a typical dilute-phase, pressure pneumatic conveying system using a positive-displacement (PD) blower, the design pressure drop across a bin vent (for example, 6 inches water column for the filters plus losses into and out of the bin vent) is typically negligible compared to the required system pressure, which may be as high as 12 to 15 psig (1 psig equals 27.68 inches water column). This means that installing a fan on the bin vent discharge typically won’t have a significant impact on the cost of the air mover.

Also, the fan performance curve, which charts the system airflow versus resistance, is relatively flat for a system with a PD blower, which means that slight changes in system resistance won’t significantly change the airflow. As a result, conveying system performance isn’t typically a concern when deciding whether to add a bin vent fan to a system using a PD blower as the air mover. Ignoring the cost of the bin vent fan itself, the choice may simply depend on the desired pressure conditions in the silo and bin vent.

Some systems control the bin vent fan using a variable frequency drive (VFD), which adjusts the fan speed to maintain a slight negative pressure inside the silo. This can be beneficial for systems that feed into an additional downstream pressure pneumatic conveying system using a rotary valve that vents back into the silo. Systems can also be designed to pneumatically fill the silo with a specified air volume.

Finally, it’s important to remember that any changes you make to your conveying system can potentially change the pressure inside your silo. Be sure to check the pressure or vacuum relief valve setting or contact the silo’s designer to make sure the change hasn’t compromised the silo’s structural integrity and safety.

For further reading
Find more information on this topic in previous “Pneumatic points to ponder…” columns or in articles listed under “Pneumatic conveying” in Powder and Bulk Engineering’s article index in the December 2016 issue or the Article Archive at PBE’s website, www.powderbulk.com. (All articles and columns listed in the archive are available for free download to registered users.)

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For pressure pneumatic conveying systems with multiple silos, each silo typically has its own bin vent.