8 Tips for Applications

1. Minimize elbows and angled runs-Pressure drop and attrition are highest in elbows (for the effective distance solids travel). Most of the wear and maintenance seen in pneumatic conveyors is due to the elbows; so it often is best not to use too many. The major exception to minimizing the number of elbows in a system is for a line that needs to go up and then horizontal. While an angled run offers the shortest distance between two points, it does not have lowest pressure drop. Indeed, a conveying line going up at a 45° angle has much higher pressure drop than a horizontal and vertical line with three elbows. Putting elbows too close together is another major mistake, due to acceleration effects. Many models just count the amount of elbows but placement in the layout is more important. The lowest number of elbows is not always optimum.

2. Calculate velocity every 10-20 feet down the line- don’t rely only on measurements of the pickup velocity or the maximum and minimum velocities in the system. The velocity of the gas and particulates should be determined along the entire length of the line, to ensure that the correct density is used to determine the choking and saltation velocities. This makes the design a trial-and-error calculation. Shortcut design methods often overlook this critical step.

3. Check acceleration lengths at feeders and around elbows -It takes time for a particle to reach its slip velocity (effective velocity below the gas velocity). Particles also must be dispersed across the conveying line so the solids-to-air ratio is uniform otherwise the saltation effects will be drastically different.

4. Extra caution with pipe joints -Piping should be carefully aligned during installation. The use of slip-couplings can allow for gaps or pinched gaskets, even with tie-bars. Even welded pipe can be improperly fabricated at the flange due to misalignment and cat teeth from the welds. When joining pipe, specialized welding methods can prevent slag inside the pipe.

5. Slow the particles down before the collector- Particle-to-particle impact is the biggest source of attrition. Even discharge into a bin can result in a significant amount of attrition as the particles strike the pile. Bag collectors increase the particle-to-particle contact unless there is a cyclonic inlet or an expansion of the line prior to the collector. The acceleration velocity can be used to judge the length of any deceleration spool piece, generally about 25% of the acceleration length, or the optimal distance between elbows, as described in Tip 4.

6. Watch for leaks - Small leaks can cripple operation by reducing or increasing the difference between the gas and saltation velocity. High velocities lead to high pressure drop and attrition; low velocities lead to transitional flow (dilute to dense). The obvious location of a leak is at the feeder. When several feeders are on the same convey line, check for leakage at each one. Diverters and misaligned pipe also can contribute to the problem. In vacuum systems, the area around the collector, including the discharge valve, can be a major leak source.
7. Vent the feeder valves and factor the amount lost into the design. If there is one thing that can upset a pneumatic conveyor its sudden changes in solids-to-air ratio. An unvented solids feeder prevents the pockets from filling uniformly and can fluidize the solids in the tank or bin above the feeder. The solids can flood the valve, prompting over-consolidation and bridging. Not only does the solids-to-air ratio change but particles also can be pinched in the feeder and break. Figure 2 shows a way to vent the valve in the absence of a vent port supplied by the manufacturer. Note the use of an insert to prevent particles being pinched between the housing and rotor.

8. Look for frictional differences between products. Sometimes after conveying one material and either making a change to the ingredients or trying to convey a different material we forget that the particles may not behave the same. While basic physical properties can be helpful in predicting a problem, you can’t go wrong with a few tests. Frictional changes can be subtle.