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Yes, Pneumatic Conveying Lines Can Be More Than 1,000 Feet Long

Source: Aerzen USA

When food processing plants need to convey material over distances greater than 1,000 feet, mechanical conveying is considered the preferred method. Pneumatic conveying, it has traditionally been thought, is too impractical and expensive for such applications.

However, mechanical conveying only works in applications where contamination isn't a concern. When contamination must be avoided, pneumatic conveying is the ideal method of transporting material. So, while uncommon, can pneumatic conveying systems work across distances of 1,000 feet or more? The answer is yes, but it requires careful consideration of multiple factors, including material, temperature, pipe diameter, and the size of the blower motor. In such cases, it is ideal to work with the blower manufacturer to ensure that the system has the necessary amount of power to handle the distance without damaging the product.

Challenges In Long Pneumatic Conveying

Pipe diameter plays a significant role in long pneumatic conveying lines. Smaller pipe diameters limit the amount of air that can be delivered, increasing speeds for the same amount of blower pressure. Moreover, longer pipe lengths have a greater risk of turbulence. To counter both problems, it is recommended that long pneumatic systems gradually increase pipe diameters. This reduces both friction and speeds, thus mitigating the risk of turbulence and damage to the product.

When conveying over long lines, it is also critical to keep in mind the impact temperature can have on the material. For speeds less than 25 meters per second, friction-induced temperatures will not cause any damage to materials such as corn flour, wheat flour, oat flour, and similar products when conveyed in a dilute phase.

However, some materials are highly sensitive to temperatures or friction, such as sugar, coffee beans, or cereals. In addition, this material will need to be conveyed in a dense phase, which means higher pressure and higher air temperature. As such, system speeds will need to be much slower, often between 2 and 8 meters per second.

Perhaps the most critical variable for a pneumatic conveying line of any length is the pressure potential of the blower. It is critical to do an analysis of the system capacity not just under normal operating conditions but also during non-normal conditions, such as during blockages.

For example, a system that is intended to convey under 3 psi may require a motor with 7.5 hp. In this scenario, if the pipe gets blocked, the pressure in the system is going to go up, which in turn is going to place additional stress on the motor. But once the motor is overtaxed, the safety will be triggered and the motor will shut down. The solution would be to use a 15-hp motor. Under normal operating conditions, the motor will only be using half its power level. However, when blockages occur, the motor will have the power to push through the blockage and keep the line moving. This is especially important in long pneumatic conveying lines, which can have more bends and greater risk of blockage.

Partnership Makes The Difference

In 2019, one of the largest confectionery producers in Argentina was facing a production challenge. The company had to pneumatically convey 15 tons per hour of wheat flour more than 1,100 feet from the flour mill to the production facility. While there were concerns about plugging in a pneumatic conveying line of such length, food safety standards meant that mechanical conveying was not an option.

To tackle the challenge, the project department partnered with a global pneumatic conveying manufacturer with extensive experience in the food sector. Together, they worked on the system design to convey the material needed for the process. The final pipe layout included:

- 246' horizontal pipe with a 6" pipe diameter
- 13' vertical pipe with a 6" pipe diameter
- 410' horizontal pipe with a 6.5" pipe diameter
- 465' horizontal pipe with a 7" pipe diameter

The manufacturer originally calculated for 460 mbar for the blower power. However, a deeper analysis conducted in partnership with blower manufacturer Aerzen determined that a pressure capacity up to 900 mbar would have enough additional pressure to overcome system shutdowns without any problem. The system began operating in March 2022 running up to 10 tons/h, with expectation to hit full capacity in the months to follow.

Working together with the production facility engineering department, system manufacturer, and equipment supplier guaranteed that the required knowledge and application expertise were available for the project. Despite the real limitations of conveying bulk materials through long piping systems, when the right know-how and expertise are applied, this challenge can be overcome.