Factors to Consider When Sourcing Pneumatic Conveying Systems for Powders That Are Difficult to Move

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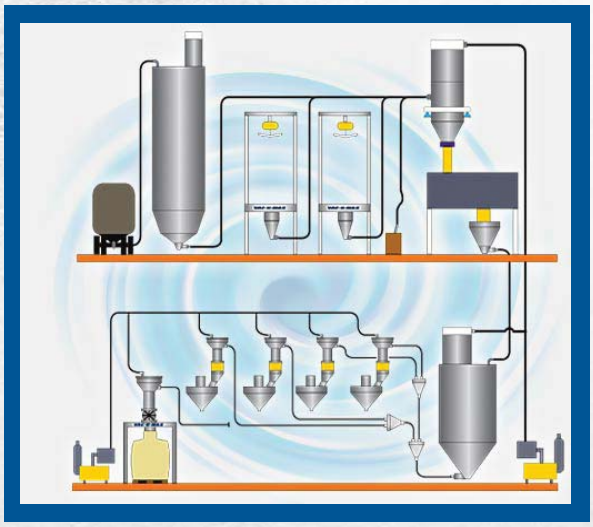
How to Source Pneumatic Conveying Systems for Powders that are Difficult-to-Move

It is important to know before purchasing or repurposing any pneumatic conveying system, whether the powders or bulk materials may be difficult to convey. Although it is a challenge to move difficult powders with a pneumatic conveying system, it is not impossible.

"Difficult Powders" are materials with poor flow properties that do not want to move. Cohesive and lightweight powders such as carbon black, ultra fine particles, non-granular powders, TiO^2, calcium carbonate, and substances known in the industry as "conveying mud" – iron oxide, zinc oxide, and toner – are very fine, sticky and difficult to convey at 2,000-5,000 lbs pr/hr or (907-2,268 kg. pr/hr), rates typical in many industries.

The main challenge in moving these powders is getting them into the conveying line from the pick-up point, feeding them at a constant rate, and getting the powder to discharge from the material receiver. Once the non-free flowing materials are entrained, they are fluidized and convey easily and do not build up on the conveying tubes.

When non-free flowing material is introduced at the pick-up point, some bulk material may go in but it could bridge or rat-hole at that point. If the bulk material does not flow down into the pick-up point, only air will be conveyed, not product



Mechanical and Air Solutions Depend on the Powder and It's Characteristics

There are several options that make it possible to get sticky or non-free flowing materials into a conveying line at a constant rate. It is critical to have the proper solids-to-air ratio. If it is too high, the line will plug. If it is too low, the pneumatic system sucks-in mainly air and does not transport much material.

One way to enter bulk materials at a constant rate is to introduce the material into the convey line where the air flow is mechanical, typically with a rotary valve, or physical, typically done with with a screw feeder. Other ways to help mechanically move the powder or bulk material, and ensure the correct solids-to-air ratio, is with the aid of specially devised flow promotion devices, specifically vacuum receivers and suitable filters placed in the correct locations. Flow promotion devices can be vibration on the outside of a bin or hopper that knocks the material loose, or a small air cannon that injects air into the material to prevents it from sticking to the hopper and feeder walls.

When repurposing a conveying system, a common problem is that it will not work with new or other bulk material. It is important to evaluate every single powder that is difficult to convey, even small differences, like processing plants that

have two locations, each using powders from different suppliers or different grades and material characteristcs, all may have an impact on processing, production and end-product quality.

There are different grades of calcium carbonate, which when mined from the earth, is rocky and free-flowing. The more it is milled down to a superfine powder, the more cakey and sticky it gets.

Titanium dioxide – a very popular additive ingredient in white paint or anything that requires a whitening additive – is similar. The finer it gets, the worse the pneumatic conveying becomes.

Unless the material is something like granulated sugar that is easy to convey and similar no matter who makes it, each difficult powder may need to be handled differently. Typically, pneumatic conveying system vendors duplicate a factory's conditions in a test lab to determine if a quoted system will work and, will make adjustments if it does not.

Before Contacting a Supplier

Before approaching a vendor to source a fully automated pneumatic conveying system for batch or continuous processes, have a good understanding of what the equipment will be expected to do. It may be as simple as moving a bucket of bulk materials from one place to another.

Know what type of bulk material will be conveyed and its bulk density, or weight in lb/cu ft. This helps determine the size of the tubing, filter, receiver, and vacuum pump in the conveying system. It is much different to move powders at 5,000 lbs/hr (2,268 kg/hr) that are 100 lbs/cu ft than those that are 500 lbs/cu ft.

Know the characteristics of the powder to move. Free-flowing products that are unproblematic and commonly conveyed may be plastic pellets, granular sugar, rice, salt, any granular powders. It is easy to test whether a material is free-flowing by taking a scoop of the material and pouring it out. If a dry powder has a slight moisture or fat content to them, or can absorb moisture, like flour, or if they are oily, they aren't free-flowing.

Know whether the material is subject to breakage and if the integrity of the material should be maintained when it is introduced into a packaging machine or to the final consumer. This is important to know in order to specify the correct handling system. Handling a fragile mix, such as cereal, so it doesn't come out as dust, is different from handling a coated tablet so it comes out intact without breakage.

Know the horizontal and vertical distances the bulk material will be conveyed. The further away the pickup point is from the filter receiver or destination, the larger the system becomes. Conveying 10' vertical and 20' horizontal at 5,000 lb/hr is different from 50' vertical and 200' horizontal at the same speed.

Know the layout of the equipment in the plant and if there are any 90 degree bends in the conveying path. Each one is equivalent to adding an extra 20' of conveying distance into the system. For conveying, the closer together the equipment, the better, but sometimes close is not possible. Equipment may need to be kept separate for cross contamination reasons, be subject to cleanroom constraints, for safety reasons to contain materials if there is a spill, or if different operators work in different locations.

Know how many pick-up points and what type of sources bulk materials will be delivered in. Material may be located in different places from different sources; a 30-gallon drum from one supplier and a 50-lb bag, supersack, or bulk bag from another. A vacuum conveying system can't pickup from multiple points at the same time since air takes the path of least resistance.

Typical VAC-U-MAX Powder-Handling Receiver for Batch & Continuous Operation

If there are multiple pick-up points, and one is full of bulk materials and the other is empty, the system will try to draw air from both, and pick-up only air. Either consolidate sources, or buy two conveying systems.

Know what device is located at the pick-up point to pick-up the bulk material. Is it a bagging station? A bulk bag loader? A wand? A lance? A tube that is inserted into a drum that an operator has to move around around to convey?

Have a good idea about what conveying rate is desired in lbs/hr (kg/hr). Users who have been in business for a long time or have process engineers with pneumatic conveying experience may know the rate, but most users do not have an idea beyond a rough guess. Start with what is known, for example, a ribbon mixer willrun 3 batches per hour and 5,000 lbs goes into each batch. The mixing time is 10 minutes and it runs for 30 minutes every hour, so it takes 5 minutes to get 5,000 lbs/hour into the mixer.

Knowing the company goals can help specify a system, such as the desire to do 3 batches per hour, but it may cost $150k at one rate and only $75k at another. Sometimes slowing down a little can drastically save on costs.

Know where the material is going. Multiple delivery points are ok. It is possible for vacuum systems to convey to many different locations. Know the size of the openings that will be fed. Sometimes openings on tops of tanks may be too small to handle the materials and may need to be modified.

Know how much headroom is available. The smallest filter receiver is 35" tall, and maintenance access may be required. Sometimes false ceilings or tiles from a 2nd floor could be removed to create headspace. If there is not enough headroom, consider other means of conveying.

Know whether materials will be subjected to fumes, heat, or vapor at any time during conveying. Almost all vacuum conveying systems use cloth filters in the vacuum systems, and fumes, heat, or vapors could stick to the filters causing problems. Air purges, isolation valves, or low pressure vacuum could be used to reduce or eliminate contact with the filters.

Know what type of steel is compatible with the materials to be conveyed. Some industrial or chemical applications such as chlorine-based swimming pool chemicals are harmful to stainless or carbon-steels, so chemical resistant coatings may be specified for the conveying system.

Know the combustibility and explosibility ratings for the materials that will be conveyed. Most pneumatic conveying is part of an automated system with few operators and little dust around. But powders are conveyed at high concentrations inside tubes, and sometimes, if the right oxygen mixture and ignition source such as an electric spark could be present, it is important to know if the powder is combustible. Have the powders tested by a third party company and check OSHA's combustible dust initiative to see if dust from the powder is combustible. Chemical suppression or explosion mitigation equipment such as a vent may be needed.

VAC-U-MAX Filter Separator and Bulk Bag Loader for Carbon Black

Conveying systems use compressed air. Know whether the facility has sufficient electricity and compressed air available. If not, a supplementary compressor may be needed.

Contact the Pneumatic Conveying Expert

VAC-U-MAX is a worldwide leader in handling difficult non-free-flowing and dusty powders, specializing in the design and manufacture of pneumatic conveying systems and supporting equipment for conveying, weighing and batching of dry powders and other bulk ingredients. VAC-U-MAX has many firsts, including the development of the first air-powered venturi, first to develop the technology of direct-loading of vacuum tolerant process equipment, and the first to develop the vertical-wall "Tube Hopper" material receiver. Additionally, VAC-U-MAX developed the first air-operated industrial vacuum cleaner built on a 55-gallon drum in 1954. VAC-U-MAX has customized and perfected process automation systems for bulk ingredient handling to process industries worldwide.

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