The Advantages of Pneumatic Conveyors vs. Mechanical



ONE WORLD-GLOBAL SERVICES

cyclonaire®

PNEUMATIC CONVEYING SYSTEMS

The Advantages Of Pneumatic Conveyors vs. Mechanical

Two primary methods for transferring bulk materials are by pneumatic and mechanical conveyors. When making choices in bulk material handling, there are a number of considerations to address in order to select an optimal convey method for handling a specific material for a unique application.

Pneumatic & Mechanical Conveyors: Overview

Pneumatic convey systems are used to transfer powders, granules and many other types of dry bulk materials from one process area to another through negative conditions (vacuum) or positive conditions (pressure). These systems are comprised of four basic elements; an air source, a material feed device, a convey line and an air-material separator. The primary difference between pneumatic and mechanical conveyors is that pneumatic systems convey material within a fully enclosed line—which greatly reduces the possibility of material loss.

The basic components of a mechanical convey system include a drive motor through a gear and/or chain reducer, connected to a drive device, such as a roller or a sprocket. The energy of the motor is transferred directly to conveyor, which is in direct contact with the material. Mechanical conveyors can be opened or closed to the atmosphere, with hundreds of moving and working parts.

Pneumatic or Mechanical Conveyors: Determining the Best Method for You

The most important factor when selecting a type of conveyor is the form of material to be transferred. Identifying the key characteristics of your material will help determine the best convey method for you. These characteristics include:

- Hygroscopic
- Abrasive
- Explosivity
- Moist, sticky or packable
- High-bulk density
- Fluidizable
- Friable
- Mixed particle sizes
- Temperature sensitive
- Very sluggish flow
- Cross contamination issues
- Other characteristics may need to be discussed with an engineer and equipment manufacture.

Ideal materials for pneumatic convey systems are fine, fluidizable, dry powders. These particular characteristics allow the material to be aerated (fluidized) and successfully pumped through a convey line. Some types of granular and pelletized materials are also good candidates for pneumatic conveying. A few materials commonly transferred with the use of pneumatic conveyors include wheat flour, cement powder, carbon black, starch, sugar, plastic pellets and resins, food products, coal fines, sands and metal powders, among many others.



Mechanical conveyors are more practical for heavy, granular materials, such as whole grains, crushed rock, gravel or wet sand.

Mechanical conveyors are well suited for heavy, granular materials that may be moist, doughy and packable. Mechanical systems are more practical for materials with widely varied particle distribution; materials with both small and large particles combined. Materials commonly transferred by mechanical convey systems include whole grains, crushed rock, gravel, wet sand and large food particles, among others.

Another significant factor when selecting a type of conveyor is the application. Application has several key areas to consider, including:

- **Transfer Rate:** Both pneumatic and mechanical systems can convey a few pounds to hundreds of tons per hour; however, the type of material and the convey conditions will determine the system.

- **Distance:** Generally, pneumatic systems are not used to convey short distances, as it requires the same amount of equipment to convey 20 feet as it does to convey 600 feet. The transfer of bulk materials over short distances can be accomplished with mechanical equipment even at the cost of some damage to the material or wear to the equipment. Both types of systems can be used for distances well over 1,000 feet if required, but the expense of installing the simple convey line (pipe) versus the structure for a belt is an important consideration. Long distances with multiple changes of direction and elevation are easily accomplished with a pneumatic system.

- **Installation Environment:** Indoor or outdoor installations; certainly the enclosed pneumatic system offers some distinct advantages for most outdoor installations. Altitude; air is less dense at altitude and in some circumstances can have enough effect on a pneumatic system design rate to create a disadvantage in the form of larger equipment, especially the air source, when handling a difficult material. System clean-out and clean-up can be problematic for mechanical systems, such as a screw conveyor or bucket elevator. However, purging of material from a rotary valve or pressure tank and convey line are ordinary features of pneumatic conveying stsyems.

Pneumatic Conveyors: A Host of Advantages

Simple Routing

Compared to mechanical conveyors, pneumatic systems help simplify the routing of bulk materials transfer paths throughout a plant. For example, screw conveyors only run in a straight line and are limited on the amount of incline (based on materials). Additionally, screw systems require precise installation to keep alignment intact and take up a large amount of floor space. Pneumatic conveyors, on the other hand, are far easier to route. Because the convey line consists of simple pipe, they usually require minimum floor space and the line can flow in both horizontal and vertical directions. Oftentimes, the convey line can be attached to existing structures, columns, or rafters, thereby eliminating the need for special foundations and support frames. Most pneumatic systems actually free up floor space if replacing a mechanical system, allowing for a high level of design flexibility in material routing. Convey lines can be easily adapted to existing equipment, and can be built to avoid or go around obstructions. Due to the straight route required by mechanical conveyors, any equipment in its path must be relocated during construction, adding expense.



Pneumatic systems are easy to route and because they consist of enclosed pipes, do not require floor space and can flow in any direction.

A Cleaner Method

Pneumatic conveyors eliminate many opportunities for spillage that occur with mechanical conveyance systems. Because mechanical conveyors primarily work in straight lines, there may be many points of transfer of the bulk materials along the way, such as changing direction or feeding from one conveyor to another. Whenever transference occurs, material spillage is possible. Spillage can also occur whenever materials are stopped in the transference process, which is especially important to consider when transporting hazardous materials.



It is not unusual to combine different types of mechanical conveyors to create a single transfer system, for example, a screw conveyor feeding a bucket elevator.

It is not unusual to combine different types of mechanical conveyors to create a single transfer system—for example, a screw conveyor feeding a bucket elevator. However, when doing so, it is vital that the design rates are compatible to avoid overfilling or underutilization of the next conveyor in the series. Overlooking this detail creates the possibility of spillage at each transfer point. Additionally, a complex dust system is often required to mitigate the escape of dust at the intersection of each conveyor.

A pneumatic conveyor is an enclosed system, so it will more fully protect a company's workforce and the environment at large from potentially dangerous spills. The enclosed design also prevents product contamination, which is especially important when dealing with sensitive products, like sugar. Contaminated food items can cause serious health and financial ramifications. Enclosed piping systems create a seal during transference that helps keep contaminants out, as well as keeping hazardous materials in. This protects the material and also protects workers and the environment from any hazardous materials being transferred.

Pneumatic conveyors also protect against dust, which can become a significant hazard when transporting certain materials such as starch or activated carbon. Exposed dust can increase the risk for explosions as well as endanger the health of employees. A pneumatic system, simply by concept, will contain particles and eliminate dust from escaping during material conveyance, nullifying these risks.

Less Maintenance

One thing that all mechanical conveyors have in common is an abundance of moving parts. A multitude of belts, rollers, and bearings are used in their construction, and all of these parts need to be maintained. If proper maintenance is not completed, failure could result, possibly leading to catastrophic results to the transportation system and the bulk material being conveyed. Mechanical systems such as bucket elevators can fail if a single belt or chain in the system breaks. Even notwithstanding the possibility of part failure, the individual maintenance and inspection of all the working components of mechanical conveyors drive up the cost of operation.

Pneumatic conveyors break down into only a few key working parts: an air compressor or vacuum pump, an in-feed device, piping or tubing for transference, and a separating device. Each part of this system is repairable at the component level with the equipment remaining in position, so the entire system will not need to be removed or replaced; only the single failed part. Pneumatic systems rely on the airflow created by a fan or blower rather than the multiple parts that make up mechanical systems. The overall result of having so many fewer moving parts is less susceptibility to mechanical failure, which keeps productivity and efficiency working at the highest levels.

Flexibility, Now and for the Future

If a process change creates the need to expand a mechanical conveyor system, it will usually entail using entirely new equipment in addition to the existing system. For example, if a conveyor belt system is set up to feed a furnace, and the company at some point wants to add another furnace, an entirely new mechanical system would need to be constructed. In this case, for a pneumatic system, a simple diverter valve and pipe for the new furnace would be installed, saving the expense of adding a great deal of new mechanical equipment. Pneumatic conveyors are far easier to work with in situations where the scope of the system could increase. In the end, this not only saves plant space, but provides substantial savings on the cost of expansion.

More Safety

Another consequence that comes from working with an abundance of moving parts is a need for greater safety awareness. Gears, bearings, belts, and other parts all contribute to the chance that a worker could suffer injury from getting too close to the moving components. There are simply more opportunities for a hand or a finger to get pinched with all of these moving parts that need to be maintained and serviced. Pneumatic systems essentially eliminate this risk since all components are sealed to contain pressure or vacuum and thus have few exposed moving parts.

Another way that pneumatic systems are safer is in relation to noise control. The motors, drives, chains, belts, and other moving parts that are essential for mechanical conveyor systems naturally create a noisier environment. The fewer working parts in pneumatic systems create a quieter operation, ultimately making for a more hospitable and safer working environment. By placing the air source in an enclosed environment, noise is virtually eliminated and the compressed air is easily piped to the point of entry into the pneumatic system.

Pneumatic systems not only help keep employees safe, they can also safeguard the materials being transferred. Sugar left open to the atmosphere will attract all type of attention from insects. The sugar also will seek moisture from the air. When sufficient moisture is available, it will cause clumping and can make things difficult for downstream equipment to operate well, such as feeders or dispensers. By keeping the sugar enclosed and purging any silos or hoppers with dry air, the material can be protected and kept dry, ensuring its ability to transfer well.



Pneumatic conveying systems can handle a variety of materials, including powdered, granular and pellet materials.

Pneumatic Conveyors: Maximum Efficiency, Optimal Performance

Today, numerous materials are transferred quickly and efficiently using pneumatic systems and their enclosed design is responsible for protecting the environment, workers, and the material itself from being disturbed during the process. The overall flexibility of this process has lent itself to handling many challenging materials, including calcium carbonate, carbon black, ceramic dust and lead oxide, among many others.

About Cyclonaire

Cyclonaire is committed to designing and manufacturing the finest pneumatic conveyor systems—from the simplest to the highly complex—and has done so since 1973. Our commitment to your project begins with a careful analysis of your needs, followed by full-scale testing in our state-of-the-art Technology Demonstration and System Proving facility. This facility allows us to simulate your conditions to ensure your company's equipment will handle the target rate, air usage, convey pressure, degradation requirements and other important parameters without risking capacity or extra capital investment.

Learn more about Cyclonaire and its products at www.cyclonaire.com.

