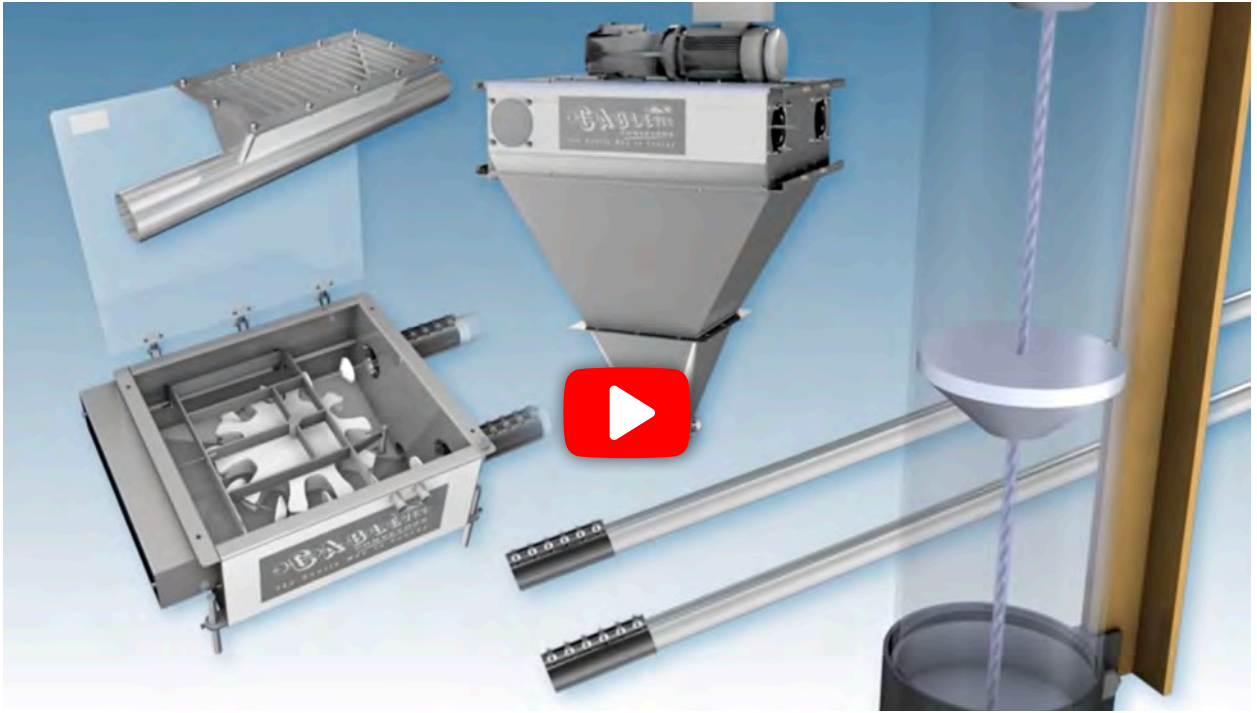




Leave Issues in the Dust:
**ENCLOSED TUBULAR
CONVEYOR SYSTEM**
Both Secure and Reliable



The Gentle Way to Convey®



Industrial processing companies such as those that manufacture food, animal food, pharmaceuticals, chemicals, and plastics handle an immense variety of powders and bulk solids. Each application and material mix has its own needs and requirements. A number of conveyor types are available to meet those needs.

Friable or more fragile materials, however, are particularly challenging to convey without creating damage. As a result, these conveyor applications demand system design and operations that can meet throughput goals while preserving product integrity. Friable materials can suffer damage or breakage during conveying, leading to spoilage, loss, and diminished product quality.

With these challenges in mind, **Todd Smith**, *Business and Strategy Manager*, and **Kevin Solofra**, *Laboratory Manager* at Kansas State University's Bulk Solids Innovation Center, evaluated one particular conveyor style for its bulk solids handling capabilities—the tubular drag conveyor—outlining its operation, advantages, disadvantages, and applications. This paper describes their findings and observations.

Explanation of the Technology Behind Tubular Drag Conveyors

Many types of conveyors are used to move dry materials from one location to another. For example, traditional drag conveyors achieve this by mechanically pulling a series of plates or paddles through a trough; conveyance occurs as the paddles drag the bulk solid materials along the conveying path.



Tubular drag conveyors refine this method by using smooth disc-shaped paddles to move the material through an enclosed tube or pipe. The refined benefit is clean and gentle conveying when the discs are attached to a continuous smooth cable, and when the cable is mechanically pulled through the tube at slow speeds.

Discs are evenly spaced along the cable, and the ends of the cable are connected, forming a continuous loop. Bulk solid materials are introduced at the source and gently conveyed through the enclosed tube to the destination. Then the empty discs and cable travel back through a parallel return tube, returning back to the source to pick up more material.

The cable and disc system is powered by a motor-driven sprocket. Since pulling a cable is much more effective than pushing it, the powered sprocket is located after the destination so that it can pull the loaded cable from the source to the destination. Another sprocket is used at the other end to make the loop. This lower sprocket is not powered, but it typically includes a tensioning device to maintain the desired tension on the cable.

The end result is a system impressively simple, clean, and reliable due to the engineering effort invested into component and system designs.

Advantages of Tubular Drag Conveyors

Most advantages of tubular drag conveyors center around the gentle handling and the clean system provided by this type of conveyor.

Product integrity is critical for many ingredients and finished products, especially maintaining the desired particle size and shape. Gentle handling to prevent product degradation is essential, and many conveyors struggle to meet this requirement.

Within many other types of conveyors, the velocity of the conveyed material is the most significant cause of particle degradation. At high velocities, particles slam into each other, causing them to fracture or round off the corners of particles. In addition, in many conveyors, the particles impact elbows, chutes, buckets, or the receiver at high velocity, striking these hard surfaces at speeds of 300 to 6000 feet per minute. In contrast, tubular drag conveyors traverse at a slow speed of 20 to 140 feet per minute. This slow speed allows them to handle even challenging friable materials such as breakfast cereals, chips, crackers, roasted nuts, and delicate agglomerates with minimal breakage.

In addition, tubular drag conveyors offer cleaner conveying than many other types of conveyors, since the conveying occurs within a closed system. There is little residual material left after the transfer, which reduces cross-contamination and the need for cleaning. Slow velocity means less dust is generated, and any dust that might be present isn't trying to escape the system due to pressure or Bernoulli/venturi aspects.



Finally, at the request of end customers who require regular cleaning to reduce the chance of contamination or pathogens, unique and thorough methods have been developed for cleaning tubular drag conveyors. The cleaning steps are somewhat intensive, but they meet the industry's and end-users' rigorous hygienic requirements, and automation of the cleaning process can eliminate most of the labor costs.

System Advantages Summarized

- Preserves product integrity due to slow conveying velocity, also reducing abrasive wear of conveying tubes and bends
- Minimizes plant contamination due to enclosed system design
- Maintains desired product mixture, avoiding segregation during transport
- Improves dust control with reduced dust collection requirements compared to other conveying systems
- Enables automated washing operations which also help eliminate residue or pathogens

- Enhances energy efficiencies due to low horsepower requirements
- Expands system layout potential compared to other mechanical systems in terms of direction changes, multiple inlets/outlets or angled installation
- Cuts lead times due to modular system design that minimizes parts while allowing for a wide variety of combinations to yield desired layout and throughput needs
- Simplifies infrastructure by eliminating need for control feedback, sophisticated controls and instrumentation, or dust collection
- Lightens loads on system supports; does not generate dynamic loads or vibration
- Reduces noise levels with quiet operation compared to other conveying systems

Bulk Materials Best Served by a Tubular Drag Conveyor



The tubular drag conveyor outperforms many other conveyor options when product degradation of friable products is a top concern. This makes it especially desirable for the transfer of friable ingredients and products within a variety of industries including food processing, breweries or specialty grains, and animal feed.

Products can include blends and mixes, nuts, coffee, crackers, snack food, cereal, specialty seeds and beans, hemp, rice, delicate or friable ingredients, pet food, and pelletized products such as animal food.

Disadvantages of Tubular Drag Conveyors

The mechanical nature of tubular drag conveyors, which provides the advantages described above, also result in this type of conveyor's disadvantages. For example, the cable must return from the destination back to the material inlet; therefore, a closed loop of tubing is required. And every direction change adds friction and stress to the moving parts, so the layout is limited to a few direction changes, and length is limited as well. Furthermore, mechanical devices can stretch, break or wear out

Each of these potential break points typically are addressed and minimized during system design and installation. Equipment engineers have developed improvements that allow equipment to last a long time, and sensors are readily included to provide an alarm if anything goes wrong. End-users cite system reliability when questioned about this type of conveyor.

System Disadvantages Summarized

- Circular system bound by its design in a loop. After the material is discharged, another tube is required to close the loop and return the cable back to the source
- Layout limitations regarding distance and number of bends, with a maximum of six bends, e.g., three on the transfer line and three on the return.
- Product residue can remain in the system, requiring a dedicated conveyor or wash sequences between changeovers to avoid cross-contamination
- Vibratory feeder is recommended to prevent overfilling at the material source into the conveyor. This also helps prevent material breakage at the infeed point since it can eliminate the pinching of material between the disc and tube at the source opening.

Case study: Oxbow Animal Feed

Oxbow Animal Health is a worldwide supplier of premium, life-staged nutrition, and supportive care products for small, exotic animals. The company takes great pride in the quality journey of its hay from initial delivery to packaging. At its facility in Omaha, Nebraska, the company decided to replace its bucket-style conveyors with 4-inch diameter tubular drag conveyors from Cablevey.

The Problem: Bucket elevators, open to the environment, caused dust and material to constantly fall onto equipment or the ground. In addition to cleanliness, the company needed to maintain its throughput as well, conveying an inherently dusty material to the packaging station.

The Solution: A 4-inch diameter tubular drag conveyor system from Cablevey Conveyors.

The new conveyor system has delivered on key desired attributes/features, including:

- Maintain a full level on the infeed hopper of the packaging equipment
- Reliable performance through two ten-hour shifts, five days a week
- Easy installation and stable structure, hanging, and supporting the conveyor system with standard Unistrut for a system that doesn't sway during operation
- Reduce dust level compared to the bucket conveyor, possible due to the tubular drag conveyor's closed system with pre-screening, wiper disc, and 360-degree air knife. This also resulted in a shockingly low level of dust build-up in the collection area at the end sprocket.
- Effective cleaning in a minimal timeframe, even for changeovers, lasting from ½ to 1 ½ hours, including a full maintenance lockout

Overall Assessment: Oxbow is pleased with the tubular drag conveyor system performance and had no negative comments.

Case study: Boulevard Brewing Company

Boulevard Brewing Company is one of the largest craft brewers in the Midwest, with a capacity reaching an estimated 600,000 barrels of craft and specialty ale and beer brewed annually for domestic and international distribution. At its facility in Kansas City, Missouri, the company decided to transfer malted barley ingredients from silos to processing with 4-inch diameter tubular drag conveyors from Cablevey.



The Problem: Malt barley, the “backbone of beer” is preferred in a friable state, because this indicates the malt has been properly stored, dried, and is ready for use. Gentle handling of friable materials preserves product integrity, and a pneumatic system was damaging the malt.

The Solution: A 4-inch diameter tubular drag conveyor system from Cablevey Conveyors, designed for gentle yet efficient transport of friable materials.

The tubular drag conveyor system was installed underneath eight malt storage silos and uniquely designed to convey malt from any one of the source silos to the next station, a destoner/cleaning operation. The tubular conveyor has delivered on key desired attributes/features, including:

Bucket elevators, open to the environment, caused dust and material to constantly fall onto equipment or the ground. In addition to cleanliness, the company needed to maintain its throughput as well, conveying an inherently dusty material to the packaging station.

The new conveyor system has delivered on key desired attributes/features, including:

- Minimal maintenance needs during production
- Preserves product integrity
- Reliable performance for years with minimal oversight, with the cable holding spring tension, with minor adjustments for cable stretch after three years’ operation
- Greater durability with a single cable replacement compared to six pneumatic elbow replacements in a similar timeframe
- Reduced dust levels, allowing clear vision through the sight glass
- Eliminated blowout of materials at joints or seals

Overall Assessment: As Boulevard Brewing expands its flavor options and compositions, this expansion could include additional Cablevey conveyors due to the system’s simplicity, lack of issues and positive performance.



Overall Conclusion

These conveyors are cleaner and generate less dust than most other types of conveyors. Furthermore, washing is feasible and can be automated. Maintenance and reliability aspects are also good, especially for the light process industries and applications described in this article.

Layout flexibility and limitations make this type of conveyor especially suitable for relatively short, simple configurations with a couple of direction changes.

When choosing the best conveying option, the project engineer must consider the requirements of the particular application, material, and regulations. No conveying option is the best for every application; that is why there are so many choices. As described, tubular drag conveyors can provide the best option when its strengths and advantages meet the challenging needs of these difficult applications.

ABOUT CABLEVEY CONVEYORS

Cablevey Conveyors is a global specialty conveyor manufacturer that designs, engineers, assembles, and services tubular drag cable and disc conveyor systems. With customers in more than 66 countries, the company specializes in moving materials for food/beverage and industrial powder processors that seek food-grade conveying performance with clean, fast, energy-efficient, and cost-effective systems. Learn more at www.cablevey.com.

