

The Most Efficient Distance between TWO POINTS

A solution for when bulk material characteristics, process parameters or space restrictions call for a flexible screw conveyor.

Deciding on the single most efficient method to move your material from point A to point B is a matter of simple deduction: match your material flow characteristics, process parameters and space limitations to the performance windows and dimensional restrictions of conveyors in contention. Then factor in purchase, maintenance, labor and cleaning costs, and your conveyor choice becomes clear.

Because the performance, size and cost of conveying methods vary, only a general knowledge of different conveyor types is necessary to determine which is optimum for you. Armed only with the fundamentals outlined below, you can therefore determine whether your application is handled most efficiently by a conveyor that contains a flexible screw.

Principle of Operation

In basic form, a flexible screw conveyor consists of a spring steel or stainless steel flexible screw that is enclosed in a flexible or rigid plastic tube, or a rigid steel tube, and driven by an elec-

tric motor normally located at the discharge end of the conveyor.

The intake end of the conveyor tube is typically equipped with a charging adapter—a U-shaped trough that connects to the outlet of a hopper or directly to the outlet of process equipment such as a bulk bag discharger, bag dump station, grinder, crusher, screener, blender, reactor or storage vessel of any kind (see Figure 3).

The flexible screw passes through the charging adapter trough, exposing a section of the screw to material flowing into the trough from above. When rotating, the exposed section of screw feeds material into the outer tube, where it is then propelled through the tube by the enclosed portion of the screw.

The loose fit of a rotating flexible screw within a tube filled with bulk material causes the screw to automatically self-center within the tube, providing clearance between the screw and tube wall. This affords sufficient space for particles to flow without damage, depending on the fragility and size of particles being conveyed (see Figure 4).



Figure 1



Figure 2

Figure 3



Figure 4

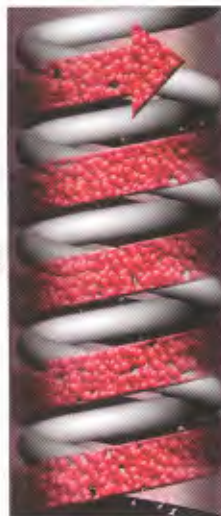


Figure 5

A removable clean-out cap covers the intake end of the conveyor tube, permitting rapid emptying and flushing of the tube, as well as disassembly and wash-down of components.

Because the intake end of the screw requires no bearing, and since the discharge end is coupled to the motor drive above and/or beyond the point at which material exits the discharge spout, material does not come in contact with seals or bearings. The flexible screw is therefore the only moving part contacting material (see Figure 5).

Matching Application Requirements with Conveyor Attributes

A flexible screw conveyor is your most likely choice if its list of distinguishing capabilities closely matches that of your requirements, or if an individual capability exclusive to a flexible screw solves an individual problem of key concern.

Needs should be compared to the following list of flexible screw conveyor attributes.

One Moving Part Contacting Material

The only moving part contacting material in a flexible screw conveyor is a rugged flexible screw, which is directly driven by an electric motor. This simple design does not require the filters, cyclone separators, internal bearings or other moving parts found on pneumatic conveyors, bucket elevators, rigid augers, drag chains, and/or aero-mechanical conveyors—parts that can add initial cost, require maintenance, wear out, breed contamination, and/or break down.

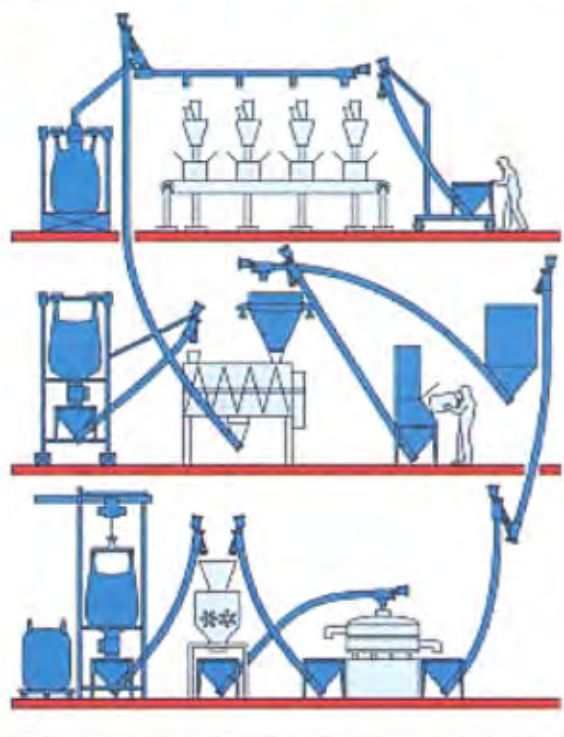
Conveys Free- and Non-Free-Flowing Materials Including Blends

A flexible screw conveyor can transport bulk materials ranging from large pellets to sub-micron powders—both free-flowing and non-free-flowing—including difficult-to-handle products that pack, cake, seize, fluidize, plug, or smear. Materials range from fine powders such as fumed silica, compressible materials such as titanium dioxide, and dense materials such as metal powder, to friable materials such as fiberglass, materials that fluidize such as carbon black, and materials comprised of particle sizes to 1 inch (25mm) such as nuts. The gentle rolling action created by the rotating screw prevents the separation of blended products, even those comprised of disparate particle sizes and and/or densities, throughout the entire length of the conveyor (see Figure 6).

Figure 6



Figure 7



Prevents Contamination

A flexible screw conveyor can be fully enclosed to prevent contamination of bulk products and the plant environment, while preserving the moisture and temperature levels of materials being conveyed. All interior surfaces are smooth, and can be easier to clean than conveyors in which material contacts internal bearings, seams, filters or other internal components. In addition, the units can be designed and finished for use with chemicals, plastics, paints, and other applications.

Conveys in Any Direction

A flexible screw conveyor can move powder and bulk solid

Figure 8



materials vertically, horizontally or at any angle — over, under, or around obstructions, through small holes in walls or ceilings, around obstructions, and over short or long distances to any interior or exterior plant location. This allows users to position the intake and discharge ends of the conveyor according to the preferred system layout, or to awkward layouts as in frequent retrofit/upgrade situations.

Typical applications include conveying of materials between storage vessels, bulk bag dischargers, manual bag dump stations, drum dump stations, crushers, screeners, blenders, reactors, packaging equipment, injection molding and extrusion machines and other process equipment (see Figure 7).

Gentle Product Handling

Depending on particle fragility and size, a flexible screw conveyor can move materials with little or no breakage or degradation. Clearance afforded between the screw and tube wall by the rotating, self-centering screw can eliminate or minimize the grinding, crushing, and impact damage that can occur with other conveying methods.

Rapid, Thorough Cleaning

A flexible screw conveyor contains no internal filters or bearings that can trap particles or breed contamination. Cleaning consists of removing the clean-out cap and reversing rotation to evacuate any residual material prior to flushing the smooth interior surfaces with air, water, steam, or cleaning solution. The screw and outer tube can also be removed rapidly for thorough wash-down of individual components.

High Reliability, Low Maintenance

A flexible screw conveyor contains no internal bearings, filters, or separators to wear, breakdown, or require maintenance. The wear- and fatigue-resistant flexible screw is dri-



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Figure 9



ven directly by an electric motor. Depending on application parameters, a flexible screw conveyor can be started and stopped repeatedly, even under a full load, with no binding or damage to the unit.

Economical to Purchase, Install

The lack of internal bearings, gears, filters or chains — and external compressors, blowers, and separators — can make flexible screw conveyors less costly to build and operate. It can also be economical to install, since the intake and discharge ends can be positioned where desired, without exact conveyor routing, reducing the need to reconfigure other upstream and downstream process equipment.

Mobile Configurations

Flexible screw conveyors can be caster-mounted on frames with conveyor support booms for in-plant mobility, avoiding the cost of multiple stationary units (see Figure 8).

Multiple Discharge Point Systems

Horizontally oriented flexible screw conveyors can feed multiple packaging machines, molding machines and process equipment simultaneously or individually. They can also convey bulk material over long distances, feed multiple discharge points selectively, or top off all points on a timed cycle through manual or automatic slide gate valves.

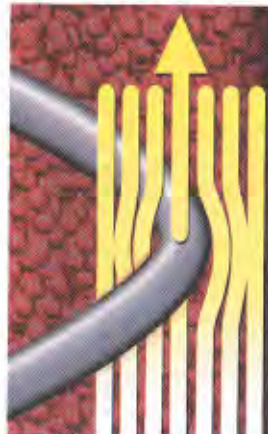
Volumetric Feeding

A flexible screw conveyor can simultaneously meter and convey bulk solid products, since the units can be equipped with AC or DC variable speed drives and hoppers with flow promotion devices for continuous feeding of both free- and non-free-flowing materials.

Weigh Batching and Weigh Feeding Systems

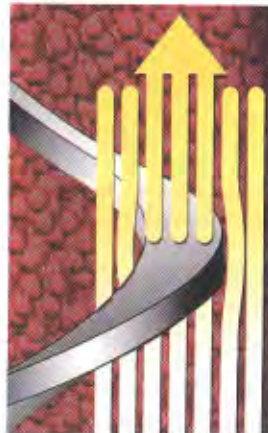
“Gain-in-weight” batching systems consist of individual or multiple flexible screw conveyors discharging into a central weigh hopper or other process equipment, which is equipped with load cells. Gain-in-weight information is transmitted to a central programmable controller, which in turn controls each

Figure 10



The rounded flight surface of round wire screws imparts the material with directional forces that propel it through the tube, and relatively high radial forces that create an effective bearing between the screw and tube wall throughout the length of the conveyor. The material bearing surface causes the screw to self center within the tube, preventing it from contacting the tube wall throughout its entire length, even when the screw/tube assembly is curved, assuming it has been correctly engineered.

Figure 11



These screws are fabricated from spring steel or stainless steel that is square or rectangular in profile. Flat bearing surfaces impart greater directional force and lesser radial force (and material compression) than do round wire screws. Flat wire screws are therefore frequently employed to convey products that tend to compress, as well as fragile materials, low mass materials and those comprised of the finest particle sizes.

conveyor. The batch sequence can be initiated by a start button or by external contact closure. The controller then activates each conveyor, in sequence, to load each ingredient into the central weigh hopper, first at high speed, then at dribble speed before stopping the conveyor when the target batch weight has been reached.

After each conveyor has deposited its ingredient, the entire batch can be automatically delivered to process equipment, storage vessels or packaging lines.

Flexibility of the conveyor tube allows the weigh hopper to be positioned directly above a blender or any other process equipment.

Since the system functions as both weigh feeder and conveyor, it can eliminate the need for separate equipment (see Figure 9).

Avoiding Conveyor Limitations

Since every mode of conveying has limitations, each must be identified and ruled unimportant, or less important than corresponding attributes, before deeming a flexible screw conveyor to be the most compromise-free alternative for your application.

Material Evacuation

Flexible screw conveyors, like other mechanical conveyors, do not generally evacuate material completely when operating in a forward direction. The clean-out cap can be removed, however, and the screw rotation reversed to fully evacuate residual material for reasons of cleaning and/or material changeovers.

Gentle Product Handling

While flexible screw conveyors can have less deleterious effect on materials than do methods that tend to grind, crush, or impact bulk products, not all materials can be conveyed damage-free. A percentage of large, brittle flakes or large, soft particles may, for example, incur breakage, particularly through long runs or steep inclines in a flexible screw conveyor. Proper engineering of a flexible screw conveyor system, however, can eliminate or minimize these effects.

Capacity Requirements

Flexible screw conveyors are currently used for applications with capacity requirements of less than 50 tons per hour (per

conveyor), explaining why they are infrequently used for off-loading of ships or railcars.

Conclusion

If the characteristics of a flexible screw conveyor align neatly with your material characteristics and process parameters, your next step is to provide material samples and application details to a flexible screw conveyor application engineer, who can suggest the optimum system for integration with your new or existing process in the form of detailed CAD drawings, specifications and guaranteed performance ratings. Should your application call for capabilities beyond those outlined above, a fundamental knowledge of other relevant modes of conveying will enable you to determine which incurs the fewest number of compromises, or which best solves your most critical application problems. ●

For more information on conveyors, contact Flexicon Corp., 2400 Emrick Blvd., Bethlehem, PA 18020-8006; phone 610/814.2400; fax 610/814.0600; e-mail sales@flexicon.com; visit www.flexicon.com; or **Circle Number 124**.



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