

FACTORS INFLUENCING SCREW CONVEYOR DESIGN

Abrasiveness, Corrosiveness and Flowability

The Bulk Material Table also presents the relative abrasiveness, corrosiveness and flowability of the bulk materials listed. These characteristics, as well as other special aspects of bulk materials, are given further consideration in the Component Selection Section. The nomenclature used in the Bulk Material Table are listed below.

Description	I	II	III	IV
Abrasiveness	Mildly Abrasive	Moderately Abrasive	Extremely Abrasive	—
Corrosiveness	Not Corrosive	Mildly Corrosive	Highly Corrosive	—
Flowability	Very Free Flowing	Free Flowing	Average Flowability	Sluggish
	Angle of Repose			
	To 30°	30° - 45°	30° - 45°	Beyond 45°

NOTE: Some bulk materials, while they are not corrosive under “normal” conditions, may become corrosive when heated or in the presence of moisture.

Special Characteristics Notes

Notable unusual bulk material characteristics are listed by alphabetical codes in the last column of the Bulk Material Table where applicable. An explanation of these numerical codes is shown on the right and in the Bulk Materials Characteristics section.

A	Builds Up and Hardens
B	Generates Static Electricity
C	Decomposes—Deteriorates in Storage
D	Flammability
E	Becomes Plastic or Tends to Soften
F	Very Dusty
G	Aerates and Becomes Fluid
H	Explosiveness
I	Stickiness—Adhesion
J	Contaminable, Affecting Use
K	Degradable, Affecting Use
L	Gives Off Harmful or Toxic Gas or Fumes
M	Hygroscopic
N	Interlocks, Mats, or Agglomerates
O	Oils Present
P	Packs Under Pressure
Q	Very Light and Fluffy—May Be Windswept
R	Elevated Temperature
V	May Be Conveyed In a Vertical Screw Conveyor
•	Consult KWS Engineering Department



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Quartz

Abrasive Bulk Materials

Abrasive bulk materials may cause excessive wear of screw conveyor components. Screw conveyors must be fabricated from abrasion resistant alloys. Typical materials of construction are AR235, AR400, AR500, TriBrazed or chromium carbide overlay. These materials are harder and tougher than A36 carbon steel for resisting abrasion. The carrying face of the screw may be Hardsurfaced with a weld-on hardsurfacing material. It is also very important to reduce the trough loading and the speed of the screw conveyor when handling abrasive bulk materials.



Copper Sulfate

Highly Corrosive

Highly corrosive bulk materials require the use of corrosion resistant alloys. Screw conveyors must be fabricated from alloys not affected by the corrosive product. Typical materials of construction for highly corrosive products are 304, 310, 316, 410 and 430 stainless steels. Also, high nickel alloys such as Inconel, Monel and Hastalloy may be used.



Drilling Sludge

Mildly Corrosive

Mildly corrosive bulk materials, or bulk materials that have a tendency to become corrosive under certain conditions, may require the use of corrosion resistant alloys. Corrosion is a relative term that is defined by each particular application. Screw conveyors must be fabricated from alloys not affected by the corrosive product. Typical materials of construction for mildly corrosive products are 304 and 316 stainless steels.



Ammonium Sulfate

Builds Up and Hardens (A)

Certain bulk materials build up and harden in the screw conveyor trough. These bulk materials also tend to pack under pressure and absorb moisture. Screw conveyors with close clearance between the screw and trough are required to prevent build up in the trough. Also, high-torque drive units are required to shear through the hardened bulk material and carbide tip teeth can be used as well.

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Generates Static Electricity (B)

Static electricity can be generated as the rotation of the screw tumbles the bulk material during conveying. Plastic pellets will generate static electricity when conveyed by a screw conveyor. Grounding the screw conveyor trough in several locations will help eliminate static electricity. Low trough loading and reducing operating speeds will also help.



Bentonite

Decomposes – Deteriorates in Storage (C)

Some bulk materials will decompose and deteriorate if stored for long periods of time. Bulk materials stored in hoppers, bins or silos must be discharged and processed before being allowed to decompose or deteriorate. As part of the complete process, screw feeder and conveyor design must take into account the characteristics of specific bulk materials that tend to decompose or deteriorate.



Ground Meat

Flammability (D)

Flammable bulk materials will burn when oxygen and an ignition source are present. Screw conveyors can be designed with non-sparking materials to eliminate a possible ignition source. Pressure tight troughs or housings with mechanical shaft seals will keep oxygen from entering the screw conveyor. The inside of the screw conveyor trough or housing can also be purged with an inert gas such as nitrogen.



Hay

Becomes Plastic or Tends to Soften (E)

Certain bulk materials are sensitive to changes in temperature or pressure. The rotation of the screw may cause friction and heat and cause the bulk material to soften. Many food products must be gently conveyed. Lower trough loading and slower screw speeds are recommended for bulk materials that tend to become plastic or soften.



Silica Gel

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Hydrated Lime

Very Dusty (F)

Some bulk materials can become very dusty and leak out from screw conveyors. These dusty bulk materials can become a hazard or even be explosive. Screw conveyors must be completely sealed with special shaft seals to contain the dusty bulk material. Design of screw conveyor troughs or housings depends on the severity of the hazard.



Aluminum Oxide

Aerates and Becomes Fluid (G)

Fluidizing bulk materials will aerate and tend to flow like liquids when conveyed. The “as conveyed” bulk density is much lower than the static or packed bulk density. In some cases the fluidized bulk material will flood and “run like water” with the loss of control of capacity or feed rate. Trough loading will increase causing the flooding of downstream equipment. Lower trough loading and slower screw speeds are recommended to reduce the chance of aeration of the bulk material.



Powdered Milk

Explosiveness (H)

Explosive bulk materials will ignite when oxygen and an ignition source are present. Screw conveyors can be designed with non-sparking materials to eliminate a possible ignition source. Pressure tight troughs or housings with mechanical shaft seals will keep oxygen from entering the screw conveyor. The inside of the screw conveyor trough or housing can be purged with an inert gas such as nitrogen. Explosion venting is also an option for relieving pressure due to an explosion.



Rice Grits

Stickiness - Adhesion (I)

Viscous or sticky bulk materials contain a high percentage of moisture or oil and are difficult to convey. Sticky bulk materials tend to stick to the center pipe of a screw conveyor where the flight is welded to the center pipe. Ribbon flighting is an excellent choice for handling sticky bulk materials. Shaftless screw conveyors provide even better performance than shafted conveyors with ribbon flighting.

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Contaminable, Affecting Use (J)

Contaminable bulk materials lose their value if contaminated by foreign materials. Screw conveyors must be completely sealed with special shaft seals and utilize hanger bearings that will not contaminate the bulk material.



Bread Crumbs

Degradable, Affecting Use (K)

Degradable bulk materials are easily broken down to smaller particles when conveyed and could lose their value. Screw conveyors must be designed for very slow speeds and lower trough loading. Larger screw conveyor sizes are recommended.



Almonds

Gives Off Harmful or Toxic Gas or Fumes (L)

Toxic bulk materials give off vapors or dusts that may be hazardous to personnel. Screw conveyors must be completely sealed with special shaft seals to contain the toxic bulk material. Design of screw conveyor troughs or housings depends on the severity of the hazard. Screw conveyors can be designed to contain internal pressure and even an explosion.



Galena

Hygroscopic (M)

Hygroscopic bulk materials readily absorb moisture and can become contaminated. Screw conveyors with vapor-tight covers are required. It also may be necessary to insulate or provide a jacket for the trough to maintain a consistent product temperature. Purging the troughs with dry gas or air may also be necessary.



Alum

Interlocks, Mats or Agglomerates (N)

Interlocking bulk materials have a tendency to mat together and become resistant to being conveyed. Heavier construction with high torque drives for screw conveyors are required. Intermediate hanger bearings can create an obstruction to flow so may need to be eliminated. Shaftless screw conveyors are a good option for interlocking bulk materials.



Wood Bark

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Fuller's Earth

Oils Present (O)

Oils contained in the bulk material may cause the bulk material to become sticky and adhere to the flights of the screw as well as the trough. Sticky bulk materials tend to stick to the center pipe of a screw conveyor where the flight is welded to the center pipe. Ribbon flighting is an excellent choice for handling sticky bulk materials. Shaftless screw conveyors provide even better performance than shafted conveyors with ribbon flighting.



Compost

Packs Under Pressure (P)

Compressible materials tend to pack under pressure. Bulk materials will lump or pack together as moisture content increases and pressure is applied. Special screw conveyors with "lump breakers" or "breaker bars" can help break up the lumps and reduce packing. Additional horsepower and torque is required to break up the lumps and convey the bulk material.



Grass

Very Light and Fluffy (Q)

Bulk materials weighing less than 15 lbs. per cubic foot have a tendency to be dusty and aerate when conveyed. A larger diameter screw conveyor with lower trough loading and slower screw speed is recommended to reduce the chance of aeration of the bulk material.



Activated Carbon

Elevated Temperature (R)

Hot bulk materials are encountered in many phases of bulk material processing. Screw conveyors should be designed and manufactured with heavy-duty construction and may require 304, 316 or even high-temperature stainless steel alloys. Hot materials can be cooled with KWS Thermal Processors that utilize jacketed troughs and hollow-flight designs.

May Be Conveyed in a Vertical Screw Conveyor (V)

Many bulk materials can easily be conveyed in a vertical screw conveyor. Bulk materials that are of medium density, free-flowing and non-abrasive are ideal for conveying vertically. Bulk materials that tend to aerate and become fluid, interlock, pack under pressure, are very light and fluffy or are degradable are not recommended for use in a vertical screw conveyor. Please consult KWS Engineering for vertical screw conveyor applications.