



BULK MATERIAL CHARACTERISTICS

Conveyor size, speed and horsepower requirements are directly affected by the following characteristics of the conveyed bulk material. More specific information will be discussed in the ensuing pages clarifying several of the factors listed in the Bulk Material Table.

Maximum Particle Size and Bulk Material Lump Size

Particle size is measured in inches or by a mesh screen gauge. Other material size designations such as irregular, shredded, or % oil have special considerations in the design process. In addition to particle size, lump size is also an important consideration and will be discussed in detail in the next few pages.

Bulk Density

Conveying capacity for screw conveyors and screw feeders is calculated volumetrically in cubic feet per hour (ft³/hr). The bulk density of the bulk material is needed in order to convert capacities given in tons per hour or pounds per hour to cubic feet per hour.

The bulk density column of the Bulk Material Table provides an average bulk density or a range of bulk densities for each bulk material. Accurate bulk density information is needed for selecting the proper screw conveyor or screw feeder.

% Trough Loading

Trough loading is a prime factor in determining conveyor size and is based on the maximum depth at which bulk materials will flow through a screw conveyor without causing undue wear on the conveyor components, such as screws, hanger bearings, couplings shafts and troughs. The recommended trough loading is lower for abrasive bulk materials in comparison to non-abrasive bulk materials.

Material Factor (MF)

Material factor represents the resistance of a bulk material to be conveyed and is used for calculating screw conveyor horsepower. The material factor may vary for screw feeders. Please consult KWS Engineering for screw feeder applications.

Component / Bearing Series

The recommended component series assists in the selection of screw conveyor components for a given bulk material. In general, lighter duty construction is acceptable for free flowing and non-abrasive bulk materials. Heavier duty construction is recommended for sluggish and abrasive bulk materials. The alphabetical code refers to the general component series and the numerical code refers to hanger bearing recommendations.

Abrasiveness, Corrosiveness, Flowability, and Special Characteristics

Each of these characteristics affect how the material reacts to and moves through the conveyor.

The characteristics explanations and the Bulk Material Table on the following pages contain important information for the proper design of screw conveyors and screw feeders. Please contact KWS Engineering for materials not listed in the Bulk Material Table.

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Bulk Material Lump Size

Bulk material lump size must be considered when designing a screw conveyor. Screw conveyor diameter not only depends on the capacity of the bulk material to be conveyed, but also the size and proportion of lumps in the bulk material. Lump size is determined by the maximum dimension of the largest lumps. If a lump has one dimension much longer than its transverse cross-section, then the longer dimension will be used to determine the lump size.

The character of the lump must also be considered when designing a screw conveyor. Some bulk materials have hard lumps that won't break up when conveyed by a screw conveyor. Other bulk materials may have lumps that are fairly hard but degrade when conveyed causing a reduction in the lump size. Bulk materials that have lumps that are easily broken up when conveyed have no limitations on conveyor size.

The allowable size of a lump in a screw conveyor is a function of the radial clearance between the outside diameter of the center pipe and the radius of the inside of the trough, as well as the proportion of lumps in the mix. The screw conveyor must be able to convey the lumps without impeding bulk material flow or damaging the conveyor. The lumps must be able to fit in the clearance between the center pipe and the inside of the trough. Radial clearance is shown below.

Bulk Material Lump Classification

Bulk materials are classified based on the percentage of lumps in the total mixture.

Class 1

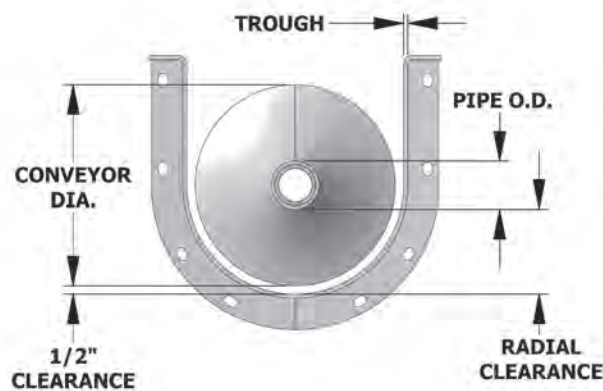
Class 1 bulk materials are a mixture of lumps and fines in which not more than 10-percent are lumps ranging from maximum size to 1/2 of maximum size and 90-percent are lumps smaller than 1/2 of maximum size.

Class 2

Class 2 bulk materials are a mixture of lumps and fines in which not more than 25-percent are lumps ranging from maximum size to 1/2 of maximum size and 75-percent are lumps smaller than 1/2 of maximum size.

Class 3

Class 3 bulk materials are a mixture of lumps and fines in which not more than 95-percent are lumps ranging from maximum size to 1/2 of maximum size and 5-percent are lumps smaller than 1/2 of maximum size.





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Lump Size Ratio

Lump Size Ratio (R) is a function of screw conveyor radial clearance and lump size. The ratio is used to determine the correct screw conveyor design based on maximum bulk material lump size.

$$\text{Ratio, } R = \frac{\text{Radial Clearance inches}}{\text{Lump Size, inches}}$$

Bulk Material Lump Size Table						
Screw Dia.	Pipe Size	Pipe O.D.	Radial Clearance	Class 1 (R = 1.75)	Class 2 (R = 2.5)	Class 3 (R = 4.5)
4"	1-1/4"	1-5/8"	1-11/16"	3/4"	1/2"	1/4"
6"	2"	2-3/8"	2-5/16"	1-1/4"	3/4"	1/2"
9"	2"	2-3/8"	3-13/16"	2"	1-1/2"	3/4"
	2-1/2"	2-7/8"	3-9/19"	2"	1-1/4"	3/4"
12"	2-1/2"	2-7/8"	5-1/16"	2-3/4"	2"	1"
	"3	3-1/2"	4-3/4"	2-1/2"	1-3/4"	1"
	3-1/2"	4"	4-1/2"	2-1/2"	1-3/4"	3/4"
14"	3"	3-1/2"	5-3/4"	3-1/4"	2-1/4"	1-1/4"
	3-1/2"	4"	5-1/2"	3"	2"	1"
16"	3-1/2"	4"	6-1/2"	3-1/2"	2-1/2"	1-1/4"
	4"	4-1/2"	6-1/4"	3-1/2"	2-1/4"	1-1/4"
18"	3-1/2"	4"	7-1/2"	4-1/4"	2-3/4"	1-1/2"
	4"	4-1/2"	7-1/4"	4"	2-3/4"	1-1/2"
20"	3-1/2"	4"	8-1/2"	4-3/4"	3-1/4"	1-3/4"
	4"	4-1/2"	8-1/4"	4-1/2"	3-1/4"	1-3/4"
24"	4"	4-1/2"	10-1/4"	5-3/4"	4"	2-1/4"
30"	5"	5-9/16"	12-11/16"	7"	5"	2-3/4"
36"	6"	6-5/8"	15-3/16"	8-1/2"	6"	3-1/4"

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Trough Loading

Trough loading is the depth of a bulk material in the trough of a screw conveyor and is measured in percent when compared to a full trough. A full trough is considered 100-percent full. Recommended trough loadings of 15, 30 and 45-percent were developed based on the characteristics of bulk materials. The recommended trough loading for a screw conveyor is a function of the density, abrasiveness and flowability of a bulk material. For a given capacity, screw conveyor size and speed is determined by trough loading percentage.

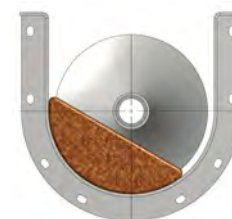
15% Trough Loading

Bulk materials with a density range of 50 to 120 lbs/ft³ that are extremely abrasive and sluggish such as alumina, glass cullet or potash are difficult to convey and do not easily flow through a screw conveyor. The trough loading must be kept well below the center pipe to reduce undue wear on the conveyor components such as screws, hanger bearings, couplings shafts and troughs. The recommended trough loading for bulk materials with similar characteristics is 15-percent.



30%A Trough Loading

Bulk materials with a density range of 15 to 60 lbs/ft³ that are mildly abrasive and free-flowing such as carbon black, fish meal or spent brewers grain will flow through a screw conveyor. The trough loading can be raised to a level below the center pipe without causing undue wear on the conveyor components such as screws, hanger bearings, couplings shafts and troughs. The recommended trough loading for bulk materials with similar characteristics is 30-percent.



30%B Trough Loading

Bulk materials with a density range of 30 to 80 lbs/ft³ that are very abrasive with average flowability such as crushed bauxite, cement clinker or flue dust are difficult to convey and do not easily flow through a screw conveyor. The trough loading can be raised to a level below the center pipe without causing undue wear on the conveyor components such as screws, hanger bearings, couplings shafts and troughs. The recommended trough loading for bulk materials with similar characteristics is 30-percent. The screw conveyor speed is reduced for bulk materials with 30B trough loading when compared to bulk materials with 30A trough loading.



45% Trough Loading

Bulk materials with a density range of 5 to 40 lbs/ft³ that are non-abrasive and very free-flowing such as alfalfa, baking soda or hulled rice will easily flow through a screw conveyor. The trough loading can be raised to the level of the center pipe without causing undue wear on the conveyor components such as screws, hanger bearings, couplings shafts and troughs. The recommended trough loading for bulk materials with similar characteristics is 45-percent.

