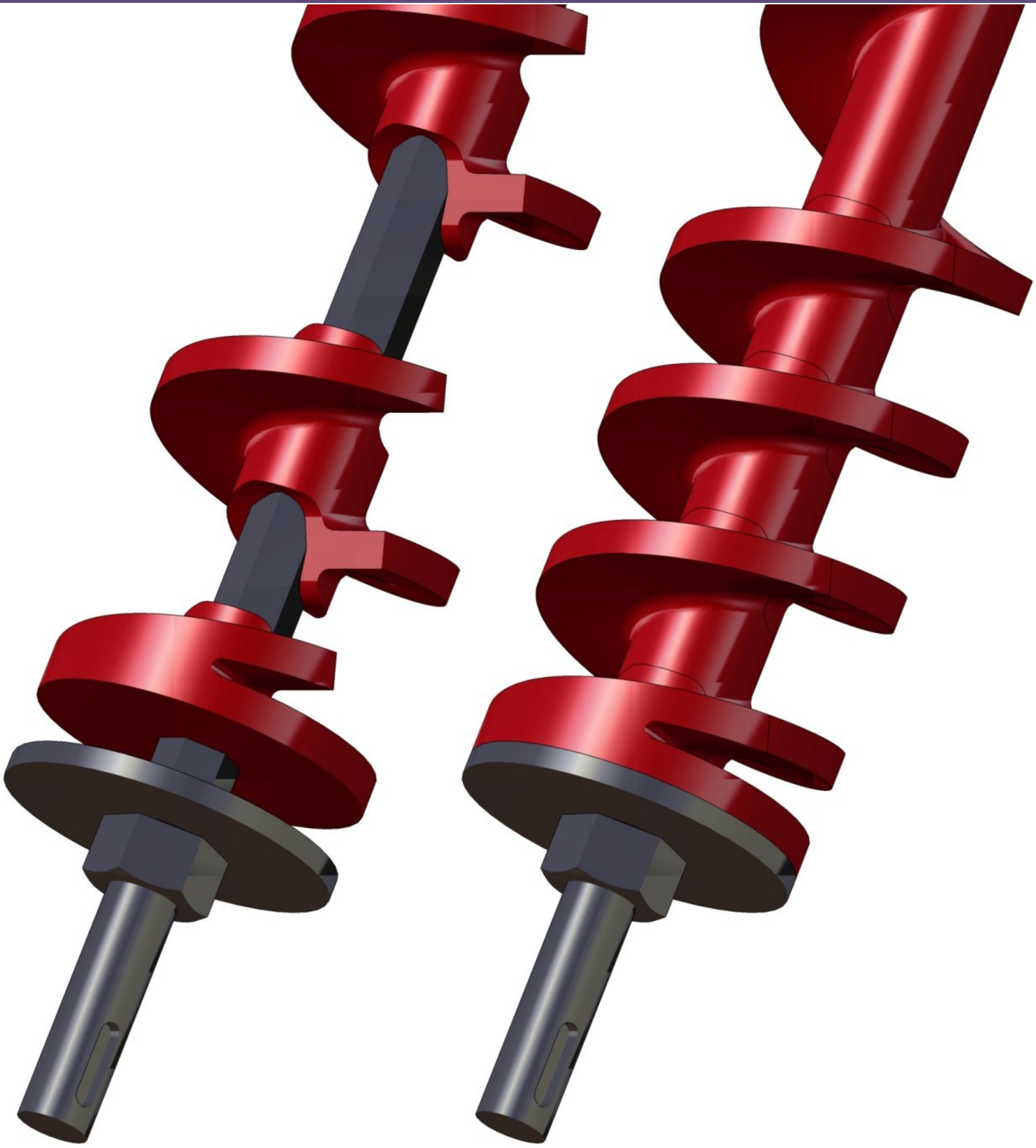


MODULAR AUGER FOR BULK HANDLING

Archimedys™

Industrial Innovation
Award 2011

Exventys
Innovative Products

Contents

Special Note: For illustrative purposes many photographs, diagrams or sketches contained in this catalog show the conveyor top open, without a cover. This is for the sake of clarity only. Conveyors should never be installed, placed ready for operation, or operated without all covers, spouts and drive guards properly installed and secured.

Archimedys™

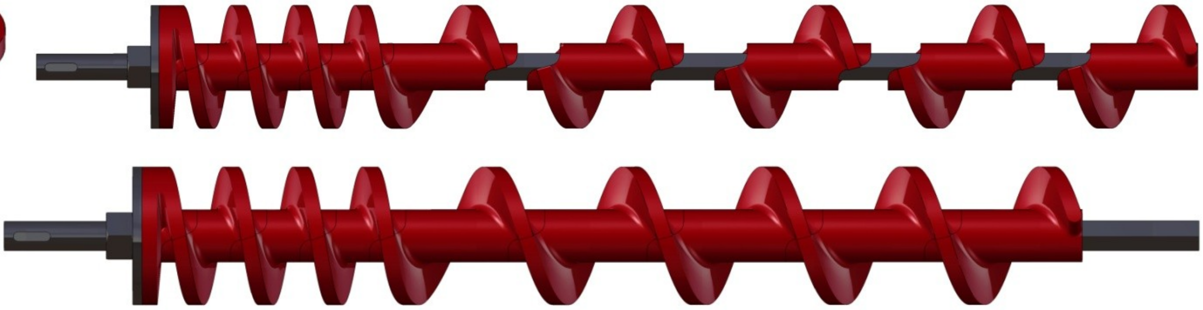
1 Archimedes' screw construction by standard modules assembly

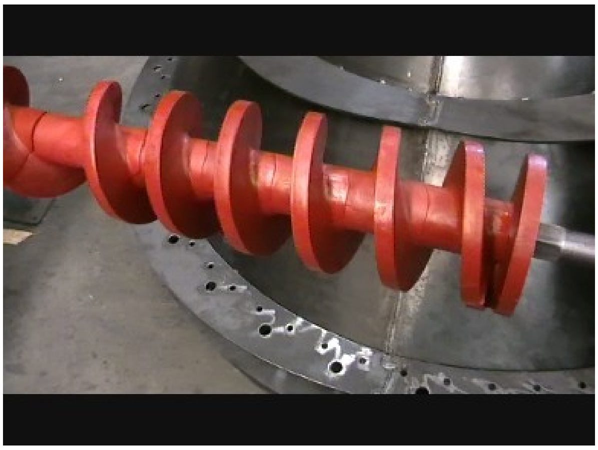
This screw auger catalog and engineering manual consolidates data with product descriptions of modular flightings and component making the Archimedys line for horizontal, inclined and vertical screw conveyors and feeders.

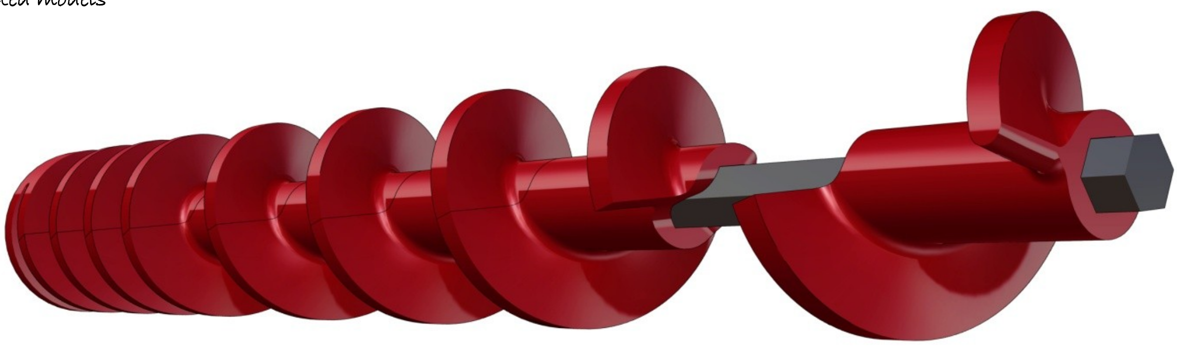
These units are now used in a wide type of industries as well as providing original equipement manufacturers or users with modular solution to fit their design requirements.

You will find in this manual complete in detail, easy to use and extremely helpful in fulfilling your conveying needs.

Patented models







2 Product description

2.1 How it works

Archimedys is a new solution for the realization of the Archimedean screws used for the construction of conveyors, feeders, metering units or for bulk treatment installations. This is simply done by assembling standard screw modules on an axle. When you have locked the assembly with a screw or a nut, your auger is ready for use. You need for example only 20 minutes to build a 7m long screw.

The Archimedys product range is conceived for manufacturers and users of screw conveyors. It has been created for light and medium duty.

2.2 Benefits

- **Easily build your screw without spotting or continuously welding metal flights to a shaft.**
- **Improved rotor spin against the conveyor's lining. No more intermediate bearings needed on long screw in many applications.**
- **Energy savings by reducing the motorization strain and torque.**
- **Simply change the pitch.**
- **Surprising noise attenuation while working.**
- **Strengthened abrasion resistance. Lab tests has shown up to three times more wear resistant than construction with steel in certain applications.**
- **Flightings are naturally resistant to corrosion impervious to a wide range of acids, caustics and other chemicals.**
- **Ensure the maintenance of your equipment and the one of your clients by replacing only the worn out areas without welding or burning. Welding operations become obsolete.**
- **Ecological design allowing the suppression of welding, sandblasting or polyurethane coating in order to protect from corrosion by toxic metals.**
- **Food approval according to FDA and European 1935/2004 regulation.**
- **Slick surface simplifies cleaning.**
- **Specific flightings can be made for any tailored applications.**
- **Excellent balance allowing high speed operation.**

3 Applications and industrial uses

Calcium chlorine conveyor without intermediate hanger

Clay and cement handling

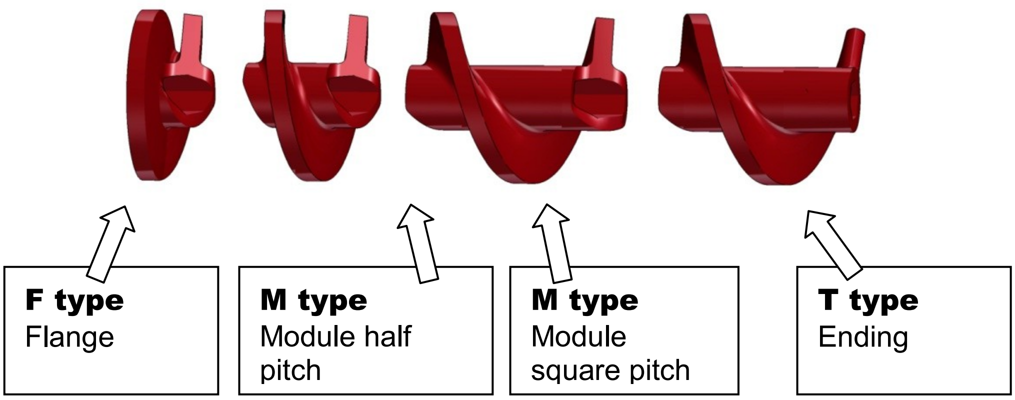
Calcium chlorine conveyor

Grapes machines

4 Product range overview

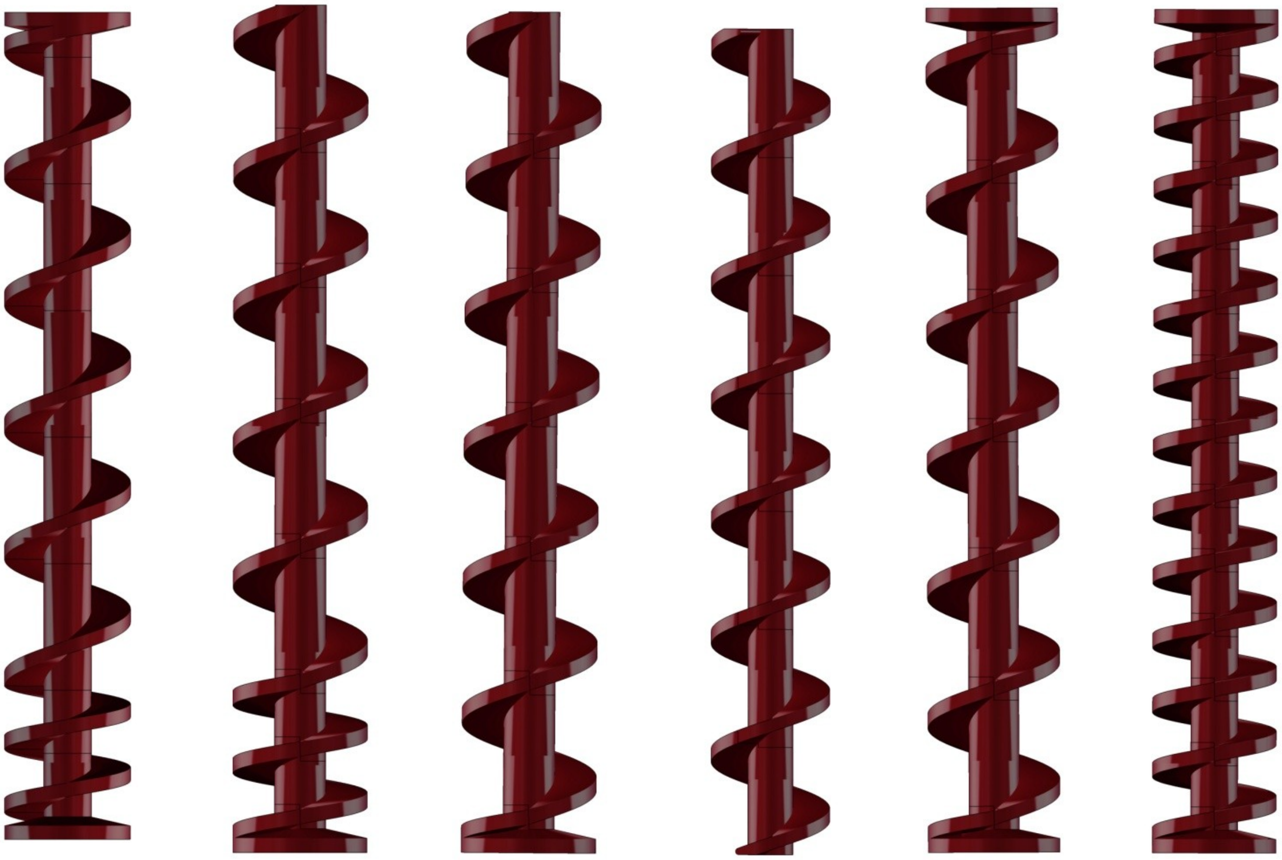
4.1 Modular flighting

The classical diameter range is build around four standard flightings as follow :



4.2 Auger configurations

With these standard modules you are able to create the auger profile according to your requirement. If you need to optimise the design, for example by the addition of a short pitch zone, you can easily have the requested modules even after having built your conveyor.



5 Materials

5.1 U1 High abrasion resistance

The red color is dedicated to the light and medium duty where a high abrasion resistance is required.

5.2 U2 Food contact FDA U3 Food contact Europe

The white color is dedicaced to food contact uses. Material are FDA approved or European regulation 1935/2004.

5.3 Explosive uses

This material has electroconductive capacities and can be used for the construction of conveyors in explosive environment. As a passive component, it has to be included in a ATEX certification done by the final installer.

6 Product codification

Example TRH 150-150 U1

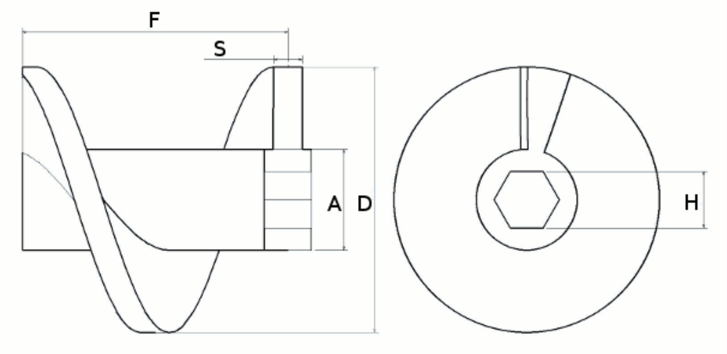
The first letter defines the type of module. **T** is for ending, **M** for conveying module, **F** for the flange and **X** for a mixing paddle. The second letter indicates the module **R** for right hand or **L** for left hand. The third letter is the shape code of the shaft. **H** is the hexagonal shaft and **S** for the square one.

The first set of digits gives in mm the outside functional diameter and the second set gives the pitch.

The last part of the code starting with the letter U1 defines the type of material (U1, U2, U4) as described in the precedent paragraph.

So the TRH 150-150 U1 is an ending module, right hand, hexagonal shaft, diameter 150 mm, pitch 150 mm for high abrasion uses. All dimensions in inches are listed on Tables 1 to 4.

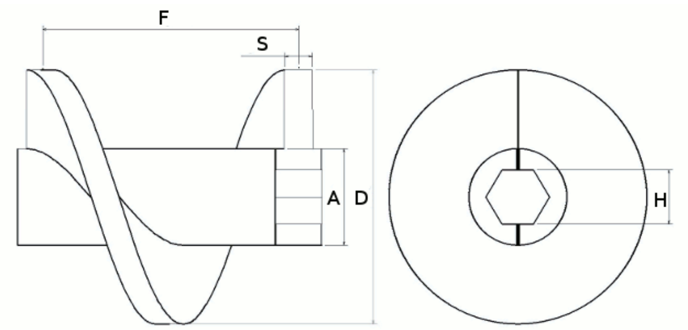
7 modules dimensions and design data



T type module

Table 1 Dimensions of ending flightingS. Sizes in mm (inches)

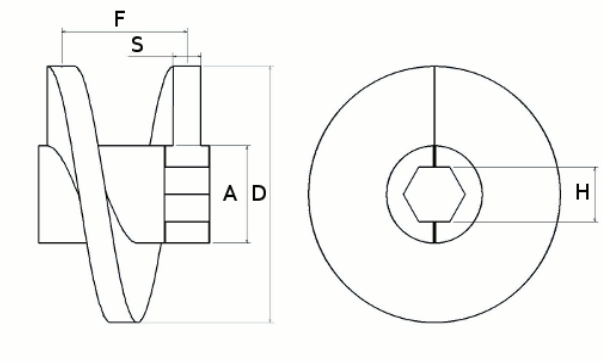
	Hand	D (inches)	Pitch	A	H	F Fuctionnal size	Throughput in cm^3 per rotation with 100% filling level	Throughput in liter per rotation with 100% filling level	Average weight g
TRH 150-150	Right	150 (6)	150	57	32	150	2266	2,27	650
TRH 100-100	Right	101,6 (4)	100	39	22	100	690	0,69	232
TRH 80-80	Right	76,2 (3)	80	30	17	80	269	0,27	110
TRH 50-50	Right	50,8 (2)	50	24	13	50	109	0,11	42



M type module

Table 2 **Dimensions of square pitch flighting. Sizes mm, g**

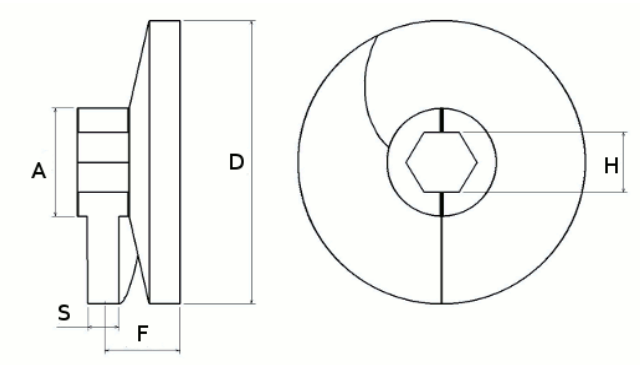
	Hand	D (inches)	Pitch	A	H	F Fuctionnal size mm	Throughput in cm^3 per rotation with 100% filling level	Throughput in liter per rotation with 100% filling level	Average weight in g
MSH 300-300	Right	304,8 (12)	300	101	*US 2’’ *EU 50	300	18800	18,8	1400
MRH 220-220	Right	228,6 (9)	220	57	32	220	8790	8,8	900
MRH 150-150	Right	150 (6)	150	57	32	150	2266	2,27	650
MRH 100-100	Right	101,6 (4)	100	39	22	100	690	0,69	232
MRH 80-80	Right	76,2 (3)	80	30	17	80	269	0,27	110
MRH 50-50	Right	50,8 (2)	50	24	13	50	109	0,11	42
MLH 150-150	Left	150 (6)	150	57	32	150	2266	2,27	650



M type module
Half pitch

Table 3 Dimensions of half pitch flighting. Sizes mm, g

	Hand	D (inch)	Pitch	A	H	F Fuctionnal size	Throughput in cm3 per rotation with 100% filling level	Throughput in liter per rotation with 100% filling level	Average weight in g
MSH 300-300	Right	304,8 (12)	150	101	*US 2 *EU 50	150	9400	9,4	900
MRH 220-220	Right	228,6 (9)	110	57	32	110	4395	4,3	700
MRH 150-75	Right	150 (6)	75	57	32	75	1133	1,13	500
MRH 100-50	Right	101,6 (4)	50	39	22	50	345	0,35	177
MRH 80-40	Right	76,2 (3)	40	30	17	40	134	0,13	85
MRH 50-25	Right	50,8 (2)	25	24	13	25	54	0,05	30



F type module

Table 4 Dimensions of flange flighting. Sizes mm, g.

	Hand	D (inches)	Pitch	A	H	F Fuctionnal size	Average weight g
FRH 150-150	Right	150 (6)	75	57	32	40	600
FRH 100-100	Right	101,6 (4)	100	39	22	25	182
FRH 80-80	Right	76,2 (3)	80	30	17	25	100
FRH 50-50	Right	50,8 (2)	50	24	13	22,5	37

8 Metallic and specific shafts

Hexagonal shaft are the core of modular Archimedys' screw. Different dimensions are available on stock. Shaft standard length is 3m. Metric standard steel and stainless steel hexagon are available anywhere in the world.

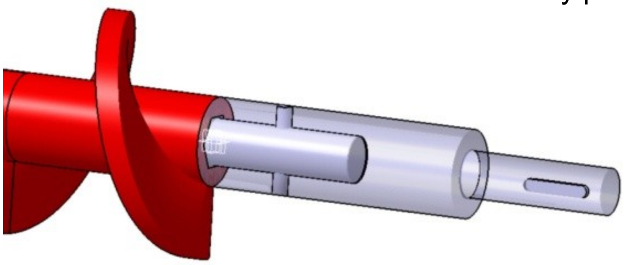
Table 5 Shafts dimensions

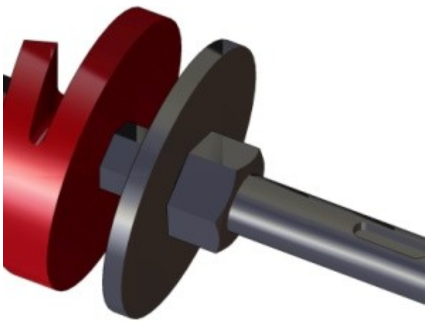
Diameter	Section mm
50 (2')	13
80 (3')	17
100 (4')	22
150 (6')	32

9 Construction principle

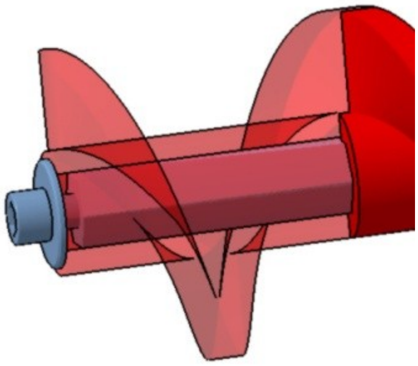
Screws are assembled by the stacking of standard component along the shaft. The main condition to obtain a durable function is to lock modules with a small pressure obtained by applying a nut or a bolt on one side and a fixed support on the other. Each user can customize the drive and or end shaft according to his requirement. Below are the main assembly principles:

Extra movable end shaft with a key pin or bolt





The drive shaft is machined directly.



Fixation with a screw

10 Installation requirement

This section contains all pertinent engineering data and procedures for prescribing and specifying the important features and details of most conveyor installations. In order to secure the design of your screw conveyor, the coming steps have to be followed.

This first step is to define the general operating condition for the conveyor you intend to use. Of course the important information is the length of the conveyor, if it is inclined or not and by witch angle, and the throughput. Special care has to be given in view of the amount of service to which the conveyor will be subject. Continuous, 24-hour-per-day operation will cause more wear than if the conveyor were operating but a few hours per day. This will influence trough thickness.

Factors to specify are :

L = Total length of conveyor in m.
C = Capacity in m^3/h.

11 Bulk material characteristics

Experience shows that the key to successful screw conveyor design is a thorough knowledge of the characteristics of the material to be handled. Table 7 offers a coded classification of many bulk materials. The code is based on the physical characteristics of the listed materials and provides a basis for determining screw conveyor specifications.

It is important to understand that the action of a screw conveyor is such that it tends to tumble and shear the material as it is being conveyed. Therefore, it follows that materials which tumble or shear readily are more easily conveyed than others which do not.

Materials, first of all, are classified according to particle size. It is important to have a screen analysis made of the material, if at all possible. For example if a material is said to consist of 12,7 mm and under, it may be similar to granules of plastic. Or it may have only 10% of 12,7 mm particle size, with 90% fines grading to micron sizes. Some materials may require use of cover gaskets and/or seals; others may not, depending upon material characteristics.

Lumpy materials must be checked against the Lump Size Table 8. Very often larger screw conveyors must be used solely to accommodate the lumps than otherwise would be required from a standpoint of normal capacity.

Irregular, stringy, and interlocking materials that mat or cling together require special consideration. Stringy materials, particularly if long enough, may wrap around the pipe shaft of the conveyor screw or around the intermediate hanger bearings, thus effectively clogging the conveyor. Materials that mat may also be those that pack under pressure. If the material does pack under pressure, it may jam the conveyor screw and seriously damage the conveyor. All materials with these characteristics must be carefully studied in detail with respect to their actions in a screw conveyor. On particular advantage of Archimedys fligthing is their flexibility. If a clogging occurs, the flight can be bended and recover is shape after clogging removal.

Materials are also classified as to their flowability. This, unfortunately, is a relative term and not easily measured. However, so far as the operation of screw conveyors is concerned, flowability is related to two factors, one the angle of slide and the other the internal friction of the material. The angle of slide may be determined by tilting a plate carrying a quantity of the material. The angle of internal friction may be evaluated from shear cell test data. Changes in moisture content, temperature, particle size distribution and chemically corrosive action of the material all affect the flowability.

It is known that some materials which are uniform in particle shape and size are quite free flowing when dry. Screened dry sand is free flowing. The addition of moisture, however, changes the flowability character. Likewise, dry granulated sugar is free flowing, but this material is hygroscopic and will pick up moisture from the air. If this happens, its flowability is changed considerably. The flowability of most materials is affected by changes in their moisture content, with consequent changes in their ability to be conveyed.

The abrasiveness of materials is also a relative quantity and isn't easily defined with accuracy. Some materials are more abrasive than others. It will be found that nonabrasive or very mildly abrasive materials may be handled with screw conveyors with standard troughs.

Very abrasive materials require heavier than standard components. Most abrasive materials in the following Material Table, (Table 7), are handled at lower cross-sectional loads than are the nonabrasive materials. This is done to attain the maximum economical life of the conveyor and its parts.

The foregoing bulk materials have hazards affecting conveyability. The effect of some of these hazards as they affect screw conveyor design follows.

K. Some bulk substances are sensitive to small changes in temperature or pressure. For example, materials containing vegetable oils or fats can become spoiled by the heat of friction in a hanger bearing.

L. Dusty materials—especially those that are very dusty—should be carefully considered. Previous experience with similar materials is the best guide. Flange gaskets and special trough end seals may be needed.

M. Some materials such as dry cement will aerate and develop fluid characteristics as a result of transport in a screw conveyor. The "as conveyed" apparent density is much lower than the normal apparent density. Many dusty and aerated materials can bypass an intermediate discharge spout. As the material becomes more fluid-like, the flowability increases markedly, and in some cases the aerated material will flood and run like water with the result that the cross-sectional load increases and control of the rate of flow is lost. Consult your conveyor manufacturer regarding materials which may aerate greatly.

N. Dusts associated with certain bulk materials are flammable or even explosive when mixed with air in the proper concentration. It therefore may be necessary to contain dust laden material at all times within the conveyor enclosure. Grain dust is an example. The very nature of a screw conveyor—being an enclosed conveying device—may be used for handling materials with flammable or explosive dusts, although more sophisticated than standard enclosures may be required. The U4 material range is a conductive material created in order to avoid static accumulation on the flight and electrical spark.

P&Q. Contaminable and degradable materials must be recognized because their salability or use may be affected by improper conveying or ill-considered conveyor specifications. Suitable non-lubricated bearings should be used. Low conveyor speeds normally will prevent excessive degradation.

R. Materials in this category are similar to those described under L and N, except that exposure of the dust or fumes may be hazardous to personnel. Tight enclosures and spouting connections—usually gasketed—are required. Elaboration of the enclosures depends upon the severity of the hazard.

S&T. Corrosion protection requiring the use of special metals is a common problem. Here again "corrosion" is a relative term which isn't easily defined numerically. The choices of materials of construction, such as the types of stainless steel or other special metals, should be referred to the conveyor manufacturer. Once again, the advantage of Archimedys flightings is their high resistance to corrosion. The trough, in difficult case can also be done with a particular plastic in order to build a complete corrosion free conveyor.

U. Certain bulk materials are hygroscopic. They absorb water from the moisture in the ambient atmosphere. The water they pick up changes their flowability, of course, and this has been taken into account for the usual behavior of such materials as listed in Table 7.

V&X. Bulk materials which interlock and mat usually will require screws of heavier than standard construction and flight edges that can cut their way through the material. Intermediate hanger bearings may have to be eliminated. A similar condition exists for materials which pack under pressure.

W. Oils or chemicals that may be contained in bulk materials require special consideration. Some of these constituents may make the materials sticky and cause adherence to the working parts of the conveyor. Ribbon type conveyor screws sometimes help. It is best to consult your conveyor manufacturer when attempting to handle such materials. Archimedys module has a non sticky surface allowing the use for a wide range of materials.

Y. Light and fluffy materials require consideration similar to those which are dusty or which tend to aerate as they are conveyed. See paragraphs L and M.

Z. Elevated temperatures are encountered in many phases of material processing. Screw conveyors should be fabricated of heavier than standard construction and designed to withstand the inevitable expansion and contraction that takes place. Intermediate hanger bearings must be protected against heat or omitted. End bearings and drive equipment may be separated from the trough end to reduce their exposure to heat. The temperature service range for standard Archimedys flighting is -30°C to 80°C. Custom made Archimedes flighting can reach a temperature of 700°C.

Flowability and abrasiveness index and flow function are presented in the general material documentation.

Table 6 Material classification code chart

Major class	Material characteristics included		Code designation
Density	Bulk Density, Loose		Actual kg/m^3
Size	Very Fine	No. 200 Sieve 0,073 mm And Under	A_{200}
		No. 100 Sieve 0,15 mm And Under	A_{100}
		No. 40 Sieve 0,4 mm And Under	A_{40}
	Fine	No. 6 Sieve 3,35 mm And Under	B_6
	Granular	12,7 mm And Under	$C_{½}$
		76 mm And Under	D_3
		177 mm And Under	D_7
	Lumpy*	400 mm And Under	D_{16}
		400 mm To Be Specified X =Actual Maximum Size in inch	D_x
	Irregular	Stringy, Fibrous, Cylindrical, Slabs, Etc.	E
Flowability	Very Free Flowing—Flow Function> 10		1
	Free Flowing—Flow Function>4 But <10		2
	Average Flowability—Flow Function>2 But <4		3
	Sluggish—Flow Function<2		4
Abrasiveness	Mildly Abrasive— Index 1-17		5
	Moderately Abrasive — Index 18-67		6
	Extremely Abrasive — Index 68-416		7
Miscellaneous Properties Or Hazards	Builds Up and Hardens		F
	Generates Static Electricity		G
	Decomposes—Deteriorates in Storage		H
	Flammability		J
	Becomes Plastic or Tends to Soften		K
	Very Dusty		L
	Aerates and Becomes Fluid		M
	Explosiveness		N
	Stickiness-Adhesion		O
	Contaminable, Affecting Use		P
	Degradable, Affecting Use		Q
	Gives Off Harmful or Toxic Gas or Fumes		R
	Highly Corrosive		S
	Mildly Corrosive		T
	Hygroscopic		U
	Interlocks, Mats or Agglomerates		V
	Oils Present		W
	Packs Under Pressure		X
	Very Light and Fluffy—May Be Windswept		Y
	Elevated Temperature		Z

The Material Table 7 lists a wide range of bulk materials that can be handled in screw conveyors. The table shows in the first column the range of density that is usually experienced in handling that material. The average density is not specifically shown but is often assumed to be at or near the minimum.

The next column shows the material code number. This consists of the average density, the usual size designation, the flowability number, the abrasive number followed by those material characteristics which are termed conveyability hazards.

A very fine 100 mesh material with an average density of 800 kg/m3, that has average flowability and is moderately abrasive, would have a material code $800A_{100}36$. If this material were very dusty and mildly corrosive the number would then be $800A_{100}36LT$.

The Material Factor is used in the horsepower formula to determine the horsepower to operate a horizontal screw conveyor. The calculation of horsepower is described in chapter 15.

The indication of suitability for handling the material in a vertical screw conveyor is only a guide.

The information and data in the Material Table 7 Material Characteristics, has been compiled by members of CEMA and represents many years of experience in the successful design and application of screw conveyors for handling the listed materials. The indicated physical characteristics of these materials are not the result of any particular laboratory tests but were learned from the actual industrial operation of countless screw conveyors.

The Material Table includes various grains, seeds, feeds, etc. that are commonly handled in many conveyor types. The published unit weights, the component series and material factors Fm are for average conditions. For instance, wheat when dry or with a low moisture of less than 10% is very free flowing, and the Fm factor of 0.4 can be used. When higher moistures are prevalent, a material factor of 0.5 or 0.6 is suggested. This phenomena is common to all grains and some other substances.

It should also be noted that soybeans are shown as being very abrasive. Heavy conveyor construction is recommended. This is because soybeans, especially when dirty and harvested at a low moisture, are extremely abrasive. On the other hand, hard iron bearings which are commonly used with abrasive materials cannot be recommended because of spark generation and consequent dust explosions. This phenomena is also true of rough rice and to a lesser degree on other grains

THE MATERIAL TABLE IS A GUIDE ONLY. THE MATERIALS CODE AND THE MATERIAL FACTOR Fm ARE BASED ON EXPERIENCE OF SEVERAL CONVEYOR MANUFACTURERS. A SPECIFIC MATERIAL SAMPLE MAY HAVE PROPERTIES THAT VARY FROM THOSE SHOWN IN THE TABLE. THE RANGE OF DENSITIES WILL ALSO VARY DEPENDING ON MOISTURE CONTENT AS WELL AS ITS SOURCE.

Table 7 Material Characteristics

Material Description	Loose Bulk Density kg/m^3	CEMA Material Code	Material Factor Fm	V	
Adipic Acid	720	720A$_{100}$35N	0.5	x	
Alfalfa, Meal	224-352	288B$_{6}$45WY	0.6	x	
Alfalfa, Pellets	657-689	673C$_{1/2}$25	0.5		
Alfalfa, Seed	160-240	208B$_{6}$15N	0.4		
Almonds, Broken	432-481	465C$_{1/2}$35Q	0.9		
Almonds, Whole, Shelled	449-481	465C$_{1/2}$35Q	0.9		
Alum, Fines	721-801	769B$_{6}$35U	0.6		
Alum, Lumps	801-961	881B$_{6}$25	1.4		
Alumina	881-1041	929B$_{6}$27MY	1.8		
Alumina, Fines	561	561A$_{100}$27MY	1.6		
Alumina, Sized or Briquette	1041	1041D$_{3}$37	2.0		
Aluminate Gel (Aluminate Hydroxide)	721	721B$_{6}$35	1.7	x	
Aluminum Chips, Dry	112-240	176E45VN	1.2		
Aluminum Chips, Oily	112-240	176E45VY	0.8	x	
Aluminum Hydrate	208-320	272C$_{1/2}$35N	1.4	x	
Aluminum, Ore (See Bauxite)			—		
Aluminum Oxide	961-1922	1442A$_{100}$17MN	1.8		
Aluminum Silicate (Andalusite)	785	785C$_{1/2}$35S	0.8	x	
Aluminum Sulfate	721-929	833C$_{1/2}$25	1.0		
Ammonium Chloride, Crystalline	721-833	785A$_{100}$45FRS	0.7		
Ammonium Nitrate	45-62	54A$_{40}$35NTU	1.3		
Ammonium Sulfate	721-929	833C$_{1/2}$35F0TU	1.0		
Antimony Powder		A$_{100}$35	1.6	x	
Apple Pomace, Dry	240	240C$_{1/2}$45Y	1.0	x	
Arsenate of Lead (See Lead Arsenate)			—		
Arsenic Oxide (Arsenolite)*	1602-1922	1762A$_{100}$35R	—		
Arsenic, Pulverized	481	481A$_{100}$25R	0.8		
Asbestos Rock, Ore	1297	1297D$_{3}$37R	1.2		
Asbestos, Shredded	320-641	481E46XY	1.0		
Ash, Black, Ground	1682	1682B$_{6}$35	2.0		
Ashes, Coal, Dry, 1/2"	561-721	641C$_{1/2}$46TY	3.0	x	
Ashes, Coal, Dry, 3"	561-641	609D$_{3}$46T	2.5		
Ashes, Coal, Wet, 1/2"	721-801	769C$_{1/2}$46T	3.0		
Ashes, Coal, Wet, 3"	721-801	769D$_{3}$46T	4.0		
Ashes, Fly (See Flyash)			—		
Asphalt, Crushed, 1/2"	721	721C$_{1/2}$45	2.0	x	
Bagasse	112-160	144E45RVXY	1.5		
Bakelite, Fines	481-721	609B$_{6}$25	1.4	x	
Baking Powder	641-881	769A$_{100}$35	0.6	x	
Baking Soda (Sodium Bicarbonate)	641-881	769A$_{100}$25	0.6	x	
Barite (Barium Sulfate), 1/2" - 3"	1922-2884	2402D$_{3}$36	2.6		
Barite, Powder	1922-2884	2402A$_{100}$35X	2.0	x	
Barium Carbonate	1153	1153A$_{100}$45R	1.6		
Bark, Wood, Refuse	160-320	240E45TVY	2.0		
Barley, Fine Ground	384-609	497B$_{6}$35	0.4	x	
Barley, Malted	497	497C$_{1/2}$35	0.4	x	
Barley, Meal	449	449C$_{1/2}$35	0.4	x	
Barley, Whole	577-769	673B$_{6}$25N	0.5	x	
Basalt	1281-1682	1490B$_{6}$27	1.8		
Bauxite, Crushed, 3"	1201-1362	1281D$_{3}$36	2.5		
Bauxite, Dry, Ground	1089	1089B$_{6}$25	1.8		
Beans, Castor, Meal	561-641	609B$_{6}$35W	0.8	x	
Beans, Castor, Whole, Shelled	577	577C$_{1/2}$15W	0.5	x	
Beans, Navy, Dry	769	769C$_{1/2}$15	0.5		
Beans, Navy, Steeped	961	961C$_{1/2}$25	0.8		

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Material Description	Loose Bulk Density kg/m^3	CEMA Material Code	Material Factor Fm	V	
Bentonite, 100 Mesh	801-961	881A_{100} 25MXY	0.7	x	
Bentonite, Crude	545-641	593D_3 45X	1.2		
Benzene Hexachloride	897	897A_{100}45R	0.6		
Bicarbonate of Soda (See Baking Soda)			—		
Blood, Dried	561-721	641D_3 45U	2.0	x	
Blood, Dried, Ground	481	481A_{100}35U	1.0	x	
Bone, Ash (See Tricalcium Phosphate)	641-801	721A_{100}45	1.6		
Boneblack	320-400	368A_{100} 25Y	1.5	x	
Bonechar	432-641	545B_6 35	1.6	x	
Bonemeal	801-961	881B_6 35	1.7	x	
Bones, Crushed	561-801	689D_3 45	2.0	x	
Bones, Ground	801	801B_6 35	1.7	x	
Bones, Whole*	561-801	689E45V	3.0		
Borate of Lime	961	961A_{100}35	0.6		
Borax Lumps, 1 1/2" to 2"	881-961	929D_3 35	1.8		
Borax Lumps, 2" to 3"	961-1121	1041D_3 35	2.0		
Borax, Fines	721-881	801B_6 25T	0.7	x	
Borax, Screenings, 1/2"	881-961	929$C_{1/2}$ 35	1.5		
Boric Acid, Fine	881	881B_6 25T	0.8	x	
Boron	1201	1201A_{100}37	1.0		
Bran, Rice - Rye - Wheat	256-320	288B_6 35NY	0.5		
Braunite (Manganese Oxide)	1922	1922A_{100}36	2.0		
Bread, Crumbs	320-400	368B_6 35PQ	0.6		
Brewer's Grain, Spent, Dry	224-481	352$C_{1/2}$ 45	0.5	x	
Brewer's Grain, Spent, Wet	881-961	929$C_{1/2}$ 45T	0.8		
Brick, Ground, 1/8"	1602-1922	110$B_6$37	2.2		
Bronze, Chips	481-801	641 B_6 45	2.0		
Buckwheat	593-673	641B_6 25N	0.4	x	
Calcine, Flour	1201-1362	1281A_{100}35	0.7		
Calcium Carbide	1121-1442	1281D_3 25N	2.0		
Calcium Carbonate (See Limestone)			—		
Calcium Fluoride (See Fluorspar)			—		
Calcium Hydrate (See Lime, Hydrated)			—		
Calcium Hydroxide (See Lime, Hydrated)			—		
Calcium Lactate	416-465	449D_3 45QTR	0.6		
Calcium Oxide (See Lime, Unslaked)			—		
Calcium Phosphate	641-801	721A_{100}45	1.6		
Calcium Sulfate (See Gypsum)			—		
Carbon, Activated, Dry, Fine*	128-320	224B_6 25Y	—		
Carbon, Black, Pelleted*	320-400	368B_6 15Q	—		
Carbon, Black, Powder*	64-112	96A_{100} 35Y	—	x	
Carborundum	1602	1602$D_3$27	3.0		
Casein Cashew,	577	577B_6 35	1.6		
Nuts Cast Iron,	513-593	561$C_{1/2}$ 45	0.7		
Chips Caustic	2082-3203	2643$C_{1/2}$45	4.0		
Soda	1410	1410B_6 35RSU	1.8		
Caustic Soda, Flakes	753	753$C_{1/2}$ 45RSUX	1.5		
Celite (See Diatomaceous Earth)			—		
Cement, Aerated (Portland)	961-1201	1089A_{100} 16M	1.4	x	
Cement, Clinker	1201-1522	1362D_3 36	1.8		
Cement, Mortar	2130	2130$B_6$35Q	3.0		
Cement, Portland	1506	1506A_{100} 26M	1.4	x	
Cerrusite (See Lead Carbonate)			—		
Chalk, Crushed	1201-1522	1362D_3 25	1.9		
Chalk, Pulverized	1073-1201	1137A_{100} 25MXY	1.4	x	

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Charcoal, Ground	288-449	$368A_{100}45N$	1.2		
Charcoal, Lumps	288-449	$368D_{3}45QN$	1.4		
Chocolate, Cake, Pressed	641-721	$689D_{3}25$	1.5		
Chrome Ore	2002-2243	$2130D_{3}36$	2.5		
Cinders, Blast Furnace	913	$913D_{3}36T$	1.9		
Cinders, Coal	641	$641D_{3}36T$	1.8		
Clay (See Bentonite, Diatomaceous Earth, Fuller's Earth, Kaolin, & Marl)			—		
Clay, Brick, Dry, Fines	1602-1922	$1762C_{1/2}36$	2.0		
Clay, Calcined	1281-1602	$1442B_{6}36$	2.4		
Clay, Ceramic, Dry, Fines	961-1281	$1121A_{100}35P$	1.5	x	
Clay, Dry, Lumpy	961-1201	$1089D_{3}35$	1.8		
Clinker, Cement (See Cement, Clinker)			—		
Clover, Seed	721-769	$753B_{6}25N$	0.4	x	
Coal, Anthracite (Culm and River)	881-977	$961B_{6}35TY$	1.0		
Coal, Anthracite, Sized, 1/2"	785-977	$881C_{1/2}25$	1.0		
Coal, Bituminous, Mined	641-961	$801D_{3}35LNXY$	0.9		
Coal, Bituminous, Mined, Sized	721-881	$769D_{3}35QVN$	1.0		
Coal, Bituminous, Mined, Slack	689-801	$753C_{1/2}45TN$	0.9		
Coal, Lignite	593-721	$657D_{3}35TN$	1.0		
Cocoa, Beans	481-721	$609C_{1/2}25Q$	0.5		
Cocoa, Nibs	561	$561C_{1/2}25$	0.5		
Cocoa, Powdered	481-561	$529A_{100}45XY$	0.9		
Coconut, Shredded	320-352	336E45	1.5	x	
Coffee, Beans, Green	400-513	$465C_{1/2}25PQ$	0.5		
Coffee, Beans, Roasted	320-481	$400C_{1/2}25PQ$	0.4	x	
Coffee, Chaff	320	$320B_{6}25MY$	1.0	x	
Coffee, Ground, Dry	400	$400A_{40}35P$	0.6	x	
Coffee, Ground, Wet	561-721	$641A_{40}45X$	0.6		
Coffee, Soluble	304	$304A_{40}35PUY$	0.4	x	
Coke, Breeze	400-561	$481C_{1/2}37NY$	1.2		
Coke, Loose	400-561	$481D_{7}37N$	1.2		
Coke, Petrol, Calcined	561-721	$641D_{7}37NY$	1.3		
Compost	481-801	$641D_{7}45TV$	1.0		
Concrete, Pre-Mix, Dry	1362-1922	$1650C_{1/2}36U$	3.0		
Copper Sulfate (Bluestone)	1201-1522	$1362C_{1/2}35S$	1.0		
Copper, Ore	1922-2403	$2162D_{X}36$	4.0		
Copper, Ore, Crushed	1602-2403	$2002D_{3}36$	4.0		
Copra, Cake, Ground	641-721	$689B_{6}45HW$	0.7	x	
Copra, Cake, Lumpy	400-481	$449D_{3}35HW$	0.8		
Copra, Lumpy	352	352E35HW	1.0		
Copra, Meal Cork,	641-721	$673B_{6}35HW$	0.7	x	
Granulated Cork,	192-240	$224C_{1/2}35JYN$	0.5	x	
Ground, Fines Corn,	80-240	$160B_{6}35JNY$	0.5	x	
Cleanings Corn,	320-481	$400B_{6}35PY$	0.4		
Cracked	641-801	$721B_{6}25PN$	0.7	x	
Corn, Grits	641-721	$689B_{6}35PN$	0.5	x	
Corn, Steeped	641-961	$801D_{3}$	0.8		
Corn Cobs, Ground	272	$272C_{1/2}25YN$	0.6		
Corn Cobs, Whole*	192-240	224E35NV	—	x	
Corn Ear*	897	$897D_{16}35NV$	—	x	
Corn Fiber Feed, Dry, Cooled	240-561	$400B_{6}35$	0.6		
Corn Fiber Feed, Dry, Ground	240-561	$400B_{6}35$	0.5		
Corn Fiber Feed, Dry, Not Cooled	240-561	$400B_{6}35$	1.5		
Corn Fiber Feed, Pellets, Dry	481-641	$561C_{1/2}35$	1.0		

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Corn Fiber Feed, Wet	240-641	$449B_6$ 35	1.5		
Corn Fiber, Dewatered	160-400	$288B_6$ 35	0.6		
Corn Fiber, Wet	240-801	$529B_6$ 35PU	0.8		
Corn Filter Aid	240-801	$529B_6$ 37	2.5		
Corn Germ	336	$336B_6$ 35PYNW	0.4	x	
Corn Germ, Dewatered	481-561	$529B_6$ 35PUN	0.6		
Corn Germ, Dry	481-641	$561B_6$ 35	0.5		
Corn Germ, Expanded Cake	481-641	$561B_6$ 35	2.0		
Corn Germ, Oil Meal	481-561	$529B_6$ 35	0.6		
Corn Oil, Cake	400	$400D_7$ 45HW	0.6	x	
Corn Seed	721	$721C_{1/2}$ 25PQN	0.4		
Corn Shelled	721	$721C_{1/2}$ 25N	0.4	x	
Corn Sugar	481-561	$529B_6$ 35PUN	1.0	x	
Corn Sugar, Crystalline, Dry	400-961	$689B_6$ 35	1.5		
Corn Sugar, Crystalline, Wet	481-961	$721C_{1/2}$ 35	1.5		
Cornmeal	513-641	$577B_6$ 35PNW	0.5	x	
Cottonseed, Cake, Crushed	641-721	$689C_{1/2}$ 45HW	1.0	x	
Cottonseed, Cake, Lumpy	641-721	$689D_7$ 45HW	1.0	x	
Cottonseed, Dry, Delinted	352-641	$497C_{1/2}$ 25X	0.6	x	
Cottonseed, Dry, Not Delinted	288-400	$352C_{1/2}$ 45XY	0.9	x	
Cottonseed, Flakes	320-400	$23C_{1/2}$ 35HWY	0.8	x	
Cottonseed, Hulls	192	$192B_6$ 35Y	0.9	x	
Cottonseed, Meal, Expeller	400-481	$449B_6$ 45HW	0.5	x	
Cottonseed, Meal, Extracted	561-641	$593B_6$ 45HW	0.5	x	
Cottonseed, Meats, Dry	641	$641B_6$ 35HW	0.6	x	
Cottonseed, Meats, Rolled	561-641	$609C_{1/2}$ 45HW	0.6	x	
Cracklings, Crushed	641-801	$721D_3$ 45HW	1.3	x	
Cryolite, Dust	1201-1442	$1330A_{100}$ 36L	2.0	x	
Cryolite, Lumpy	1442-1762	$1602D_{16}$ 36	2.1	x	
Cullet, Fines	1281-1922	$1602C_{1/2}$ 37	2.0		
Cullet, Lumps	1281-1922	$1602D_{16}$ 37	2.5		
Culm (See Coal, Anthracite)			—		
Cupric Sulfate (See Copper Sulfate)			—		
Detergent (See Soap, Detergent)			—		
Diatomaceous Earth	176-272	$224A_{40}$ 36Y	1.6		
Dicalcium Phosphate	641-801	$721A_{40}$ 35	1.6	x	
Disodium Phosphate	400-497	$449A_{40}$ 35	0.5		
Distiller's Grain, Spent, Dry	481	$481B_6$ 35	0.5		
Distiller's Grain, Spent, Wet	641-961	$801C_{1/2}$ 45V	0.8		
Dolomite, Crushed	1281-1602	$1442C_{1/2}$ 36	2.0		
Dolomite, Lumpy	1442-1602	$1522D_X$ 36	2.0		
Earth, Loam, Dry, Loose	1217	$1217C_{1/2}$ 36	1.2		
Ebonite, Crushed	1009-1121	$1073C_{1/2}$ 35	0.8	x	
Egg, Powder	256	$256A_{40}$ 35MPYN	1.0		
Epsom Salts (Magnesium Sulfate)	641-801	$721A_{40}$ 35U	0.8	x	
Ethane Diacid Crystal (See Oxalic Acid, Crystal)			—		
Feldspar, Ground	1041-1281	$1169A_{100}$ 37	2.0		
Feldspar, Lumps	1442-1602	$1522D_7$ 37	2.0		
Feldspar, Powder, 200 Mesh	1602	$1602A_{200}$ 36	2.0		
Feldspar, Screenings	1201-1281	$1249C_{1/2}$ 37	2.0		
Ferrous Sulfate	801-1201	$1009C_{1/2}$ 35U	1.0		
Ferrous Sulfide, 1/2"	1922-2162	$2050C_{1/2}$ 26	2.0	x	
Ferrous Sulfide, 100 Mesh	1682-1922	$1810A_{100}$ 36	2.0	x	
Fish, Meal	561-641	$609C_{1/2}$ 45HP	1.0	x	

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Fish, Scraps	641-801	721D$_7$ 45H	1.5		
Flaxseed	689-721	705B$_6$ 35X	0.4	x	
Flaxseed Cake (Linseed Cake)	769-801	785D$_7$ 45W	0.7		
Flaxseed Meal (Linseed Meal)	400-721	561B$_6$ 45W	0.4	x	
Flour, Wheat	529-641	593A$_{40}$ 45LP	0.6	x	
Flue Dust, Basic Oxygen Furnace	721-961	849A$_{40}$ 36LM	3.5		
Flue Dust, Blast Furnace	1762-2002	1890A$_{40}$ 36	3.5		
Flue Dust, Boiler H. Dry	481-721	609A$_{40}$ 36LM	2.0		
Fluorspar, Fines (Calcium Fluoride)	1281-1602	1442B$_6$ 36	2.0		
Fluorspar, Lumps, 1 1/2" to 3"	1442-1762	1602D$_7$ 36	2.0		
Flyash	481-721	609A$_{40}$ 36M	2.0		
Flyash, Coal	481-961	721A$_{40}$ 36M	2.0		
Flyash, Fluidized Bed	961-1442	1201A$_{40}$ 36	3.0		
Foundry Sand, Dry (See Sand)			—		
Fuller's Earth, Calcined	481-641	561A$_{100}$ 25	2.0		
Fuller's Earth, Dry, Raw	481-641	561A$_{40}$ 25	2.0		
Fuller's Earth, Oily, Spent	961-1041	1009C$_{½}$ 45OW	2.0		
Galena (See Lead Sulfide)			—		
Gelatine, Granulated	513	513B$_6$ 35PU	0.8	x	
Gilsonite	593	593C$_{½}$ 35	1.5		
Glass, Batch	1281-1602	1442C$_{½}$ 37	2.5		
Glue, Ground	641	641B$_6$ 45U	1.7		
Glue, Pearl	641	641C$_{1/2}$ 35U	0.5		
Glue, Veg. Powdered	641	641A$_{40}$ 45U	0.6		
Gluten Cake, Wet	481-801	641C$_{½}$ 45	2.5		
Gluten, Meal, Dry	481-641	561B$_6$ 35P	0.6		
Granite, Fines	1281-1442	1362C$_{½}$ 27	2.5		
Grape, Pomace	240-320	288D$_3$ 45U	1.4	x	
Graphite, Flakes	641	641B$_6$ 25LP	0.5	x	
Graphite, Flour	449	449A$_{100}$ 35LMP	0.5	x	
Graphite, Ore	1041-1201	1121D$_X$ 35L	1.0		
Guano, Dry*	1121	1121C$_{½}$ 35	2.0		
Gypsum, Calcined	881-961	929B$_6$ 35U	1.6		
Gypsum, Calcined, Powdered	961-1281	1121A$_{100}$ 35U	2.0		
Gypsum, Raw, 1"	70-80	1201D$_3$ 25	2.0		
Hay, Chopped*	128-192	160C$_{½}$ 35JY	1.6		
Hexanedioic Acid (See Adipic Acid)			—		
Hominy, Dry	561-801	689C$_{½}$ 25PD	0.4	x	
Hops, Spent, Dry	561	561D$_3$ 35	1.0	x	
Hops, Spent, Wet	801-881	849D$_3$ 45V	1.5		
Ice, Crushed	561-721	641D$_3$ 35Q	0.4	x	
Ice, Cubed	529-561	545D$_3$ 35Q	0.4	x	
Ice, Flaked*	641-721	673C$_{½}$ 35Q	0.6	x	
Ice, Shells	529-561	545D$_3$ 45Q	0.4	x	
Ilmenite, Ore	2243-2562	2402D$_3$ 37	2.0		
Iron Ore, Concentrate	1922-2883	2402A$_{40}$ 37	2.2		
Iron Oxide Pigment	400	400A$_{100}$ 36LMP	1.0		
Iron Oxide, Millscale	1201	1201C$_{1/2}$ 36	1.6		
Iron Pyrites (See Ferrous Sulfide)			—		
Iron Sulfate (See Ferrous Sulfate)			—		
Iron Sulfide (See Ferrous Sulfide)			—		
Iron Vitriol (See Ferrous Sulfate)			—		
Kafir (Corn)	641-721	689C$_{½}$ 25	0.5	x	
Kaolin Clay	1009	1009D$_3$ 25	2.0		
Kaolin Clay, Talc	673-897	785A$_{40}$ 35LMP	2.0		

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Kryalith (See Cryolite)			—		
Lactose	513	$513A_{40}$ 35PUN	0.6		
Lamp Black (See Carbon, Black)			—		
Lead Arsenate	1153	$1153A_{40}$ 35R	1.4		
Lead Arsenite	1153	$1153A_{40}$ 35R	1.4		
Lead Carbonate	3844-4164	$4004A_{40}$ 35R	1.0		
Lead Ore, 1/8"	3203-4324	$3764B_{6}$ 35R	1.4		
Lead Ore, 1/2"	2883-3684	$3283C_{½}$ 36R	1.4		
Lead Oxide, 100 Mesh Red Lead	481-2402	$1442A_{100}$ 35P	1.2		
Lead Oxide, 200 Mesh Red Lead	480-2883	$1681A_{200}$ 35LP	1.2		
Lead Sulfide, 100 Mesh	3844-4164	$4004A_{100}$ 35RX	—		
Lignite (See Coal, Lignite)			—		
Lime, Ground, Unslaked	961-1041	$1009B_{6}$ 35U	0.6	x	
Lime, Hydrated	641	$641B_{6}$ 35LM	0.8	x	
Lime, Hydrated, Pulverized	513-641	$577A_{40}$ 35LMX	0.6	x	
Lime, Pebble	849-897	$881C_{½}$ 25HU	2.0		
Limestone, Agricultural	1089	$1089B_{6}$ 35	2.0		
Limestone, Crushed	1362-1442	$1410D_{X}$ 36	2.0		
Limestone, Dust	881-1522	$1201A_{40}$ 46MY	1.6-2.0		
Limonite, Ore, Brown (Limonite)	1922	$1922C_{½}$ 47	1.7		
Lindane (See Benzene Hexachloride)			—		
Linseed (See Flaxseed)			—		
Litharge (See Lead Oxide)			—		
Lithopone	721-801	$769A_{325}$ 35MR	1.0		
Magnesium Chloride (Magnesite)	529	$529C_{½}$ 45	1.0		
Maize (See Milo)			—		
Malt, Dry, Ground	320-481	$400B_{6}$ 35NPR	0.5	x	
Malt, Dry, Whole	320-481	$400C_{½}$ 35N	0.5	x	
Malt, Meal Malt,	577-641	$38B_{6}$ 25P	0.4	x	
Sprouts Manganese	208-240	$224C_{½}$ 35P	0.4	x	
Dioxide* Manganese	1121-1362	$1249A_{100}$ 35NRT	1.5		
Ore Manganese	2002-2243	$2130D_{X}$ 37	2.0		
Oxide Manganous	1922	$1922A_{100}$ 36	2.0		
Sulfate Marble,	1121	$1121C_{½}$ 37	2.4		
Crushed	1281-1522	$1410B_{6}$ 37	2.0		
Marl (Clay)	1281	$1281D_{X}$ 36	1.6		
Meat, Ground	801-881	849E45HQTX	1.5		
Meat, Scrap, W/bone	641	641E46H	1.5		
Mica, Flakes	272-352	$320B_{6}$ 16MY	1.0	x	
Mica, Ground	208-240	$224B_{6}$ 36	0.9	x	
Mica, Pulverized	208-240	$224A_{100}$ 36M	1.0	x	
Milk, Dried, Flake	80-96	$96B_{6}$ 35PUYN	0.4		
Milk, Malted	432-481	$465A_{40}$ 45PXN	0.9		
Milk, Powdered	320-721	$529B_{6}$ 25PMN	0.5		
Milk, Powdered, Whole	320-577	$449B_{6}$ 35PUX	0.5		
Milk, Sugar	513	$513A_{100}$ 35PXN	0.8		
Mill Scale (Steel)	1922-2002	1970E46T	3.0		
Milo, Ground	513-577	$545B_{6}$ 25	0.5	x	
Milo, Maize (Kafir)	641-721	$689B_{6}$ 15N	0.4	x	
Molybdenite Powder	1714	$1714B_{6}$ 26	1.5		
Monosodium Phosphate	801	$801B_{6}$ 36	0.6		
Mortar, Wet*	2402	2402E46T	3.0		
Mustard, Seeds	721	$721B_{6}$ 15N	0.4	x	
Naphtalene, Flakes	721	$721B_{6}$ 35	0.7	x	
Niacin (Nicotinic Acid)	561	$561A_{40}$ 35P	0.8		

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Oats	416	$416C_{1/2}$ 25MN	0.6	x	
Oats, Crimped	304-416	$368C_{1/2}$ 35	0.5	x	
Oats, Crushed	352	$352B_{6}$ 45NY	0.6	x	
Oats, Flour	561	$561A_{100}$35	0.5	x	
Oats, Hulls	128-160	$160B_{6}$ 35NY	0.5	x	
Oats, Rolled	304-384	$352C_{1/2}$ NY	0.6	x	
Oleo (Margarine)	945	945E45HKPWX	0.4		
Orange, Peels, Dry	240	240E45	1.5		
Oxalic Acid, Crystal - Ethane Diacid Crystal	961	$961B_{6}$35QSU	1.0		
Oyster, Shells, Ground	801-961	$881C_{1/2}$36T	2.0		
Oyster, Shells, Whole	1281	$1281D_{3}$ 36TV	2.5		
Paper, Pulp, 4%	993	993E45	1.5		
Paper, Pulp, 6% to 15%	961-993	977E45	1.7		
Paraffin, Cake, 1/2"	721	$721C_{1/2}$ 45K	0.6		
Peanut Meal	481	$481B_{6}$ 35P	0.6	x	
Peanuts, Clean, Shelled	240-320	$288D_{3}$ 35Q	0.6		
Peanuts, Raw, Uncleaned, Unshelled	240-320	$288D_{3}$ 36Q	0.7		
Peanuts, Shelled	561-721	$641C_{1/2}$ 35Q	0.4	x	
Peas, Dried	721-801	$769C_{1/2}$ 15NQ	0.5	x	
Perlite, Expanded	128-192	$160C_{1/2}$ 36	0.6		
Phosphate Disodium (See Sodium Phosphate) Phosphate			—		
Rock, Broken Phosphate	1201-1362	$1281D_{X}$ 36	2.1		
Rock, Pulverized Phosphate	961	$961B_{6}$ 36	1.7		
Sand	1442-1602	$1522B_{6}$ 37	2.0		
Phosphate, Acid, Fertilizer	961	$961B_{6}$ 25T	1.4		
Plaster of Paris (See Gypsum)			—		
Plumbago (See Graphite)			—		
Polystyrene Beads	641	$641B_{6}$ 35PQ	0.4	x	
Polyvinyl Chloride, Pellets	320-481	400E45KPQT	0.6		
Polyvinyl Chloride, Powder	320-481	$400A_{100}$45KT	1.0		
Potash, Dry (Muriate)	1121	$1121B_{6}$37	2.0		
Potash, Mine Run (Muriate)	1201	$1201D_{X}$37	2.2		
Potassium Carbonate	817	$817B_{6}$36	1.0		
Potassium Chloride, Pellets	1922-2082	$2002C_{1/2}$ 25TU	1.6		
Potassium Nitrate, 1/2"	1217	$1217C_{1/2}$ 16NT	1.2	x	
Potassium Nitrate, 1/8"	1281	$1281B_{6}$26NT	1.2	x	
Potassium Sulfate	673-769	$721B_{6}$ 46X	1.0		
Potato, Flour	769	$769A_{200}$35MNP	0.5	x	
Pumice, 1/8"	673-769	$721B_{6}$46	1.6		
Pyrite, Pellets	1922-2082	$2002C_{1/2}$ 26	2.0		
Quartz, 1/2"	1281-1442	$1362C_{1/2}$ 27	2.5		
Quartz, 100 Mesh	1121-1281	$1201A_{100}$27	1.7		
Rice, Bran	320	$320B_{6}$ 35NY	0.4	x	
Rice, Grits	673-721	$705B_{6}$ 35P	0.4	x	
Rice, Hulled	721-785	$753C_{1/2}$ 25P	0.4	x	
Rice, Hulls	320-336	$336B_{6}$ 35NY	0.4	x	
Rice, Polished	481	$481C_{1/2}$ 15P	0.4	x	
Rice, Rough	513-577	$545C_{1/2}$ 35N	0.6	x	
Rosin, 1/2"	1041-1089	$1073C_{1/2}$ 45Q	1.5	x	
Rubber, Pelleted	801-881	$849D_{3}$ 45	1.5		
Rubber, Reclaimed, Ground	368-801	$593C_{1/2}$ 45	0.8	x	
Rye	673-769	$721B_{6}$ 15N	0.4	x	
Rye, Bran	240-320	$288B_{6}$ 35Y	0.4	x	
Rye, Feed	539	$529B_{6}$ 35N	0.5	x	

*Consult Conveyor Manufacturer.
V - Those materials which show an X may be handled in vertical screw conveyors.

Material Description	Loose Bulk Density kg/m^3	CEMA Material Code	Material Factor Fm	V	
Rye, Meal	561-641	609B$_6$ 35	0.5	x	
Rye, Middlings	673	673B$_6$ 35	0.5	x	
Rye, Shorts	513-529	529C$_{1/2}$ 35	0.5	x	
Safflower, Cake	801	801D$_3$ 26	0.6		
Safflower, Meal	801	801B$_6$ 35	0.6	x	
Safflower, Seed	721	721B$_6$ 15N	0.4	x	
Saffron (See Safflower)			—		
Sal Ammoniac (See Ammonium Chloride)			—		
Salicylic Acid	465	465B$_6$ 37U	0.6		
Salt Cake, Dry, Coarse	1362	1362B$_6$ 36TU	2.1		
Salt Cake, Dry, Pulverized	1041-1362	1201B$_6$ 36TU	1.7		
Salt, Dry, Coarse	721-961	849C$_{1/2}$ 36TU	1.0	x	
Salt, Dry, Fine	1121-1281	1201B$_6$ 36TU	1.7	x	
Saltpeter (See Potassium Nitrate)			—		
Sand, Dry Bank, Damp	1762-2082	1922B$_6$ 47	2.8		
Sand, Dry Bank, Dry	1442-1762	1602B$_6$ 37	1.7		
Sand, Foundry, Shake Out	1442-1602	1522D$_3$ 37Z	3.0		
Sand, Silica, Dry	1442-1602	1522B$_6$ 27	2.0		
Sand, Silica, Resin Coated	1666	1666B$_6$ 27	2.0		
Sand, Zircon, Resin Coated	1842	1842A$_{100}$ 27	2.3		
Sawdust, Dry	160-208	192B$_6$ 45UX	1.4		
Sea-Coal	1041	1041B$_6$ 36	1.0		
Sesame Seed	432-657	545B$_6$ 26	0.6	x	
Shale, Crushed	1362-1442	1410C$_{1/2}$ 36	2.0		
Shellac, Powdered or Granulated	497	497B$_6$ 35P	0.6	x	
Silica, Flour	1281	1281A$_{40}$ 46	1.5		
Silica, Gel, 1/2" to 3" Silicon	721	721D$_3$ 37HKQU	2.0		
Dioxide (See Quartz) Slag,			—		
Blast Furnace, Crushed Slag,	2082-2883	2483D$_3$ 37Y	2.4		
Furnace, Granular, Dry Slate,	961-1041	1009C$_{1/2}$ 37	2.2		
Crushed, 1/2"	1281-1442	1362C$_{1/2}$ 36	2.0		
Slate, Ground, 1/8"	1314-1362	1346B$_6$ 36	1.6		
Sludge, Sewage, Dry	641-801	721E46TW	0.8		
Sludge, Sewage, Dry, Ground	721-881	801B$_6$ 46T	0.8		
Soap, Beads or Granules	240-561	400B$_6$ 35Q	0.6		
Soap, Chips	240-400	320C$_{1/2}$ 35Q	0.6		
Soap, Detergent	240-801	529B$_6$ 35FQ	0.8		
Soap, Flakes	80-240	160B$_6$ 35QXY	0.6		
Soap, Powder	320-481	400B$_6$ 25X	0.9		
Soapstone, Talc, Fine	641-801	721A$_{200}$ 45XY	2.0		
Soda Ash, Heavy	881-1041	961B$_6$ 36	1.0		
Soda Ash, Light	320-561	449A$_{40}$ 36Y	0.8	x	
Sodium Aluminate, Ground	1153	1153B$_6$ 36	1.0		
Sodium Aluminum Fluoride (See Cryolite)			—		
Sodium Aluminum Sulphate*	1201	1201A$_{100}$ 36	1.0		
Sodium Bentonite (See Bentonite)			—		
Sodium Bicarbonate (See Baking Soda)			—		
Sodium Borate (See Borax)			—		
Sodium Carbonate (See Soda Ash)			—		
Sodium Chloride (See Salt)			—		
Sodium Hydrate (See Caustic Soda)			—		
Sodium Hydroxide (See Caustic Soda)			—		
Sodium Nitrate	1121-1281	1201D$_3$ 25NS	1.2		
Sodium Phosphate	801-961	881B$_6$ 35	0.9		
Sodium Sulfate (See Salt Cake)			—		

*Consult Conveyor Manufacturer.
V - Those materials which show an X may be handled in vertical screw conveyors.

Material Description	Loose Bulk Density kg/m^3	CEMA Material Code	Material Factor Fm	V	
Sodium Sulfite	1538	1538B_6 46X	1.5		
Sorghum Seed (See Kafir or Milo)			—		
Soybean Dust	400-561	481A_{40} 35MN	2.0		
Soybean, Cake	641-689	673D_3 35W	1.0	x	
Soybean, Cracked	481-641	561$C_{1/2}$ 36NW	0.6	x	
Soybean, Flakes, Raw	240-561	400$C_{1/2}$ 35Y	0.8	x	
Soybean, Flour	400-561	481A_{40} 35MN	1.0	x	
Soybean, Meal, Cold	561-721	641B_6 35	0.6	x	
Soybean, Meal, Hot	641	641B_6 35T	0.6		
Soybean, Whole	721-801	769$C_{1/2}$ 26NW	1.0		
Starch	400-801	609A_{40} 15MN	1.0	x	
Steel Turnings, Crushed	1602-2403	2002D_3 46WV	3.0		
Sugar Beet, Pulp, Dry	192-240	224$C_{1/2}$ 26N	0.9		
Sugar Beet, Pulp, Wet	400-721	561$C_{1/2}$ 35XN	1.2		
Sugar, Powdered	801-961	881A_{100} 35PXN	0.8	x	
Sugar, Raw	881-1041	961B_6 35PXN	1.5		
Sugar, Refined, Granulated, Dry	801-881	849B_6 35PUN	1.0-1.2	x	
Sugar, Refined, Granulated, Wet	881-1041	961$C_{1/2}$ 35X	1.4-2.0		
Sulphur, Crushed, -1/2"	801-961	881$C_{1/2}$ 35N	0.8		
Sulphur, Lumps, -3"	1281-1362	1330D_3 35N	0.8		
Sulphur, Powdered	801-961	881A_{40} 35MN	0.6		
Sunflower Seed	304-609	465$C_{1/2}$ 15	0.5	x	
Talcum, -1/2"	1281-1442	1362$C_{1/2}$ 36	0.9		
Talcum, Powder	801-961	881A_{200} 36M	0.8	x	
Tanbark, Ground*	881	881B_6 45	0.7		
Timothy Seed	577	577B_6 35NY	0.6	x	
Titanium Dioxide (See Limonite, Ore)			—		
Tobacco, Scraps	240-400	320D_3 45Y	0.8		
Tobacco, Snuff	481	481B_6 45MQ	0.9	x	
Tricalcium Phosphate	641-801	721A_{40} 45	1.6		
Triple Super Phosphate	801-881	849B_6 36RS	2.0		
Trisodium Phosphate	961	961$C_{1/2}$ 36	1.7		
Trisodium Phosphate, Granular	961	961B_6 36	1.7		
Trisodium Phosphate, Pulverized	801	801A_{40} 36	1.6	x	
Tung Nuts	400-481	449D_3 15	0.7	x	
Tung Nuts, Meat, Crushed	449	449D_3 25W	0.8	x	
Urea Prills, Coated	689-737	721B_6 25	1.2		
Vermiculite, Expanded	256	256$C_{1/2}$ 35Y	0.5		
Vermiculite, Ore	1281	1281D_3 36	1.0		
Vetch	769	769B_6 16N	0.4	x	
Walnut Shells, Crushed	561-721	641B_6 36	1.0	x	
Wheat	721-769	753$C_{1/2}$ 25N	0.4	x	
Wheat, Cracked	641-721	689B_6 25N	0.4	x	
Wheat, Germ	288-449	368B_6 25	0.4	x	
White Lead, Dry	1201-1602	1410A_{40} 36MR	1.0	x	
Wood, Chips, Screened	160-481	320D_3 45VY	0.6		
Wood, Flour	256-577	416B_6 35N	0.4	x	
Wood, Shavings	128-256	192E45VY	1.5		
Zinc Oxide, Heavy	481-561	529A_{100} 45X	1.0		
Zinc Oxide, Light	160-240	208A_{100} 45XY	1.0	x	
Zinc, Concentrate, Residue	1201-1281	1249B_6 37	1.0		

REFERENCE TO SPECIFIC MATERIALS IN TABLE 2 SHOULD NOT BE CONSTRUED AS INDICATING THAT ALL OF THE MATERIALS ARE RECOMMENDED FOR SCREW CONVEYOR APPLICATION.

*Consult Conveyor Manufacturer.
V - Those materials which show an X may be handled in vertical screw conveyors.

12 Lump size limitation

The size of a screw conveyor not only depends on the capacity required, but also on the size and proportion of lumps in the material to be handled. The size of a lump is the maximum dimension it has. A closer definition of the lump size would be the diameter of a ring through which the lump would pass. However, if a lump has one dimension much longer than its transverse cross-section, the long dimension or length would determine the lump size.

The character of the lump also is involved. Some materials have hard lumps that won't break up in transit through a screw conveyor. In that case provision must be made to handle these lumps. Other materials may have lumps that are fairly hard, but degradable in transit through the screw conveyor, thus really reducing the lump size to be handled. Still other materials have lumps that are easily broken in a screw conveyor and lumps of these materials impose no limitations.

Three classes of lump sizes apply as follow:

Class 1

A mixture of lumps and fines in which not more than 10% are lumps ranging from maximum size to one half of the maximum; and 90% are lumps smaller than one half of the maximum size.

Class 2

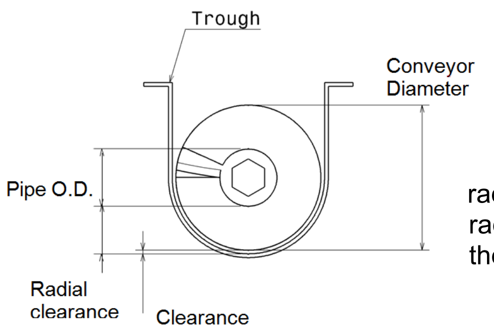
A mixture of lumps and fines in which not more than 25% are lumps ranging from the maximum size to one half of the maximum; and 75% are lumps smaller than one half of the maximum size.

Class 3

A mixture of lumps only in which 95% or more are lumps ranging from maximum size to one half of the maximum size; and 5% or less are lumps less than one tenth of the maximum size.

Table 8 Maximum lump size shows the recommended maximum lump size for each customary screw diameter and the three lump classes. The ratio, *R*, is included to show the average factor used for the normal screw diameters which then may be used as a guide for special screw sizes and constructions.

Figure 1 Clearance definition



$$R = \frac{\text{Radial Clearance,mm}}{\text{Lump Size,mm}} \quad \text{Equation 1}$$

The allowable size of a lump in a screw conveyor is a function of the radial clearance between the outside diameter of the central pipe and the radius of the inside of the screw trough, as well as the proportion of lumps in the mix. The following illustration illustrates this relationship.

Table 8 Maximum lump size

Screw Diameter. (Inches)	Pipe O.D mm	Radial Clearance mm	Class 1 10% Lump Ratio R=1.75 Max. lump, mm	Class 2 25% Lump Ratio R=2.5 Max. lump, Inch (mm)	Class 3 95% Lump Ratio R=4.5 Max. lump, Inch (mm)
50,8 (2)	24	13	6	3,8	2,5
76,2 (3)	30	25	13	6	2,5
101,6 (4)	39	33	17	13	6
150 (6)	57	49	31	19	13
228,6 (9)	57	86	57	38	19
304,8 (12)	104,4	102	70	50	25

13 Conveyor speed

For screw conveyors with screws having regular helical flights all of standard pitch, the conveyor speeds can be found with the capacity charts. The material code refers to a recommended calculation chart. The optimized speed is found directly by reading on the chart. You can also compare with the screw diameter chart which one is the best suitable for your needs. The lump size limitation must be taken in consideration for small dimensions.

For the calculation of conveyor speeds where special types of screws are used, such as short pitch screws, an equivalent required capacity must be used, based on factors CF_1.

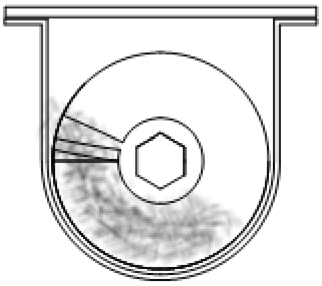
Factor *CF1* relates to the pitch of the screw.

For standard pitch CF_1=1 and for Half pitch CF_1=2

The equivalent capacity then is found by multiplying the required capacity by the capacity factors :

Equivalent Capacity = (Required Capacity)x (*CF1*)

Mildly Abrasive Materials
Filling level 45%



Degree of trough loading 45%

Material Class code

A-15
A-25
B-15
B-25
C-15
C-25

Always check the lump size to validate your choice

Chart 1 Conveyor speed calculation with 45%filling level

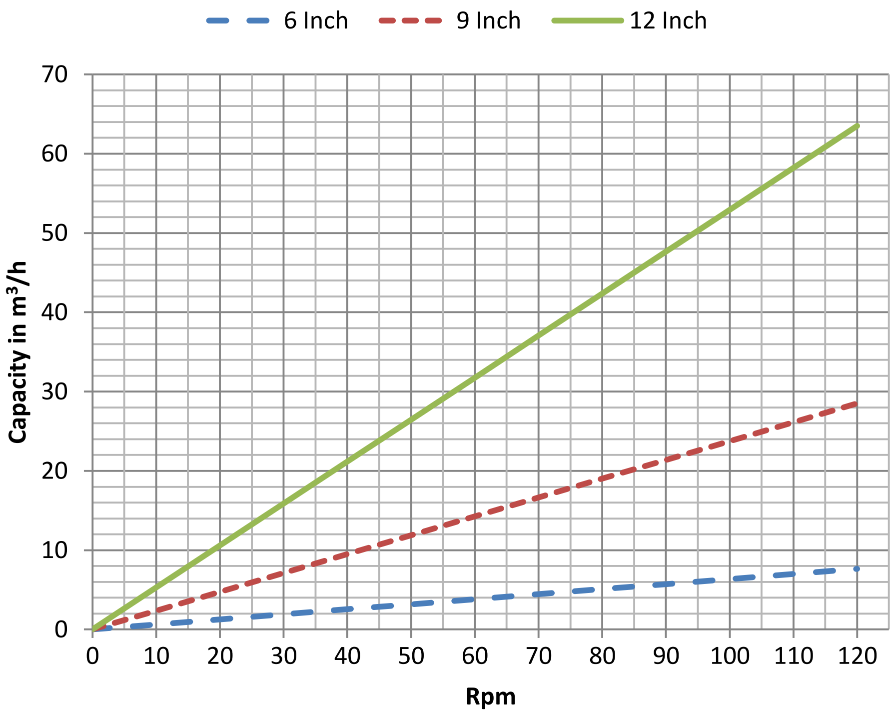
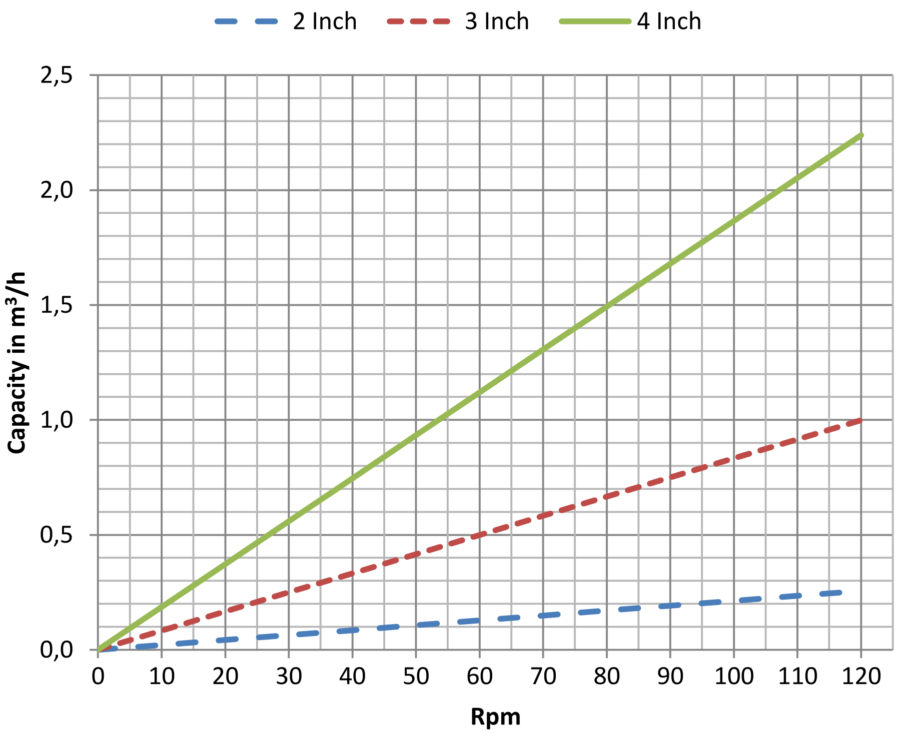


Chart 2 Conveyor speed calculation with 45%filling level

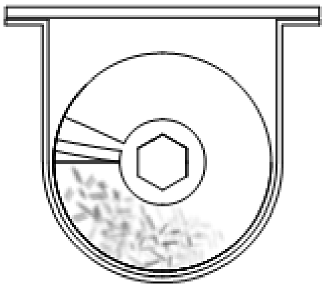


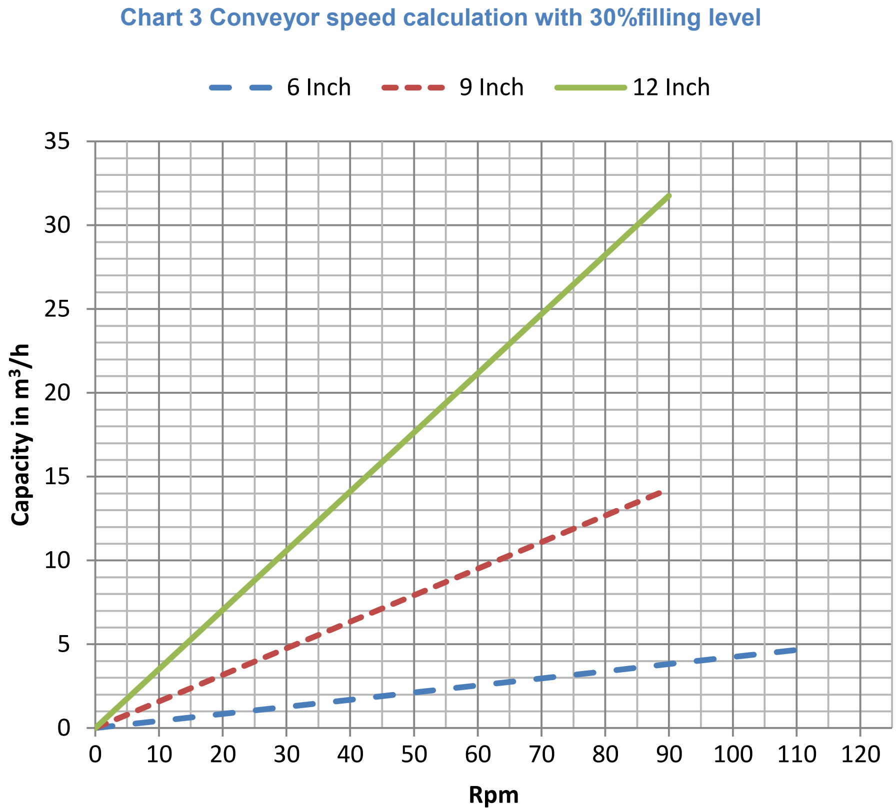
Degree of trough loading 45%

Material Class code

A-15
A-25
B-15
B-25
C-15
C-25

Moderatly Abrasive Materials
Filling level 30%



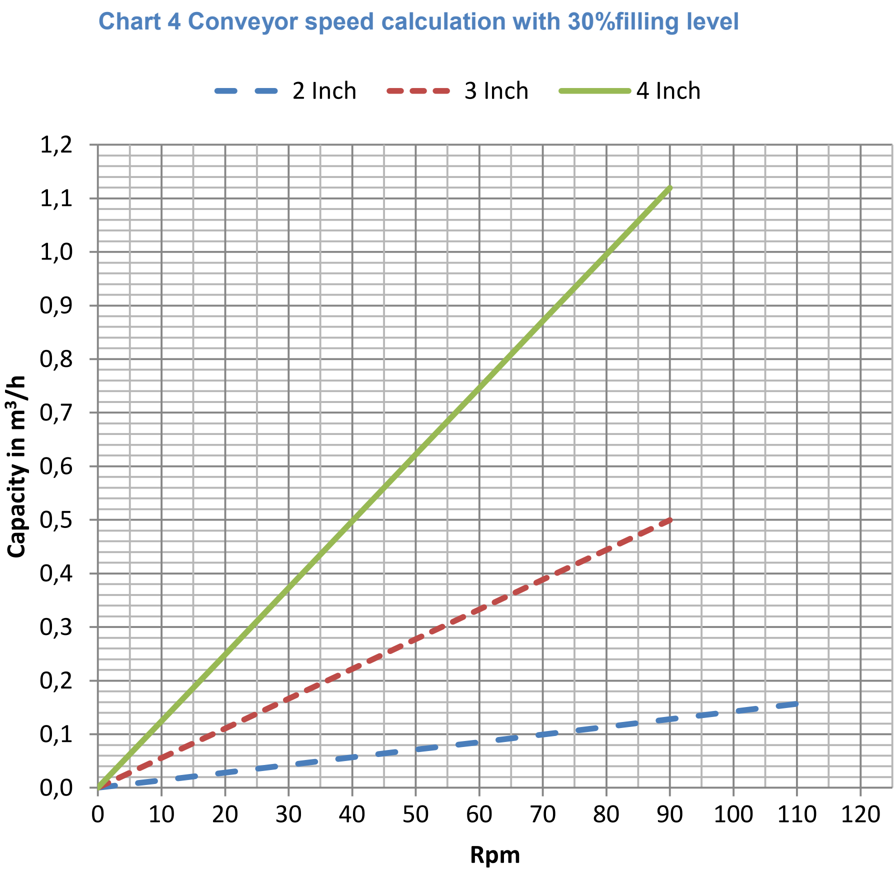


Degree of trough loading 30%

Material Class code

A-35	D-25	E-15
A-45	D-35	E-25
B-35	D-45	E-35
B-45	D-15	E-45
C-35		
C-45		

Always check the lump size to validate your choice

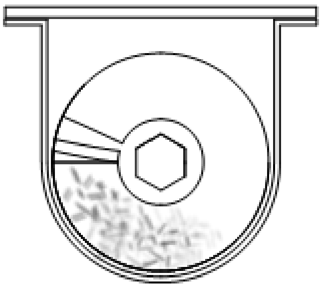


Degree of trough loading 30%

Material Class code

A-35	D-25	E-15
A-45	D-35	E-25
B-35	D-45	E-35
B-45	D-15	E-45
C-35		
C-45		

Abrasive Materials
Filling level 30%



Degree of trough loading 30%

Material Class code

A-16	C-16	E-16
A-26	C-26	E-26
A-36	C-36	E-36
A-46	C-46	E-46
B-16	D-16	
B-26	D-26	
B-36	D-36	
B-46	D-46	

Always check the lump size to validate your choice

Chart 5 Conveyor speed calculation with 30%filling level

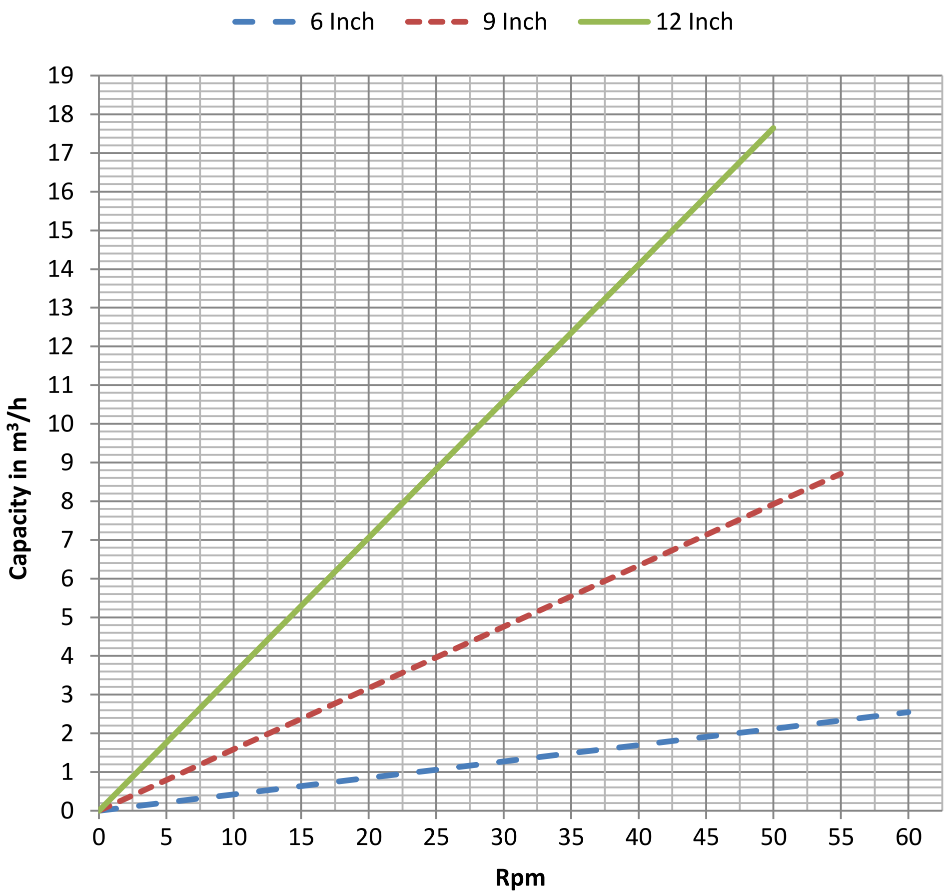
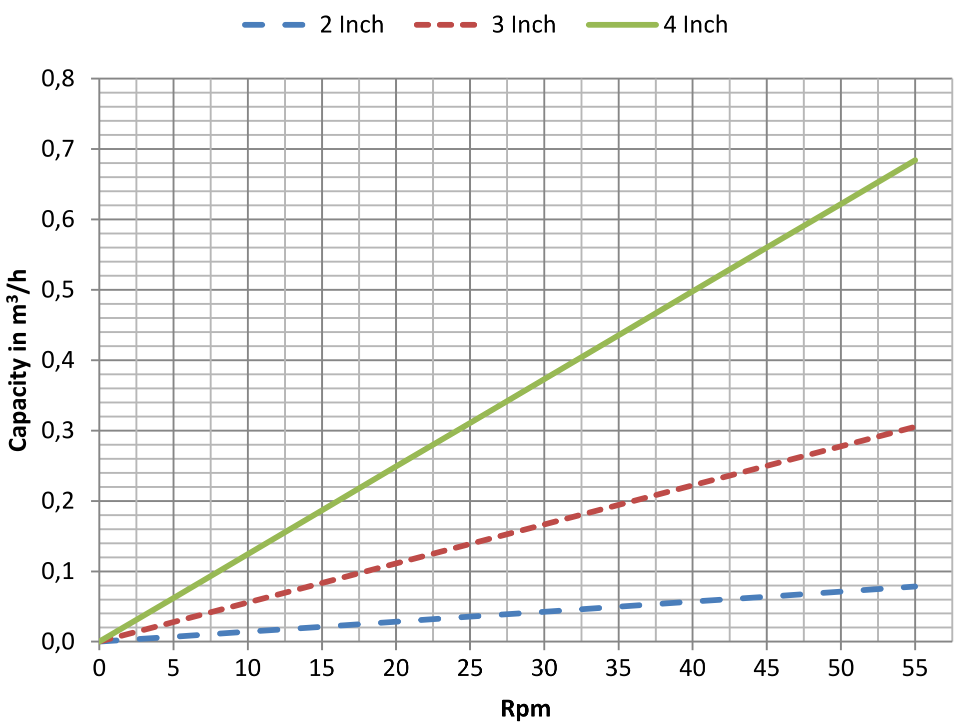


Chart 6 Conveyor speed calculation with 30%filling level

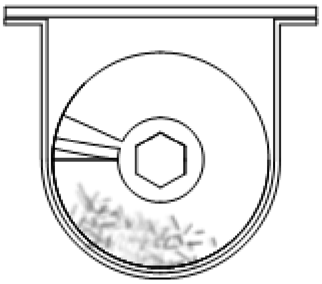


Degree of trough loading 30%

Material Class code

A-16	C-16	E-16
A-26	C-26	E-26
A-36	C-36	E-36
A-46	C-46	E-46
B-16	D-16	
B-26	D-26	
B-36	D-36	
B-46	D-46	

Very Abrasive Materials
Filling level 15%

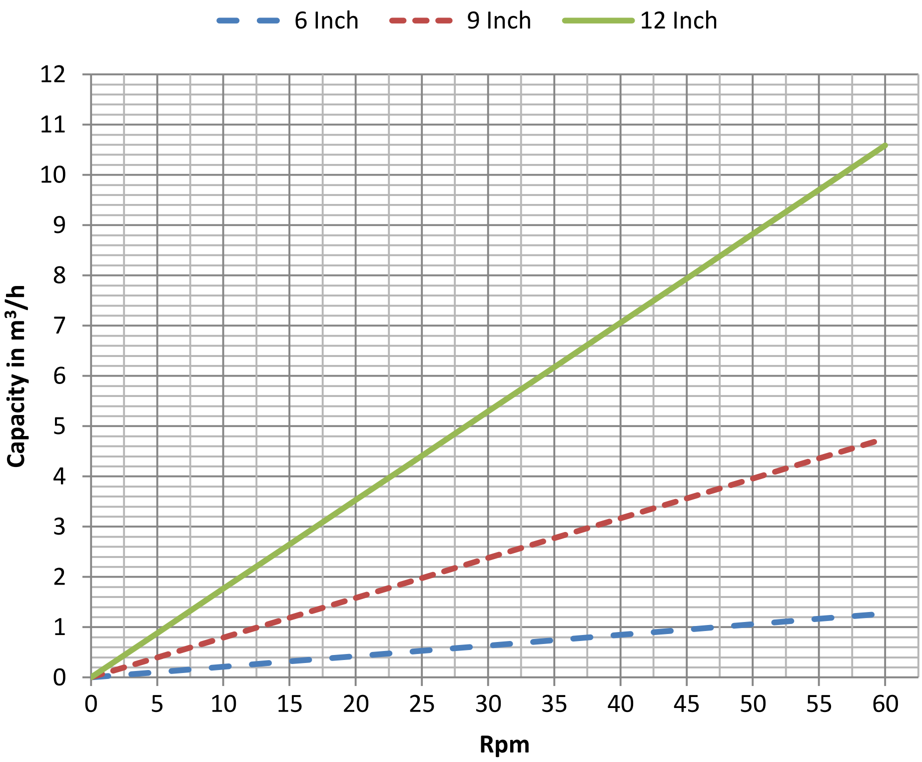


Degree of trough loading 15%

Material Class code

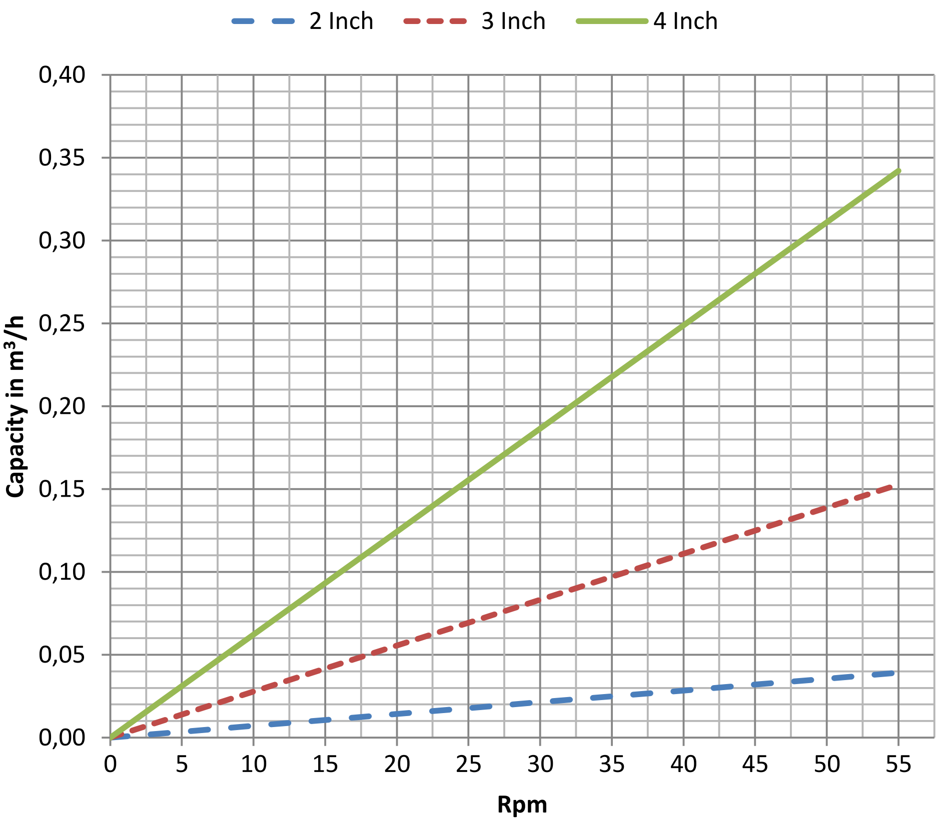
A-17	C-17	E-17
A-27	C-27	E-27
A-37	C-37	E-37
A-47	C-47	E-47
B-17	D-17	
B-27	D-27	
B-37	D-37	
B-47	D-47	

Chart 7 Conveyor speed calculation with 15 %filling level



Always check the lump size to validate your choice

Chart 8 Conveyor speed calculation with 15 % filling level



Degree of trough loading 15%

Material Class code

A-17	C-17	E-17
A-27	C-27	E-27
A-37	C-37	E-37
A-47	C-47	E-47
B-17	D-17	
B-27	D-27	
B-37	D-37	
B-47	D-47	

For example, if you want Sulphur powered, 16 000 kg/h. The material weighing 850 kg/m³, The material code in the table 2 is $881A_{40}$ 35MN. As indicated on the selection chart, the recommended conveyor filling level is 30%.

The required capacity is : $\frac{16000}{881} = 18{,}2$ m³/h

Then you can read directly on the chart that the recommended screw diameter is 300 mm (12 inch) with a speed of 50 rpm.

14 Higher filling level extra charts

In some case, conveyor manufacturer uses higher filling level, mainly for the design of screw feeders or short screws. This filling level is obtained with a 2/3 flightings or rotary valves at the inlet. Followings charts allows the calculation of rotation speed (rpm) for a throughput. A particular care should be taken with such filling level due to the stacking risks of material in the screw. A 100% filling level must be avoided.

Chart 9 Capacity of 300 mm (12 inch) auger

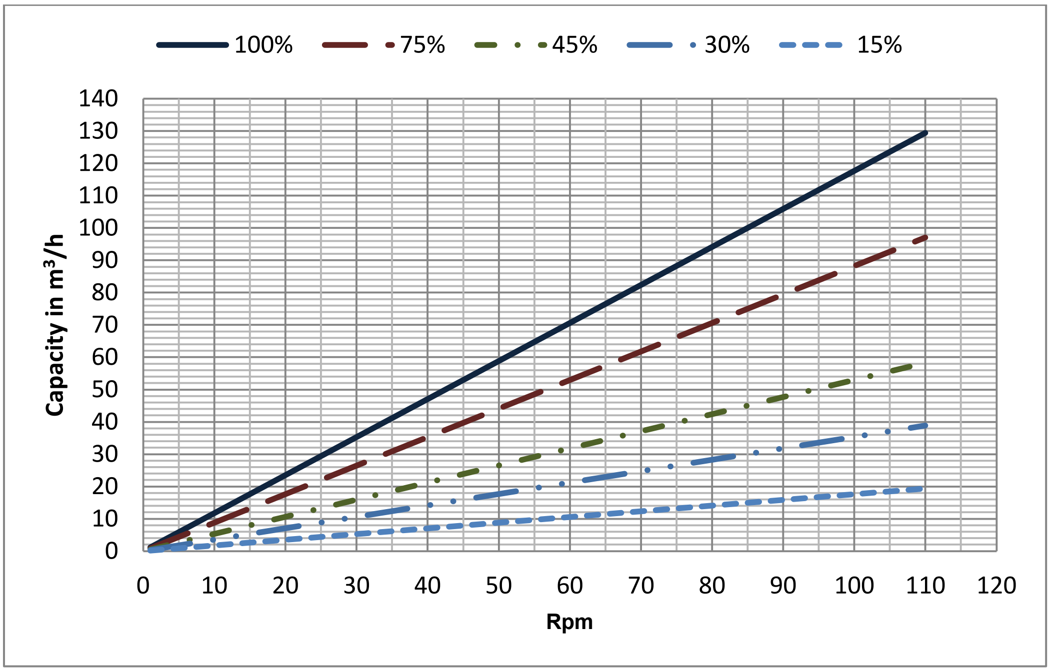


Chart 10 Capacity chart 220 mm (9 inch) Auger

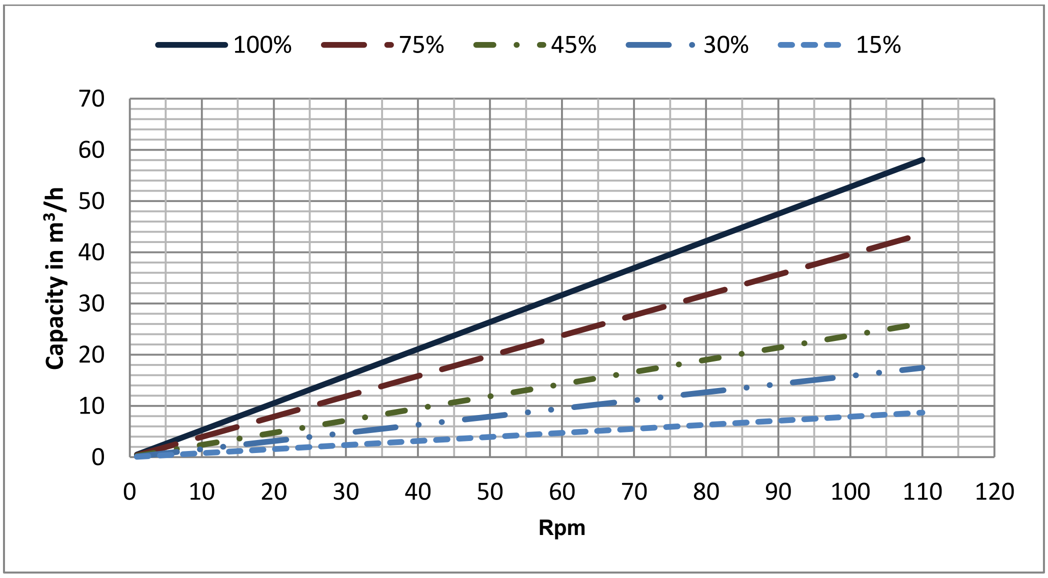


Chart 11 Capacity chart of a 150 mm (6 inch) Auger

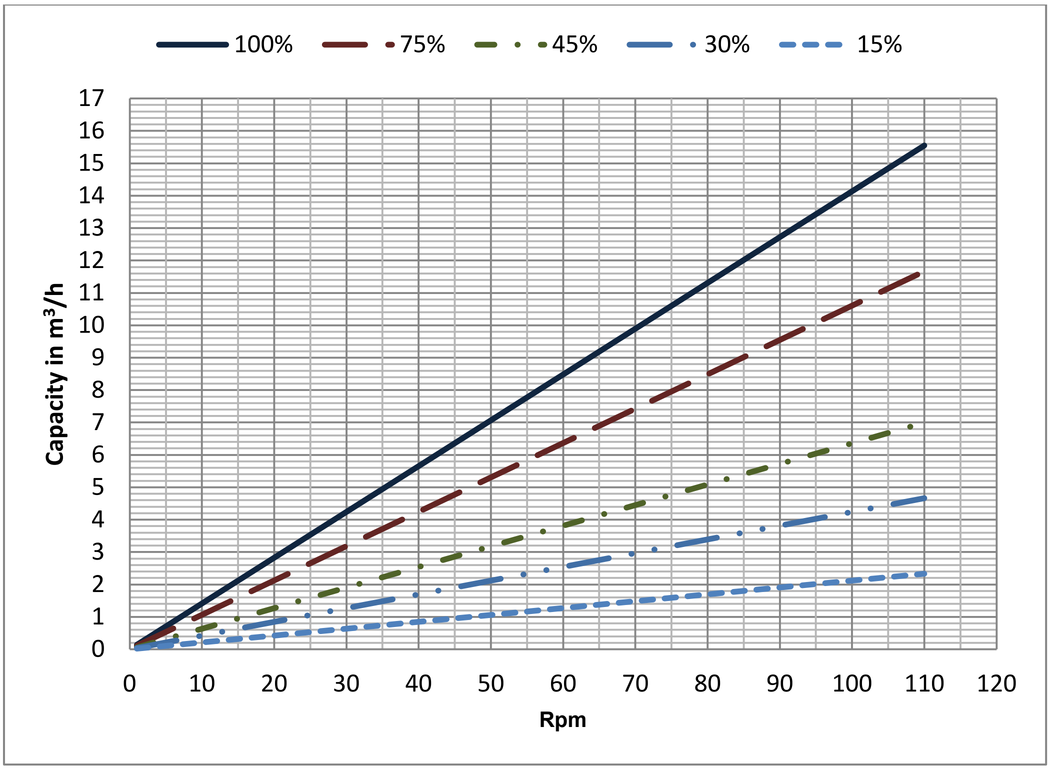


Chart 12 Capacity chart 100 mm (4 inch) auger

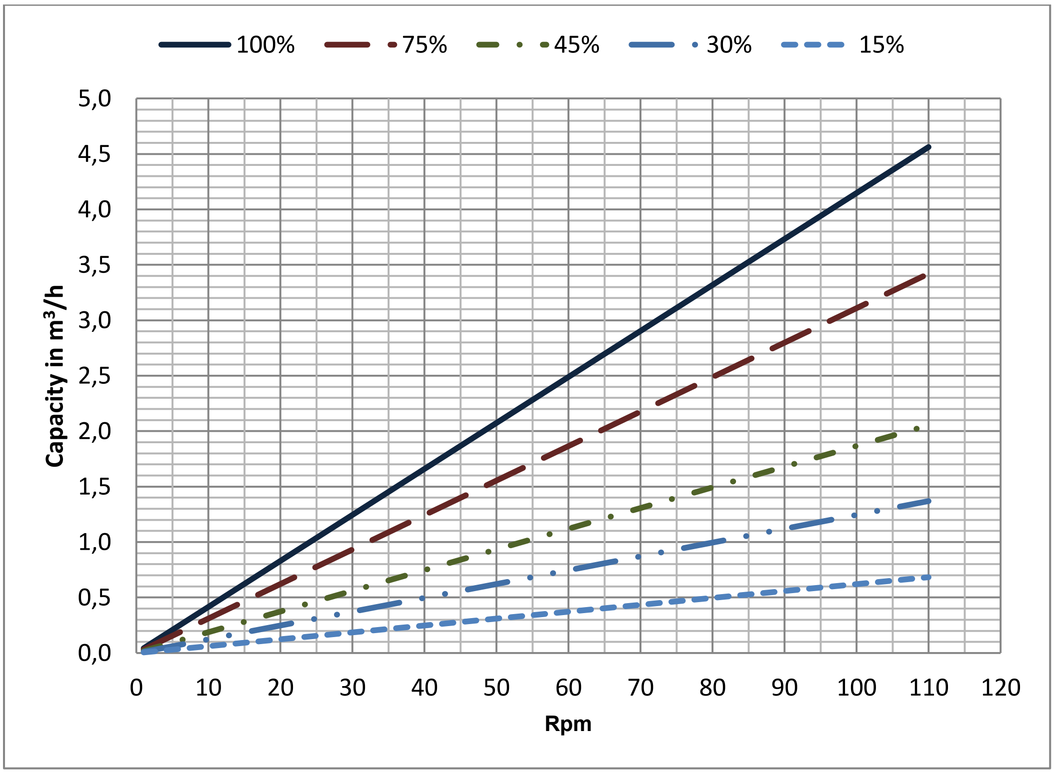


Chart 13 Capacity chart for 80 mm (3 inch) auger

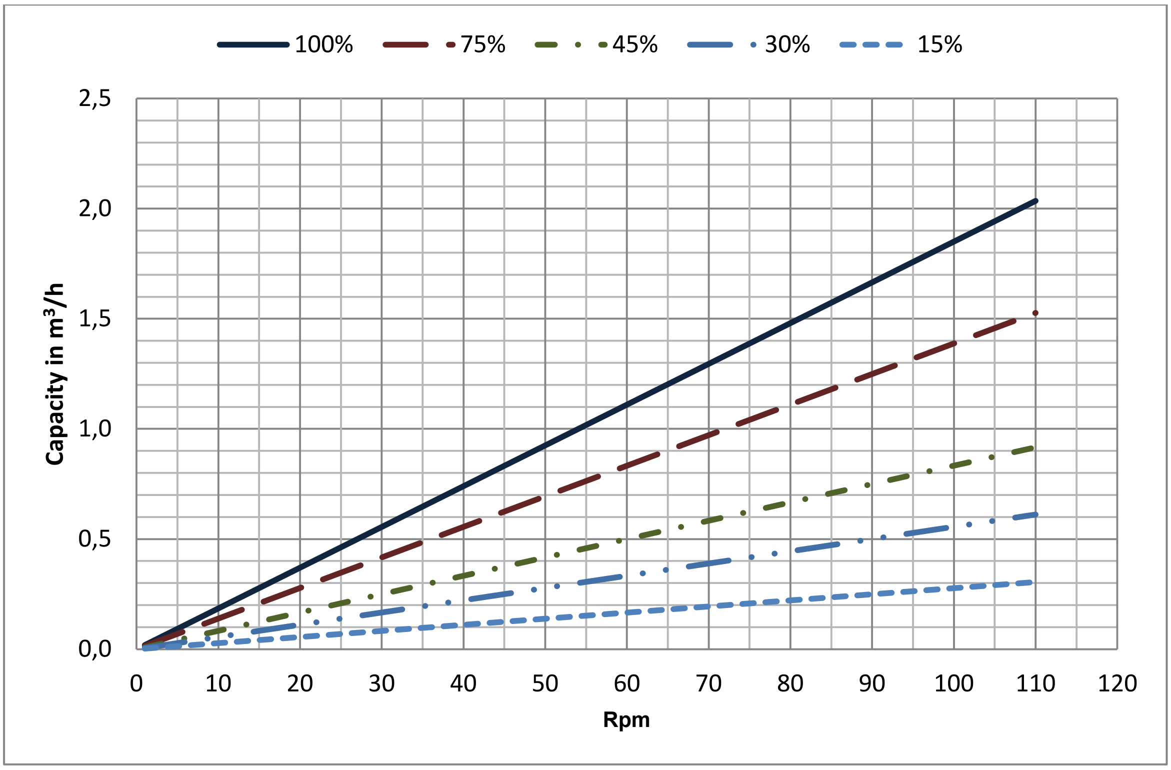
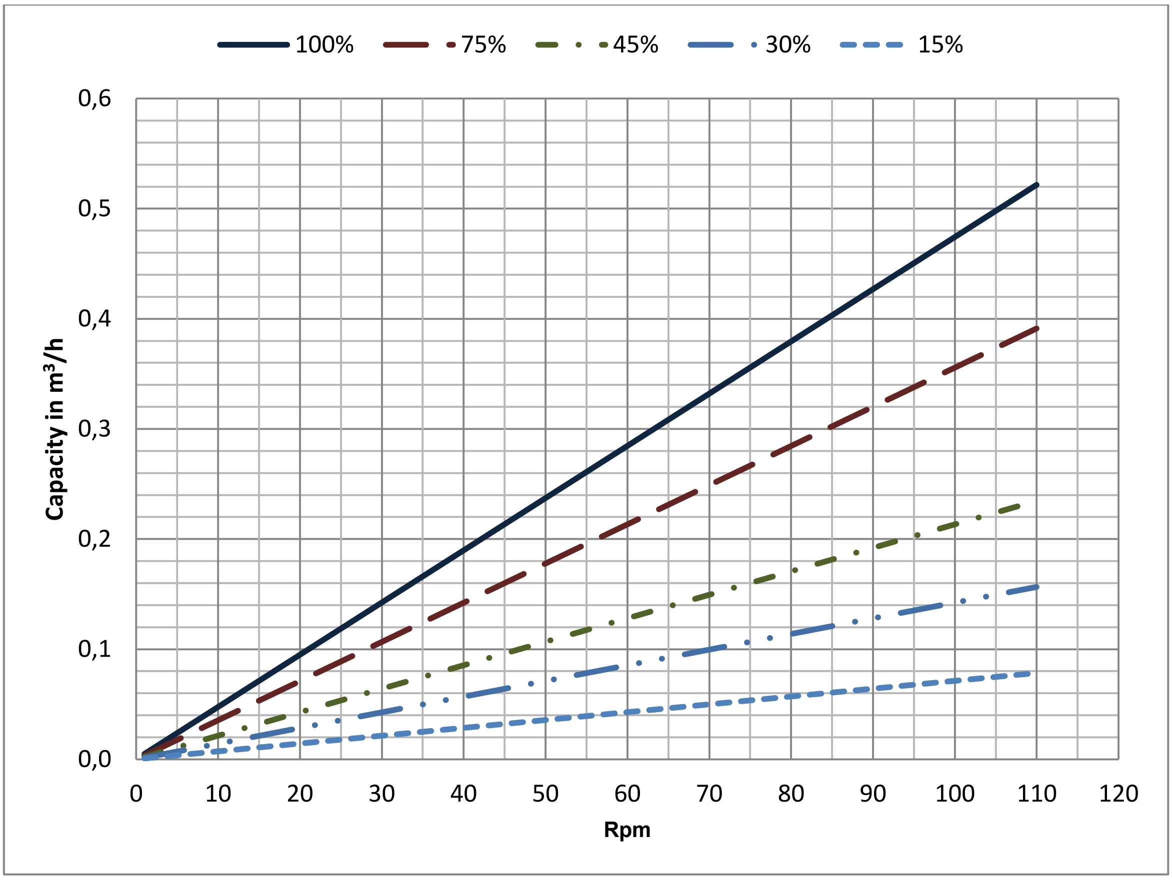


Chart 14 Capacity chart for a 50 mm (2 inch) Auger



15 Conveyors Horsepower requirements on horizontal screw

15.1 Calculation foreword

The horsepower required to operate an horizontal screw conveyor is based on proper installation, uniform and regular feed rate to the conveyor, and other design criteria.

The following factors determine the horsepower requirement of a screw conveyor operating under the foregoing conditions.

C = Capacity in m^3/h
e = Drive efficiency.
F_b = Hanger bearing factor.
F_d = Screw diameter factor.
F_f = Flight factor.
F_m = Material factor.
F_o = Overload factor.
L = Total length of conveyor, m.
N = Operating speed, RPM (revolutions per minute).
Wa = Apparent density of the material AS CONVEYED in kg/m^3,

The horsepower requirement is the total of the horsepower to overcome conveyor friction (HP_f) and the horsepower to transport the material at the specified rate (HP_m) multiplied by the overload factor F_o and divided by the total drive efficiency e, or:

$$HP_F = \frac{LNF_dF_b}{409}$$

Equation 2

$$HP_m = \frac{CLW_aF_fF_m}{185}$$

Equation 3

$$Total\ \ HP = \frac{(HP_{f+}HP_m)F_o}{e}$$

Equation 4

HP_f, HP_m total HP are in Watt.

It is apparent that with capacity, conveyor size and speed plus conveyor length all known, that factors F_m, F_d and F_b are quite important. Small changes in these factors cause significant changes in the required horsepower.

- The factor F_b is related to the friction in the hanger bearings, due to rubbing of the bearing and including, for sleeve type hanger bearings, an allowance for the entry into the bearing of some foreign material. This factor is empirically derived and estimated for Archimedys screw.
- Factor F_d has been computed proportional to the average weight per foot of the heaviest rotating parts and to the coupling shaft diameter.
- The factor F_m depends upon the characteristics of the material. It is an entirely empirical factor determined by long experience in designing and operating screw conveyors. It has no measurable relation to any physical property of the material transported.
- The overload factor F_o is a correction for calculated horsepower of less than five horsepower. This factor is necessary because screw conveyors often require a greater torque range than small motors are able to provide. In other words, small overloads or minor choke conditions could easily stall a drive and create an intolerable nuisance in a continuous process. Increasing the horsepower

of these small motors has been found a satisfactory means of correcting such undesirable conditions, and the factor F_o does just that.

- Factors F_f and F_p are provided as correction factors for the various conveyor screw flight forms. They are empirically derived but have relation to the net effective area of the screw flight.
- While it is good procedure in the conveying of bulk materials to run the conveyor until it is empty, prior to a work stoppage, frequently conveyors must of necessity be stopped while fully loaded. In that event, starting the conveyor again may possibly cause serious overloading of the driving motor. The characteristics of the material have much to do with the restarting of a fully loaded screw conveyor. Some materials will settle and pack or otherwise change their “as conveyed” characteristics.

It is quite important that a conveyor system operate as demanded by its controls. Start-up conditions or temporary overloads should not cause interruptions in service, so all components of the drive, as well as the motor, should be chosen accordingly.

15.2 Factors Fb, Fd, Ff, Fo and e

Archimedys screw are mainly used without intermediate hanger. If for a particular reason hangers have to be used, the right factor value is to be chosen in the following list :

Table 9 Hanger bearing factor Fb

Bearing type	Fb
Archimedys hanger free	1,2
Ball bearing	1
Bronze, graphite, oil impregnated	1,7
Plastic	2,0
Hard iron	4,4

Consult our technical team for any help in the choice of bearing type according to the material to convey.

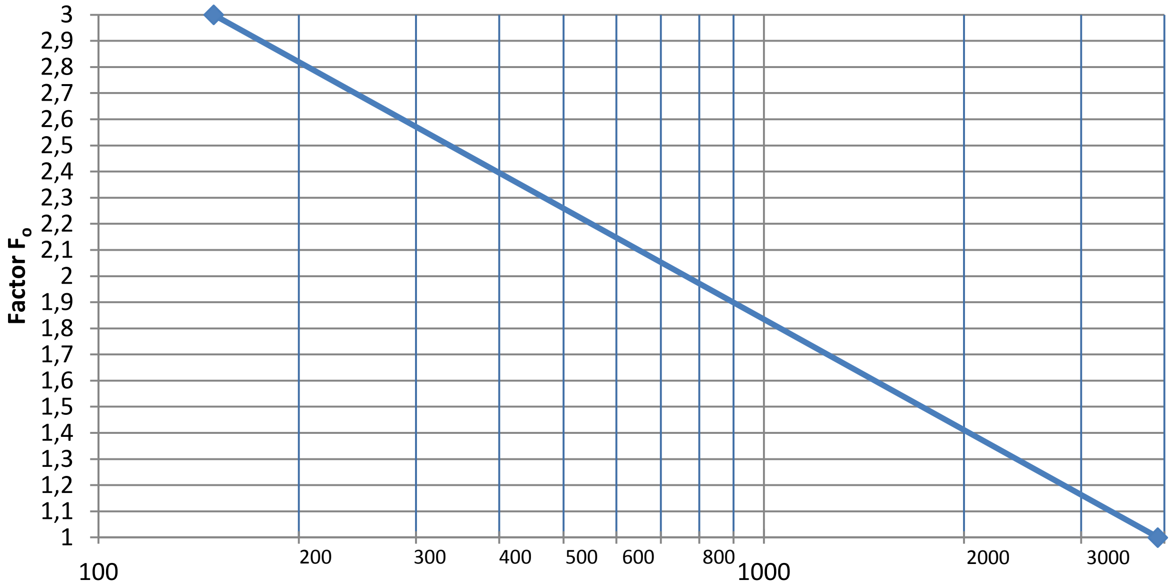
Table 10 Screw diameter factor Fd

Screw diameter mm (inch)	Fd
50 (2)	5
80 (3)	7
100 (4)	12
150 (6)	18
225 (9)	31
300 (12)	55

Table 11 Flight factor Ff

Type of flight	Conveyor loading			
	15%	30%	45%	95%
Standard square flight	1	1	1	1
Standard and half pitch flight	1,10	1,15	1,20	1,30

Chart 15 Fo Overload factor



Horse power $HP_f + HP_m$
For value of HP_f+HP_m greater than 3800 Fo =1

Table 12 e Mechanical efficiencies of speed reduction mechanisms

Type of Speed Reduction Mechanism	Approximate Efficiencies
V-Belts and Sheaves Precision Roller Chain on Cut Tooth Sprockets, Open Guard Precision Roller Chain on Cut Tooth Sprockets, Oil Tight Casing	0.94 0.93 0.94
Single Reduction Helical or Herringbone Enclosed Gear Reducer or Gearmotor Double Reduction Helical or Herringbone Enclosed Gear Reducer or Gearmotor Triple Reduction Helical or Herringbone Enclosed Gear Reducer or Gearmotor Single Reduction Helical Gear, Enclosed Shaft Mounted Speed Reducers and Screw Conveyor Drives Double Reduction Helical Gear, Enclosed Shaft Mounted Speed Reducers and Screw Conveyor Drives	0.95 0.94 0.93 0.95 0.94
Low Ratio (up to 20:1 range) Enclosed Worm Gear Speed Reducers Medium Ratio (20:1 to 60:1 range) Enclosed Worm Gear Speed Reducers High Ratio (over 60:1 to 100:1 range) Enclosed Worm Gear Speed Reducers	0.90 0.70 0.50
Cut Tooth, Miter or Bevel Gear, Enclosed Countershaft Box Ends Cut Tooth Spur Gears, Enclosed, For Each Reduction Cut Tooth Miter or Bevel Gear Open Type Countershaft Box Ends Cut Tooth Spur Gears, Open For Each Reduction Cast Tooth Spur Gears, Open For Each Reduction	0.93 0.93 0.90 0.90 0.85

16 Torque limitation

Screw conveyors are limited in overall length by the amount of torque that can be safely transmitted through the pipes and couplings. The following formula is used in order to estimate the torsional rating of conveyor screw parts in Nm.

$$T = \frac{9{,}56 * HP}{N}$$

Equation 5

Where :

HP : calculated screw horsepower in Watt
N : screw conveyor rotation speed in rpm

17 Inclined screw conveyor

As the angle of incline of the screw conveyor is increased there is a serious loss of efficiency. Primarily, two things happen to bring this about:

- The capacity, or the maximum available capacity of a given screw conveyor, decreases with increase of incline.
- The horsepower per unit of capacity increases. The turbulence and tumbling of the material requires more power, power that really is not useful in conveying the material.

Tubular housings are of advantage on many inclined screw conveyors because they tend to contain the material in the screw and prevent the fall-back of material over the top of the screw which takes place in U-shaped troughs. This is especially true when using higher than usual rotational speeds. One major advantage of Archimedys screw is that it can stay in contact with the inside face of the trough, avoiding clearance and optimizing the material flow.

Several things can be done to overcome many of the problems associated with inclined screw conveyors, and obtain a workable inclined screw conveyor installation.

These are:

- Use close clearance between trough and screw.
- Increase the speed over that applicable for a horizontal screw conveyor of the same size.
- Use short pitch screws, 1/2 pitch as the material to be handled will permit.
- Don’t use intermediate hanger as far as possible.
- Use tubular troughs with minimum clearance between trough and screw.
- The increase in speed of screw rotation imparts a greater forward material

Chart 16 Average effect on incline on screw conveyor capacity

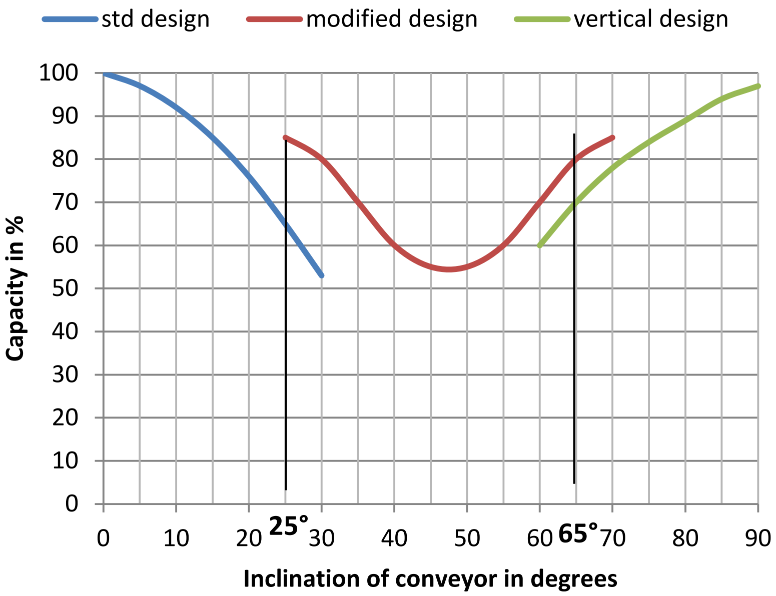


Chart 16 shows in a qualitative manner the percent capacities of screw conveyors at various angles of incline for standard designs, modified designs and for vertical designs. Please consult our engineering team for construction recommendation.

18 Horsepower of inclined conveyors

The horsepower HP_i required by inclined screw conveyors may be approximated by using the following method:

a) Calculate the horsepower HP of the screw conveyor just as though it were a horizontal screw conveyor, using the horsepower formulas previously detailed
b) Calculate the actual horsepower HP_L to lift the material the total height of the incline. This may be done as follows:

$$HP_L = \frac{CW_a L_i}{366}$$

Equation 6

With :

C : Capacity in m^3/h
L_i : Total Height of Lift of conveyor, in m.
W_a : apparent density of the material in kg/m^3
HP_L in Watt

c) The Empirical horsepower factor required to overcoming the decrease in efficiency due to the extra agitation and tumbling of the material is F_i. This factor will vary with each application.

Table 13 Evaluation of Fi overcome factor.

Material flowability (in material codification)	Fi
Very Free Flowing—Flow Function> 10	1,05
Free Flowing—Flow Function>4 But <10	1,10
Average Flowability—Flow Function>2 But <4	1,15
Sluggish—Flow Function<2	1,20

d) The total horse power HP_i for a inclined conveyor is given by the formula :

$$HP_i = \frac{HP + HP_L\ F_i}{e}$$

Equation 7

With :

e : drive efficiency

19 Vertical screw conveyors

Vertical screw conveyors can handle many of the bulk materials shown in the material table Chapter 2, column IV. Generally this includes all materials listed except those containing large lumps, or which are very dense or are extremely abrasive.

The vertical screw conveyor consists of conveyor screw rotating in a vertical casing or housing with a suitable inlet at the lower end and an outlet at the upper end.

The drive may be located at the top or the bottom. The top bearing for the screw shaft must be adequate to handle both the radial and thrust loads.

One of the features of vertical screw conveyors is that if the rotation of the vertical screw be stopped, the conveyor will be full of material. It is also true that if the vertical screw be left turning but the feed of material cease, the vertical screw conveyor will not empty itself; some material will be left in it, in an amount depending on the material characteristics. It is important to realize, however, that material left over from a previous operation will be the first to discharge when the vertical screw conveyor is started again.

19.1 Capacities of vertical screw conveyor

Table 14 Vertical screw conveyor capacities indicates typical average capacities for various sizes of vertical screw conveyors. These capacities can be exceeded when handling some materials which have particularly favorable characteristics.

A range of vertical screw speeds is shown and although the screw speed is constant for any given application, the speed will have to be chosen to suit the material characteristics.

Helicoids flights with standard diameters and pitches are normally used for this application.

Often longer than standard screw sections are used, to reduce the number of intermediate hanger bearings. Because of the high speed, screw sections may deflect if made too long and tend to whip, particularly when extended heights of lift are required. Before using a Archimedys screw for a vertical conveyor, consult our technical team. A speed limit is to be taken in consideration in order to avoid local melting due to contact on the pipe.

Table 14 Vertical screw conveyor capacities

Screw diameter mm (inch)	Capacity in m^3/h	Rpm
50 (2)	0,15	80 to 100
80 (3)	0,60	100 to 150
100 (4)	1,13	110 to 150
150 (6)	2,83	110 to 140
228 (9)	Not recommended	-
300 (12)	Not recommended	-

19.2 Horsepower for vertical screw conveyors

The following horsepower formula is to be used only for approximating the horsepower required for a vertical screw conveyor. Because of the many variables that may affect the horsepower of a vertical screw conveyor installation, it is recommended that the supplier of the vertical conveyor be consulted to determine the horsepower that actually may be needed.

Because of the difficulty in determining theoretically the power losses in a vertical screw conveyor, most manufacturers of these units have done extensive testing and, through such experience, have developed empirical factors that can be used to set up realistic horsepower requirements. These factors may be combined here in a single factor, F_V , which of course will vary for different applications and for different manufacturers' designs of vertical screw conveyors.

The basic horsepower formula has been empirically determined as:

$$HP = \frac{(HP_f + HP_v)}{0,90}$$

Equation 8

Where :

HP_f is the horsepower to drive the empty conveyor
HP_v is the horsepower to convey the material vertically

And where :

$$HP_f = \frac{L_1 N F_d F_b}{410}$$

Equation 9

L_1 : total length of the vertical screw conveyor in m
N : speed of vertical conveyor screw in rpm
F_d : Conveyor diameter factor from Table 10 Screw diameter factor Fd
F_b : hanger bearing factor from Table 9

And where :

$$HP_v = \frac{CLWF_v}{186}$$

Equation 10

L : total lift height in m, measured from the centerline of opening to the bottom of the discharge opening.
C : capacity in m^3/h
W : apparent density of the conveyed material, kg/m^3
F_v : conveyor manufacturer empirical factor.

20 Safety and warning

Safety must be considered a basic factor in machinery operation at all time. Most accidents are the results of carelessness or negligence. All rotating power transmission products are potentially dangerous and must be guarded by the contractor, installer, purchaser, owner, and user as required by applicable laws, regulations, standards, and good safety practice.

It is the responsibility of the contractor, installer, purchaser, owner, and user to install, maintain, and operate the parts or components manufactured and supplied by Exventys, in such a manner as to comply with all state and local laws, ordinances, regulations.

Taking into consideration all of the physical aspects of the installation, any or all of the following safeguards may be required to protect the operators and those working in the immediate area of the conveyor.

- COVERS AND GRATINGS. Use rugged gratings in all open loading areas and solid covers in other areas. Covers, guards and gratings at inlet points must be such that personnel cannot be injured by the screw.
- LOCK-OUT AND TAG-OUT. A formalized lock-out or tag-out procedure must be followed when a conveyor is stopped for maintenance or repairs and before conveyors or guards are removed. All safety devices, covers, and guards shall be replaced before starting equipment for operation.
- GUARDS. For protection of the operator and other persons in the working area, purchaser should provide guards for all exposed equipment such as drives, gears, shafts, couplings, etc.

In this publication, some guards and covers are shown removed to facilitate viewing of moving parts. Equipment must not be operated without guards and covers in place.

NOTE: DO NOT STEP OR WALK ON CONVEYOR COVERS OR GRATING OR POWER TRANSMISSION GUARDS.

Static Electricity may accumulate on modular plastic conveyor screws and may produce an electrical spark. Do Not Use to Convey Non-Conductive Materials in a Combustible Environment without prior consultation with Exventys. A custom made conductive material can be used under the U4 classification for explosive products.

Following labels can be purchased at : www.cemanet.org

21 Horsepower calculation empty form

Project ____ Date ___/___/20__

Material to convey : ____________________________________

Material code (Table 7) : ________________ F_m : ____________ Material factor.

W : ________ kg/m^3, Apparent density as conveyed

C : _____________ m^3/h Capacity L : __________ m, Total length of conveyor

N : ___________ rpm, Operating speed Screw diameter : _______________________mm_

F_b : __________ Hanger bearing factor. Table 9

F_d : __________ Screw diameter factor. Table 10

F_f : __________ Flight factor. Table 11

F_o : __________ Overload factor. Chart 15

e : ___________ Drive efficiency. Table 12

$$HP_F = \frac{LNF_dF_b}{409} = \frac{\qquad\qquad}{409} =$$

$$HP_m = \frac{CLW_aF_fF_m}{185} = \frac{\qquad\qquad}{185} =$$

HPf+HPm=______

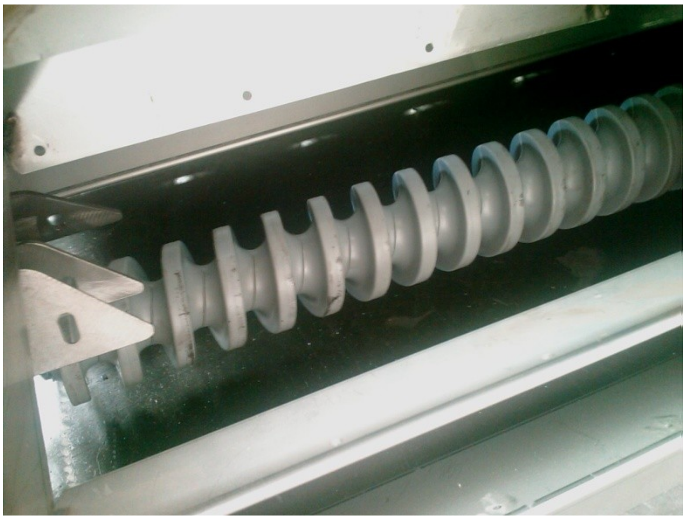
$$Total\ \ HP = \frac{(HP_{f+}HP_m)F_o}{e} = \underline{\qquad\qquad} =$$ W

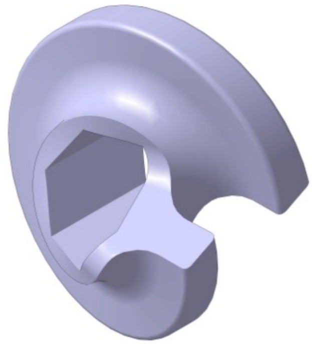
Request for quotation at : contact@archimedys.com

22 Table list

Tables

Charts





Customized flightings can also be realized for any kind of application.

Download all technical drawing for your cad software from Traceparts cad library www.traceparts.com catalogue : Archimedys

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