Plan Views **Cutaway View**

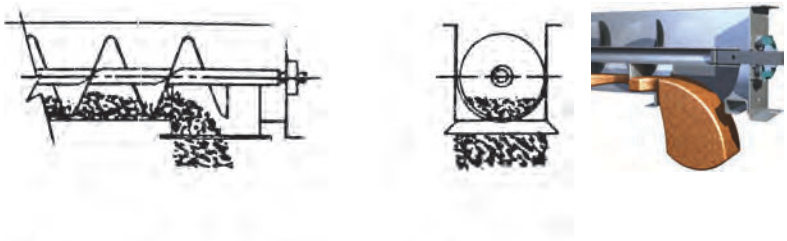

Figure 4.18A Standard Discharge Spout
This discharge spout is one of the most widely used discharge arrangements. It provides means of direct attachment to interconnecting spouts, processing machinery, other conveyors or storage bins. It may be provided with cutoff gates, manually operated as in Fig. 4.18C or operated by power.

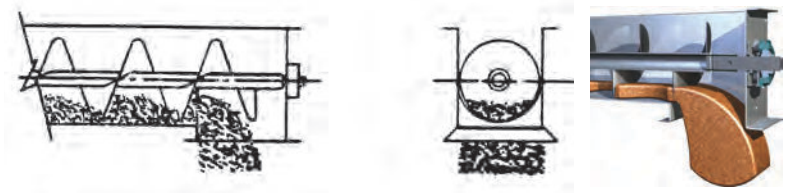

Figure 4.18B Flush End Discharge Spout
This discharge spout is similar to the standard discharge spout shown above, except it is located at the extreme end of the trough, integral with the fabricated trough end.

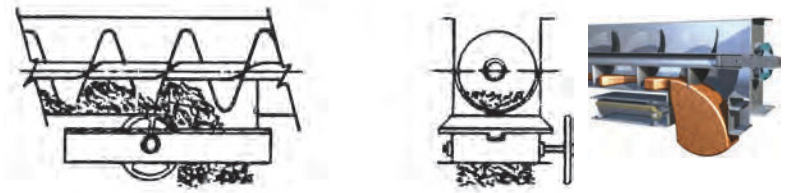

Figure 4.18C Mechanically Operated Gates
Mechanically operated gates, actuated manually or by power, control the discharge of material from the conveyor. These gates can be operated by remote control if desired.

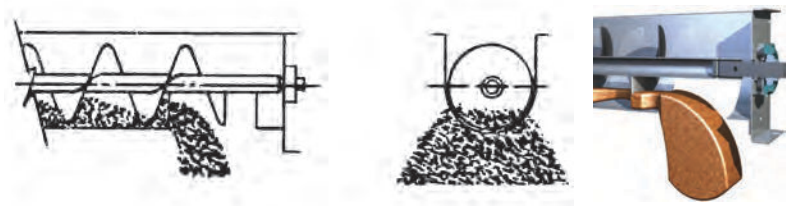

Figure 4.18D Plain Trough Opening
This simple opening in the bottom of trough lets the material drop directly through it. It is a useful arrangement where it is not necessary to stop or control the discharge of material from the conveyor, such as discharge to open storage piles.

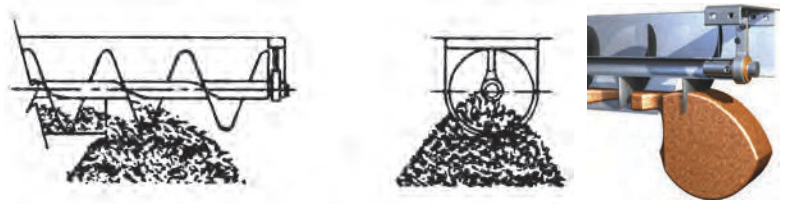

Figure 4.18E Open Bottom Discharge
This type of discharge is especially useful for distributing material to long storage piles. As the pile rises to the bottom of the conveyor screw, the top of the pile forms the “natural” trough and the material continuously is carried over to the forward edge of the pile.

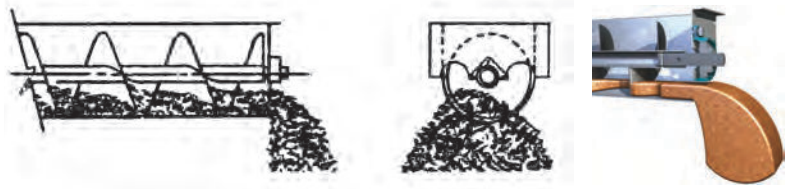

Figure 4.18F Trough End Discharge
Here the lower portion of the trough end is cut away (See Fig. 4.12G) to permit the material to discharge. This type of discharge should not be used for screw conveyors more than 30% full.

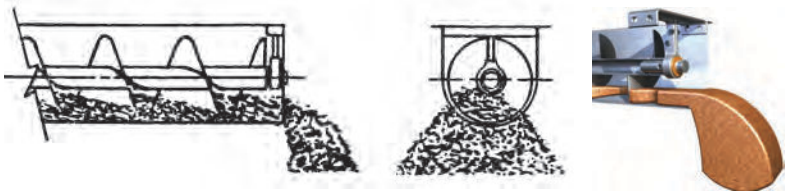

Figure 4.18G Open Discharge End
This method of discharge is widely used. The end of the conveyor screw is supported in a hanger bearing. The bottom of the trough often is cut back a bit to allow more free passage of the discharging material.

Saddles and Feet

Intermediate supports for a conveyor trough are called “saddles and feet.” Saddles are used when the support is between the trough joints. Feet are used when the support is at the trough joint, usually attached to the angle flanges at the joint. See Figures 4.19A, B, and C.

Figure 4.19A Foot

Figure 4.19B Trough with Foot

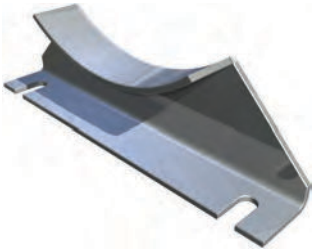

Figure 4.19C Saddle

CHAPTER 5

Materials of Construction, Classes of Enclosure, Weld Finish, Special Features and Modifications, Installation, Operation, Maintenance, Expansion

Special Features

In this chapter many special features are shown that may be incorporated in screw conveyors to attain certain objectives. The following pages list and illustrate these special features.

This chapter also covers the materials of construction of standard components, the various classes of enclosure of screw conveyor troughs and the calculation of the expansion of a screw conveyor handling hot materials.

The illustration in Figure 5.1 shows an assembled screw conveyor equipped with many of the special features described in this chapter. This conveyor, which is used in a food handling operation, has a central round inlet and two round discharge spouts. The drive is reversible so that by reversing the direction of rotation of the screw, material may be carried from the inlet to either discharge spout. Two hinged, quick opening trough cover sections and one section of hinged, drop bottom trough are used for ease of inspection and cleaning. A pressure sensitive limit switch device is located over one of the discharges to cut off the power to the drive motor if the conveyor is overloaded. A continuously welded conveyor screw, outboard shaft seals and a neoprene gasket for the cover are other special features used in this conveyor.

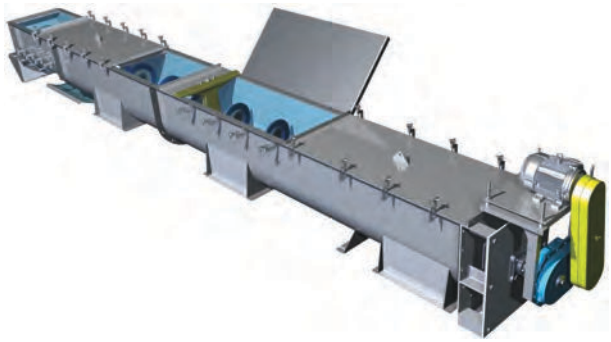

Figure 5.1 Assembled Screw Conveyor

Materials of Construction

For Standard Components

Standard screw flighting, pipe, shafts, troughs, trough ends, covers, hanger straps, feed spouts, discharge spouts, and gates are ordinarily made of low carbon, hot rolled steel in the form of sheets, plates, bars, strip, angles, channels and pipe.

Standard shafting normally is made of cold finished mild steel. However, coupling shafts may be hardened, depending on the materials conveyed.

Flanged sleeve type end bearing housings and the housings for ball and roller bearing mounts are usually made of cast iron.

The hanger bearing materials vary with the service conditions to which they are exposed. Sometimes they are of ordinary cast iron, lined with babbitt, bronze, oil impregnated hard wood or plastic such as nylon; sometimes they are made of extremely hard white cast iron; and sometimes ball bearing cartridges are employed.

While the materials of construction of standard components, as outlined previously, are satisfactory for many screw conveyor applications, there are a number of not uncommon service

conditions that require different materials. Table 5-1 indicates the changes in the construction materials for certain components for nine specified service conditions. Before proceeding with component selections, the intended service conditions should be checked with those enumerated in Table 5-1.

Table 5-1. Component Group Selection

Service Conditions	Troughs	Covers	Helical Flighting	Sectional Flighting	Screw Pipes	Shafting	Gates & Spouts
Material packs and builds on trough	C O S S						
Material is slightly corrosive	C O C R	C R C O	C O	C O C R	C O		C O C R
Material is mildly corrosive	C O S S	C O S S	C O S S	C O S S	C O S S	S S	C O S S
Material is highly corrosive	C O S S	C O S S	C O S S	C O S S	C O S S	S S	C O S S
Material must not be contaminated	S S C O	S S C O	S S C O	S S C O	S S C O	S S	S S C O
Material must not be discolored	C O S S	C O S S	C O S S	C O S S	C O S S	S S	C O S S
Material is very hot	S S	S S	S S	S S	S S	S S	S S
Material is very abrasive	C O A R		C O A H H C	C O	C O	H S	C O A R
Material is very wet (with water)	C O S S	C O S S	C O S S	C O S S	C O S S	S S	C O S S

Where the abbreviations used signify:

Abbreviation	Construction Material
HC	Mild steel over which a hard coating has been applied by Welding
SS	Stainless steel of a suitable grade
CR	Corrosion resisting steel
HS	Carburized and hardened mild steel shaft
AR	Abrasion resisting steel
CO	Mild steel coated with epoxy resin, plastic, rubber, ceramic fused on, galvanizing, whichever is most suitable for the required conveying application

In addition to the above, other coatings such as various paints and platings may be used to secure the desired results; or the parts may be wholly made of brass, various bronzes, monel, inconel or aluminum as the occasion requires.

Classes of Enclosures

General

The terms "dust-tight," "semi-dust-tight," "commercially dust-tight," "weatherproof," are used in specifications relating to conveyor enclosure. These are extremely broad terms and subject to many interpretations depending on individual conception and experience. It is difficult, if not impractical to attempt to define these terms by their degree of effectiveness. Enclosure of conveyors beyond that which is necessary for the conveying function can be designed to protect most material being handled from a hazardous surrounding or to protect most surroundings from a hazardous material being conveyed.

Recognizing these facts, this section establishes CEMA recommended classes of construction for conveyor enclosures—without regard to their end use or application. These several classes call for specific things to be done to a standard conveyor housing to provide several degrees of enclosure protection and will eliminate the general terms listed previously.

It is recognized that other types of enclosures are sometimes practical and that additional design features can be incorporated as dictated by specific job requirements. They are too numerous and too special to be included here.

CEMA Enclosure Classifications

Class IE — Class IE enclosures are those provided primarily for the protection of operating personnel or equipment, or where the enclosure forms an integral or functional part of the conveyor or structure. They are generally used where dust control is not a factor or where protection for, or against, the material being handled is not necessary—although as conveyor enclosures, a certain amount of protection is afforded.

Class IIE — Class IIE enclosures employ construction which provides some measure of protection against dust, or for or against the material being handled.

Class IIIE — Class IIIE enclosures employ construction which provides a higher degree of protection in these classes against dust, and for or against the material being handled.

Class IVE — Class IVE enclosures are for outdoor applications and under normal circumstances, provide for the exclusion of water from the inside of the casing. They are not to be construed as being watertight, as this may not always be the case.

When more than one method of fabrication is shown, either is acceptable.

Table 5-2. Enclosure Construction

Component Classification	Enclosure Classifications			
	IE	IIE	IIIE	IVE
A. TROUGH CONSTRUCTION -Formed & Angle Top Flange				
1. Plate type end flange	X	X	X	X
a. Continuous arc weld	X	X	X	X
b. Continuous arc weld on top of end flange and trough top rail				
2. Trough top rail angles (angle top trough only)				
a. Staggered intermittent arc and spot weld	X			
b. Continuous arc weld on top leg of angle on inside of trough and intermittent arc weld on lower leg of angle to outside of trough		X	X	X
c. Staggered intermittent arc weld on top leg of angle on inside of trough and intermittent arc weld on lower leg of angle to out-side of trough, or spot weld when mastic is used between leg of angle and trough sheet		X	X	X
B. COVER CONSTRUCTION				
1. Plain flat				
a. Only butted when hanger is at cover joint	X			
b. Lapped when hanger is not at cover joint	X			
2. Semi-flanged				
a. Only butted when hanger is at cover joint	X	X	X	X
b. Lapped when hanger is not at cover joint	X			
C. With buttstrap when hanger is not at cover joint		X	X	X
3. Flanged				
a. Only butted when hanger is at cover joint		X	X	X
b. Buttstrap when hanger is not at cover joint		X	X	X
4. Hip Roof				
a. Ends with a buttstrap connection				X
C. COVER FASTENER FOR STANDARD GA. COVERS				
1. Spring, screw or toggle clamp fasteners or bolted construction*				
a. Max. spacing plain flat covers	60”			
b. Max. spacing semi-flanged cover	60”	30”	18”	18”
c. Max. spacing flanged and hip-roof covers		40”	24”	24”
* For bolted construction use:				
1/4” bolts—4”-10” dia. screws—(min. dia.)				
5/16” bolts—larger dia. screws—(min. dia.)				

Table 5-2. Enclosure Construction (cont.)

Component Classification	Enclosure Classifications			
	IE	IIE	IIIE	IVE
D. GASKETS				
1. Covers				
a. Red rubber or felt up to 230°F		X	X	
b. Neoprene rubber, when contamination is a problem		X	X	X
c. Closed cell foam type elastic material to suit temperature rating of gasket		X	X	X
2. Trough end flanges				
a. Mastic type compounds		X	X	X
b. Red rubber up to 230°F		X	X	X
c. Neoprene rubber, when contamination is a problem		X	X	X
d. Closed cell foam type elastic material to suit temperature rating of gasket		X	X	X
E. TROUGH END SHAFT SEALS *				
1. When handling non-abrasive materials			X	X
2. When handling abrasive materials	X	X	X	X
* Lip type seals for non-abrasive materials				
Felt type for mildly abrasive materials				
Waste type for highly abrasive materials				
F. DUST COLLECTING SYSTEMS				
1. Provisions should be made for connecting to external dust collecting systems			X	

Special Screw Conveyor Continuous Weld Finishes†

Specifications on screw conveyors occasionally include the term "grind smooth" when referring to the finish on continuous welds. This specification is usually used for stainless steel, but occasionally it will appear in carbon steel specifications as well.

"Grind smooth" is a general term and subject to various interpretations. This section establishes CEMA recommended classes of finishes, which should be used to help you find the class required for an application.

Operation	Class of Finish				
	I	II	III	IV	V
Weld spatter and slag removed	X	X	X	X	X
Rough grind welds to remove heavy weld ripple or unusual roughness (Equivalent to a 40-50 grit finish)		X			
Medium grind welds—leaving some pits and crevices (Equivalent to a 80-100 grit finish)			X		
Fine grind welds—no pits or crevices permissible (Equivalent to a 140-150 grit finish)				X	X
Polish to a bright uniform finish					X

Class I finish has the weld spatter and slag removed, but no grinding of the welds.

Class II finish is a refinement of the "as welded condition" with the welds rough ground to remove heavy weld ripple or unusual roughness.

Class III finish has the welds medium ground with some pits and crevices permitted. This finish is recommended for materials which do not tend to contaminate or hang up in pits or crevices.

Class IV & V finishes have the welds ground fine with no pits or crevices. The only difference between the two finishes is the degree of polish. These finishes are recommended where sanitary regulations dictate exclusion of the materials being handled from the welded surface. The type of finish is dependent on the application and/or industry.

†Special weld finishes do not apply to standard stock conveyor screws.

Special Features and Modifications

The following descriptions cover the most commonly used special features available for equipping screw conveyors to perform various functions in conveying systems. When added to the many available standard constructions, these special features greatly broaden the range of usefulness of screw conveyors. While standard components are more desirable and practical in the design of a screw conveyor system, the inclusion of one or more of the following special features may result in a more compact or efficient overall arrangement.

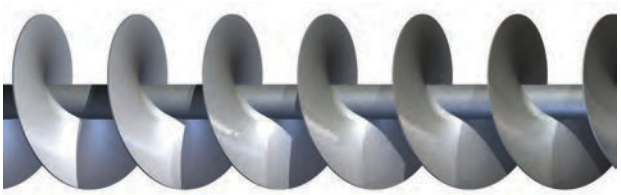

Figure 5.2A Short Pitch Conveyor Screw
Short pitch conveyor screws are of regular construction except that the pitch of the flights is made less than the outside diameter of the screw. These short pitch screws are recommended for use in inclined screw conveyors of slopes 20° and over. They also are used extensively as feeder screws, especially as the feeder portion of a uniform diameter conveyor screw consisting of a section of short pitch flights and the balance regular pitch. The cross-sectional loading of the regular pitch portion of the screw thus is controlled.

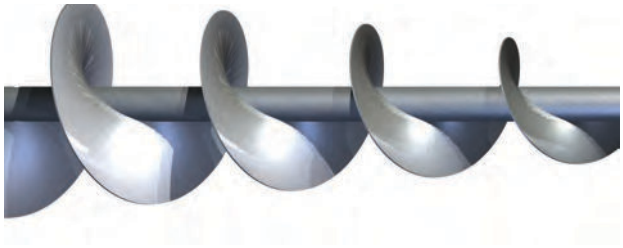

Figure 5.2B Tapering Flight Conveyor Screw
Tapering flight conveyor screws are frequently used as feeder screws for handling friable, lumpy materials from bins or hoppers. Tapered screws draw material uniformly from the entire length of the feed opening. The trough tapers to suit.

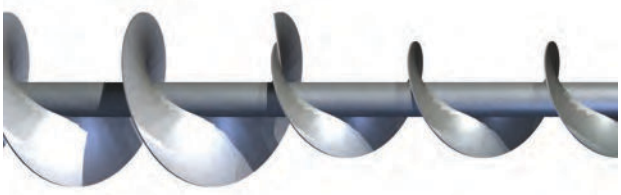

Figure 5.2C Stepped Diameter Conveyor Screw
Stepped diameter conveyor screws consist of flights of different diameters, each with regular pitch, mounted in tandem on one pipe or solid shaft. They are frequently used as feeder screws, with the portion having the smaller diameter being under the feed opening of a bin or hopper to regulate the flow of material. The screw portion with the smaller diameter usually operates in a correspondingly smaller trough.

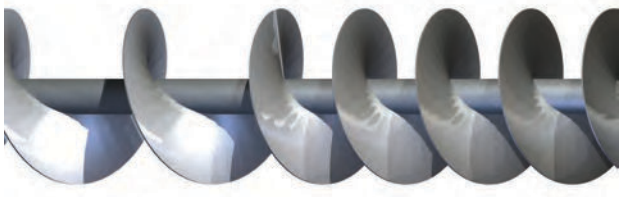

Figure 5.2D Stepped Pitch Conveyor Screw
Stepped pitch conveyor screws have succeeding single or groups of flights progressively increasing in pitch. They are used to draw free-flowing materials uniformly from the entire length of the feed opening.

Figure 5.2E Long Pitch Conveyor Screws
Long pitch conveyor screws occasionally are used for rapid conveying of very free-flowing materials or as agitators for liquids.

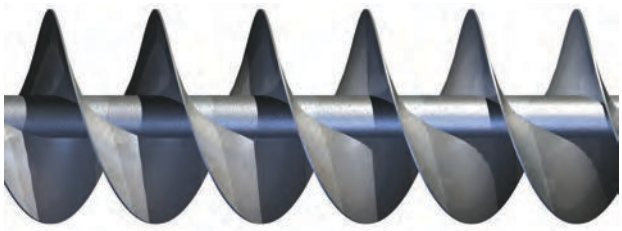

Figure 5.2F Double Flight Conveyor Screws
Double flight conveyor screws of regular pitch promote a smooth gentle flow and discharge of certain materials. Very short portions of double flight screws may be used either side of a hanger point, for smooth flow past the hanger.

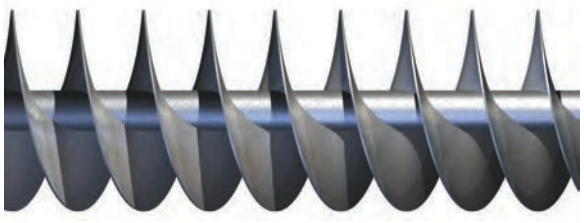

Figure 5.2G Double Flight Short Pitch Conveyor Screw
Double flight short pitch conveyor screws assure more accurate regulation of feed and flow in screw feeders and effectively deter the flushing action of materials that have become fluidized.

Figure 5.2H Multiple Ribbon Flight Conveyor Screws
This type of screw consists of two or more ribbon flights of different diameters and hand, mounted one within the other on the same pipe or solid shaft by rigid supporting lugs. Material is moved forward by one flight and backward by the other, thereby inducing positive and thorough mixing.

Conveyor Screw Modifications

Regular conveyor screws and many with special features, may be modified in arrangement or construction. The common modifications are described in the following text.

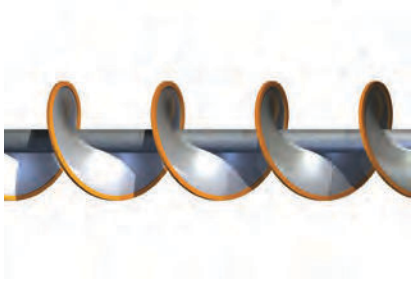

Figure 5.3A Bearing Shoes
Bearing shoes of nylon, PTFE, brass and other materials are used in place of intermediate hanger bearings. The shoes are bolted to the periphery of the screw, and project radially beyond the flight edge thus preventing the metal flight from wearing the trough. These bearing shoes extend along the screw helix slightly more than one pitch and are located along the screw at the same distance as normal hangers.

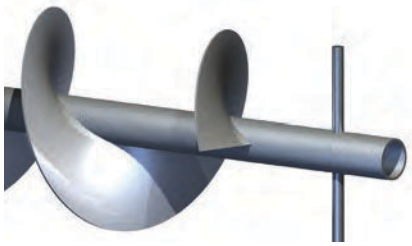

Figure 5.3B Breaker Pins
A breaker pin is a rod of a length approximately equal to the screw diameter, inserted through and secured to the pipe shaft at the screw discharge point. These breaker pins aid the discharge by breaking up relatively soft lumpy materials.

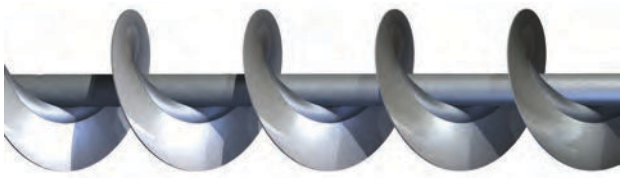

Figure 5.3C Continuous Welding of Screw Flights
To prevent ripping the flights from a conveyor screw under extremely heavy loads, the flights may be continuously welded to the pipe shaft on one or both flight sides. Continuously welded flights are also used to eliminate the small aperture between the flights and pipe, for sanitary purposes.

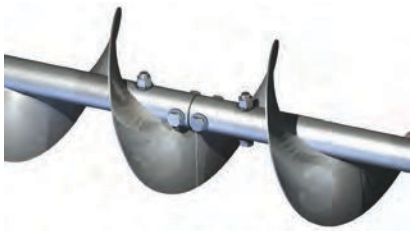

Figure 5.3D Close Coupled Conveyor Screw
Close coupled conveyor screws form a continuous helix. The space for the hanger bearing is omitted, and a short coupling shaft is used.