Twin screws with hollow pipes and flights filled with circulating cooling medium

3 Screw Conveyor Solutions for Problem Applications

By Bill Mecke, KWS Manufacturing Co.

One of the workhorses of dry bulk solids handling, the screw conveyor provides enclosed transfer while moving materials horizontally, vertically, or at an incline. The versatile conveyor's wide range of configurations, components, and construction materials makes it suitable for handling the most problematic materials and application requirements.

The screw conveyor typically consists of a screw mounted in an enclosed U-shaped trough (or tubular housing). The screw can have one or several sections, each consisting of flighting mounted on a pipe. At one end, the screw is connected to a rotating drive shaft, and the opposite end is connected to an end shaft. The screw is supported by bearings at both ends. If the conveyor is long enough to require more support, hanger bearings can be suspended from the top of the trough to support the screw at points between the screw sections.

To choose a screw conveyor that can handle your challenging application, work with the conveyor supplier. The following provides guidelines for handling three difficult conveying applications.

1) Resisting Wear from an Abrasive Material

When you use a screw conveyor constructed with standard carbon steel or stainless steel components to move an abrasive material such as iron ore, titanium dioxide, foundry sand, or cement clinker, the conveyor will usually wear rapidly. This will lead to frequent conveyor maintenance and downtime, higher overall operating costs, and the equipment's premature failure. One common method for combating these problems is to use abrasion-resistant plate or hard surfacing on the trough and screw. Hard surfacing is a layer of abrasion-resistant material applied over softer standard construction materials to lengthen component life and reduce overall operating costs.

Suitable base materials and available hard surfacing materials. Hard surfacing can be applied to screw conveyor components constructed of carbon steel, stainless steel, or special metal alloy base materials. The hard surfacing itself can consist of various combinations of chromium, tungsten, molybdenum, carbon, cobalt, and other more exotic materials. The best combination for your application depends on the conveyor component's base material as well as your conveyed material, application requirements, and operating environment.

Application methods. Hard surfacing can be applied in different ways. Conventional welding methods using stick or wire electrodes are most common. In a few light-duty and precision applications that require screw flights made of a thin base metal, a plasma or oxyacetylene torch is used to apply a powdered abrasion-resistant material to the metal.

Working with your equipment supplier to select the right hard-surfacing material and application method for your screw conveyor will ensure that it handles your abrasive material and provides many years of reliable service.

2) Preventing Dust Leaks

When you're moving a fine, dusty material in a screw conveyor, you need to ensure that the cover is tightly sealed to the trough to prevent leaks that can create worker health risks and combustible dust hazards. This requires selecting the right cover thickness, gasket material, and, in some cases, clamps.

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The best way to get a tight seal on a screw conveyor is to use a flanged cover that's bolted on 12-inch centers (or closer) with a high-quality compressible gasket between the cover and trough. The cover is made of carbon steel or stainless steel to match the trough construction materials, and the steel thickness and turned-down edges at both sides of the cover provide the cover's rigidity, improving its ability to seal to the trough. The typical cover's steel thickness is from 12 to 14 gauge, but a thicker cover that provides additional rigidity can be required for a very dusty application. A gasket made of a nitrile rubber blend with closed-cell foam construction will provide a positive seal even if the sealing surfaces are irregular. This gasket material is available in black for standard applications and white for chemical, food, and other sanitary applications.

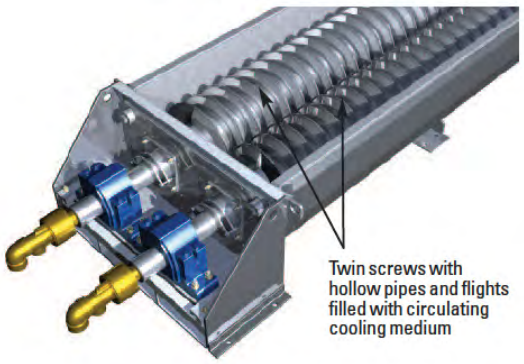
Bolting the cover to the trough rather than clamping it is generally better because bolting eliminates safety hazards and prevents worker injuries. But for some applications — such as those requiring regular hanger bearing maintenance or frequent washdowns — clamping is more practical. Two clamps that seal well and provide easy access to the conveyor are a toggle clamp with an adjustable clamping force and a pivoting C-clamp with a knob that allows the operator to apply a large amount of force to seal the cover.

3) Cooling an Extremely Hot Material

A very hot material discharged from a rotary kiln or similar equipment can damage your downstream process and handling equipment. Common examples are limestone exiting a kiln and fly ash discharging from a boiler. A screw conveyor can be designed to cool the material as it's transferred — for instance, cooling a material that leaves a kiln at 1,400°F to less than 150°F — indefinitely extending your equipment life.

Figure 1

Cooling screw conveyor



In a cooling screw conveyor (also called a heat transfer screw processor), a cooling medium — typically cool water — continuously circulates through a hollow trough jacket or the screw, or both, to transfer heat from the hot material. In the screw, the cooling medium circulates through the pipe and hollow flights. A cooling screw conveyor with twin screws is shown in Figure 1.
To select a cooling screw conveyor for your hot material, you'll need to work with the conveyor supplier to calculate the conveyor's surface area and design the cooling medium flow to match your application's heat load: that is, the amount of heat you must remove from the hot material. The supplier will calculate this heat load based on your material's inlet temperature and desired outlet temperature and the cooling medium's temperature and flowrate, then will size the conveyor to handle the heat load — and your material's volumetric flowrate — with a conservative safety factor.

To learn about conveying a wet, sticky material, read the article "Screw conveyor solutions for four problem applications," by Bill Mecke, KWS Manufacturing Co.

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