MATCHING UP TO REQUIREMENTS

JOSE MARIN, ERIEZ, USA, OUTLINES HOW HIGH-CAPACITY CONVEYORS CAN MEET CUSTOMER EFFICIENCY NEEDS.

There is a great need in the coal mining industry today for more reliable conveyors that last longer and yet remain cost competitive. At the same time, the industry is heading toward higher-horsepower and higher-capacity conveyors for the efficient and controlled movement of coal.

In many cases, as belt technology improves, these conveyors traverse challenging terrain features, including steep inclines and declines. The industry's rising productivity goals are putting increased stresses on conveyor system components, with most conveyors transporting massive amounts of coal continuously at

Rugged, high-capacity conveyors feature compact, straight-line design and an extremely low profile for ease of maintenance. Minimum headroom is required for installation.

speeds of approximately 183 m/min. (600 ft/min.), stopping only occasionally for required maintenance.

Coal processing manufacturers have developed a variety of technologies and hardware that meet the needs of modern coal operators in regards to safety, longevity and availability. Conveyors have undergone numerous design changes and upgrades that today enhance their role in coal applications. The latest equipment offers increased energy savings, more precise control over material flow, easier maintenance, better technical support and, in some cases, faster delivery of product to the mine site.

In broad terms, to convey is to 'take or carry from one place to another or to transport'. Conveyors serve as arteries for coal mines as they move raw coal over long distances from the mine face to the preparation plant. For example, once raw coal is cut from the face, it is loaded onto a network of conveyors that funnel it to a mainline slope belt. This delivers the coal to the surface where another set of overland conveyors brings it to the preparation plant. After the coal is washed, another conveyor will transport the clean coal to a loadout facility.

Each type of vibrating conveyor is designed with a different amplitude, frequency and angle of deflection to move different materials at specific rates. The design is based on many factors, including the material being processed (coal, in this case), flowrate of the process, nature of the environment, need to start and stop (cycle) the process, operative cost and likelihood of repairs.

An example of this is an Eriez® high-volume vibrating conveyor. A standard three-phase motor is belt-connected to a variable pitch sheave and factory set to drive an eccentric shaft at between 900 and 1000 rpm, depending upon the length of the conveyor. The vibratory motion created by the shaft is amplified and transmitted to the trough by polyisoprene springs, to which the trough is bolted. Heavy-duty construction assures long life under difficult operating conditions.

Moving high volumes with accuracy

Today's conveyors engineered for the coal industry feature a number of components to accurately meter and move product.

A variety of trough sizes and types are available to match the conveyor to specific applications, including: troughs of mild steel and stainless steel; liners of abrasion-resistant steel, stainless steel, polyethylene, rubber or other materials; and tubular troughs, as well as grizzly and screening troughs. The Eriez high-volume conveyors (HVC) can be provided with typical flat or completely enclosed troughs, as well as with screening decks.

Selection of the right electrical, instrumentation and automation equipment directly impacts the performance and flexibility of operation, efficiency, reliability and total lifecycle cost. Conveying systems are required to be solid and dependable and use process repeatable technology to ensure the highest availability under the most diverse conditions.

Sharing common components

All conveyors engineered for coal processing feature several components necessary for optimum operation: a drive system to generate the vibration, a trough to carry the coal and springs to give the vibration amplitude creating motion. Every system requires an AC or DC power source and must be mounted either from above or below to produce a consistent force.

Mechanical drives

These are the most common types of drives found in heavy-duty conveyors for coal processing. These drives create a back and forth motion of a trough caused by either direct mechanical linkage (push rod) or by a stimulation motion with out-of-balance weights, then amplifying that vibration into the trough through a set of springs. There are several types of mechanical drives applicable for conveyors used in the coal industry.

Brute force mechanical drives use two motor vibrators, incorporating eccentric weights on each end of a shaft to create an out-of-balance vibration and motion into the conveyor trough. These are simple designs needing large motors to overcome the head load (weight of material) resting in the trough.

Eccentric shaft mechanical drives use a standard off-the-shelf motor driving an out-of-balance eccentric shaft. The eccentric shaft creates a small vibration that is amplified through a spring system. These units are considered two-mass systems that work to increase amplitude under the head load.

Direct drive mechanical drives use a crank arm powered by a rotating motor that is attached directly to the conveyor's trough. These are less efficient, antiquated designs that require much larger motors and a lot of maintenance.

Electromagnetic drives

These systems operate by either AC or DC power and use magnetic circuits to energise the vibratory motion. A spring setup is mounted to a mass within or on the drive and attached to the conveyor's trough. Each drive has its advantages, with AC units providing high precision with lower operating costs and the DC models typically being less expensive.

Single-mass vs two-mass designs

Conveyors transfer their drive's natural vibration to the trough either through a single-mass or two-mass system. The drive unit is contained in the moving mass and creates the vibratory motion. Single-mass units are anchored in position (usually to the ground or floor) and transfer the drive's vibration directly to the trough through its springs. A two-mass unit, more common in coal processing, has the moving mass connected to the reaction mass by springs, which drive the vibration in the trough.

Spring systems

Springs are used to convert the vibration from the drive to trough, causing coal to move. Springs come in a variety of materials, sizes and configurations, but a few are used primarily to move coal.

Dense rubber springs provide stability and motion control between the drive and trough. However, rubber springs are limited to use in environments below 120ºF. Steel coil springs are commonly used in heavy-duty and high-temperature applications. These coils are effective in ambient temperatures up to 300ºF and offer low replacement cost.

Trough designs

Selecting the proper trough depends on the material being moved, distance travelled and the equipment's application. Troughs are fabricated from mild steel and stainless steel. Mild steel is ideal for

general purpose use similar to coal processing, while stainless steel is typically found in food or other corrosive environments and pharmaceutical applications.

Troughs can be lined with abrasion resistant steel, stainless steel, polyethylene, epoxy and rubber, as well as other coatings. The shape, length and width options are almost limitless. Every configuration of flat, curved, v-channel and tubular designs are available. Standard conveyors up to 30 ft (9.1 m) in length are available from Eriez. Additional length can easily be obtained with very little loss of headroom by having one conveyor feed into another.

Equipping conveyors with metal detectors

Several designs of industrial metal detectors are specifically used to fit onto conveyors to detect tramp metal in coal processing applications. For example, Eriez's Metalarm series of metal detectors has the unique advantage of fitting easily to virtually any conveyor or belt.

These metal detectors employ pulse induction technology and use a single printed circuit board for maximum dependability and easy access for servicing. All units are CE certified and have a high level of immunity to radiated signals, which typically result in false tripping of traditional metal detectors.

These units feature an advanced high-density polyethylene encased coil system. Search coils are fully screened to reduce unwanted emissions. These detectors' sensitivity levels can be set to meet application specific requirements. Plug-in connectors allow simple installation and maintenance of the units.

Other styles of metal detectors installed on coal conveyors can be tuned to ignore conductive or magnetic ores, such as magnetite and pyrite, even if they are carried by high-tension steel-corded belts with rip detection loops. An example is Eriez's Model 1220, used mostly to detect large pieces of ferrous and non-ferrous metals like bucket teeth.

Most metal detectors are available for any conveyor belt width and can be field-adjusted to fit most standard conveyor configurations. Some are pre-fabricated to meet CEMA standard conveyors with easy to adjust coil spacing to handle the majority of standard applications. The 1200 Series detectors from Eriez can be installed without having to cut the belt or use special tools.

Conclusion

Conveying systems are required to be solid and dependable and use process repeatable technology to ensure the highest availability, under the most diverse conditions.

New, innovative solutions are being developed to transport more materials faster, along routes and across terrains that would not have been possible not long ago. The higher belt speeds and variability in materials makes it even more important to install the proper conveyor in coal processing. Not only does this make the conveying easier but it also reduces spillage, belt wear, dusting and material attrition. WC