Ups and Downs: Tips for Using Cleats to Improve Your Conveyor Belts

When cleats are used with belt conveyors, the results can include better efficiencies, faster speeds, greater inclines, and less floor space. Here's a primer on the various types of cleats and what they can do for you.

By Beth Miller

Most plant and material handling engineers know that belt conveyors enhanced with cleats can boost conveyor efficiency, permit faster speeds, and allow steeper inclines that use less belt and save floor space. As a thought-starter for increasing conveyor belt efficiencies and uptime, this article provides an overview of various types of cleats.

Cleat Shapes

Inverted Capital "T"
For light-duty applications, such as small parts, packaged items, or food products, cleats shaped like an inverted capital "T" standing perpendicular to the belt surface provide product support with flexibility that affords "shock" protection for delicate items.
Forward-Leaning Capital "L"
Angled cleats are designed for reliable transport of light- to medium-weight bulk material, especially where steeper inclines are involved. These take the shape of a forward-leaning capital "L," using a wide base that makes the cleat more resistant to leverage forces. Some models provide a curved face, which adds a scooping capability that is helpful with granular bulk movement.
Inverted "V"
For transport of abrasive, heavy, or large-piece bulk materials, cleats are offered in an inverted "V" (trapezoid) shape similar in profile to the cross-section of standard V-belts. These smooth-surfaced, wide-based cleats are designed to withstand heavy impact. Generally no taller than 2 inches, these cleats are flexible enough to allow for conveyor belt troughing.
Lugs and Pegs
Cleats in the form of individual lugs and pegs accommodate specialized needs. For example, conveyor belts transporting wet products, such as washed fruit or vegetables, might use either type to promote run-off of liquids and minimize drag through rinsing tubs. They also offer a cost-cutting alternative for cargo that does not require support across the full belt width, such as rods, tubes, or cartons. In some cases, they can be positioned to selectively move products exceeding a particular size or to hold individual products in specified positions on the belt for counting, timing, spacing, or collating purposes.

Cleated Belt Production

Let's compare the ways cleated belts are fabricated &#151 molded, fabricated, or mechanically attached &#151 and assess the advantages and drawbacks of each.

Molded Cleats

Molded cleats are formed as integral features of the belt cover at the time of manufacture. This produces a reliable cleat with no attachment seams to present potential points of separation or cargo infiltration. Some distributors may stock a selection of molded belt with standard cleat types and patterns and may even offer custom molding of unique or proprietary designs to suit specialized cleat requirements. Because of its expense, molded-cleat belting is best suited for plants with a large number of cleated-belt conveyors and/or extremely long cleated belts or for conveyorized-equipment OEMs that buy belt in production quantities. Buying directly from belt manufacturers usually is the best way to get large quantities of belt with the same cleat style and pattern. Smaller users, however, will probably find molded-belt prices and long lead times impractical. Users of molded belts must be committed to stocking spare belts to avoid lengthy downtime in case of belt damage or failure.

Fabricated Cleats

Some local distributors and belt shops offer the capability to fabricate cleated belts to order by attaching standard cleats to stock belting using one of three methods: hot vulcanization, cold-bonding, or heat-welding.

&#149 Hot vulcanization, the oldest method, involves special cleat-shaping molds and a vulcanizing press. The molds are filled with uncured rubber and heated by the press to both form and cure the raw cleat. Concurrently, the belt is pressed down on the mouths of the molds, causing the cleats to adhere as they harden. This process &#151 generally limited to rubber belts &#151 requires a highly skilled and experienced technician as well as considerable equipment investment. A flawless job yields a strong, lasting bond much like that of a vulcanized belt splice. But because of this method's low tolerance for error, results can be erratic. For instance, if the molds are not precisely filled with rubber, an uneven and weaker bond may form or the cleat profile may be erratic, affecting load-carrying capacity.

&#149 Cold bonding, also known as cold vulcanization, requires less equipment than hot vulcanization but no less skill. This method relies on a two-component chemical adhesive that works with cured rubber and plastic belts. The installer must properly mix the adhesive and then brush a precise amount evenly across a narrow strip of the belt and across the bottom of the cleat. When the adhesive is dry to the touch, a second coat is applied. After that dries adequately, the cleat and belt are pressed together. It's essential to maintain an even thickness of adhesive and to know when it's dry enough &#151 though not too dry &#151 to form a strong bond. Finally, the installer must perform a labor-intensive "stitching" process that drives out trapped air that could detract from the bond. Like hot vulcanization, cold-bonding effectiveness varies from shop to shop. If the bond is not absolutely tight along the length of the cleat, fines or oils from the conveyed material can attack the adhesives. In addition, the bonding procedure is susceptible to such environmental factors as humidity and extreme variances in temperature. Also, the chemicals used in cold bonding have a very limited shelf life; if they are used beyond their expiration date, even a good initial bond may have a questionable life expectancy.

&#149 Heat welding, the third alternative for bonding cleats, is used for belts made of PVC and PVC blends &#151 those with small amounts of rubber. In this method, hot-air application machinery heats the base of the cleat and the surface of the belt

simultaneously; in this way, cleats are "melted" onto the belt under a variable-speed pressure roller that advances along the cleat as the heat-gun retreats. Like the other two methods, the quality of the bond is directly related to the skill of the welding-machine operator. Newer advanced equipment, however, promotes greater welding consistency and repeatability, producing higher quality applications with shorter turnaround times. An emerging variation of heat welding using RF (radio frequency) energy as the heating agent shows promise but remains in limited application.

Although fabricating generally offers price advantages over molded-cleat belting, it still can't achieve specialty designs, such as lugs and pegs, and remains limited by compatibility between cleat and belt material. In addition, lead times may still be too long for some users as operations in urgent need of a belt may have to wait in line behind a shop's backlog of orders. Some distributors or belt shops might alleviate that problem by stocking made-up spare belts for emergency delivery.

The heat-welding technique can provide a cost-effective alternative for vertically integrated equipment OEMs whose production and replacement-part quantity requirements might make in-house belt fabrication capability more economical than buying custom-molded or fabricated belts.

Mechanically Attached Cleats

Mechanically attached cleats offer an economical solution with more versatility and convenience than fabricating methods. Fastened to belts with specially engineered screws or bolts, these attachable cleats allow easy on-site installation by in-house maintenance personnel. Unlike bonding methods, mechanical attachment is not affected by belt material, age, or condition. For example, a mechanical rubber cleat can be attached to a PVC belt &#151 even to a chain or plastic link belt. Nor is installation sensitive to ambient temperature, moisture, or dust. Some attachable cleat designs feature "pressure-cup" concave bases that enable the cleat to be drawn into a tight seal against the belt surface. This prevents materials from being trapped between the belt and cleat, which would not affect cleat attachment but may be important where cleanliness, contamination, or spoilage is of concern.

Another advantage is that some companies need to experiment with or periodically reconfigure belt cleat patterns, perhaps even change belt locations and functions. Mechanical attachment lets cleats be rearranged into different patterns or removed and used again later without requiring replacement of the conveyor belt.

Mechanically attached cleats can even help correct minor belt tracking problems. When installed as center guides on the underside of the belt and used with grooved pulleys and idlers or as edge guides that overlap the ends of standard pulleys, small V-Guides can counteract side-thrust forces that otherwise would draw the belt off-track.

Maintenance Tips

Damaged and broken cleats result from a variety of circumstances. Sometimes cleats suffer abuse on the conveyor's return side, banging into the framework and return idlers. In the case of vulcanized or bonded cleats, bonds can simply deteriorate over time. Severe operating environments, such as extreme or wildly fluctuating temperatures or added drag forces brought on by the conveyor passing through water, can cause cleats to weaken at the base or lead to vertical cracking. The conveyed products themselves &#151 especially those made of abrasive, jagged, and heavy materials or those dropped from hoppers &#151 also can lead to

cleat failure.
Maintaining cleated belting is important because a nearly direct ratio can be drawn between the number of broken cleats and the loss of conveyor efficiency. A 10-cleat conveyor loses 10 percent of its potential productivity for each broken cleat. Furthermore, one missing cleat overloads the one immediately behind it, creating a domino effect. Damaged cleats usually become more costly and disruptive the longer they go unrepaired.
Be careful which action you take. Often when cleats break, conveyor users improvise with a piece of wood, angle-iron, or whatever else is handy crudely attached to the belt where the broken cleat sat. Although such improvised cleats might move product with varying degrees of success, their inflexibility can initiate new problems. In addition to potentially harming conveyed products, a makeshift cleat may damage the conveyor system as well. A piece of angle-iron, for instance, will not yield if it catches on framing or return idlers; more likely it will rip out the belt. Angle-iron or wood will not flex going around a pulley but instead will stress the belt and eventually shear the belt fabric.
Likewise, improper fasteners such as nails, wire, standard bolts, or screws can tear and weaken the belt's carcass, contributing to early belt failure and perhaps damaging pulleys or lagging. Although some belt productivity may be temporarily saved, this type of improvisation can easily do more harm than good.
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