Circumventing Conveyor Costs

Conveyor belting specialist Steven Kidd explains the causes of unplanned conveyor stoppages and how proactive solutions can minimise lost output and costly repairs.

When a conveyor stops running, the costs do not stop. The cost of lost loading and unloading time plus the cost of carrying out running repairs and emergency belt replacement runs into many millions every year. This article explains the causes and how much of the loss can easily be avoided.

Belt carcass-related stoppages

The inner carcass is the backbone of every conveyor belt, providing inherent characteristics such as tensile strength and elongation ('stretch' under tension). There can be enormous differences in the strength and quality of

the synthetic fabric used to create the carcass. These are dictated by whether the belt manufacturer is at the 'quality end' of the market or the 'cut-price' end. Despite apparently being the same specification on paper, the strength under load both longitudinally and transversely can be inconsistent. Although the amount of nylon used in the longitudinal strands of the fabric may be sufficient to achieve the required tensile strength, in an effort to reduce cost, the use of the nylon transversal weft material is often kept to a minimum and in many cases, not used at all.

Consequently, rip and tear resistance is reduced, leading to stoppages for patch and clip repairs and, in more serious cases, the replacement of inserts or the entire belt. In addition, low-quality fabric plies with an inconsistent longitudinal and/or transversal spread of tension can cause a conveyor to be stopped to rectify tracking, steering, and handling problems.

Such inconsistencies are problematic because the declared longitudinal tensile strength of a belt is the combined result of the individual fabric plies working together in tension.

'Cheap' imported belts are much more prone to ripping.

Surface cuts in low grade rubber propagate more quickly and link up with other areas of damage, causing pieces of rubber to detach completely.

For example, an EP 630/4 belt contains four layers of polyester/nylon (EP) fabric reinforcement and has a nominal overall tensile strength of 630 N/mm. Each ply has its own breaking strength, typically around 160 N/mm. When the plies are bonded together to form the belt's carcass, their individual strengths effectively 'join forces', so consistency is highly important.

Stoppages caused by cover related problems

The physical properties of the rubber are the single biggest influence on both the durability and the length of a belt's working lifetime. The primary cause of intervention to deal with cover damage is an inadequate resistance to abrasive wear, cutting, and gouging of the surface. There are two internationally recognised sets of standards for abrasive wear, EN ISO 14890 (H, D, and L) and DIN 22102 (Y, W, and X). In Europe it is the longer-established DIN standards that are most commonly used.

Both standards measure abrasion resistance based on the amount of rubber lost during ISO 4649 / DIN 53516 testing, but the test cannot measure resistance to cut and tear propagation. If it is insufficient, a small area of damage can easily grow due to continuous material loading and the flexing around drums and pulleys. This can link with other damaged areas, causing pieces of rubber to be cut from the surface and creating yet another reason for stoppages and running repairs. The overall quality and strength of the rubber is critical in minimising the need to carry out repairs. It is therefore important to understand that rubber represents around 50% of the material cost of producing a conveyor belt. For manufacturers seeking a price-competitive edge, this creates an irresistible temptation to compromise on resilience in exchange for higher sales and faster reordering of replacements. This is why the sharp stone that finds its way between the drum and the belt will cut into low-grade rubber with ease, whereas it will hardly make a mark on good quality rubber that has been deliberately engineered to withstand such demands.

Quality is more important than thickness

Faced with recurring stoppages caused by belt damage, there can be a temptation to fit a belt with thicker covers and more plies, but almost invariably this is not the solution. Again, it comes back to the quality and strength of the rubber itself, along with the design of the inner ply fabric that has the biggest influence. A belt that is too thick for the size of the pulleys and drums, or that has reduced flexibility in both length and width, can result in dynamic stress issues, as well as troughing and handling problems. Thicker covers will also not prevent surface damage and its propagation, or rip and tear. For rip and tear damage, the only real solution is to fit belts that have been specifically engineered to handle such demands, including super-strong, special weave pattern fabric plies.

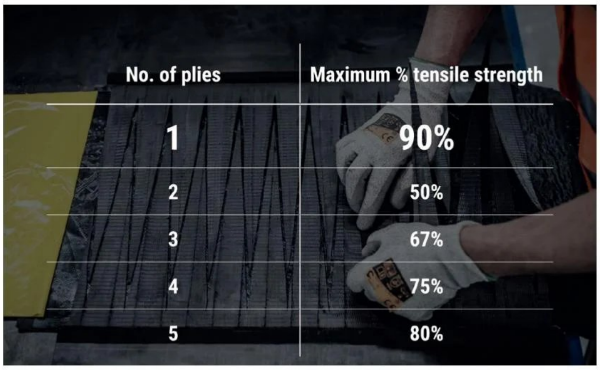
The weakest link

The splice joint is the weakest point of any conveyor belt, and splice joint failures are widely regarded as the most common cause of conveyor stoppages. Beyond the considerable costs of lost output and repairs, or replacements, there are also safety implications. Maximising the strength and long-term durability of splice joints is therefore an effective way to reduce costs.

Joint problems are most prevalent in low-grade imported belting, where poor adhesion between the plies – or between the belt and splicing materials – combined with low belt elongation (elasticity), is an inherent weakness. Having the optimum level of adhesion has an enormous impact on the creation and ongoing reliability of splice joints. Adhesion levels that are too high can cause significant difficulties and slow the making of both hot and cold vulcanised joints. It can also result in insufficient tension, which can lead to premature wear and tear. Far more commonplace, however, is an inadequate level of adhesion, which can severely compromise the strength and reliability of the splice.

Splice joint problems are a major cause of stoppages for repair or replacement.

Insufficient elongation is a major cause of delamination.



No. of plies	Maximum % tensile strength
1	90%
2	50%
3	67%
4	75%
5	80%

Much stronger – a finger splice retains up to 90% of the tensile strength.

Low elongation is another symptom of low-price multi-ply belting and is mostly an issue in areas where the belt needs to stretch, such as troughing and bending round pulleys. This can cause localised tension build-up, leading to shear stresses that may, in turn, result in delamination (ply separation) issues.

With raw materials making up around 70% of the cost of producing a rubber conveyor belt, the use of sub-standard rubber and fabric ply material is unavoidable.

Improving splice joint reliability

The most common method of making a splice joint is the step splice, which requires the removal of one of the layers of fabric plies so that the belt ends can be overlapped and then either cold glued or hot vulcanised together. This method is popular because it is regarded as being easier and quicker. However, although it takes a little longer to make and requires a higher level of skill, the finger splice method results in a far stronger and more reliable joint that, when made properly, can outlive a step splice many times over.

For the uninitiated, a finger splice joint is where a zigzag pattern is cut into both sides of the belt ends, creating several interlocking 'fingers'. These are then aligned, interlocked together and finally bonded using a hot vulcanising press to create a splice that is exceptionally strong and smooth, which makes it almost impossible for the joint to be damaged by scrapers.

Crucially, when the belt is working under load, the finger splice is vastly superior in terms of resistance to dynamic failure because they retain up to 90% of the belt's original tensile strength.

By comparison, a 3-ply step joint only achieves a maximum tensile strength of 67%. The superior strength and durability of finger splices therefore reduce the frequency of repairing and re-splicing almost entirely.

Conclusion

There is no such thing as a 'cheap' conveyor belt because the irrefutable fact is that low prices necessitate the use of poor quality, low-grade raw materials, the omission of essential protectors such as anti-ozonants, and lower production values. Such deficiencies are the primary cause of unplanned stoppages and premature belt replacements. The often unseen cost of lost output and repairs is huge, so it is essential that it become an integral part of the calculation when comparing conveyor belt price offers. As the old adage goes: 'price is what you pay, but cost is what you spend'. **DB**