WHO CARES, WINS

Leslie David, Conveyor Belt Specialist, warns of the real cost of poor conveyor maintenance in mining operations.

Downtime is hugely expensive. It is estimated that for a mid-sized facility operating 24/7, a single conveyor breakdown lasting just four hours can cost €25 000 or more in lost production, plus emergency repairs costs, which generally range between €2000 and €5000. If the costliest component, the conveyor belt itself, is irreparably damaged then those costs can easily double or treble.

There are two primary causes of conveyor stoppages – inadequate preventative maintenance and the use of low-grade components.

Maintenance: It's not what you expect, it's what you inspect

Most maintenance tasks fall in two categories – 'reactive' and 'preventive'. Over reliance on reactive maintenance can lead to costly stoppages that could and should have been avoided, with some industry experts stating that reactive maintenance costs three to four times as much as preventative maintenance over the lifespan of the equipment. Yet many operators still work reactively, essentially throwing money away on preventable problems.

Daily inspection

A daily inspection is essential. Maintenance teams should 'walk the conveyor' at the start of each shift to spot potential problems before they escalate. At the top of the list should be ensuring that the working environment is clean and safe. Waste build-up is a common cause of damage to idlers and drums as well as a collateral belt damage. Even small accumulations of debris, especially on the bottom side of the conveyor belt or drums and pulleys, can throw off belt alignment sufficiently to cause the belt to catch on the conveyor framework. It also creates uneven component wear, particularly on the conveyor belt. Areas where product spillage occurs regularly need to be actioned for more frequent cleaning. Other factors include making sure that any scrapers are correctly adjusted and that drum linings (where applicable) are in good condition.

A big cause of stoppages is conveyor belt damage caused by material becoming trapped. When lodged in part of the conveyor mechanism or simply finding their way between the belt and the drum, even small, sharp stones can puncture the belt cover. Larger objects can penetrate the carcass and, in some cases, cut the belt lengthwise. The first step in reducing the risk is to identify where foreign objects and rogue material is most likely to become trapped and take preventative measures such as installing skirts or screening.

Figure 1.Double trouble – a damaged component and an unclean environment.

Figure 2. Waste build-up is a common sight and causes a lot of avoidable wear and stoppages.

A significant proportion of stoppages to deal with a damaged belt incident are caused by incorrect installation of auxiliary equipment, damaged, protruding steelwork, and components that vibrate loose and ultimately becoming detached, all of which can be identified and rectified through regular inspection.

Start-up – Look and listen

On start up, look for any wobbling, swaying, or irregular movement that indicates alignment issues. Very importantly, listen carefully for unusual noises because they often signal problems with bearings, misalignment, or loose connections. A healthy conveyor system produces a consistent, steady sound. Any squealing, grinding, or rattling deserves immediate attention.

The causes of noise can be many and varied including the screech of a slipping belt caused by worn drum linings and/or waste matter between belt and drum; misaligned belts, rollers, pulleys, or bearings that cause friction, vibration, and wear. Loose or damaged components can affect belt alignment while a loose belt can cause slippage, all of which can contribute to the volume of noise. Noise can be amplified if the conveyor frame is vibrating.

Dust discharge caused by cracks in the belt surface

One of the most common causes of waste build-up is when dust particles penetrate cracks in the surface of rubber belts caused by the effects of ground-level ozone (O_3), and ultraviolet light and are then shaken out on the return (underside) run. At low altitude, ozone becomes a pollutant that is created by the photolysis of nitrogen dioxide (NO_2). Exposure is unavoidable and even tiny traces of ozone in the air will attack the molecular structure of rubber. Ultraviolet light, including fluorescent light, also accelerates rubber deterioration.

Although easy to prevent by including antioxidants within the rubber compound mix, laboratory testing shows that more than 80% of belts sold in Europe, Asia, and Africa are unprotected because 'economy' manufacturers see the additives both as an avoidable cost and something that noticeably slows down the belt replacement cycle. It is advisable to demand documented confirmation of ozone and ultraviolet resistance when requesting a quotation for any rubber conveyor belt.

Conveyor components: When 'good enough' is not good enough

Many operators choose cheaper, lower-quality components to reduce outlay. However, experience tells us that placing a higher importance on the buying price of a component rather than its whole life cost is invariably a false economy. Apparent savings are quickly lost in unexpected failures, frequent repairs, and premature replacement, all of which mean costly downtime. The two components that most likely to cause stoppages are rollers/idlers and conveyor belts.

Rollers/idlers

Low-grade bearings and rollers are susceptible to premature wear and can seize up or disintegrate, causing significant friction that can lead to motor burnout or extremely expensive belt damage, stopping the entire line in its tracks. To reduce stoppages, only use premium quality rollers. As with conveyor belts, there are huge price differences, but low-priced components are cheap for a reason. Precision-engineered bearings and robust rollers are designed for prolonged use and require less energy to operate.

The two most common types are steel and nylon, with steel being the most regularly used, but the quality can vary enormously. Steel rollers rollers with high quality seals and bearings are generally the most durable and longer lasting. Nylon rollers are usually fine for lighter duty work and applications where there are moisture/chemical corrosion concerns caused by the type of materials being conveyed. In these environments, nylon rollers will often outlast poorly sealed steel rollers.

Yet again we come back to the need to keep working environments as clean as possible, as bearings and rollers are particularly prone to contamination from materials which can break down lubricants and cause increased friction.

Conveyor belts

The physical properties of the rubber are the single biggest influence on both durability and consequently the length of a belt's working lifetime. The major cause of 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 the most used.

Both 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 insufficient, a small area of damage can easily spread and link up with another area of damage causing pieces of rubber to be cut from the surface and become yet another reason to stop and carry out repairs.

Rubber represents some 50% of the material cost of a conveyor belt so for manufacturers who want to create a price-competitive edge, it provides an irresistible temptation to sacrifice standards of resilience in return for greater sales and faster re-ordering 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 but hardly make a mark in good quality rubber that is deliberately engineered to withstand such demands.

The weakest link

Splice joint repairs are a major cause of stoppages and the biggest single cause of splice problems are shortcomings in the quality of the conveyor belt itself. Poor quality rubber and poor adhesion between the inner plies are both common faults found in the low-grade belts, and as the rubber prematurely ages and degrades because of ozone and ultraviolet exposure, the problems become increasingly persistent.

Figure 3. A big cause of stoppages is material becoming trapped.

Figure 4. The cost of splice repairs and lost output is considerable

Maintaining control

Maintenance disciplines and purchasing policies based on quality and longevity may make complete sense, but implementation is much more difficult if those responsibilities – especially the supply of components – have been outsourced to a service provider. The harsh reality is that the real money is made by service companies through the mark-up applied to components such as rollers and conveyor belts rather than labour and call out charges so the incentive to 'buy low and re-sell high' is very real indeed. The cheaper the component, the bigger the profit margin and the more frequent the need for replacements. Service companies that have a genuine quality ethos are, of course, out there and they are certainly worth looking for. GMR