IMPROVING SPLICE JOINT RELIABILITY

In the first article of a two-part feature, Rob van Oijen, one of Europe's most highly regarded application engineers, provides valuable guidance on how to improve splice joint reliability.

The weakest point of any rubber conveyor belt is the splice joint, and its failure is a frequent cause of disruptive stoppages, costly repairs, and consequent lost productivity. A complete separation can also be extremely dangerous. However, there is one very avoidable error that is common to the vast majority of splice problems.

A question of compatibility

Even when using the highest quality conveyor belt available and relying on a highly skilled, experienced splice technician, the use of incompatible or

low-grade splicing materials will lead to reliability problems and, ultimately, failure. It is estimated that splice joint problems account for some 80% of unplanned stoppages, which is a statistic that aligns with expectations.

The avoidable error is the use of splice materials that are not compatible with the rubber used to make the belt. To achieve the strongest and most reliable splice joints, it is essential that the various splicing materials – such as unvulcanised adhesion rubber, unvulcanised cover rubber, and the rubber used on reinforcement fabric in splice kits – have physical properties (such as adhesion) and behavioural characteristics (such as elongation) that closely match those of the belt itself, including the outer cover and skim (inter-ply) rubber. And perhaps even more important, the various materials must allow them to be joined together. This includes vulcanised materials in the belt against unvulcanised materials used to build up the splice, including any solvents used as a cleaner and in rubber solution.

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The cost of splice repairs and lost output is considerable.

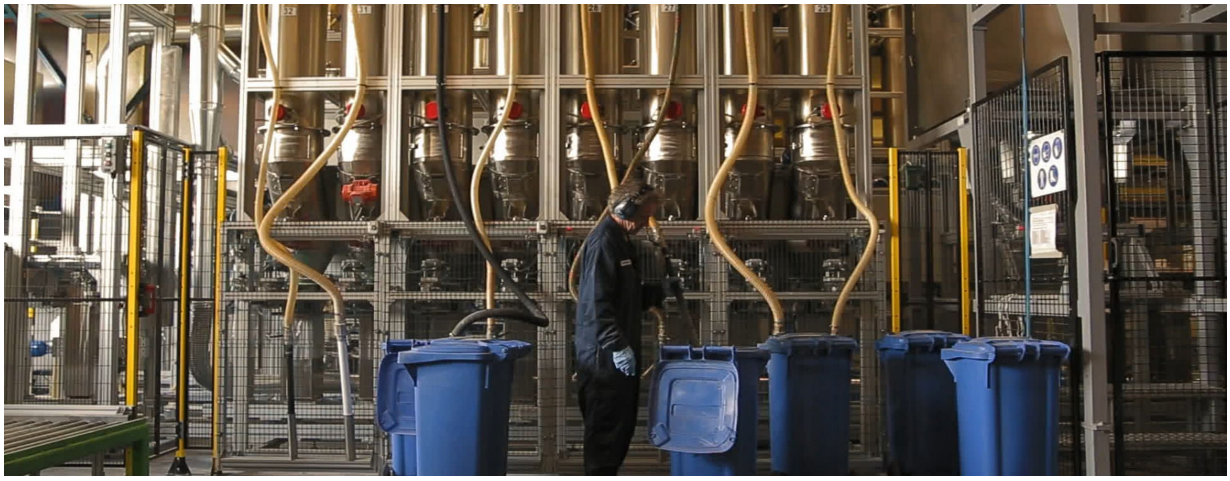
One type does not suit all

For reasons of cost and convenience (i.e. 'practicality') there is a strong tendency among professional splice technicians to use their preferred selection of generic splicing materials. To be fair, their choice is often limited based on cost by those who hold the purse strings. However, the reality is that, when it comes to splicing materials, one type definitely does not suit all. In effect, all the rubber elements involved in making a splice joint need to be compatible, ideally from the same source. To better understand why this is so crucially important, it is helpful to have a basic understanding of the complex technology involved in the creation of conveyor belt rubber.

Rubber – a science in itself

Most rubber is now almost entirely synthetic due to its innate ability to be adaptable to meet a wide variety of demands. In fact, nowadays, there is very limited need to use natural rubber (NR).

A wide range of rubber compounds is required to suit different applications. The creation of these compounds, known as rubber compounding, involves carefully controlled blending of precisely measured, task-specific chemical additives. These include cross-linking agents such as sulfur and



Creating rubber compounds is a highly complex process.

accelerators, polymers such as carbon black, along with reinforcements, plasticisers, antioxidants, anti-degradants, and zinc oxide, all combined according to a defined formulation for the intended rubber type.

The most common polymers used in conveyor belts are styrene-butadiene rubber (SBR) and nitrile rubber (NBR). The whole process is highly scientific and even more complex when considering the multitude of different ingredients and the huge range of different physical properties and characteristics that the rubber needs to possess. The key fact here is that no two manufacturers' rubber compound recipes are the same. Some may be more similar than others, but they are never the same.

Although a very abbreviated insight, the purpose of explaining all this is to demonstrate why the physical properties of virtually every rubber are so unique. Indeed, thanks to a growing trend among belt manufacturers to outsource the production of rubber to specialist mass-producers of rubber compound, the chances of compatibility are becoming increasingly remote. In fact, very few Europe-based belt manufacturers still make their own rubber and splice materials.

Incompatible and inadequate

In addition to splice materials that do not match the belt rubber, there is also the question of quality. Rubber represents the biggest single influence on the performance and longevity of a conveyor belt. It also represents some 70% of the volume and up to 50% (or more) of the cost of making a belt. Consequently, in these times of ever-increasing price competition, dominated by manufacturers in South and East Asia, primarily China, rubber and splice materials are the biggest target for savings. Cost-cutting practices include the use of unregulated*, low-grade versions of the ingredients listed earlier, the increased use of large proportions of rejected and used rubber, and reduced quantities (or total omission) of essential ingredients such as antioxidants.

Worth the effort

Although all splicing materials must be a compatible match to bond with each other, to get the best results it is essential that the splicing materials have very similar physical properties and characteristics compared to the rubber used to make the belt. They should also not simply be cut-price, poor quality 'generic' versions, but materials that have been specifically engineered to achieve the strongest and most efficient bond so that good adhesions on both carcass and the transition to the base belt are obtained.

The importance of compatibility increases with more specialised belt types, such as fire-resistant grades, where precise matching becomes critical. These requirements are most reliably met by using splicing kits and materials supplied or recommended by the belt manufacturer. Although sourcing such materials can present challenges, improved reliability and a significant reduction in splice-related stoppages make the effort worthwhile. ■

Notes

*For the safety of splice technicians, it is extremely important to ensure that both the belts and the splicing materials used comply with European safety and environmental regulations, including REACH and POPs (persistent organic pollutants). These regulations protect human health and the environment by restricting or banning chemicals that pose hazards including those chemicals or substances that may have Category 2 carcinogenic classifications. Manufacturers based outside of Europe and the UK are not subject to these regulations.

Fenner Dunlop are one of only very few manufacturers that still make their own rubber and splice materials.

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