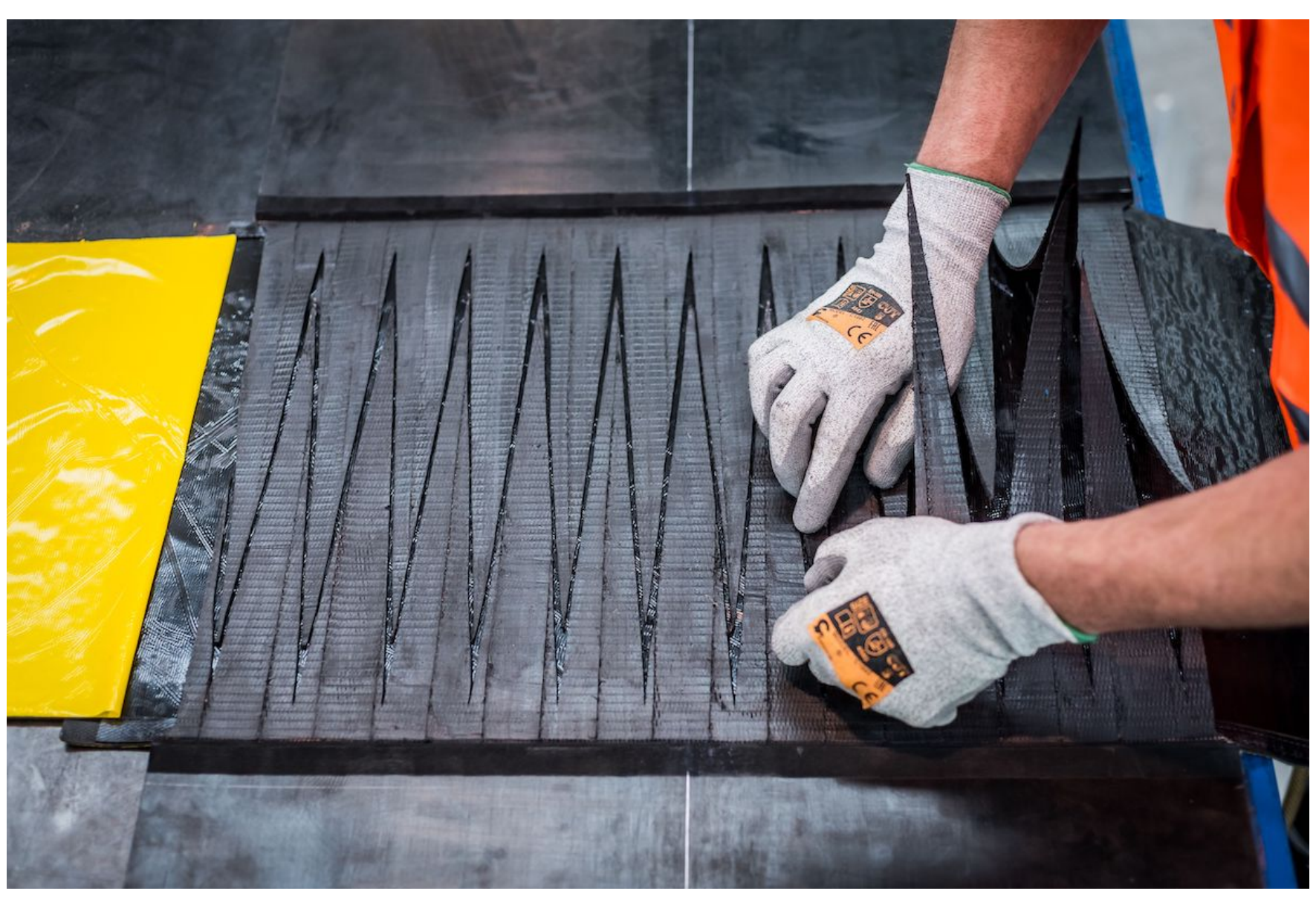
MECHANICAL CONVEYING

11 JUNE 2021

The Splice of Life



Finger splicing – how going back to the old ways can help increase reliability and save costs

The weakest point

The area where the open ends of a conveyor belt are joined together to create one continuous loop (better known as the splice joint) is, almost without exception, the weakest point of any conveyor belt. In fact, it is estimated that nearly 80 percent of all conveyor stoppages are caused by splice joint problems. Because of the potential loss of output, as well as the safety implications caused by splice joint failure, it has always been critically important to maximize the strength and long-term durability of the joint.

The most popular method of making a splice joint is the use of vulcanized splicing, which can be either a hot or cold (glue) splice. Within this, the two most common techniques used to create a vulcanized splice joint are the step splice and the finger splice. Historically, finger splicing was the favoured technique. Although it remains standard practice for joining solid woven belts used underground and for most fabric ply mono and dual ply rubber belting, the use of the standard step splice technique has now become the most popular because they are generally easier and quicker to make. But has this been at the expense of reliability and long-term cost-effectiveness? Here, Dunlop Conveyor Belting's chief application engineer, Rob van Oijen, provides reasons why in many cases a return to finger splicing can improve reliability and reduce downtime.

Handling the demands

Over the years, I have witnessed customers expending a great deal of time and effort trying to choose the correct specification of the belt for their critical conveyor applications. Painstaking calculations and lengthy inspections are carried out to identify the specification that will maximize output and achieve the longest belt lifecycle. At the same time, much less consideration is often given to the installation of the belt and, in particular, what is the best kind of splice joint to use. All too often, this can result in a critical error. While the quality of the belt is paramount, the type and quality of the splice is equally important.

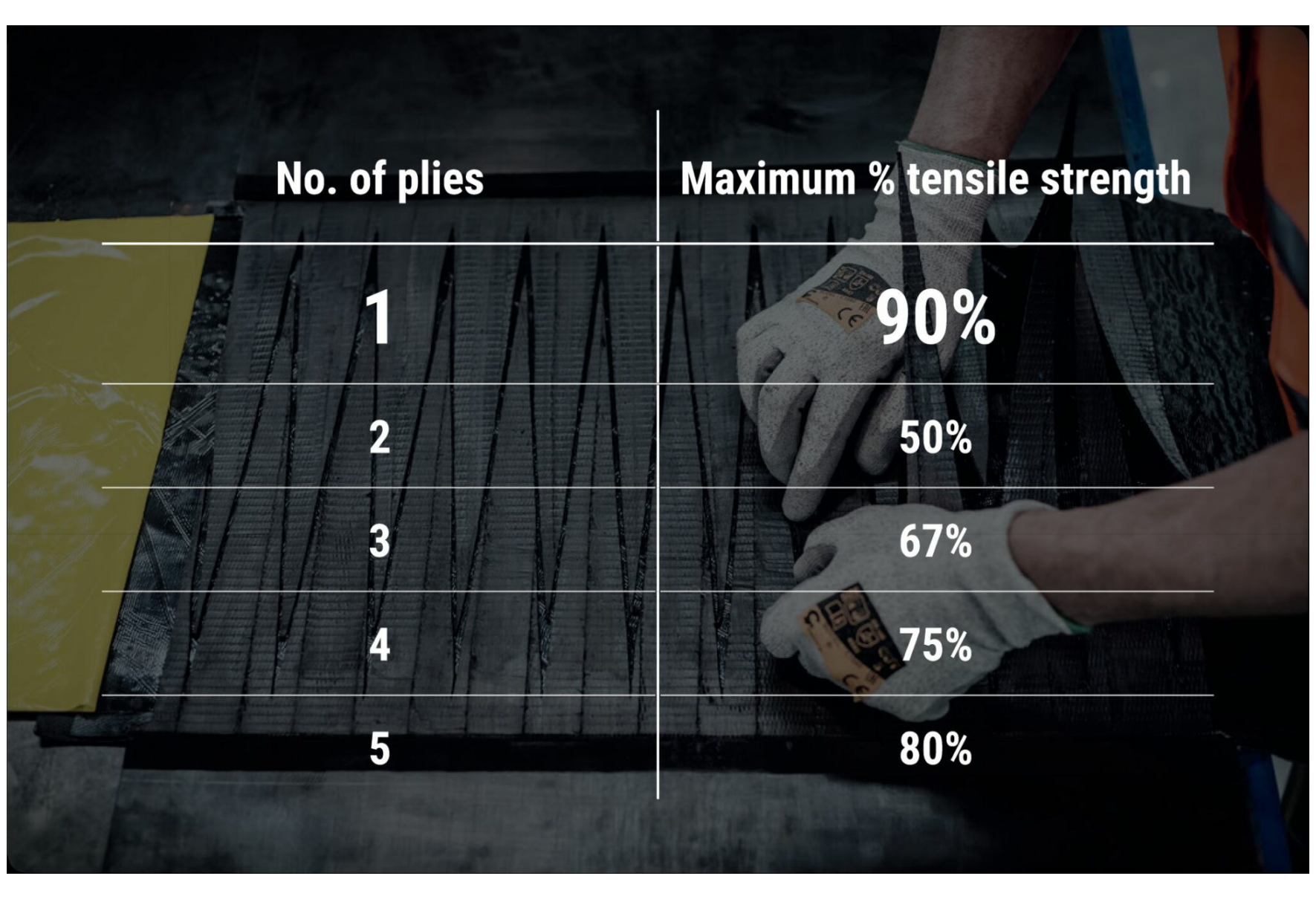
It can be easy to forget that industrial conveyor belt splice joints need to be capable of handling several different demands. Firstly, the splice must withstand a wide range of changes in tension, including conditions where belt tension may reach levels of 150% of rated load. Other challenges that are placed on the splice joint include short transitions, 'S' drive arrangements, and impact from heavy materials falling from a height onto the joint. Added to that, there is the dynamic stress caused by the continual flexing over drums and pulleys. Even though a great deal of time and care may have been taken in calculating the correct belt specification and buying a good quality conveyor belt, it can all be easily wasted if the splice joint proves to be unreliable.

The advantages of Finger splicing

For those who may not be familiar with splicing terminology and techniques, a step splice requires the removal of one of the layers of fabric plies so that the two belt ends can be overlapped and then either cold glued or hot vulcanised together.

Finger splicing is where a zigzag pattern is cut into both sides of the belt ends, creating several interlocking 'fingers'. These fingers are carefully aligned, interlocked together, and finally bonded using a hot vulcanising press to make a splice that is typically very strong and flat.

Regardless of the splice method or technique used, it is not physically possible to join a belt without some loss of longitudinal tensile strength. With this in mind, especially on more critical conveyors, it is important to optimize the strength of the splice joint. Although easier and some 30% faster to make, the main disadvantage of a standard step splice is that it will always create a proportional loss of tensile strength equivalent to one ply.



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

Table 1

As can be seen in table 1, a 2-ply step splice only retains a maximum of 50% of the belt's longitudinal tensile strength, a 3-ply step joint can only achieve a maximum tensile strength of 67%. In contrast, the primary advantage of the finger splice method is that it retains up to 90% of the belt's 'static' tensile strength. Another area of advantage in favor of the finger splice is that, crucially, in dynamically stressed conditions (when the belt is working and under load) the resistance to dynamic fatigue the finger splice is again vastly superior to a stepped splice.

Maximising speed and accuracy

Although much is made of how much longer it takes to make a good quality finger splice, that is often more of a reflection on the skill of the person actually making the splice. Skill, experience, and making the best use of available tools make a big difference. For example, when preparing to make a finger splice it is a good practice to make use of dedicated templates with the finger shape predefined and ready to trace onto the belt. This helps to speed up the process and greatly improve accuracy.

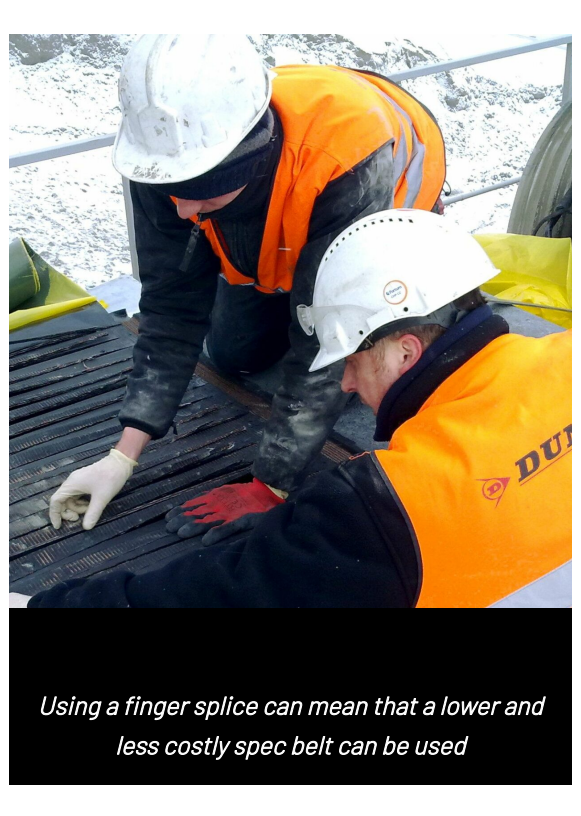
Templates are not available for stepped splices so the accuracy depends much more on the skill and attention of the splicer who is measuring and cutting. The use of a template allows very accurate preparation and enables perfect alignment and matching and therefore the perfect splice between both belt ends. The end result is the achievement of maximum strength and durability.

Potential cost savings

For example, it could mean that a 630/3-ply belt could safely be fitted instead of the 630/4-ply that would otherwise be necessary if a step splice was being used. The superior strength and durability of finger splices also reduce the frequency of repair and re-splice. This is an important consideration because it can significantly lower both direct (actual repair) and indirect (lost output) costs.

The even greater economy can be achieved by significantly reducing belt repair and replacement costs on applications where belts are prone to be damaged. This is because using the finger splice means that specialist mono-ply and dual-ply belts such as Dunlop Ultra X and Dunlop UsFlex specifically designed to handle very tough working conditions can be used. Both belts have outstanding resistance to ripping and tearing and impact, which makes them far more durable and longer-lasting compared to conventional multi-ply belts. In fact, their strength is actually enhanced by the finger splice joint.

Templates speed up the process and improve accuracy



Using a finger splice can mean that a lower and less costly spec belt can be used

The cost of making the splice is a small fraction of the cost of a system shutdown

Finger splicing allows super-tough belts such as Ultra X to be used on demanding applications

Summary

Do not be put off by warnings from your service provider or the potentially higher initial outlay. As I touched on earlier, reluctance to make a finger splice is usually based on the skillset needed to complete the task rather than the suitability and benefits of the joint that the technique creates.

As for the 'higher' cost, I would argue that this is invariably compensated for many times over by the improved reliability and avoiding the need to fit a higher than necessary specification of the belt in the first place. The cost of making the splice is a small fraction of the cost of a system shutdown or the many thousands that have will have been spent buying and installing the belt in the first place. In my view, it surely makes no sense to try and 'save' a few hundred euros by opting for the less durable step splice or by not having the work carried out by the most skilled service provider available.

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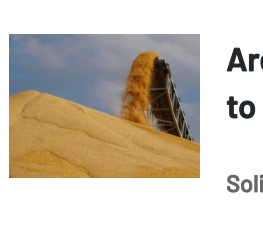

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