The advantages of finger splicing

The Strongest Link – turning a weak link into the strongest link

Virtually without exception, the weakest point of any conveyor belt is the splice joint. 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 is critically important to maximise the strength and long-term durability of the joint. The most common method of making a splice joint is the step splice but is it the best? Here, conveyor specialist Bob Nelson explains how and why finger splicing creates a joint with far superior strength and reliability.

HANDLING THE DEMANDS

Users of conveyor belts can spend a great deal of time and effort calculating the correct specification of belt, especially for more critical conveyor applications, in an effort to minimise downtime caused by repair stoppages and maximise belt life. Rather strangely, much less consideration seems to be given to deciding the best kind of splice joint to use. This can result in a critical error because although the quality of the belt is paramount, the type and quality of the splice is equally crucial.

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 demands placed on the splice joint include short transitions, 'S' drive arrangements and impact from heavy materials falling from height onto the joint. Added to that is the dynamic stress caused by the continual flexing over drums and pulleys. Even though a great deal of care may have been taken in calculating the correct specification and buying a good quality conveyor belt, the effort can easily be wasted if the splice joint proves to be unreliable.

THE STEP SPLICE

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 two belt ends can be overlapped

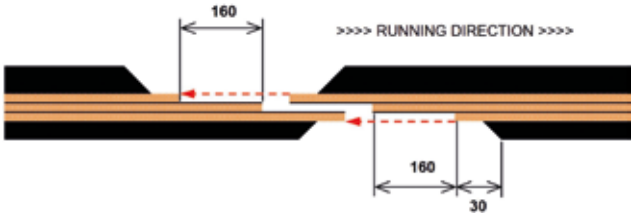

Diagram of a typical step splice on a 3-ply belt

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

Table 1

and then either cold glued or hot vulcanised together. This method is popular because it is seen to be generally easier and quicker to make a step splice.

Regardless of the method used, it is not physically possible to join a belt without some loss of longitudinal tensile strength but in the case of the step splice, its biggest disadvantage is that the loss is so significant because it always creates a proportional loss of tensile strength equivalent to one ply. For example, a 3-ply step joint can only achieve a maximum longitudinal tensile strength of 67%. This effectively means that in a typical multi-ply belt containing three plies or more, at least one ply exists purely to compensate for loss of the longitudinal strength incurred by making a step splice joint.

THE ADVANTAGES OF FINGER SPLICING

For those who may not be familiar with the terminology, 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. It is also very flat, which makes it much less prone to being caught and damaged by scrapers.

As can be seen in **Table 1**, in comparison to the loss of up to 50% in a step splice, the finger splice method retains up to 90% of the belt's 'static' tensile strength, which is, of course, an enormous advantage. Another crucial advantage of the finger splice is in dynamically stressed conditions when the belt is working and under load because the finger splice is vastly superior to a stepped splice in terms of resistance to dynamic failure.

Apart from the greater strength, using a finger splice also allows the possibility of installing a lower and therefore less expensive specification such as a 630/3-ply belt instead of a 630/4-ply. Yet another advantage is that the superior strength and durability of finger splices reduces the frequency of repairs and re-splicing. These are important considerations because they can significantly reduce both direct (actual repair) and indirect (lost output) costs. For example, one quarry in the UK had been replacing the splices on its multi-ply belts on average every three months. They were naturally delighted to discover that 18 months after installing single-ply belts using the finger splice method, they still had not repaired or replaced a single splice.

Templates speed up the process and improve accuracy

MAXIMISING SPEED AND ACCURACY

Although much is sometimes made of the fact it can take longer to make a good quality finger splice, this 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 makes a big difference. For example, dedicated templates with the finger shape predefined and ready to trace onto the belt are available that help speed up the process and greatly assist the accuracy of 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.

Ironically, 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.

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

OTHER COST SAVINGS

Even greater economy can be achieved by significantly reducing belt repair and replacement costs on applications where belts are prone to being damaged. This is because using the finger splice means that specialist single-ply and dual-ply belts such as Dunlop Ultra X and Dunlop UsFlex that are specifically designed to handle very tough working conditions can be used. Both belts have a strong reputation for 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 and durability is actually enhanced by the finger splice joint.

SUMMARY

Finger splices are nothing new of course. Historically, finger splicing was the favoured technique and remains the standard practice for joining solid woven belts used underground and for most fabric single-ply and dual-ply rubber belting. Do not be put off by warnings from your service provider because, as I touched on earlier, the 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.

All the evidence points to the fact that it 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. The perceived ‘speed and ease’ cost advantages are a small fraction of the cost of a system shutdown to carry out joint repairs and replacements.

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

AUTHOR

Bob Nelson