

# Belt Fastener Selections

Kevin Finnegan, Flexible Steel Lacing Company, USA, outlines how proper fastener selection, installation and maintenance will keep belts moving efficiently and profitably.



Figure 1. Flexco's Quick-Fit™ bolt solid plate fasteners enable fast, simple on-site installation with portable hand or power tools.

## Introduction

Unanticipated breaks in production have a fast and severe effect on the bottom line. Losses in production and profit begin as soon as a breakdown occurs. This is the constant risk with the belts that convey aggregates to the rock crusher. This interruption in production makes the performance and selection of mechanical fasteners very important to successful plant operation.

Tight profit margins within the industry demand reliable conveyor operations. Conveyors have to handle a high volume of heavy stone at a high rate of speed under high tension. Since downtime can be predictable, the goal is to minimise production and time losses. Plant managers can steer clear of many of these interruptions through scheduled maintenance and properly matching the right splice for the belt operating conditions.

A maintenance crew equipped with the right fasteners and the right tools to handle breaks when they occur can have a big impact on profitability.

Although vulcanising is the choice of many operations to bring belts back in service, newer synthetic belting fabrics have triggered an increased preference for mechanical fastener solutions for belt tensions up to 1500 PIW. (263 kN/m). Accommodating

those higher tension ratings combines with the speed and simplicity of mechanical fastener installation. As a result, mechanical fasteners have become the choice when fast, dependable and economical belt repairs help companies maintain top productivity. Compared with vulcanisation, mechanical fasteners afford much faster belt splice times, taking just 1 – 2 hours at the most to bring the belt back into operation.



Figure 2. The broad width and heavy gauge of Flexco's BR™ solid plate fasteners provide long fastener wear life and higher tension splices.

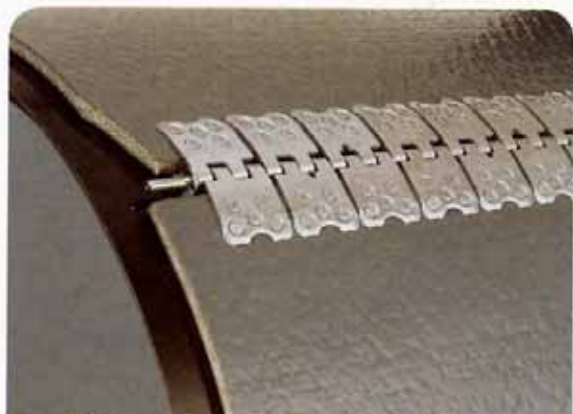


Figure 3. Hinged fasteners - well suited for belt conveyors with smaller pulley diameters.

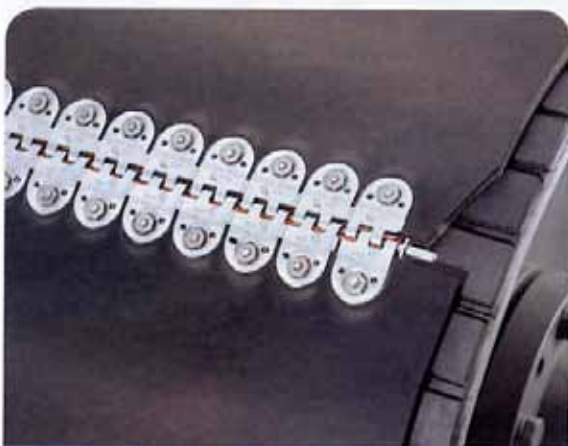


Figure 4. Bolt-hinged fasteners - also well suited for belt conveyors with smaller pulley diameters.



Figure 5. Rubber covered fasteners, such as Flexco® VP fasteners are ideal for use with belt cleaners and highly abrasive materials.

Certainly, fastener selection will influence overall performance. With no two cement plant operations the same, the wide selection of fastener designs can be chosen to correspond with factors including:

- Composition and design of the belt.

- Environmental conditions at the plant.
- Belt thickness - if fasteners are to be countersunk, belt thickness should be measured after the belt cover is removed.
- Belt rate of speed.
- Belt tensioning - most conveyor belting has a mechanical fastener rating that determines fastener selection.
- The type and weight of loads going into the crusher.
- Pulley dimension - consider all of the pulleys over which the belt makes at least a 90° wrap and determine the smallest pulley diameter in the system. Pulley size is getting smaller, and these tighter turns put stress on belt fibres. Portable rock crushers tend to use smaller pulleys.

## Suitable fastener types

Depending on the type of performance expected from the belt, there is a fastener specially designed to handle the operating conditions for the conveyor line. Fastener options and their attributes are listed below.

### Overall strength of splice - rivet solid plate fasteners

These are designed for the most demanding, high-tension applications. A staggered, multiple-point attachment on the fastener delivers long-lasting holding for mechanical ratings up to 800 PIW (140 kN/m).

These fasteners have a smooth coined-edge profile, eliminating fastener projections and potential hang-ups. The broad width and heavy gauge of the plates provides long fastener wear life and can also provide tension splices higher than 800 PIW (140 kN/m).

Rivet strips are available, some making it easy to load 20 rivets into the multiple guide block at one time. For this task, simply insert the pilot nails into the guide block holes, hit the strip with a hammer to release the rivets from the plastic and continue with the installation of the splice.

These fasteners are for belts 7/32 in. up to 15/16 in. (6 mm up to 24 mm) thick running on pulleys of at least 18 in. - 36 in. (450 mm - 900 mm) dia.

### Inexpensive splice/abrasion resistance - bolt solid plate

Bolt fasteners are the most frequently used in the aggregate industry. Engineered to meet the demands of the toughest material-handling applications, these fasteners can be applied to belts mechanically rated up to 620 PIW (105 kN/m). Commonly used on higher-tension main-haulage belts, these fasteners withstand the highly abrasive materials used for cement production.

The solid plate fasteners provide a strong, sift-free splice with superior holding ability. The strength of this fastener is derived from the compression of the plates with high tensile strength bolts. The bolts compress the top and bottom plates to distribute splice tension evenly across the entire width of each fastener plate. For added strength and pullout resistance, specially formed teeth



Figure 6. Maximum uptime can be enhanced through proper fastener selections and solutions.



Figure 7. Specially designed skivers quickly, safely and uniformly remove strips of rubber top cover to lower fastener plates below the surface of the belt.

penetrate deep into the belt carcass – without damaging the carcass fibres.

Specially designed templates, punches and boring tools make it easy to quickly and accurately punch holes into belts. Fasteners can then be installed on site using portable hand or power tools.

### *Long, jagged rips - conveyor rip repair fasteners*

Jagged-edged materials or tramp iron, such as tools or parts from broken equipment, inflict heavy punishment on a conveyor belt. This debris can catch on the conveyor support structure and idlers and tangle around rollers. In time, the debris results in punching through and forming rips that can range from short rips to rips running the length of the belt, even in the thickest belts, forcing the line to shut down.

Rip repair fasteners temporarily preserve belt strength and integrity until the belt section can be replaced. Available in steel, stainless steel and other non-magnetic alloys, these fasteners will not interfere with magnetic pulleys or separator performance.

Conveyor rip repair fasteners quickly bring belts back into service, reducing lengthy downtime and

expensive repairs when these long, jagged rips occur. Along with fixing rips, the maintenance crew can keep an eye on the belt to bridge soft spots before they cause real damage.

These fasteners are made for fast repairs. Though power tools make the job go twice as fast, hand tools can also get the repair done in as little as 20 minutes. Their small size enables them to be always on hand in an emergency repair kit.

### *Impact resistance - vulcanised plate rubber*

Strips of rubber cover the plate fasteners to protect them against highly abrasive sand, gravel and crushed stone to provide increased splice life and maximum belt up-time. They can be applied to belts mechanically rated up to 440 PIW (75 kN/m).

The rubber covering offers a sift-free, sealed splice to protect against seepage of fines and moisture and also reduces noise on return idlers and other conveyor components. Rubber covering allows for a continuous, smooth surface when plate strips are countersunk. In many cases these fasteners provide for improved belt cleaner interface and help to extend the life of the belt cleaner blade.

Fasteners are applied on-site with portable hand or power tools. Templates can be used to locate holes quickly and precisely for fast installation.

These fasteners can handle belts 3/16 in. to 13/16 in. (5 mm – 21 mm) thick, running over pulleys of at least 14 – 30 in. (360 mm – 760 mm) dia.

### *Small pulley diameters - rivet hinged or bolt hinged*

The rivet hinged fasteners are among the strongest, used for rubber-plied and PVC-solid woven belting and for worn belts unfit for vulcanised splices. These fasteners feature a scallop edge that significantly reduces exposure to cleaner blades, skirt rubber, and return idlers. The staggered rivet pattern also provides maximum holding ability by allowing the rivets to pass between the carcass fibres without damaging them.

The self-setting rivets are installed from the topside of the belt for faster installation. Hinged construction makes rivet hinged fasteners ideal for applications requiring frequent belt-length alterations. Simply removing the hinge pin can separate the joint. A variety of hinge pins are available to match the application.

Mechanical fastener ratings are up to 700 PIW (123 kN/m) for belts ranging in thickness 1/8 in. up to 1 in. (3 mm up to 25.5 mm) running over pulleys at least 5 in. – 42 in. (125 mm – 1050 mm) dia. Fasteners, hinge pins and rivets are available in a variety of materials.

Heavy-duty versions handle the most demanding high-tension or thick belt applications, offering greater reach-back, a thicker plate and an enhanced loop area to accommodate a larger diameter hinge pin. These rivet-hinged fasteners are for mainline and panel belts with mechanical fastener ratings up to 2000 PIW (350 kN/m). They are also designed for thick belts measuring 5/8 in. – 1 in. (16 – 25.5 mm) used in front of chute transfer points and for other high-tension impact applications.



Figure 8. The right fasteners properly installed can have an impact on productivity and profitability.

## Bolt-hinged fasteners

Bolt-hinged fasteners are designed as compression fasteners and are fastened to the belt ends with high tensile strength bolts, compressing the plates in the belt cover. Fastener teeth that imbed in the belt provide additional holding capacity without damage to the belt carcass. Splice tension is distributed across the entire plate width and the teeth secure the fastener to resist pullout.

Hinged construction makes bolt-hinged fasteners ideal for applications requiring frequent belt-length alterations. Simply removing the hinge pin can separate the joint. As with rivet-hinged fasteners, a variety of hinge pins are available to match the application.

These fasteners can handle operating tension up to 400 PIW (70 kN/m) on belts 1/4 in. – 7/8 in. (6 mm up to 22 mm) thick, running over pulleys at a minimum of 6 in. – 20 in. (150 mm to 500 mm) dia.

On-site installation requires only portable hand or power tools. Specially designed templates are available. Boring tools or belt punches quickly and accurately punch bolt holes into belts.

## Belt care

One of the best tools to minimise belt breaks is a good pair of eyes. At least once a day, someone should walk the length of the conveyor belt to check the belt, the fasteners and the system in general. Any pulling away of the belt from the fastener gives plenty of early warning that the splice needs to be redone. Therefore, the best time of the day to take that walk is an hour or two before the operation begins, so that any repairs or fastener replacements can be made without disruption to the operation.

Using the right tools and techniques will reduce the possibilities of breaks, making the fastener installation safer and more successful. These tools are listed below.

## Belt cutters

Everyone in maintenance carries a utility knife, but keep it in the tool belt when it comes to conveyor belt repairs. The thickness and toughness of conveyor belts make manual cutting unsafe and imprecise.

Precision is important. Cuts that are straight and perpendicular enable the fastener to stay attached to the belt ends longer and facilitates better tracking for smoother belt operation to prevent premature belt and splice wear, load spillage and fastener pullouts. Portable, lightweight cutters make straight, square cuts easier, faster and safer.

## Skivers

Countersinking fasteners or removing a strip of rubber top cover to lower fastener plates below the surface of the belt enables

greater compatibility between fasteners and cleaners. This is another job that cannot be done well or safely with a utility knife. Specially designed skivers do the job quickly, safely and accurately. Some use routers for this job, but a skiver tool is faster and cleaner, removing the top cover in one continuous strip.

## Rivet drivers and sets

Portable power driven belt repair tools offer the benefits of increased speed, precision and a better fastener installation. Repairs in tight clearances are easier and more uniform. Collated rivet sets reduce installation time significantly.

## Conclusion

Many cement plant operators know that broken belts are a fact of life, yet chalk up these disruptions to bad luck. However, management can make their own luck by keeping an eye on their fasteners and choosing fasteners carefully. Getting advice from those who sell conveyor belt accessories is a good place to start. This small investment in time and parts can pay off by minimising the conveyor belt breaks and maximising profit.