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Bulk Material Conveyor Belt Installation, Vulcanizing and Maintenance



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Bulk Material Conveyor Belt Installation, Vulcanizing and Maintenance

Summary

This article provides an overview of conveyor belt installations, vulcanizing, and preventive maintenance. Installation activities covered include installation point determination, pulling methods, belt braking, and positioning for splicing. Vulcanizing activities covered include general splicing considerations for fabric carcass and steel cable belts. Maintenance activities covered focus on the importance of inspections and provide guidelines on repair methods.

Introduction

Once the belt has been specified and purchased for the bulk material conveyors, three activities must take place to ensure that the system delivers the designed output and that the belt meets, or exceeds, its expected service life. The belt must be installed on the system; it must be spliced; and the system must have regular maintenance.

Belt installation, by its simplest definition, is the placing of the new belt on the conveyor system. In those cases where the new belt is replacing a worn or damaged one, the old belt is normally used as a guide to ensure that the new belt follows the correct belt path around pulleys and on idlers. When a belt is being installed on a new system, or when the old belt has been removed, a cable is strung on the system to perform this task. Proper installation techniques allow the new belt to be put in place without damage to the belt or the system.

Splicing is the activity of joining the two belt ends together to form one continuous belt that is capable of carrying the bulk material. Although there are essentially three methods of splicing conveyor belts, this article will focus on the vulcanization method only, as this is the only method which can be used for both fabric carcass belts and steel cable belts. The vulcanized splice is also recognized as the splice method which provides the greatest strength and longevity. Proper vulcanizing techniques ensure optimum total belt strength.

Maintenance of the conveyor system is the single most important activity that a conveyor system operator can perform to promote continuous, trouble-free movement of the bulk material being carried. This activity, which is the identification and correction of problem areas as they

occur, helps to avoid untimely and costly shutdowns or catastrophic belt failures.

In this article, general methods for completing all three of the above activities are presented with the intent of providing an overview for the reader. In practice, the best methods for installing, splicing, and maintaining any given conveyor belt are system specific. The conveyor operator should confer with the belt manufacturer, system designer, installation/splicing company (if used), and conveyor industry associations to determine which methods are best suited to the system in question.

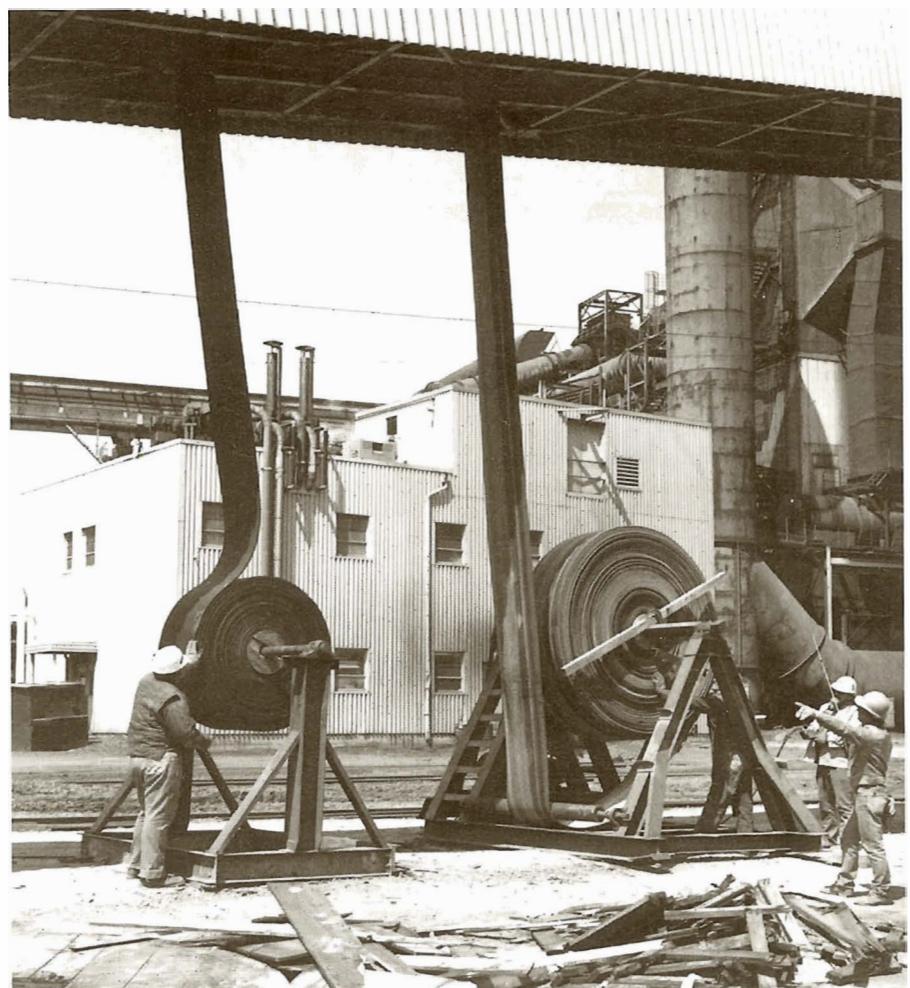
Belt Installations

Before installing a new conveyor belt on a system, a number of factors must be taken into consideration. Important decisions have to be made concerning the in-

stallation point, the belt roll handling method, the means of pulling the new belt on, and the preferred splicing point. On systems where a significant change in elevation is present, consideration must also be given to a braking device to prevent unexpected runaway of the new belt. All aspects of the installation should be considered before starting.

The new roll, or rolls, of belt must be placed where there is adequate space available for them and for a winder, or other belt-pulling device. This space requirement is the prime factor in determining the new belt installation point. Other important factors include worker safety, accessibility, utility hook-up points, and heavy equipment needs. The Belt Maintenance Group attempts to have the new belt installation point at the tail pulley. However, too many systems have walls or other conveyors at this point. When

Using the old belt to feed the new one ensures proper placement



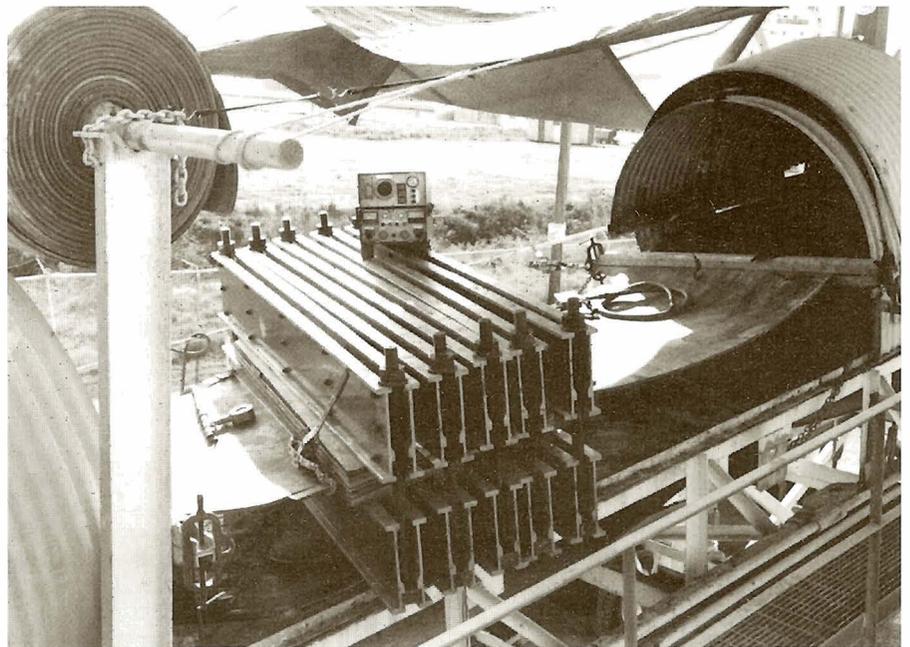
this occurs, the installation point may have to be either under or over the system. In some installations, part of the conveyor system, building, or other structure may have to be dismantled to allow access.

If the new belt is a replacement for one that is on the system, the old belt is commonly used to pull the new belt into place. This has the added advantage of helping to ensure that the new belt is installed "right side up" as the top cover can be matched with that of the old belt. The new belt is generally attached to the old belt by means of mechanical fasteners for fabric carcass belts or by means of a joiner plate or a partial splice for steel cable belts. If the belt is being installed on a system that does not have an existing belt, the general practice is to run a cable along the intended belt path and use it to pull the belt into position. The fastening method between the new belt and the old belt, or cable, must be strong enough to overcome all frictional forces of the belt against the idlers and pulleys, the gravitational forces of any changes in elevation, and the inertia forces involved with the start of the pull.

Depending on the length and weight of the belting being installed, the most common method of pulling the belt on is to use a winder. The winder reels the cable or old belt at a controlled speed. In doing so, the new belt is fed on to the conveyor. In some cases, a winder is not sufficiently strong enough to pull the belting into position. Heavy motorized equipment, such as earth movers or trains, have been used to provide the necessary pulling force. Specialized methods are required when a straight pulling force is not practical. In some cases, the use of a crane to support a diverting roller will facilitate pulling by a winder or by a piece of heavy equipment. A belt winder is the preferred method for pulling a belt on the system as the old belt or the cable is conveniently wound during the installation process. This saves time and expense, as extra steps to handle the old belt or cable are not required.

One special installation criteria needs to be considered whenever a belt is being installed on a system that has a significant change in elevation – a braking system must be used for the roll of new belting. This is to prevent the belt from unrolling by itself. If this happens, severe damage could occur to anything – or anyone – in its path. An efficient installation is done at controlled speeds where spotters follow the leading end of the new belting as it is being pulled. A brake on the new belt roll will protect these "walkers" from injury.

Other considerations with belt installation include the positioning of the take-up and spotting the belt ends at the desired



Vulcanizing the splice

splice station. The take-up positioning is important whenever belt stretch must be considered, as with fabric carcass belts. The take-up should be positioned to allow for the anticipated stretch of the belt. Ideally, it can be placed so that an additional splice is not required.

If the optimum splice station is different than the installation point, a means of moving the two ends of the belt to the splicing area must be used. Frequently, this is accomplished by temporarily joining the belt ends together and using the system drive to move the belt. Alternatively, pulling one end of the belt with a winch or air-tugger can move the belt ends to the desired position.

Once the new belt is installed and properly positioned, it can be vulcanized and put into service.

Vulcanizing

The vulcanized splice is widely accepted as the preferred means of joining two belt ends together to form one continuous belt on the conveyor system. The most commonly used belts for bulk material handling are fabric carcass and steel cable. There are many variations in the composition of fabric carcass belts and there are variations in steel cable belt structure resulting from the tensile strength requirements. In addition to these variations, there are special vulcanization techniques required for the different rubber materials used by the belt manufacturers. Also, there are a number of specialty belts and specialty systems which demand specific splicing configurations. To a large extent, almost every belt installation must be evaluated to determine which vulcanization method is

most suitable. Due to the multitude of vulcanization methods used, this article will be restricted to very general considerations.

The first factor to be considered for the vulcanization process is the belt itself. This will determine the minimum splice requirement. Once the belt specifications are known, the proper cements, rubber, and breaker fabric can be determined. The actual splice layout should be determined by following the belt manufacturer's and system designer's recommendations. It is important to remember that the system design may require a more involved splice than that generally required by the belt manufacturer. An example of this is with steeply inclined systems with a sharp bend at the upper elevation. Frequently, an extra-long step length for fabric belts or a longer splice length for steel cable belts should be used to counter the extra forces placed on the belt at this point.

The main vulcanization techniques to be considered for multi-ply fabric carcass belts include belt squaring to ensure a straight splice; material choice to ensure compatibility and strength; and step length to ensure proper splice strength. With some systems, the bias angle of the splice is important. Some systems require a 45° bias angle while others require less of an angle or no bias at all. It is mandatory to determine the splice requirements for the belt before starting. Generally, the Belt Maintenance Group has found that the splice should be made with materials produced by the belt manufacturer or with quality Rema Tip Top splice materials. When this is not possible, compatible materials must be used. If the belt is properly squared; is properly stripped without damage to the fabric; has the correct step length; is built with

the right materials; and is vulcanized under the proper temperature, pressure and time; the splice will be good. The squaring and stripping help to ensure that the splice is straight. All of the above steps help to ensure that the splice is strong.

Single ply belts, such as solid woven carcass, straight warp carcass, and aramid carcass belts have specific vulcanized splice patterns ranging from finger splices to scab splices. As with the multi-ply belts, the important considerations are the squaring, stripping, fabric cutting, material selection, vulcanization temperature, vulcanization pressure, and vulcanization time.

Steel cable or steel cord belts will have specific splice layout patterns and splice lengths which are largely dependent on the cable diameter size and spacing. Although the strength of the vulcanized splice is largely dependent on the splice length, it is mandatory that good adhesion be achieved between the cables and the rubber that is between them. This is one of the reasons why extra pressure is used on steel cord splices. It is also desirable to strip the steel cords in such a

port bulk materials. The next stage of belt related care is the ongoing, or preventive, maintenance of the conveyor system.

Maintenance

Preventive maintenance is by far the most labor-intensive activity related to the conveyor belt. It, literally, never ends. However, preventive maintenance is also the most cost-effective means of protecting the operator's conveyor system investment. It pays for itself through increased conveyor productivity, optimized energy efficiency, and avoidance of unscheduled system downtime.

The key ingredient of an effective maintenance program is the inspection. The conveyor system, including the belt, should be inspected before each use or on a frequent, regular basis. By conducting inspections, faulty equipment can be identified and repaired or replaced before damage is caused. The Belt Maintenance Group inspects all components of the conveyor system; including the pulleys, the idlers, the belt cleaners, skirting systems, chute liners, impact pads, and the

be done. A stalled idler can rapidly be strapped by the belt to the point where it becomes a double bladed knife that can cut the belt. A worn or poorly adjusted belt cleaner or skirting can trap material, which can cause severe wear of the belt cover. Worn or poorly adjusted return cleaners can allow material to build-up between the pulleys and the belt. This can result in damage to both the bottom cover and carcass of the belt. Trapped material can cut a belt in half. Taking action can be very important.

Damage can occur to the belt even when all preventive maintenance stops are taken. When this occurs certain action steps can be taken to prolong the service life of the belt.

If it is noted that the belt has a hole or rip in it, it should be repaired immediately. Although a temporary repair of fabric carcass belts can be effected by using solid plate type mechanical fasteners, the belt should have a vulcanized repair as soon as possible. Depending on the extent of the damage, a cold care repair may work well.

Whenever damage to the belt is noted, a decision must be made as to which type of repair, if any, is most suitable. Long term repairs can be achieved by both cold cure and hot vulcanization methods. A large variety of repair materials are available to help correct cover gouges, wear lines, and carcass damage. Generally, cover gouges are repaired with cold cure materials and damage to the splice or to the carcass results in hot vulcanized repairs. Whatever repair methods are used, it is important to make repairs before the injury becomes major.

Repairs to steel cable conveyor belts are generally done by means of the hot vulcanization method.

Maintenance work will prolong the service life of the conveyor belt and the conveyor – providing the most cost-effective way of moving tons of material.



Inspection and action of system faults can prevent costly wear of the belt and idlers

manner as to avoid baring or nicking them. A stronger bond is achieved when vulcanizing fresh rubber to the rubber around the steel cords, as opposed to the metal itself.

With all vulcanized splices, the pressure should not be relieved until the press platens have cooled to the temperature recommended by the belt manufacturer. Normally, this is 70° C or 150°F.

Upon the successful completion of the vulcanized splice and the re-assembly of any conveyor system components disturbed, the system can be used to trans-

port bulk materials. In addition to these static inspections, the system should be inspected while running with a load. This helps to identify idlers that are starting to fail, improperly functioning belt cleaners or skirting, and mistraining points.

The inspections provide information on what maintenance work needs to be done to prevent a breakdown. Preventive maintenance requires that the information gathered by the inspections be acted upon before there is a problem. Therefore, any hardware component that needs replacement or adjustment, must

Conclusion

A conveyor belt is an important part of the bulk materials handling process. Proper installation, vulcanization, and preventive maintenance will help to provide the expected capacity and service life of the belt. The longer the belt lasts without any unscheduled downtime, the more profitable the system is. Taking care can pay dividends.

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