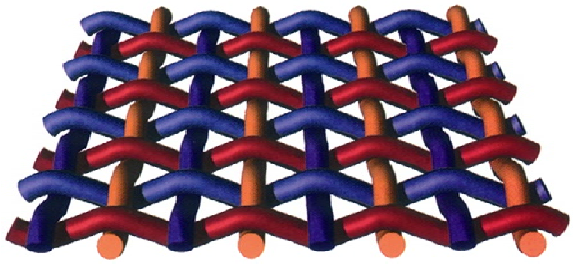
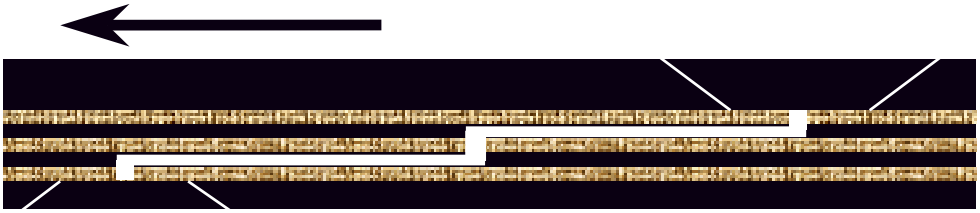
FENNER DUNLOP
CONVEYOR BELTING

General Splicing of Plied Conveyor Belts

In general plied belts are made up of layers of high tenacity fibers in the longitudinal direction acting as strength members (warp members). The crosswise or filler (weft members) fibers are used as a reinforcement to optimize the fatigue properties and troughing characteristics of the belt design. These warp and weft members are held together by inter-weaving them both lengthwise and crosswise directions in most cases.



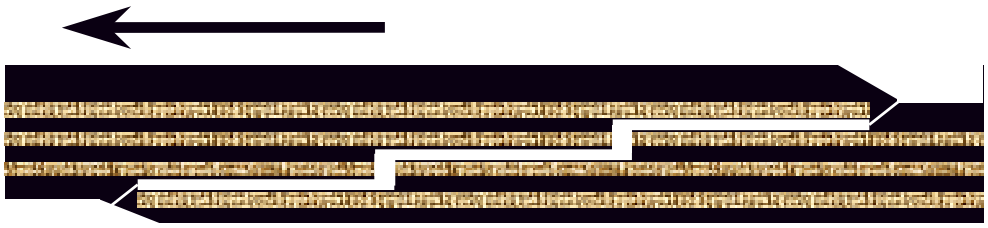
When splicing plied conveyor belts they in general require the use of cutting away layers of fabric (plies) so the two belt ends can be overlapped and thus used as a load-carrying members.



During this process the elimination of one ply reduces the power transmission of the total tensile forces in the splice area. The lower the number of plies in the belt the greater the loss of strength as a percentage of the overall belt strength.

- For example a 2-ply belt splice using a 1-step splice type would be 50% less in total breaking strength than the factory belt.
- Using this same process a 3-ply belt splice using a 2-step splice type is 33% less in total breaking strength than the factory belt.
- Thus a 4-ply belt splice using a 3-step splice type is 25% less in total breaking strength than the factory belt and a 5-ply belt splice using a 4-ply step type would be 20% less in total breaking strength than factory belt.

The same belt types can also be spliced using a complete overlap or full-ply step (lap) splice using this area as load-carrying members.



The break strength of these splice types comes close to the breaking strength of the factory belt, but since the overall gauge of this splice type is greater than the factory belt, thus thin or worn covers is possible.

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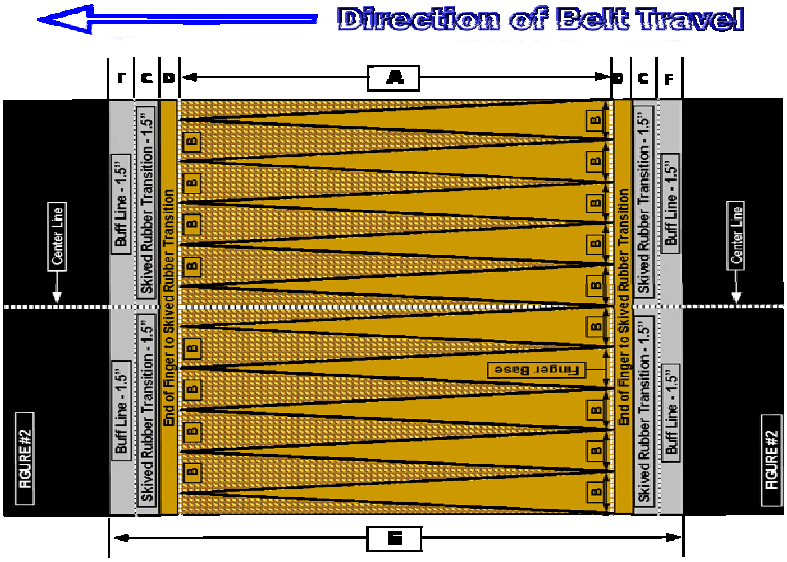
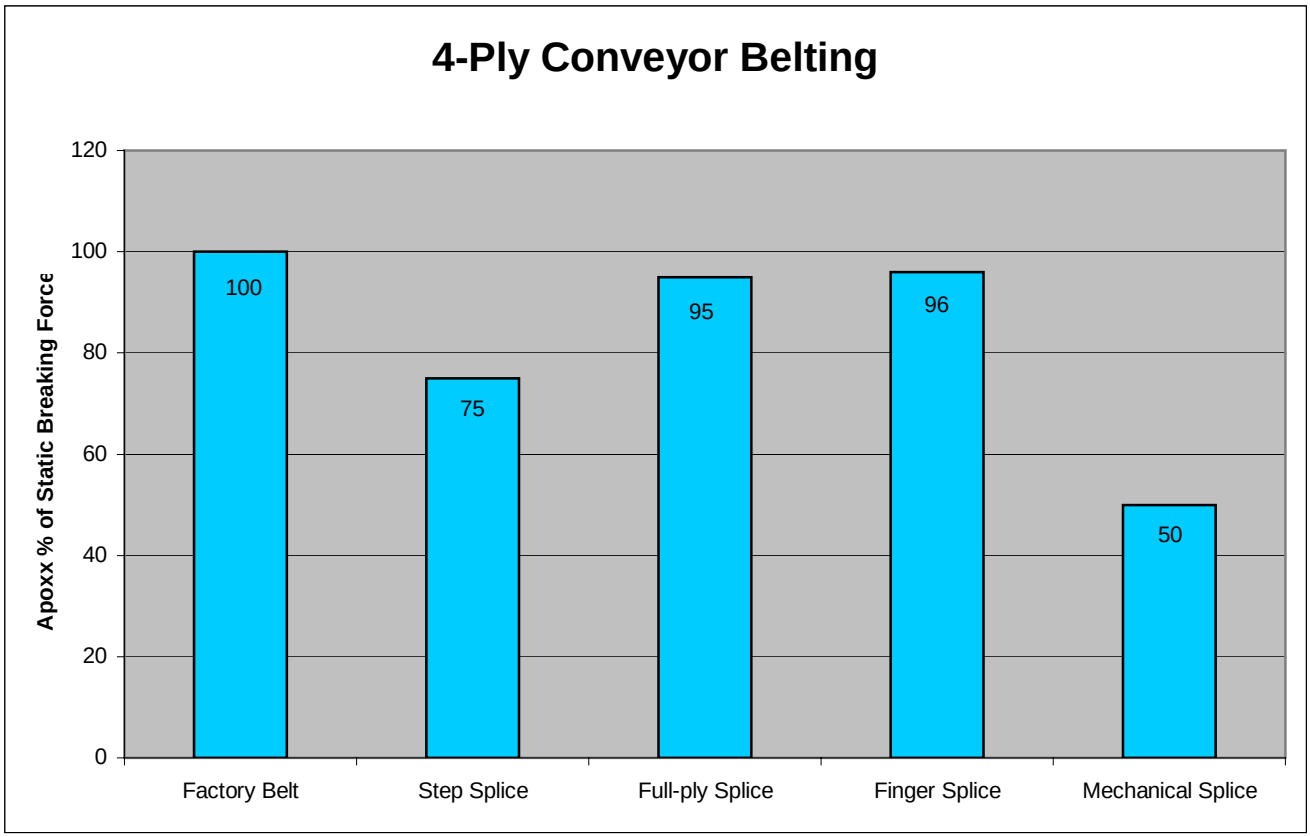
Under dynamic analysis the full-ply splice type will not flex as well as a standard step splice but has apox 95% the strength of the static breaking value of the factory belt. In general belt splices don't fail from static tension but fail from dynamic fatigue (i.e. – the splice in high-tension around the pulleys).

When using the standard step (lap) or full ply splice at high tension they can have a delamination along the load member outside ends. Some small improvement can be made using interlocking short fingers (6") along the load carrying outside fabric ends; this would be called a step-finger splice type.



The best mix of splice strength and dynamic life in high-tension belting is the Finger Splice, when made with the special non-reverting splice materials.

This splice type has proven to have a



dynamic failure value more than 10 times better than the standard step (lap) splice and a break strength apoxx 96 % that of the factory belt at break.

The Finger Splice also has many benefits such as keeping all of the factory belt plies in power transmission in the splice area with out using any steps and thus keeping factory bonded plies together with-in the splice area.

Also mechanical fasteners can be used on traditional crimp-weave (plied) belting conveyor belting. In general a 4:1 safety factor is typical if the manufacture directions are followed in selection and installation of the fastener.

The following are a few of the reasons why fasteners may fail.

- Comb Out tensile failure of the belt. Fill yarn combs out of the end of the belt leaving warp yarns and fasteners intact.
- Fatigue or wear failure of the belt. After extensive use belt warp yarns fracture behind the fasteners.
- Tensile failure of the belt. Warp yarns fracture with fasteners intact.

In summary the ultimate breaking/tensile strength of a belt is the result of subjecting a belt sample to a tension that surpasses the **maximum working tension** of the belt. The belt is literally "pulled in two" to determine the breaking strength. During this test, the fabric sample will "neck down" the yarns will elongate and the strength of the belt will be reduced until there is no elongation nor strength left in carcass components and the sample will break. In standard plied fabric carcass belting this is generally done in a static test as prescribed by ASTM D378.

The ratio between the maximum working tension and the actual breaking tension is referred to as the ***Service Factor*** (also called Safety Factor). Traditionally, in North America the optimum Service Factor for a belt utilizing Polyester as the warp or tension member was 10:1 (i.e. a 2 ply 220 pound working tension belt would break at 2200 pounds). In general Polyester warp or tension member safety factors range from 7:1 to 10:1, depending on belt and fabric type.

The Service Factor in a belt helps handle the "shock load" introduced into a belt on loaded start-ups and at other times when the belt is subjected to "unusual" tensions in the system. Higher Service Factors may also provide higher modulus in a belt specification resulting in lower elongation in a given application.

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