



NIBA—The Belting Association  
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# Technical Article

Technical Article Content Pulled from the NIBA Belt Line Newsletter

## Working Strength vs. Breaking Strength

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When dealing with conveyor belt tension ratings, it is not uncommon to hear references to *working tensions* or *maximum working tensions* and *ultimate breaking strength* or *ultimate tensile strength* of a belt. At times there is confusion about the meanings of these ratings. Both of these ratings refer to the capabilities of the carcass of the belt and are interrelated.

### Working Tension

**NIBA** defines working tension or maximum working tension as the “maximum safe working tension recommended by the belt manufacturer.”

Each belt manufacturer tests the physical properties of the carcass materials utilized in the construction of their belting products in accordance with whatever testing standard they adopt (generally ASTM D378 in North America).

The test results are reviewed, and based on the findings, the belt manufacturer determines the maximum tension that can be applied to the belt in everyday use over the useful life of the belt. This tension unit is generally related in pounds per inch of width or PIW, i.e., 220, 330, etc. In the metric system all tension values are in BREAKING TRENNGTH not operating tension. For example, an EP800 construction is 800 N/mm breaking strength. The operating tension, after converting to metric (assuming a 10:1 safety factor) would be 80 N/mm or 457 PIW.

### Ultimate Breaking/Tensile

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 woven fabric carcass belting this is generally done in a static test as prescribed by ASTM D378. Lightweight European-style belting is subjected to a different set of test criteria that are more dynamic in nature.

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. Currently, polyester safety factors range from 7:1 to 12:1, depending on manufacturer



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and fabric type. Due to the differences in elongation between polyester and nylon, belting utilizing nylon as the warp or tension member traditionally had an optimum Service Factor of 13-15:1. Currently, nylon safety factors range from 10:1 to 18:1, depending on the manufacturer 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.