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Technical Article
Technical Article Content Pulled from the NIBA Belt Line Newsletter

Belt Fabrics 101 (Part 2)

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Classifying Fabric Yarns and Cord Sizes; Weave Styles

There are several methods of classifying fabric yarns or cord sizes. Natural fibers (cotton) are classified by the English system in which the yarn size number is based on the weight of a hank. Staple fibers are twisted to form single yarns. These yarns are then measured as a hank, which is 840 yards of material; therefore, a #10 cotton yarn has ten times 840 (8400 yards) of yarn per pound. A #8 cotton yarn would be 6,720 yards per pound. It must be noted that the higher the number, the higher the yield in yards per pound, consequently, the lighter the gauge. A yarn specified as 8/1 means that there is one end of a #8 twisted single and will yield 6,720 yards per pound. A yarn specified as 8/3 means there are three strands of the #8 yarn twisted together. The yield will be approximately 1/3 of resultant yards per pound and about three times the cross sectional area (not gauge). Some yardage and gauge is lost in the twisting. This is referred to as a plied yarn.

A yarn specified as 8/3/3 adds another twist. The last "3" determines that three strands of the previously twisted 8/3 yarn are twisted together. The end result is 3x3=9 strands of #8 yarn in the construction, yield=6,720/9 or 746 yards per pound. As yarns are plied and twisted, a direction may be specified (S or Z). The twist is in the direction of the shape of the letter.

Synthetic organic fibers such as nylon, polyester, rayon, and aramids are described and measured in terms of a metric measurement known as denier. Denier is the weight in grams of material per 9000 meters of length. Therefore, if 9000 meters of yarn weighs 1650 grams, it is known as 1650 denier. The lower the denier the lighter the yarn and the greater the yield in yards per pound. Typical examples of denier are 1,000 and 1,300 for polyester, 840 and 1,260 for nylon, 1,100 and 1,650 for rayon and 1,000, 1,500, and 3,000 for aramids. Designations such as 2200/1, 1100/1, 3300/1, and 840/1 are all single with a little twist on the fine filaments. These fibers can be twisted to varying degrees and plied into various combinations. A yarn designated as 1100/2/5 defines that there are two strands of 1100 denier yarn twisted and then five of them are twisted to form the combinations.

Steel cords have an entirely different method of nomenclature; calling out each filament diameter and the number of filaments per bundle. For example a 4x.25 cord is comprised of four filaments each .25 mm in diameter.

Fiberglass measurement utilizes a system known as tex. The tex system has been implemented worldwide in which both filament and staple yarns are rated on the same basis. Yarns are designated by a tex number in which the weight in grams is per 1,000 meters. Typical fiberglass cord sizes are 330/1, 660/1, and 990/1 tex.

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Belt duck is a common fabric utilized in the belting industry. It is a hard, tightly woven fabric, not square woven, and its tensile strength is not equal in both directions. The predominant strength is in the warp direction, in order to withstand the longitudinal stresses encountered by a belt in service. The warp strength of a belt duck is often twice as much as the fill strength. The designation of a belt duck is based on the weight in ounces of a three-foot long by 42-inch wide fabric.

Tire cord and tire cord fabrics have become popular choices in the design of many new belt constructions. They are produced by ply twisting the yarn of choice by the desired number of turns per inch. After ply twisting, two or more spools of twisted yarn are twisted into cord. Generally, the direction of twist of the cord is opposite to that in the yarn. This is called a balanced twist. Twist imparts durability and fatigue resistance to the cord. After cable twisting the weaving process imparts multiple cords woven together in the warp direction being held in place by small fill threads.

Fabric is a planar structure produced by interlacing yarns. It is comprised of warp yarns (ends) which run lengthwise and fill or weft yarns (picks) which run crosswise as the fabric is woven. In most cases, these two yarns are at right angles to each other.

There are four basic principal types of weave:

- Plain weave
- Basket weave
- Leno weave
- Twill weave

The plain weave is the most common pattern. It consists of yarns interlaced in an alternating pattern, one over and one under every other yarn. Plain weaves provide a very stable construction.

The basket weave is similar to the plain weave except that two or more of the warp yarns, and two or more of the fill yarns are alternately interlaced over and under each other. The basket weave is more pliable, flatter, and stronger than the plain weave, but it is not as stable.

The leno weave is used where a relatively low number of yarns are involved. The leno weave locks the yarns in place by crossing two or more warp threads over each other and interlacing with one or more filling threads. Leno weaves are utilized as a breaker ply for dispersing a blunt force or impact on the belt (less likely to fracture). They yield excellent adhesions to rubber due to the strike through; however, they will stretch.

The twill weave is much more pliable than the plain weave. The weave pattern is characterized by a diagonal rib caused by one warp yarn floating over at least two fill yarns.

The belting industry consumes a very large quantity of reinforcing materials in the manufacture of its products. Yarns, cords, fabrics, and steel are among the most commonly used and are equally as important as the

elastomers in affecting the properties of a finished product. Knowledge of their basic properties and behavior is essential to proper selection.

General References

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