YARN STRENGTH IS AFFECTED BY FRICTIONAL PROPERTIES

Michael L. Honeycutt
President Lawson-Hemphill Sales, Inc.
Spartanburg, S.C.

Abstract

Yarn was tested on Lawson-Hemphill's CTT, which was set up with a friction element to provide a value of the force required to break the yarn with or without a frictional load. Because of the drag induced on a yarn as it touches machine components in processing or testing, a yarn will break at a lower tension. The drop in strength for these samples due to the insertion of a friction element varied from 38% to 55%. Yarn strength testing with the addition of speed and friction is more adaptive to what the yarn performance will be in a manufacturing environment. Certain yarns with a high single end break number and a high coefficient of friction will break in knitting or weaving before some yarns having a lower single end strength number but a lower coefficient of friction.

Dynamic Strength

Yarn (Table 1) was tested on Lawson-Hemphill's CTT. Yarn speed was 360 m/min. Each package was subjected to a low tension and gradually increased until the yarn broke. Yarn tension was backed off 10% from the tension at which the yarn broke. If the yarn did not break at this tension then the first yarn break was recorded. If the yarn broke at 90% tension of the first break, the tension was then reduced another 10%. The level of tension where the yarn would run was considered acceptable and the break tension was recorded. Each level of tension subjected to the yarn was applied for 1000 meters.

Dynamic Strength with Friction Element

The Lawson-Hemphill CTT was set up with a friction element of stainless steel. The path of the yarn had 180 degree angle of wrap around the friction element. The same yarn speed, 360 m/min. was run. The same procedure of recording the breaking tension was done, as in the previous dynamic strength test. Yarn strength testing provides a number associated with the force required to break the yarn. Because of the drag induced on a yarn as it touches machine components, a yarn will break at a lower tension. The drop in strength from these samples varied from 38% to 55% with the insertion of a friction element (Table 2).

The Influence of Friction

A yarn that is stronger in breaking strength and has a higher coefficient of friction breaks in weaving or knitting before a yarn with a lesser breaking strength and lower coefficient of friction. This is shown (Table 3) when comparing the results of the 12/1 NeC Blue and Green packages. The Green packages had a slightly higher average breaking strength, than the Blue. With the friction element inserted, the Green packages breaking strength fell way below the strength of the Blue packages.

Conclusion

Yarn strength testing is an indication of comparing results from package to package. Yarn strength testing with the addition of speed and friction is more adaptive to what the yarn performance will be in a manufacturing environment. When a yarn passes over a machine component, frictional properties of the yarn are included in the manufacturing process. Certain yarns may have a high single end break number and a high coefficient of friction. The yarns will break in knitting or weaving before some yarns with a lower single end strength number and a lower coefficient of friction.

Table 1. Sample size of packages. Total packages = 36.

12/1 NeC = 18	9.5/1 NeC = 18
Natural = 6	Natural = 6
Blue = 6	Blue = 6
Green = 6	Blue = 6

Table 2. Breaking Strength (grams).

Group 1 (12/1)			
	Yarn Strength w/o Friction	Yarn Strength% w/Friction	Drop in Strength
Natural	353.3	200.0	43%
Blue	336.7	170.0	55%
Green	343.3	155.0	55%
Group 2 (9.5/1)			
	Yarn Strength w/o Friction	Yarn Strength% w/Friction	Drop in Strength
Natural	500.0	308.0	38%
Blue	495.0	283.3	43%
Green	483.3	256.7	47%

Table 3. Influence of friction.

	Yarn Strength No Friction	Yarn Strength With Friction
Blue	336.7 g	170.0 g
Green	343.3 g	155.0 g

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:705-706 (1997)
National Cotton Council, Memphis TN