

# Technical Tuesdays

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## YARN QUALITY - IMPORTANT TERMS

### YARN STRENGTH AND ELONGATION

Breaking strength, elongation, elastic modulus, resistance to abrasion etc are some important factors, which will represent the performance of the yarn during actual use or further processing. Strength testing is broadly classified into two methods

- **Single end strength testing .**
- **Skein strength or Lea Strength .**

- **TENSILE STRENGTH OF SINGLE STRANDS OF YARN :**

- During the routine testing, both the breaking load and the extension of yarn at break are usually recorded for assessing the yarn quality. Most of the instruments record the load-elongation diagram also .

- Various parameters such as initial elastic modulus, the yield point, the tenacity or the elongation at any stress or strain, breaking load, breaking extension etc can be obtained from the load-extension diagram.

- Two types of strengths can be determined for a yarn

**Tensile strength - Load is applied gradually.**

**Ballistic strength - Applying load under rapid impact conditions.**

Tensile strength tests are more common tests and these are carried out using either a single strand or a skein containing a definite number of strands as the test specimen.

- An important factor which affects the test results is the length of the test specimen actually used for carrying out the test. The strength of a test specimen is limited by that of the weakest link in it .If the test specimen is longer, it is likely to contain more weak spots, than shorter test specimen. Hence the test results will be different for the different test lengths due to the weak spots.

- The amount of the moisture in the yarn also influences the test results .Cotton yarn when fully wet show higher strength than when dry. While opposite is the case with Viscose rayon yarns .Hence, to eliminate the effect of variation due to moisture content of the yarn ,all the yarn strength tests are carried out, after conditioning in a room where the standard atmospheric condition is maintained .

- The rate of loading as determined by the “ time-to-break”, which is the time interval between the commencement of the application of the load and the rupture of the yarn, is an important factor, which determines the strength value recorded by using any instrument. The same specimen will show a lower strength when the time-to-break is

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high, or higher when the time-to-break is low.

## INSTRUMENT TYPES - BASED ON PRINCIPLE .

The instruments used for determining the tensile strength are classified into 3 groups on the principle of working .

- **CRT** - Constant Rate of **T**ransverse.
  - **CRE** - Constant Rate of **E**xtension.
  - **CRL** - Constant Rate of **L**oading.
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- In the instruments of the CRE type, the application of load is made in such a way that the rate of elongation of the specimen is kept constant. In the instruments of the CRL type, the application load is made in such a way that the rate of loading is constant throughout the duration of the test . These type of instruments are usually preferred for the accurate scientific work. In the CRE and CRL type of instruments it is easy to adjust the “ time-to-break” while the adjustment is not easy in the CRT types of instruments.
  - The **Tensorapid** applies CRE Principle of tensile testing . Constant Rate of Extension describes the simple fact that the moving clamp is displaced at a constant velocity. As a result, the specimen between the stationary and the moving clamp is extended by a constant distance per unit of time and the forces required to do so is measured. Apart from the single values, this instrument also calculates mean values coefficient of variation and the 95% confidence range of the maximum force , tenacity , elongation and work done .
  - The total coefficient of variation describes the overall variability of a tested lot, i.e. the within sample variation plus the between sample variation . If 20 individual single end tensile test are performed on each of the ten bobbins or packages in a sample lot, the total coefficient of variation is calculated from the pooled data of the total number of tests that were carried out .
  - In **Tensorapid**, the breaking tenacity is calculated from the peak force which occurs anywhere between the beginning of the test and the final rupture of the specimen . The peak force or the maximum force is not identical with the force measured at the very moment of the rupture (elongation at rupture).
  - The work to break is defined as the area below the stress/strain curve drawn to the point of peak force and the corresponding elongation at peak force. The work at the point of peak force is not identical with the work at the very moment of rupture.
  - To compare the **Tensorapid** results with the other results, a measurement must be performed according to the CRE principle and testing speed must be exactly 5m/min.
  - The gauge length or the length of the specimen should be 500 mm
  - The pretension should be 0.5 Cn/tex.

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## SKEIN STRENGTH OR LEA STRENGTH

The skein breaking strength was the most widely used measure of the yarn quality in the cotton textile industry. The measurement of yarn quality by this method has certain drawbacks.

- 1) In most subsequent processing such as winding, warping or weaving, yarn is used as single strand and not in the form of a skein except occasionally when sizing, bleaching, mercerising or dyeing treatments are carried out on hanks.
- 2) In the method used for testing skein strength, the rupture of a single strand at a weak place affects the result for the whole skein.
- 3) Further the method of test does not give an indication of extensibility and the elastic properties of the yarn, the characters which play an important role during the weaving operations.
- 4) Since a large size sample is used in a skein test as against that in a single strand test, the sampling error is less. The skein used for strength test can be used for determination of the linear density of the yarn as well.

● In addition to the factors influencing the yarn strength, the size of the skein (lea) will affect to a large extent the strength recorded. The usual practice is to use a lea (120 yds) of yarn prepared by winding 80 turns on a wrap reel having a perimeter of 1.5 yds (54 inches), so that during a test, there are 160 strand of 27 inch length. There are different systems in use.

● After finding out the skein strength, broken skeins are used to determine the linear density of the yarn. The most common skein used is the lea and the results of the lea strength tests are expressed in C.S.P, which is product of the linear density (count) of the yarn in the English System (Ne) and the Lea breaking strength expressed in Lbs.

In the view of the fact that C.S.P is much less dependant on yarn count than on strength, especially when count differences are small, C.S.P is the most widely used measure of yarn quality.

to be contd in coming weeks

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