Ragini International

Yarn Testing

Yarn occupies the intermediate position in the production of fabric from raw material. Yarn results are very essential, both for estimating the quality of raw material and for controlling the quality of fabric produced. The important characteristics of yarn being tested are :

- **Yarn Count**
- **Yarn Twist**
- **Yarn Strength & Elongation**
- **Yarn Evenness**
- **Yarn Hairiness etc.**

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(We at **"Ragini International"** have tried our best to provide all the necessary information absolutely truth from the best of our knowledge. Even though if there is any mistake, we are keen to hear suggestions.)

For Ragini International

(Authorised Signatory)

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Once the cartons are are ready for shipment, the packing lists are ready, our representative visit the mill, make a random selection of cartons. He will take one cones each from the selected cartons for the test. If the quality will be acceptable the tested cones must be shipped marking tested cone.

1.0 Yarn Count

The fineness of the yarn is usually expressed in terms of its linear density or count.

There are a number of systems and units for expressing yarn fineness. But they are classified as follows

DIRECT SYSTEM:

1. English count (Ne)
2. Metric count (Nm)

INDIRECT SYSTEM:

1. Tex
2. Denier

1. Ne: No of 840 yards yarn weighing in One pound
2. Nm: No of one kilometer yarn weighing in One Kilogram
3. Tex: Weight in grams of 1000 meter (1 kilometer) yarn
4. Denier: Weight in grams of 9000 meter (9 kilometer) yarn

For the determination of the count of yarn, it is necessary to determine the weight of a known length of the yarn. For taking out known lengths of yarns, a wrap-reel is used. The length of yarn reeled off depends upon the count system used.

One of the most important requirements for a spinner is to maintain the average count and count variation within control.

1.1 Yarn Count Variation

The term count variation is generally used to express variation in the weight of a lea and this is expressed as C.V.%. The number of samples and the length being considered for count checking affects this. While assessing count variation, it is very important to test adequate number of leas. After reeling the appropriate length of yarn, the yarn is conditioned in the standard atmosphere for testing before it's weight is determined.

1.2 Conversion Table For Yarn Counts

	Tex	Ne	Den	Nm
Tex			Den/9	1000/Nm
Ne	590.54/Tex		5314.9/Den	Nm x .5905
Den	Tex x 9			9000/Nm
Nm	1000/Tex		9000/Den	

2.0 Yarn Twist

Twist is defined as the spiral disposition of the components of yarn, which is generally expressed as the number of turns per unit length of yarn, e.g. turns per inch, turns per meter, etc.

With increase in twist, the yarn strength increases first, reaches a maximum and then decreases.

Depending on the end use, two or more single yarns are twisted together to form "plied yarns" or "folded yarns" and a number of plied yarns twisted together to form "cabled yarn". Among the plied yarns, the most commonly used are the doubled yarns, wherein two single yarns of identical twist are twisted together in a direction opposite to that of the single yarns. Thus for cabled and plied yarns, the direction of twist and the number of turns per unit length of the resultant yarn as well as of each component have to be determined for a detailed analysis.

Direction of twist is expressed as "S"-Twist or "Z"-Twist. Direction depends upon the direction of rotation of the twisting element.

Twist take up is defined as, "The decrease in length of yarn on twisting, expressed as a percentage of the length of yarn before twisting.

2.1 Twist Standards

Cotton combed knitting T.M. = 3.4 to 3.6
Cotton combed weaving T.M. = 3.7 to 3.8
Cotton carded knitting T.M. = 3.8 to 4.0
Cotton carded weaving T.M. = 3.9 to 4.2

3.0 Yarn Strength & Elongation

Breaking strength, elongation, elastic modulus, resistance 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

1. Single End Strength Testing
2. Lea Strength

3.1.Tensile strength of single yarn

During routine testing, both the breaking load and 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 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

1. Tensile strength -load is applied gradually
2. Ballistic strength - applying load under rapid impact conditions

3.2. Skein strength or lea strength

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

Firstly, in most of the subsequent processing, such as winding, warping or weaving, yarn is used as single stranding not in the form of a skein except occasionally when sizing, bleaching, mercerizing or dyeing treatments are carried out on hanks.

Secondly, 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. Further, this method of test does not give an indication of the extensibility and elastic properties of a yarn, the characters which play and important role during the weaving operations.

However, 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.

After finding out skein strength, broken skeins are also weighed to determine the linear density. The most common skein used is the lea and the results of lea strength tests are expressed as C.S.P., which is the product of the linear density (count) of the yarn in the English system (Ne) and the lea breaking strength expressed in lbs. In view of the fact that C.S.P. is much less dependent on yarn count than on strength, especially when count differences are small, C.S.P. is the most widely used measure of yarn quality.

4.0 Yarn Evenness

Non-uniformity in variety of properties exists in yarns. There can be variation twist, bulk, strength, elongation, fineness etc. Yarn evenness deals with the variation in yarn fineness. This is the property, commonly measured, as the variation in mass per unit length along the yarn, is a basic and important one, since it can influence so many other properties of the yarn and of fabric made from it. Such variations are inevitable, because they arise from the fundamental nature of textile fibres and from their resulting arrangement.

Accordingly, there are limits to the achievable yarn evenness.

4.1 Unevenness / Irregularity

The mass per unit length variation due to variation in fiber assembly is generally known as "IRREGULARITY" or "UNEVENNESS". It is true that the diagram can represent a true reflection of the mass or weight per unit length variation in a fiber assembly. For a complete analysis of the quality, however, the diagram alone is not enough. It is also necessary to have a numerical value that represents the mass variation. The mathematical statistics offer 2 methods

1. The irregularity U%: It is the percentage mass deviation of unit length of material and is caused by uneven fiber distribution along the length of the strand.
2. The coefficient of variation C.V.%

4.2 Imperfections

Yarns spun from staple fibres contain "IMPERFECTIONS”. They are also referred to as frequently occurring yarn faults. They can be subdivided into three groups

1. Think places
2. Thick places
3. Neps

The reasons for these different types of faults are due to raw material or improper preparation process. A reliable analysis of these imperfections will provide some reference to the quality of the raw material used.

The standard sensitive levels are as follows

- Thin place: -50%
- Thick place: +50%
- Neps: +200%

Thin places and thick places in a yarn can, on the one hand, quite considerably affect the appearance of a woven or knitted fabric. Furthermore, an increase in the number of thin places and thick places refer to a particularly valuable indication that the raw material or the method of processing has become worse.

On the other hand, it cannot be concluded from the increased number of thin place faults that this yarn, the downtime of weaving or knitting machines will be increased to a similar degree. Thin places usually exhibit a higher yarn twist, because of fewer fibres in the cross-section resulting in less resistance to torsion. The yarn tension does not become smaller proportionally with reduced number of fibres. With thick place faults the contrary is the case. More fibres in the cross-section result in a higher resistance to torsion. Thick places have therefore, in many cases, a yarn twist which is lower than the average. The yarn tension in the yarn at the position of the thick place is only in very few cases proportional to the number of fibres. These considerations are valid primarily for ring-spun yarns.

Neps can influence the appearance of woven or knitted fabrics quite considerably. Furthermore neps of a certain size can lead to processing difficulties, particularly in the knitting machines. Therefore the avoidance of neps in the production of spun yarns is a fundamental textile technological problem.

Neps can be divided, fundamentally, into two categories:

-Raw material neps
-Processing neps

The raw material neps in cotton yarn are primarily the result of vegetable matter and immature fibres in the raw material. The influence of the raw material with wool and synthetic fibres in terms of neps production is negligible. Processing neps are produced at ginning and also in cotton, woolen and worsted carding. Their fabrication is influenced by the type of card clothing, the setting of the card flats, workers and strippers, and by the production speeds used.

4.3 Relative Count

It is a measure used to calculate the count variations using capacitance method of USTER TESTER. It calculates a value called "Average Value Factor AF". This factor is proportional to the mean count of the tested sample length.

The relative count describes the variation of count between separate measurements within a sample. The single values are calculated such that they are in direct reference to the mean value of the sample that is always considered to be 100%. The relative count is always estimated with reference to a test length of 100m or 100 yards.

From the single-overall report, it is possible to recognize immediately which samples are lying above or below the mean value. The standard deviation provides a reference to the variation in count between samples. As the mean value is always 100%, the standard deviation also provides a reference to the coefficient of variation. If the samples are from the same bobbin this would indicate the "within bobbin" variation and if the samples are from the same bobbin this would indicate the "within bobbin" variation and if the samples are from different bobbins this would indicate "between bobbin" variation.

5.0 Yarn Hairiness

Hairiness is a measure of the amount of fibres protruding from the structure of the yarn. In the past, hairiness was not considered so important. But with the advent of high-speed looms and knitting machines, the hairiness has become a very important parameter.

In general, yarn spun with Indian cotton show high level of hairiness due to the following reasons.

I. High short fiber content in mixing.

II. Low uniformity ratio.

III. High spindle speeds.

Hence most of the Indian yarns have a hairiness index above 50% Uster standards.

Hairiness is measured in two different methods.

5.1 Uster Hairiness Index

This is the common method followed in India. The hairiness index H corresponds to the total length of protruding fibres within the measurement field of 1cm length of the yarn.

5.2 Zweigle Hairiness Index

This zweigle hairiness measurement (S3) gives the number of protruding fibres more than 3 mm in length in a measurement length of one meter of the yarn.

From the above you can infer that Uster hairiness index give the total length of hairs whereas zweigle hairiness testers give the absolute number of fibres. Though the later measurement is more accurate, most of the Indian spinners are still following Uster hairiness index only.

6.0 Standards

We have fixed the standards for different yarn characteristics for cotton spun yarns for different end uses. The following table gives the quality requirement.

6.1 Cotton Yarn Standards

Characteristic	Required value Ne 20/2 Carded Weaving	Required value Ne 30/1 Carded Knitting	Required value Ne 30/1 Combed Knitting	Required value Ne40/1 Combed Knitting	Other Yarn Combed
Average count	10 (9.85 - 10.15)	30 (29.6 to 30.4)	30 (29.6 to 30.4)	40 (39.5 to 40.5)	Count +/-1.3%
Count C.V%	<1.5	<1.5	<1.5	<1.5	< 1.5%
Twist Multiplier	3.9 to 4.2	3.8 to 4	3.4 to 3.6	3.4 to 3.6	3.4 to 3.6
U%	9.5 to 10	11.5 to 12	9.2 to 9.8	9.8 to 10.2	5 to 10% Uster Value
-50% Thin Place/1000m	<4	<15	<2	<4	5 to 10% Uster Value
+50% Thick Place/1000m	<10	<200	<20	<30	5 to 10% Uster Value
+200 Neps/1000m	<20	<250	<50	<60	5 to 10% Uster Value
Imperfection Total/1000 m	<34	<465	<72	<94	5 to 10% Uster Value
RKM Tenacity (Gms/Tex)	>17	>14	>16	>16	>16
Elongation %	>4.5	>4.5	>4.5	>4.5	>4.5
Hairiness H	<6.5	<7	<6.5	<6	<50% Uster Value
Hairiness Standard Deviation	<1.5	<1.5	<1.5	<1.5	25% Uster Value
Classimat faults (Short and Long) Objectionable	<5	<5	<1	<1	<1
Classimate faults (Total)	<100	<150	<130	<150	5 to 10% Uster Value
H1- Thin faults	<5	<5	<1	<1 per 100 km	5 to 10% Uster Value
Shade Variation Cones in UV lamp	No	No	No	No	No

- Winding speed should be around 1250 meters/ min
- Machines with tension management is preferred
- Clearers settings should be as close as possible. Loephe Yarn master setting is given below

N -4.0 (nep) DS-2.0 (short) LS-1.6 (short) DL-1.18 (long) LL-40: (long) DS-14%(thin) DL-40(thin)

Since loephe has a facility of class clearing. "C"s to be added in such a way that the following faults which are displayed in Loephe class clearing should be cleared.

A4,A3,B4,B3, B2(50%),C1,C2,C3,C4,D1,D2,D3,D4,E,F,G,H1(50%),H2,I1,I2

- Count channel setting should be less than 7%
- Setting for cluster faults should be set such that, if a yarn produced without bottom apron, or damaged rubber cots is fed, it should be cut by the clearer
- Long thick faults in the cone yarn should be zero
- Long thin faults should be zero
- If the waxing attachment is below the clearers, the clearers should be cleaned once in a day
- Splice strength should be more than 75% of yarn strength
- Splice appearance should be good and all the splicers should be checked at least once in a week
- Good quality wax should be used
- Wax pick up should be around 0.1%
- Uniform application of wax to ensure uniform coefficient of friction (0.125 to 0.15)
- Uniform moisture in the cones is important, because coefficient of friction varies as a function of moisture
- All wax rollers should rotate properly
- Repeaters should be as low as possible, because this will affect the package quality
- It is advisable to produce cones with 1.8 to 2.4 kegs
- Yarn tension in winding should not be very high
- Imperfection increase between ring frame and winding should not be more than 30% for cotton combed yarns

GENERAL:

- Finished garments rejection should be less than 1%
- Yarn faults contribute to 25% of the rejections. Major yarn faults are

Contamination
Thick and thinks
Unevenness
Periodicity
Stiff yarn - Higher TPI (holes)
Higher friction
High hairiness variation
Mixed properties of yarn - "Barre"
Neps
White specs (immature fibres)
Kitties (vegetable matters, dust content)
Lower elongation and elasticity

- It is better to use cottons with less contaminations like Andy, SJV, Alto, etc
- Contaminations of length more than 20 mm should be nil in the yarn
- As per Japanese standard, the no of contamination per Kg of fabric should be less than 5
- If cotton has contamination, it is compulsory to use manual picking on preopener lattice, contamination detectors at blow room, visual clearer (siro) at winding.
- It is advisable to go to the supplier (cotton ginner) for quality - a concept of Japanese
- 10 meter C.V% of yarn should be controlled and it should be as low as possible. This affects the fabric appearance

6.2 Testing Equipments

Premiere Tester – 4
Uster Tester – 3
Uster Tensorapid – 3
Classmate I I
Coefficient of Friction Meter
Wrap Reel
Compusortor
Electronic Wrap block
Twist Tester
Zweigle Hairiness Tester
Splice strength Tester
Online testing instruments
Sliver data on Draw frames
Ring Data on Ring frames
On line Classmate on Autoconer