



# Challenges in the production of stretch yarn spinning

by Iftikhar Ahmed

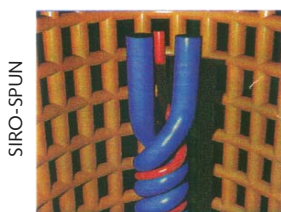
The stretching property of stretch yarn is achieved through elastane fiber. Elastane fiber is inducted into normal yarn with different ways and means. The fabric made by such stretch yarn, provides wear comfort as the molecular structure of stretch fiber consists of hard and soft segments. The soft segment is formed either by polyester or by polyther (polyurethane), and is responsible of high degree of stretchability of elastane fiber. The hard segment consists of polyureas, and is responsible for the good thermal stability of elastane fiber.

The fabrics made with stretch yarn offer fitness awareness, easy care, freedom of movement, durability, comfort, and wrinkle resistance.

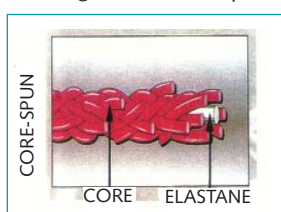
There are many stretch brands such as "DORLSTANE" by BAYER "SPANDEX" by ACELAN and "LYCRA" by INVISTA. Lycra is the most popular brand in Pakistan. There are different ways and means to use elastane fiber to produce stretch yarn and ultimately the stretch fabrics. The details about spun yarns, covered yarns and twisted yarn are given as under:

### 1. Spun yarn

- ❖ Siro yarn



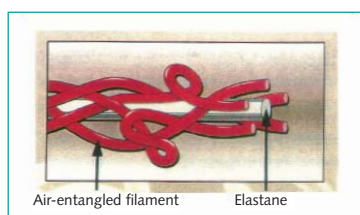
- ❖ Single Yarn [Core spun]



### 2. Covered yarn

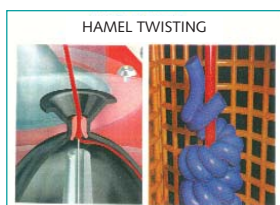
- ❖ Staple yarns

- ❖ Filament yarns



### 3. Twisted yarn

- ❖ Hamel



- ❖ Two for one



After this brief introduction, the article is meant to address the problems of stretch yarn and their solutions, at different stages of yarn, fabric and finished garments.

### Care at spinning stage

#### (a) Friction

It is imperative that the friction, which may create micro breaks in elastane fiber is to be avoided at the first spinning stage, where the moving parts are draft rollers, these rollers must be friction free. Normally special coated rollers are used for this purpose. Second friction point at spinning stage is ring traveler, if elastane material is not properly cored in yarn, the portion of elastane fiber being out of core, touches the high speed hot traveler, resulting in break of elastane fiber. Such broken elastane is only visible at final stage after weaving and finishing.

At winding stage, yarn contact points should always be smooth. Winding drum should also be smooth, friction free and cut free. Ceramic guides should be in good condition and need to be replaced regularly. Package hardness should not exceed 60 shore hardness.

If the package is too tight, this may cause elasticity variation along the yarn. Elastane fiber when stretched under tension can be "fixed" with the passage of time.

#### (b) Temperature

Temperature is enemy of elastane fiber products. If the running points of the machines are overheated due to poor maintenance, it may cause damaging of elastane fiber.

In order to ensure that the travelers should not have high temperature during spinning, the travelers speed should not exceed to 26 m/s. High temperature can result in melting of elastane fiber. Even the storage of elastane fiber and elastane fiber products should be at below 30° C.

#### (c) Draft limit

The recommended drafts for different decitex for the weaving purpose are:

22 Decitex – 2.80 Maximum Draft.

44 Decitex – 3.50 Maximum Draft.

78 Decitex – 3.90 Maximum Draft.

156 Decitex – 4.00 Maximum Draft.

The elastane yarn has to bear the stress and strain in the subsequent process of winding, weaving, finishing, so application of draft beyond the limit at spinning stage may cause serious problems of broken elastane in the final product.

#### (d) Twist for elastane yarn

Optimum twist has to be applied in order to ensure better pilling resistance and good tear strength. To achieve better weaving performance, if the high twist applied on elastane yarn, it may block elastane fiber and may resist to its recovery characteristics.

The correct twist for elastane yarn will be the, addition of 0.30 twist multiplier to same count (NE) without elastane. For example if T.M is 4.30 for plain yarn of Ne20, than T.M for the same count with elastane fiber will be 4.60.

### Care at weaving stage

**Stretch yarn used in woven fabric as:**

- ❖ Weft elastic fabrics (common is use).
- ❖ Warp elastic fabrics.
- ❖ Bi-elastic fabrics (warp & weft, both elastic).

## Practical Hints

### Warping with stretch yarn:

- ❖ Apply constant tension of 0.2gm/nominal dtex of final yarn.
- ❖ For direct warping, beams to be mixed.
- ❖ Install malt breaks in section warping machine.
- ❖ Optimize control to avoid tension difference.
- ❖ Avoid the shocks of stop.
- ❖ Increase in warp length by the amount of desired elongation.

#### (a) Sizing

- ❖ Polyvinyl alcohol stretch.
- ❖ 0.5% wax
- ❖ Size temperature maximum 70° C.G
- ❖ Sizing machine with precision tension control.
- ❖ Avoid jumbo beams.

#### (b) Drawing-in and weaving

- ❖ Needs to stabilize ends drawing-in.
- ❖ Loom setting essentially the same as for Rigid fabrics.
- ❖ Avoid variation of tension for warp ends.
- ❖ For weft stretch fabric, it is recommended to weave and pick from two or more supply packages to ensure even distribution of yarn.
- ❖ Use correct Reed and Reed density to get desired elongation and fabric width. An example is given below for the adjustment of Reed and Reed density on loom. (Table 1)

### Care at dyeing and finishing stage

- ❖ If the dyeing on beam, elastane fabrics must be pre-shrunk and possibly be set with hot air to ensure no width shrinkage in the autoclave.
- ❖ Material prone to creasing must be dyed in open-width, preferably on the jig or on the beam.
- ❖ Tension of the fabric should be sufficiently low, if dyeing on jig machine.
- ❖ Good quality fabric may obtained by avoiding unnecessary stoppage that lead to the formation of water pocket.
- ❖ The treatment time and temperature should be kept as minimum as possible.
- ❖ The fabric should be wound evenly on to the dye beams at the end of the tenter frame at a constant tension.
- ❖ In the autoclave the liquor should be circulated only from the inside to the outside. A differential pressure of 0.1 ~ 0.2 bar should be obtained by reducing the flow rate of the liquor and the temperature of the liquor should be increased / decreased gradually.
- ❖ The elastane fabrics which are not prone to creasing can be dyed in rope form winch beck, overflow or jet dyeing machine with minimum tension.

### Care in case of stretch compact yarn

#### (a) Centering of elastane fibre in core

Normally in Ring Spinning, at the entering point of elastane fiber, the cotton fleece is wide enough to get centered the elas-

tane fiber. At this entering point cotton fleece is about 4mm in width depend on cotton count. While in Compact Spinning, at this entering point, the cotton fleece get compacted, and instead of fleece it is hardly in the shape of yarn, having about 1-2 mm width. To enter elastane fiber in this width of 1-2 mm is difficult task. If once entered, then keep it centered in to cotton for long time, is another task. This need to have proper skill & continuous watching of the process. If there is slightly slackness, and the elastane fiber is out of cotton core, then there are bright chances of following two problems.

- ❖ Broken elastane fiber: if any part or any length of elastane fiber is out of core, it will be cut by the traveler. Ultimately there will be broken elastane fiber portion in the fabric. Such fabric should be rejected.
- ❖ Elastane fiber appearance on the surface of dyed fabric: If the elastane fiber is not properly cored or come out of core at any stage of process will remain undyed and ultimately the dyed fabric will show shining contamination at the surface of fabric.

#### (b) Effect of traveller temperature on elastane fiber:

As compact yarn is low hairiness yarn, as for as the yarn quality is concerned, "low hairiness" is the most wanted quality parameter of yarn, but at other end during spinning process, hairiness provides air in to traveler, when yarn process through traveler. This air generation makes the traveler cooler and helps ultimately the traveler to run at high speed, baring less temperature.

Incase of Compact Spinning, as the hairiness is less in yarn, so temperature at this point of yarn path between traveler and ring cup is much higher than that of Ring Spinning. Passing of elastane yarn through this high temperature zone is critical. This may cause breakage of elastane fiber even with in the core.

Elastane fiber, which is in the core, nevertheless, can be affected by outside temperature, and may cause broken or melting points along the yarn, resulting in bad shaped fabric.

It is required here to reduce temperature at this zone of yarn path (Between traveler and ring cup) and this is only possible by reducing the spindle speed and traveler speed.

The increased production advantages normally taken by Compact Spinning are not applicable for stretch yarn. Infact for better quality and problem free stretch yarn, production speed of Compact, should be lower than Conventional Ring Spinning.

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Effect of traveller temperature on elastane fiber

**Table 1: Adjustment data on the loom**

	Non-elastic	Stretchable in the weft (20%)	Stretchable in the warp (20%)
Number of warp threads	4995	4995	4995
Read width	166.6 cm	$166.6 \times (1+20/100) = 200$ cm	166.6 cm
Read density	300 threads per 10 cm	250 threads per 10 cm	300 threads per 10 cm
Weft density	250 threads per 10 cm	250 threads per 10 cm	$250 : (1+20/100) = 208$ threads/10 cm