

# Explaining The Complexities Of Knitting Technology

By JACK MURRAY  
Director of Technical Information,  
Kurt Salmon Associates, Inc.

KNITTING involves a complicated technology that is to most suit manufacturers completely new. It is also complex.

At the present time some aspects of knitted fabrics are affecting the operations of clothing manufacturers, but some of them are showing little concern for the knitting technology behind those problems. Others are showing a degree of panic and therefore misdirected concern about the effects of knit fabric characteristics on their entire operations, beginning with the initial selection of the fabrics, the fabrication of garments from them, and the merchandising and marketing of these knitted fabric garments.

What are some of the detailed problems which arise from knitting technology, not from the manufacturer's ignorance of it—not from knit characteristics which are identical with those of woven fabric character-

istics? Stretch, recovery, growth, shrinkage, snagging, pilling, glazing, loss of hand, are all familiar terms in the clothing industry. We did not have to invent any new terms simply because we start using knitted fabrics in lieu of woven ones.

What are the essential differences and similarities between knitted and woven fabrics?

First the similarities. Both knits and wovens are made with both natural fibers and synthetic fibers. Second, both knits and woven fabrics are made with staple yarns, or spun yarns and filament yarns. Third, both knits and woven fabrics are made with monofilament yarns as well as multi-filament yarns.

Next, both knits and wovens are made with plied—multi-plied yarns—2 ply, 3 ply, 4 ply yarns as well as single ply yarns. Next, both knits and wovens are made with untextured yarns as well as textured yarns.

Both knits and wovens can be made from stretch yarns as well as non-stretch yarns, that is they can be woven from spandex yarns and knitted from spandex yarns or both can be non-elastic yarns.

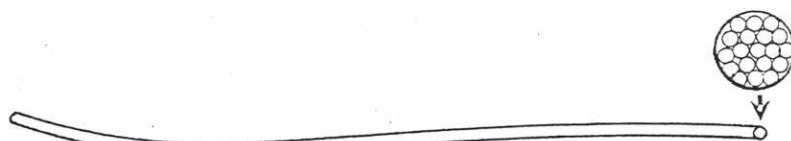
## Differences

The first and major difference between woven fabrics and knitted fabrics is simply this: woven fabrics consist of two separate yarn systems, one of them running lengthwise in the cloth and the other running crosswise in the cloth. Knitted fabrics, on the other hand, consist essentially of a single yarn system which, runs in all directions in the fabric. Second, in woven fabrics the matrix or structure is given body and interlacing to hold it together by right angle crossing of the two yarn systems. That is, the lengthwise yarns intersect the crosswise yarns at right angles.

Knitted fabrics, on the other hand, are formed into their structure by chaining together a succession of loops which are chained into other loops. The direction of loop formation is the basis for distinguishing warp knits and weft knits. If the loops are formed side by side across the cloth in succession, that is next to each other, the fabric is called a weft knit fabric. If, on the other hand, the loops are formed end to end, that is in succession along the length of the

---

Excerpts from a talk on knitting technology given at the Philadelphia College of Textiles and Science conducted for the Clothing Manufacturers Association by Kurt Salmon Associates, Inc., management consultants, Saturday, March 13, 1971.



PLAIN MULTIFILAMENT YARN



TEXTURIZED YARN - BEFORE KNITTING



HEATSET AFTER KNITTING - Deknit and relaxed



STRETCHED

FIGURE 1, left.

FIGURE 2, center.

FIGURE 3, bottom.

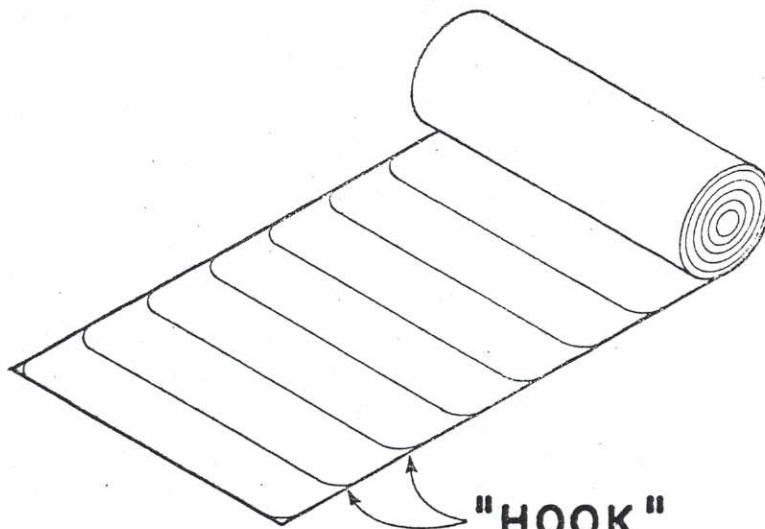
cloth, it is called a warp knit.

On tricot knit, for example, the basic direction is along the length of the cloth so this is a warp knit. However, there is some sidewise or shogging motion in the knitting action of tricot fabrics. However, is it never side by side for the same yarn. There is some advancing along the length of the fabric in synchronism with movement sideways for any two successive loops formed by one yarn.

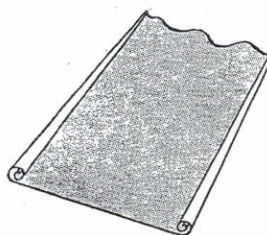
The looped path of the yarns in knitted fabrics brings us to another major difference. It is the relationship of the length of filling yarn to the width of woven fabric, the length of warp yarn to the length of the piece of woven fabric, and the ratio of these same lengths to the width of weft knit fabrics, and the length of warp knit fabrics. For example: in any woven fabric the length of the filling yarn across the fabric will always be approximately equal to the width of the fabric plus 10 to 25 per cent.

In a weft knit fabric, however, the length of a single yarn may be two, three, or five times the width of the fabric.

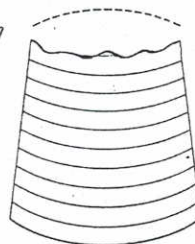
(Continued on Page 132)



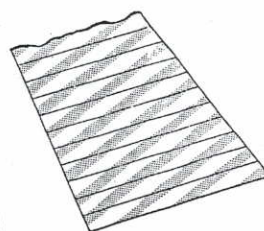
TIGHT OR LOOSE EDGES



EDGE CURL



BOW



SKEW



Double jersey fabrics consist of two sets of loops—one on the face side of the fabric and one on the back side of the fabric. They are essentially two sides knitted in two layers and sewn together by lacing the yarns from the front layer to the back and the back layer to the front. Now what do the differences between a right angle two yarn system and a loop system of fabric construction make to the suit manufacturer?

### Crease Resistance

The basic reason for improved wrinkle resistant knit fabrics is also the reason it is so difficult to obtain a good sharp crease in knitted fabrics. Or simplified it is this: In woven fabrics any wrinkle or crease tends to intersect all of the filling yarns at the same angle, and also intersects all of the warped yarns at the same angle. Thus, they are bent in unison, and must straighten themselves out together.

In knitted fabrics, on the other hand, due to the internal mobility and "slip," creases and wrinkles will tend to shift the yarns within the fabric structure rather than bend them at sharp angles. Thus the crimping of the yarn is not so severe. When the wrinkle or crease pressure is relieved, the yarns merely shift back into their original position and the wrinkle disappears.

However, this quality is almost entirely dependent upon good heat setting in synthetic fabrics and blends with a high proportion of synthetics.

### Notions About Knits

"Knits are stretchy." Some knits are very stretchy. Some knits don't stretch at all.

"Knits are marvelous because they recover after being stretched." Some knits recover partially when stretched. Some knits do not recover at all when stretched.

Some recover quickly. Some recover slowly. Some recover very, very slowly. Where does the stretch come from?

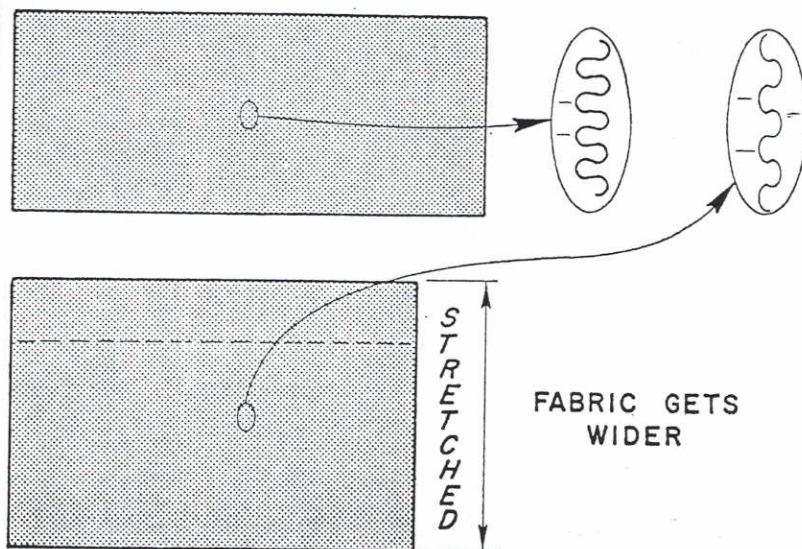
- Stretch comes from yarn; some stretch comes from knit loop elongation.

- Some stretch—restricted to spun yarns.

- Some stretch comes from straightening texturizing kinks.

## KNIT STRETCH CHARACTERISTICS

### NORMAL

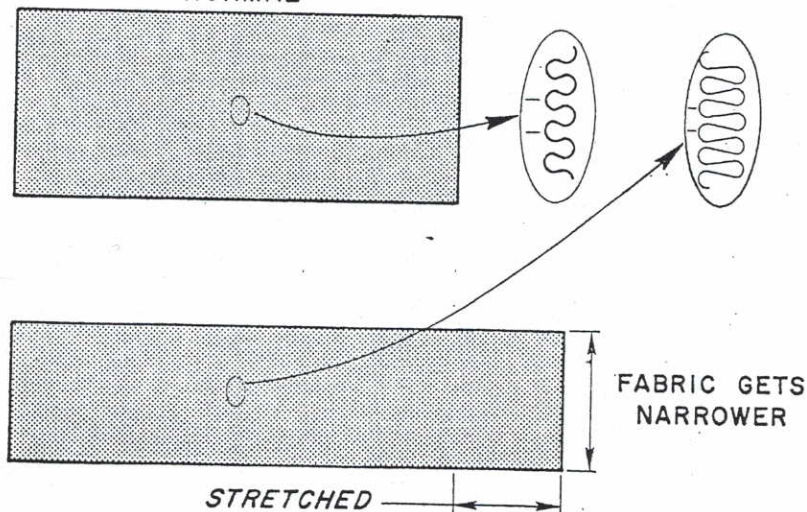


## STRETCH IN THE WIDTH FABRIC GETS THINNER

FIGURE 5

## KNIT STRETCH CHARACTERISTICS

### NORMAL

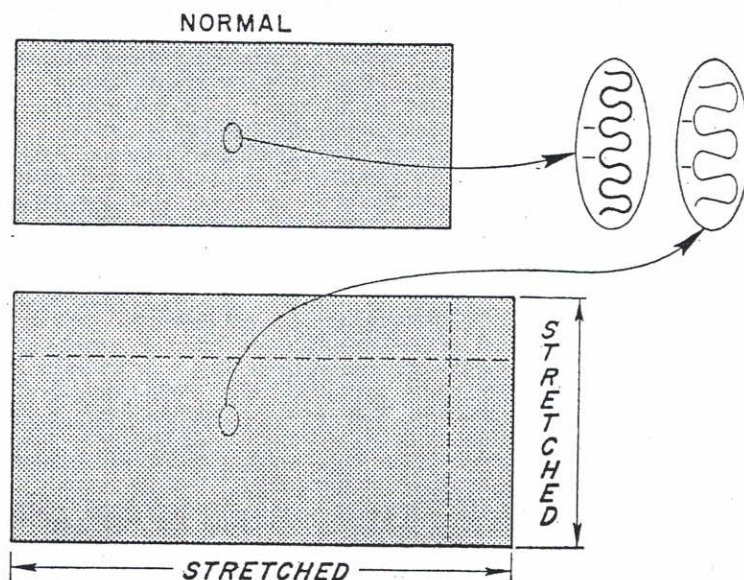


## STRETCH IN THE LENGTH FABRIC GETS THINNER

FIGURE 6

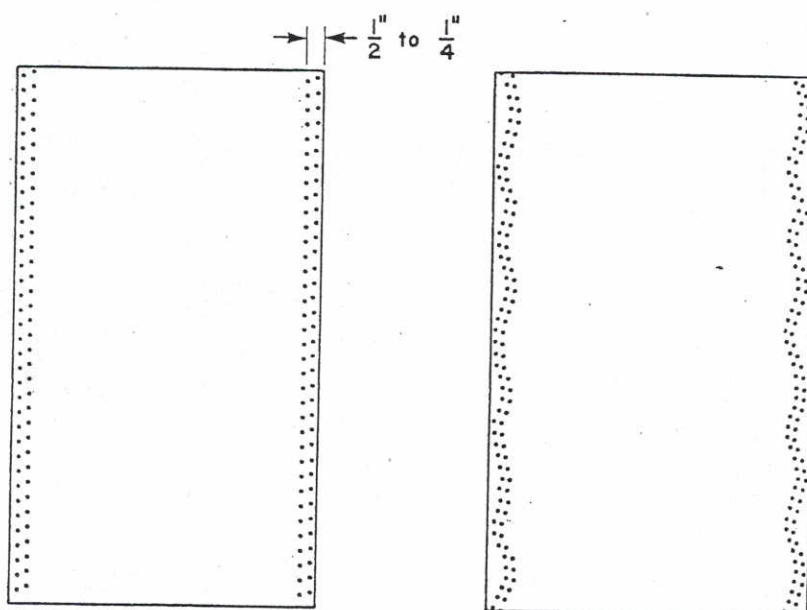


## KNIT STRETCH CHARACTERISTICS



### STRETCH IN WIDTH AND LENGTH FABRIC GETS MUCH THINNER

FIGURE 7



CLIPTENTER

versus

PIN TENTER

FIGURE 8

- Some stretch comes from fabric elasticity—this is usually recoverable.

- Some stretch comes from plastic flow property—this is not usually recoverable.

What insures good recovery when a knit is stretched? Many factors—the design of the knitted fabric, but most important for most knits used in men's fabrics with synthetic yarns or synthetic blends is proper heat setting in the proper dimensional configuration for the knitted fabric design.

What is heat setting? When does it occur? What does it do? Heat setting in synthetic fabrics is almost analogous to annealing in metals, glass, and similar materials. Heat setting is accomplished by putting tension on the fabrics to frame it in the proper width and length; apply heat until it approaches the softening point. This causes the fabric to "relax" in this condition. It is then quickly cooled.

With proper heat setting, a knitted loop will always tend to return to the exact shape it had during heat setting. If the loop was long and narrow, it will attempt to return to that shape. If it was short and wide, it will also attempt to return to the same shape.

Tension applied to knitted fabric will stretch it, but when the tension is relieved, it will recover, especially if it is agitated, handled, or wet with dry-cleaning fluid and laundering liquids.

**Seambusting:** One of the difficulties in achieving flat seams at seam-busting operations is caused by the initial heat set on synthetic fabrics. In order to overcome the initial heat set, it is necessary to approach those temperatures at which the yarn was originally relaxed.

In addition, seambusting can best be accomplished by a strong vacuum to achieve immediate cooling after the iron pressure has been released.

"Knits snag easily." All knits? Some knits snag easily. Some knits snag hardly at all. Some knits snag terribly.

Most snagging problems, however, can be eliminated by following a few rules. For example: do not use fabrics designed for women's wear for men's clothing; test the fabrics before sewing and base fabric selection on the tests; and train an assembly operator to reknit. It is also important to caution a customer about the snagging problem.