

SOURCING THE BEST COTTON PRODUCTS:
Understanding and Overcoming Skewing





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SOURCING THE BEST COTTON PRODUCTS:
Understanding and Overcoming Skewing

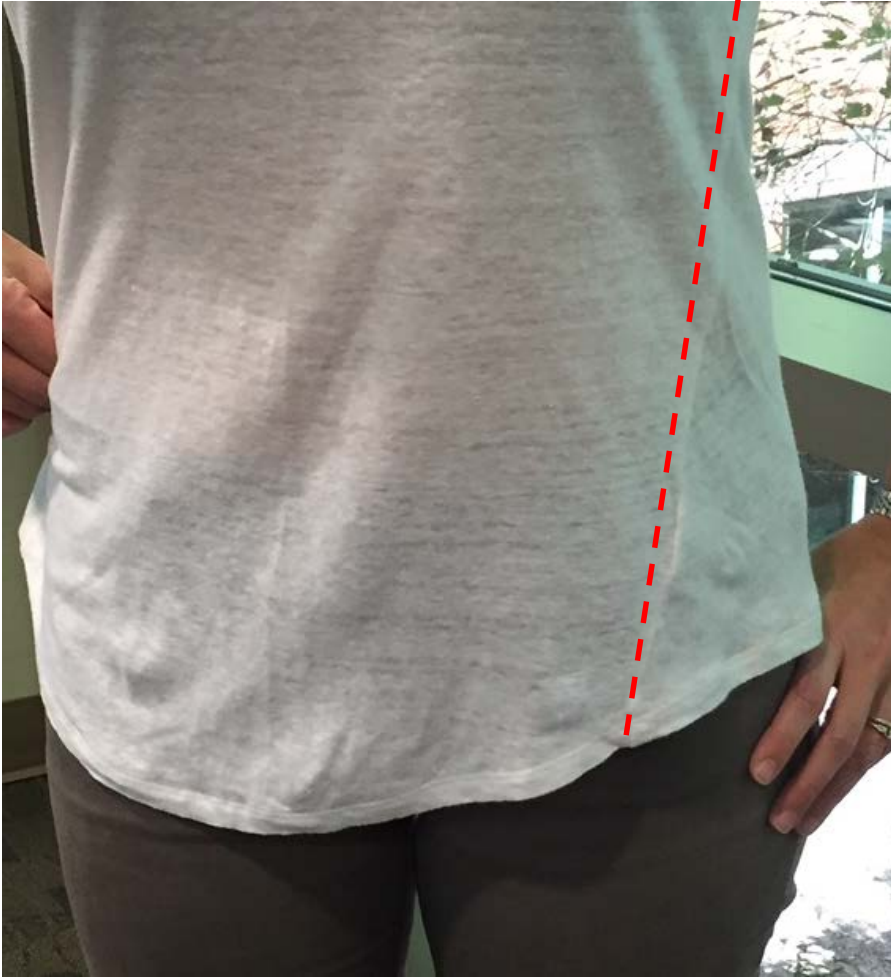


Garment Skew or Torque



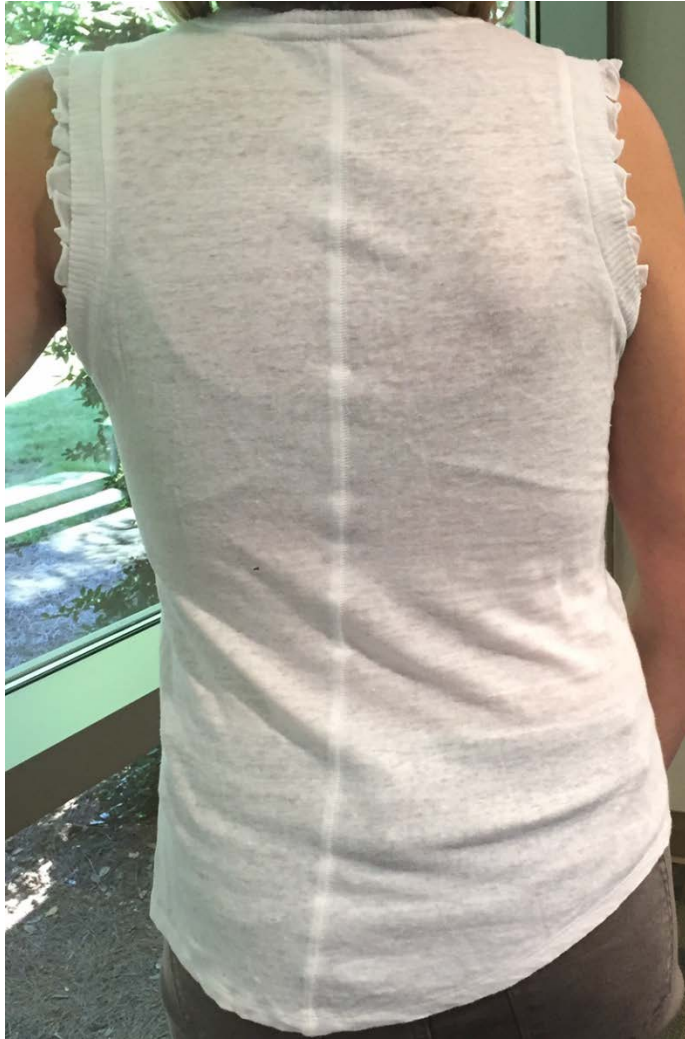
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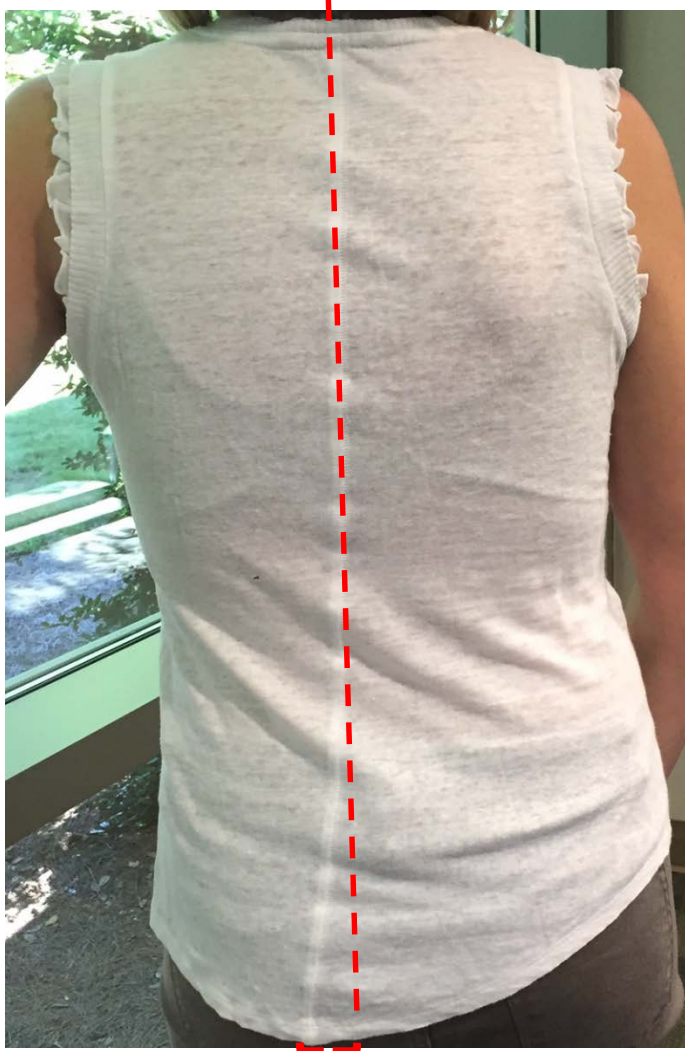
Garment Skew or Torque



Further, the consumer expects those items to remain free of those types of defects **after both wash and wear.**

Concurrently, the brand or retailer expects merchandise to have the **same appearance and performance** when they are offered for sale.

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Concurrently, the brand or retailer expects merchandise to have the **same appearance and performance** when they are offered for sale.

There are many names for this fabric/garment problem:

Spirality

Skew (Skewness)

Torque

Twist (Garment Twist)

Shear Distortion

Bias

AATCC Test Method 179's definition:

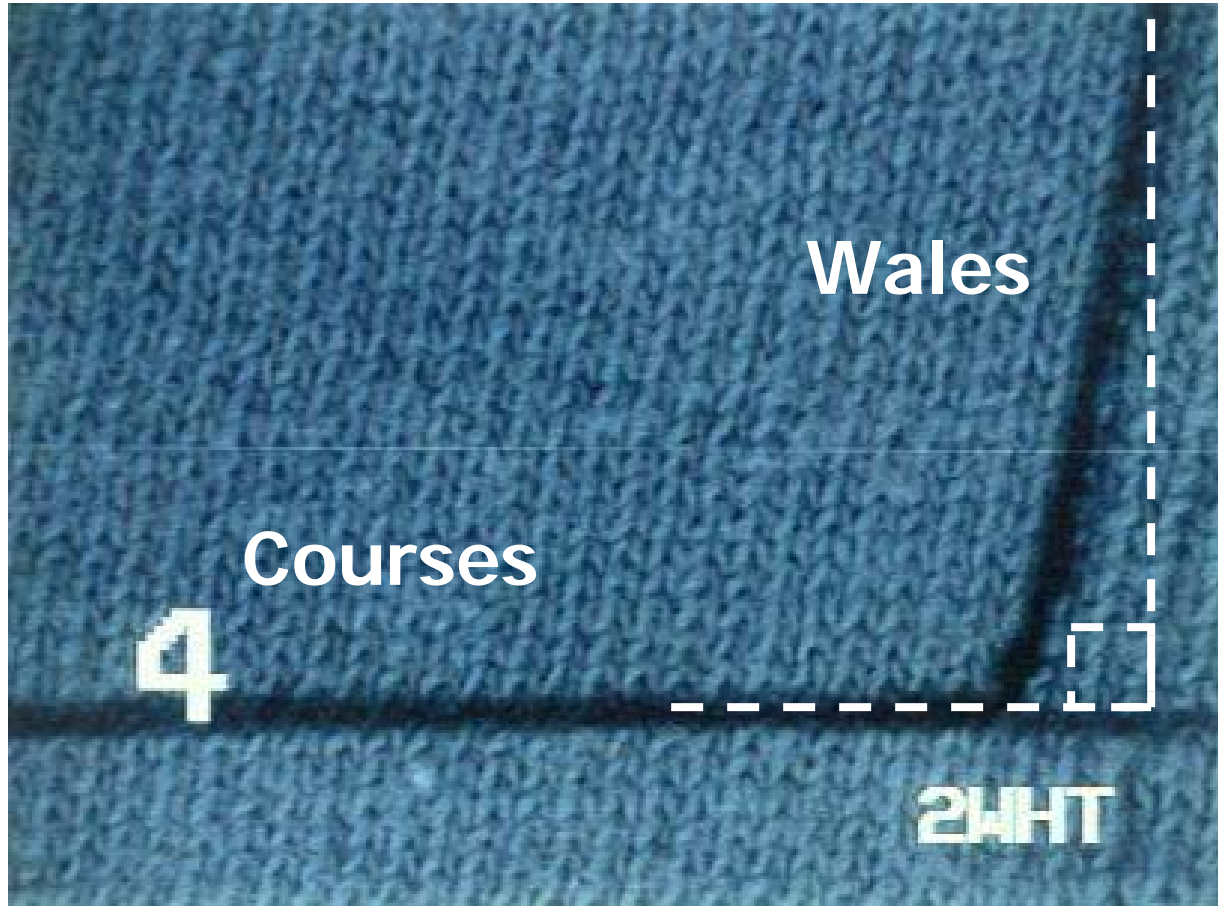
Skewness is defined as a fabric condition resulting when filling yarns or knitted courses are angularly displaced from a line perpendicular to the edge or side of the fabric.

However, the actual cause of almost all “observed” skew in knits is the displacement of the wales.

Skewness of knitted fabrics is a condition where the knitted courses and wales are not at right angles to each other.



Skewness of knitted fabrics is a condition where the knitted courses and wales are not at right angles to each other.





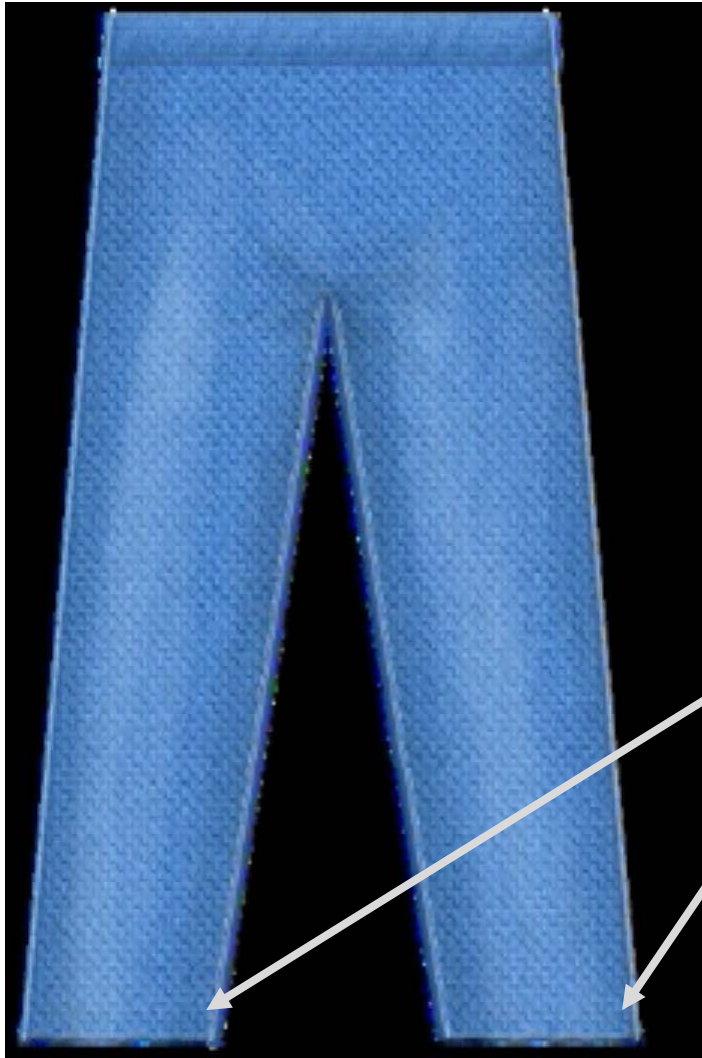
Right-hand skew in a
knitted fabric/garment.



Garment twist is defined as a rotation, usually lateral, between different panels of a garment resulting from the release of latent stresses found in the woven or knitted fabric forming the garment. These stresses build up in manufacturing and are released during wet processing and laundering. This twist may also be referred to as torque.

Twist may also relate to the spiraling of a knitted fabric tube.

Pants BEFORE Washing



No Skew

Pants AFTER Washing



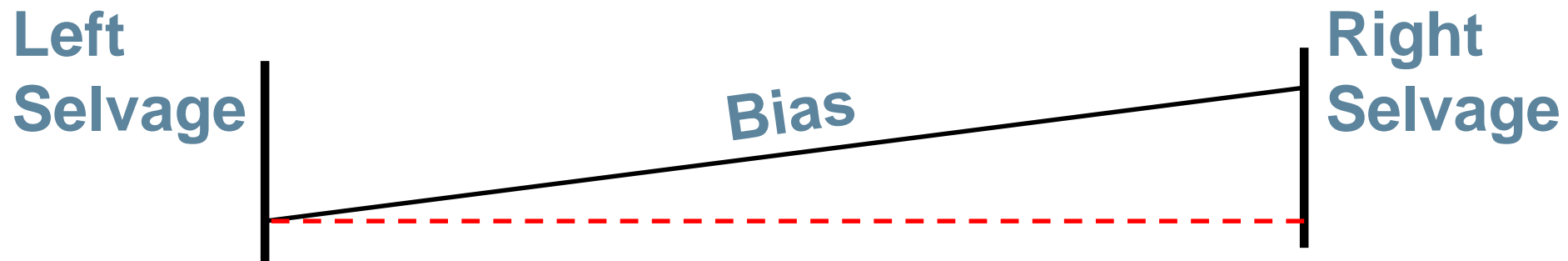
Leg Torque

Skewness of woven fabrics is a condition where the warp and filling yarns are not at right angles to each other.

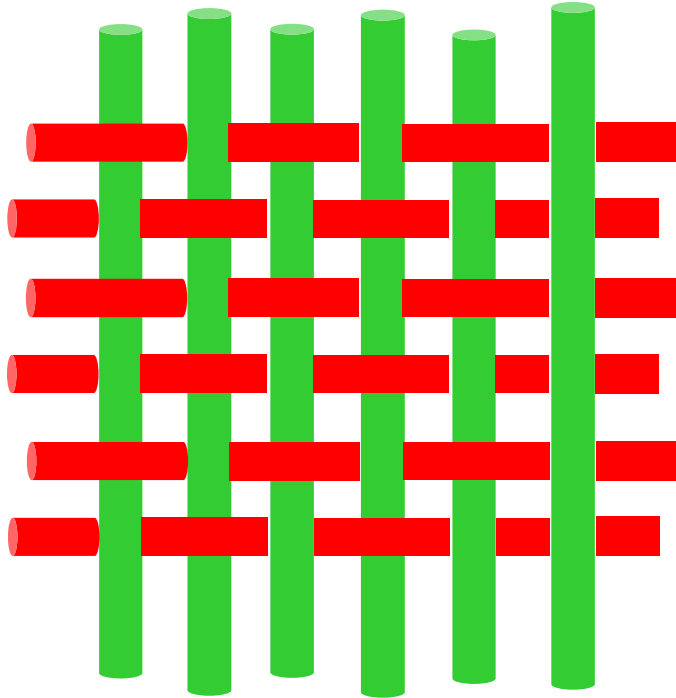
In the garment form, skewness is seen as torque in pant legs, sleeves, etc.



Bias is defined as a displacement of the filling yarns from being perpendicular to the selvage (warp yarns) in the woven fabric. The filling yarns will be in a straight line, just not at 90 degrees.

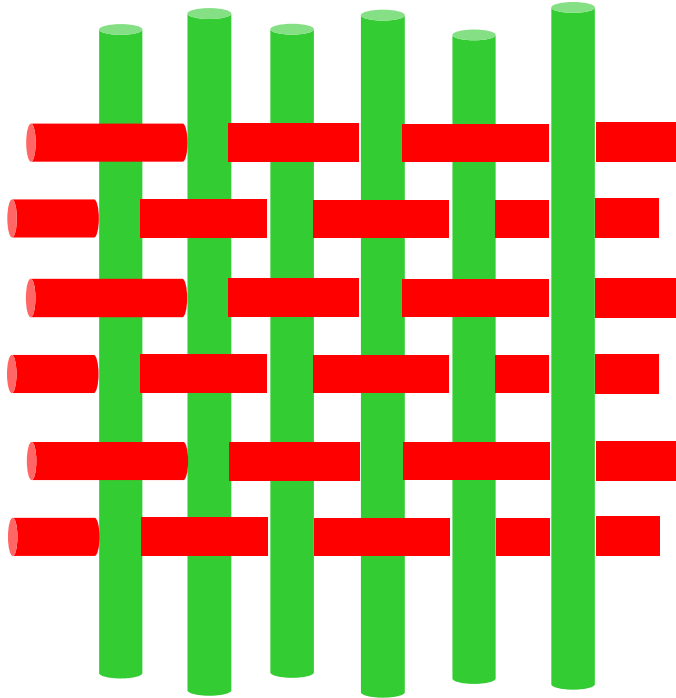


Woven Fabric Skewness

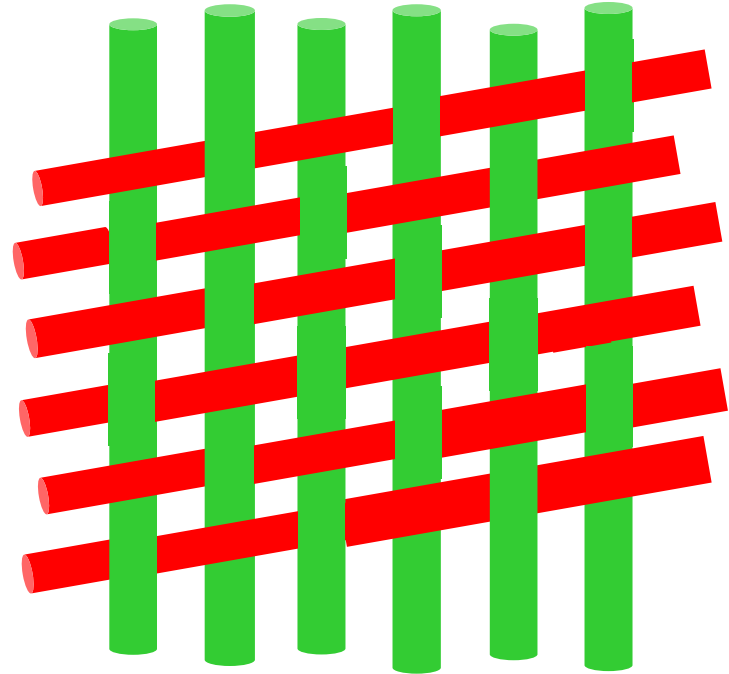


Fabric With No Skew
Warp and Filling
Ends at 90°

Woven Fabric Skewness



Fabric With No Skew
Warp and Filling
Ends at 90°

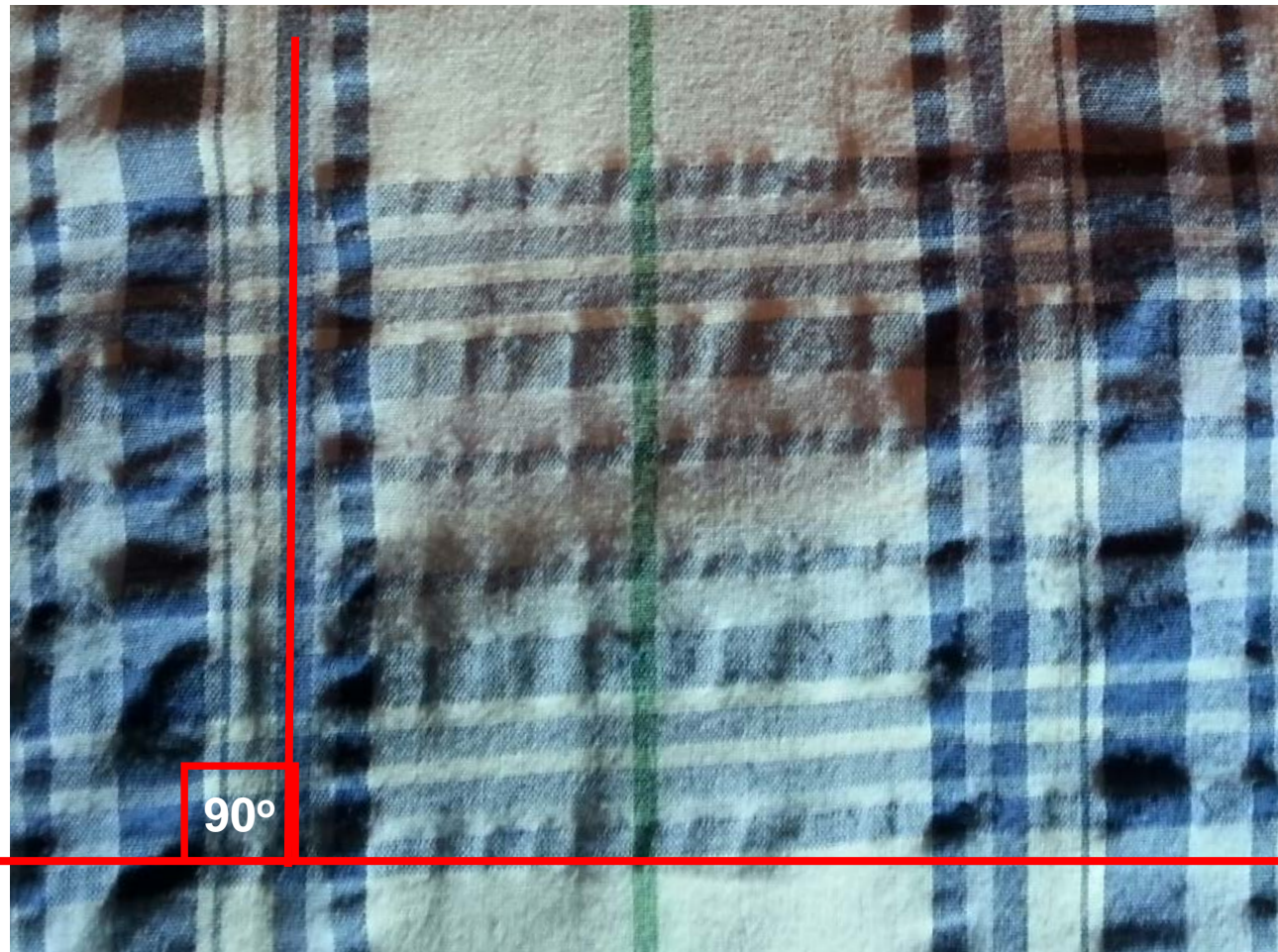


Fabric With Skew
Warp Parallel To Edge
& Filling Skewed

Seersucker Woven With High Twist Warp Yarns

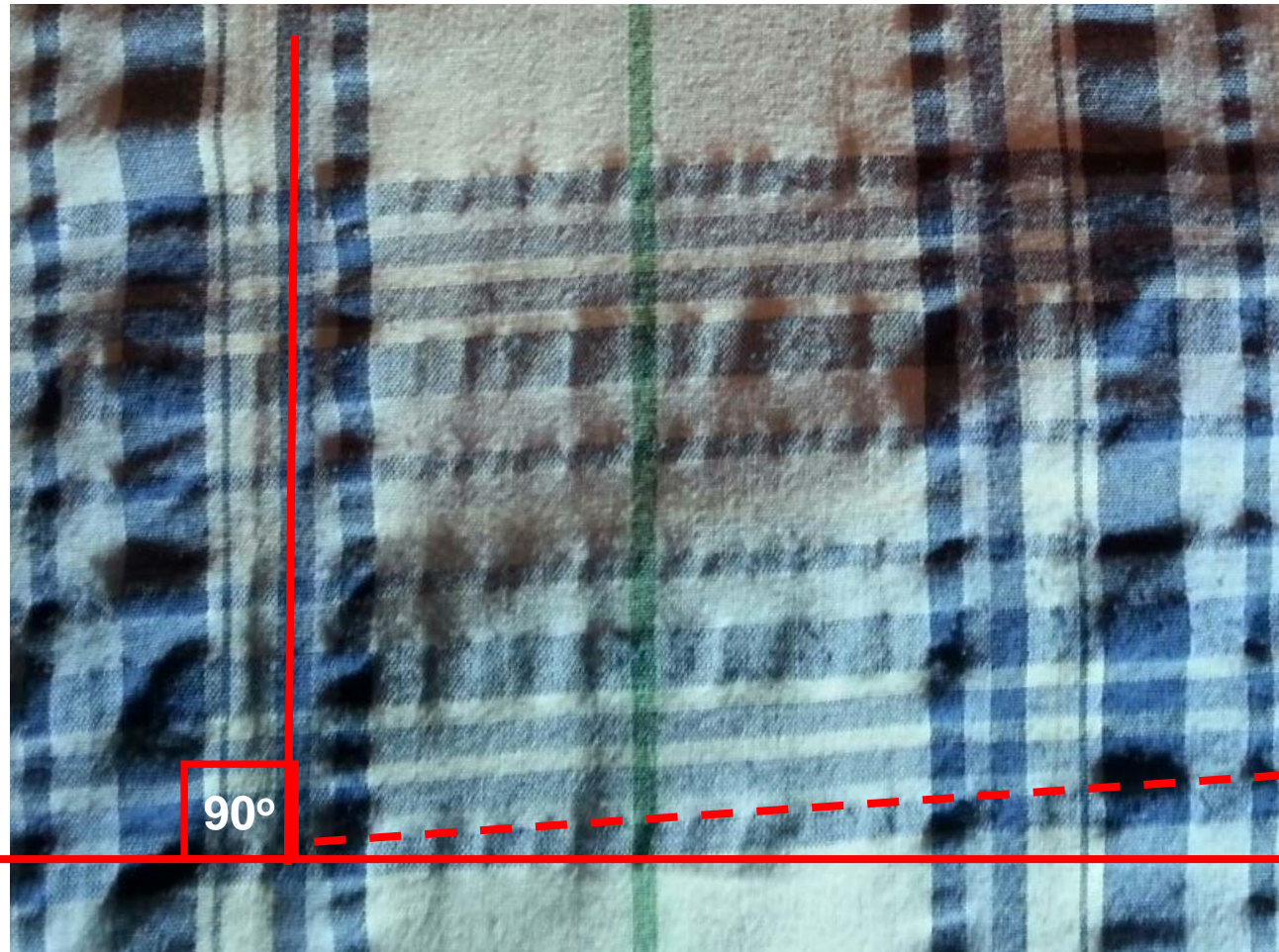


Seersucker Woven With High Twist Warp Yarns



Bias

Seersucker Woven With High Twist Warp Yarns

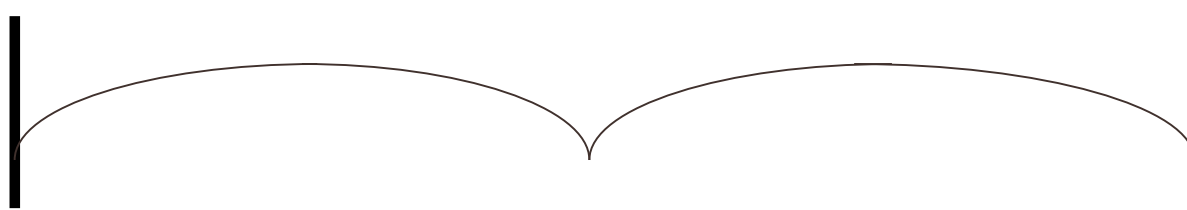


Bias

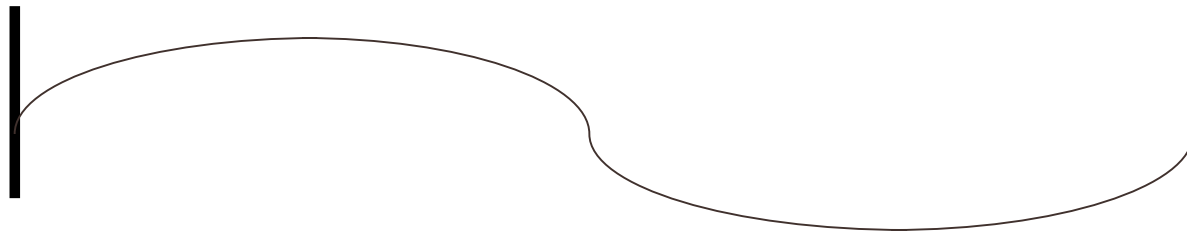
Bow is defined as a displacement of the filling yarns or courses from being straight across the fabric. They may or may not be in a bias configuration.



Bow



Double Bow

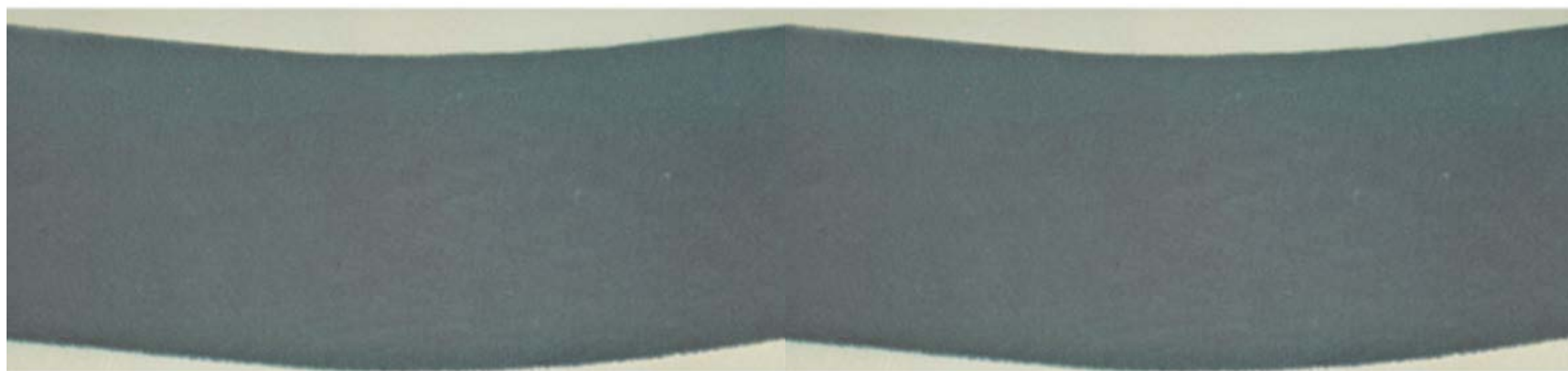


S-Bow

Bow is defined as a displacement of the filling yarns or courses from being straight across the fabric. Bow can result in too narrow a finished width, too much or too little overfeed in drying, and a pattern imbalance.



Double Bow is defined as a displacement of the courses in a knit fabric that is dyed and dried tubular but finished open width. If the tube has bow on each side, it will appear as double bow when opened. Too much or too little overfeed in tubular drying can cause double bow. Finishing wider in the open form can reduce the double bow but might increase width shrinkage.



Pant leg twist with side seam skewing to the left.

The longer the pant leg, the greater the displacement.

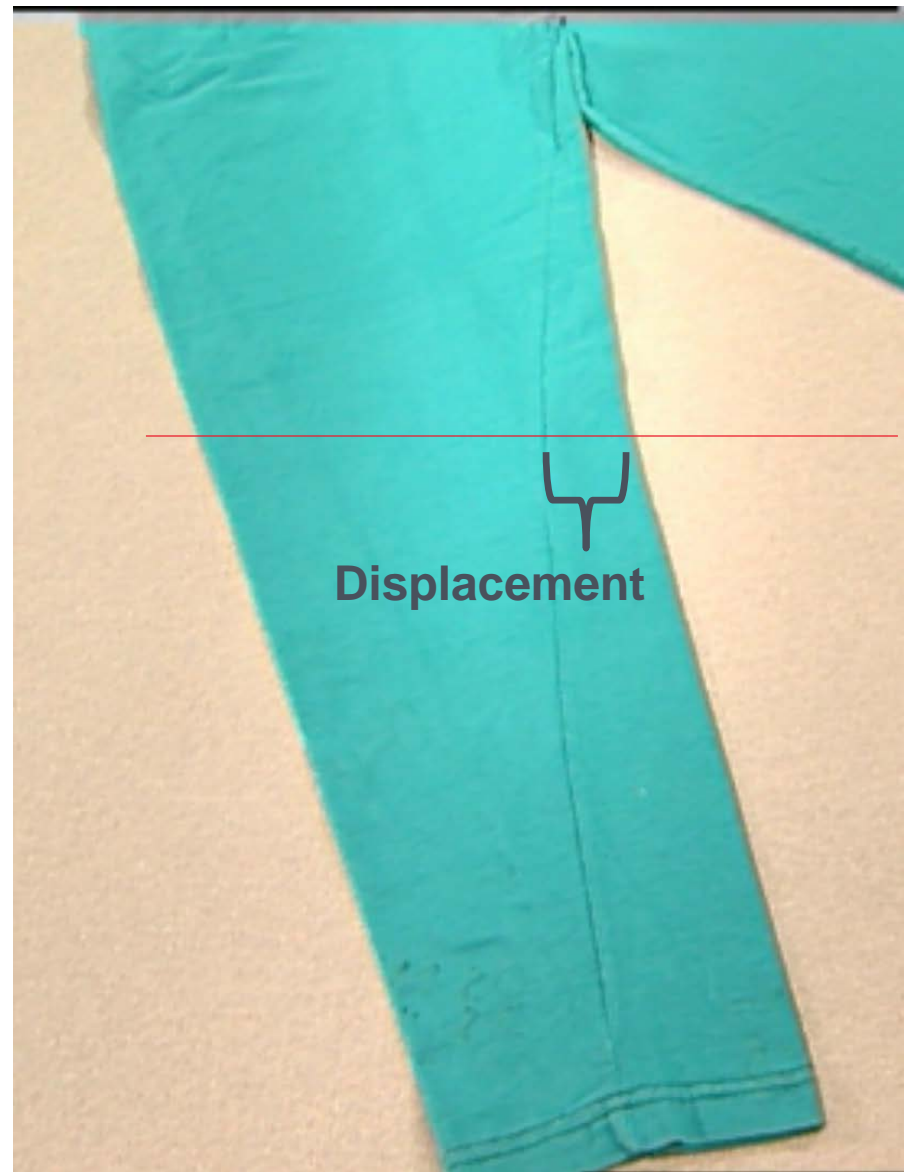


Displacement

Pant leg twist with side seam skewing to the left.

The longer the pant leg, the greater the displacement.

However, the percentage (%) is the same.



Displacement



0.3"

**Displacement of 0.3
inches**



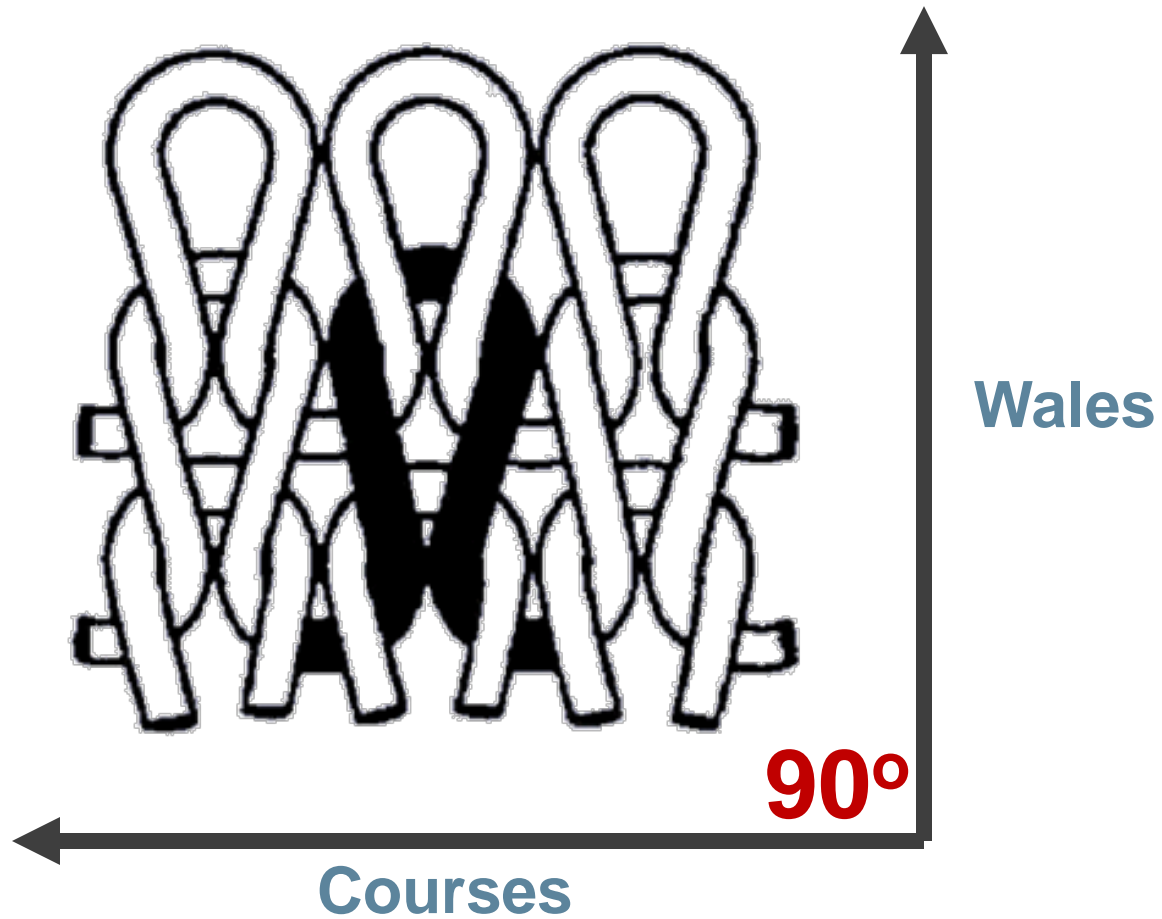
0.3"

**Displacement of 0.3
inches**

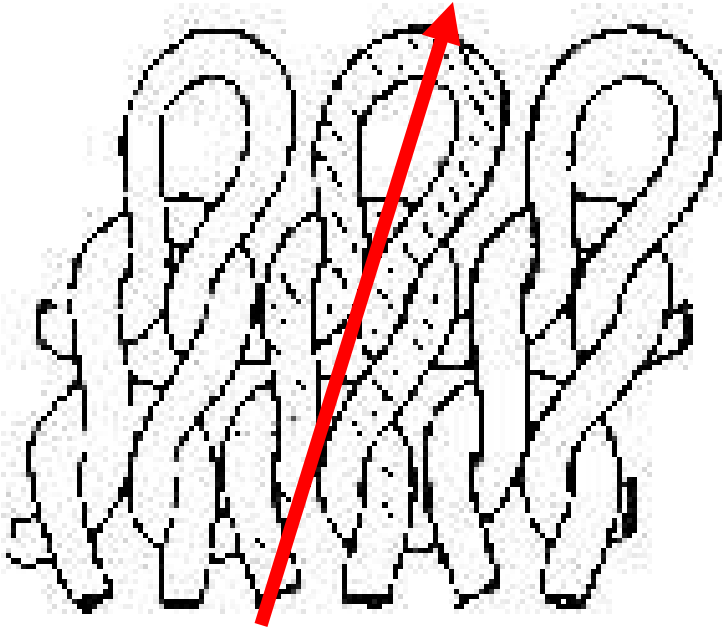


0.9"

Single Jersey Knit

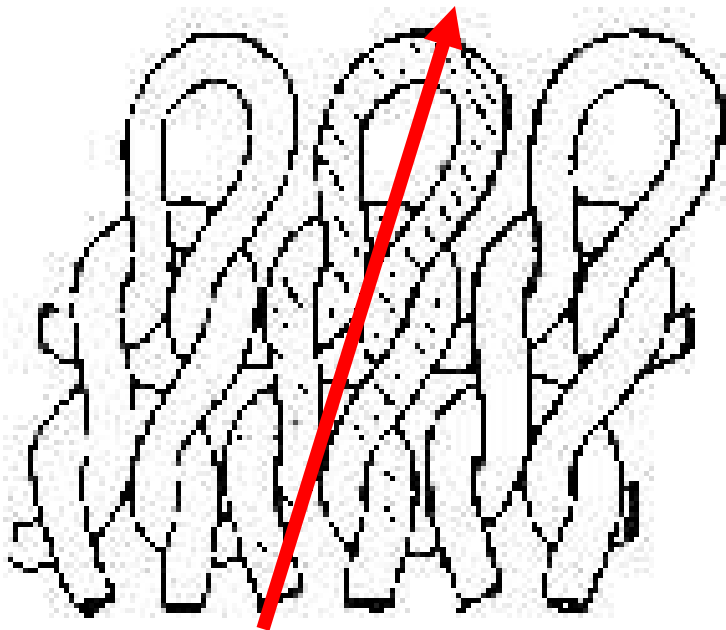


Skew

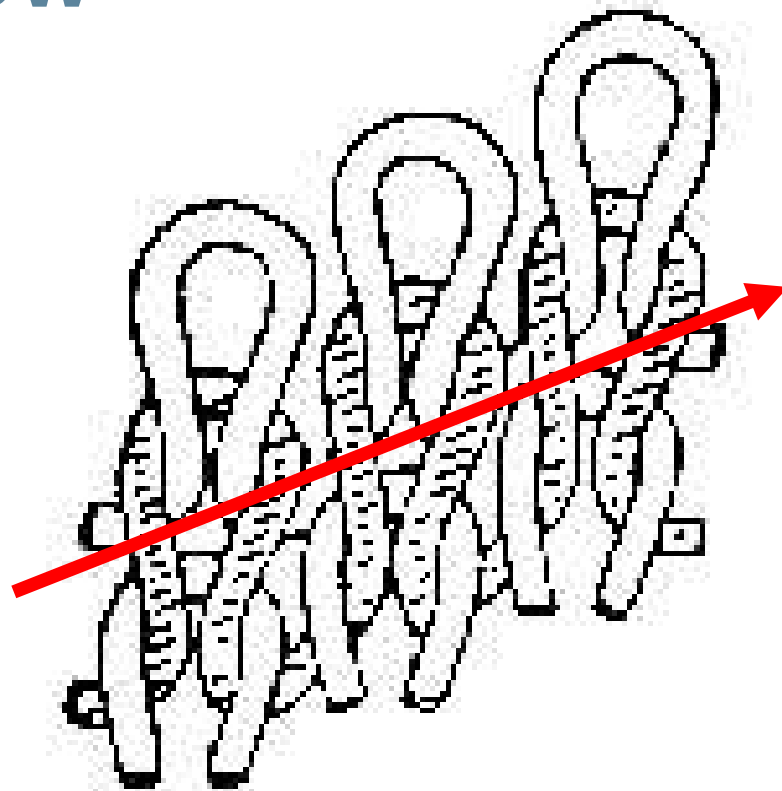


Wale Skew is caused in part by the twisted yarn trying to untwist due to twist liveliness.

Skew

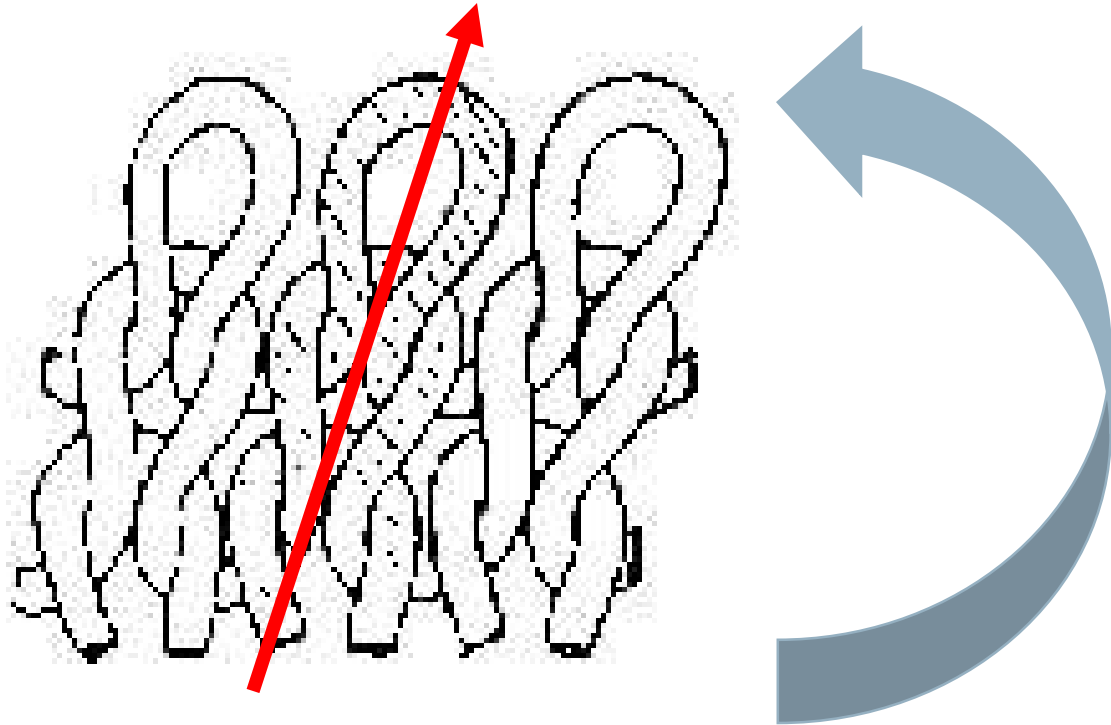


Wale Skew is caused in part by the twisted yarn trying to untwist due to twist liveliness.



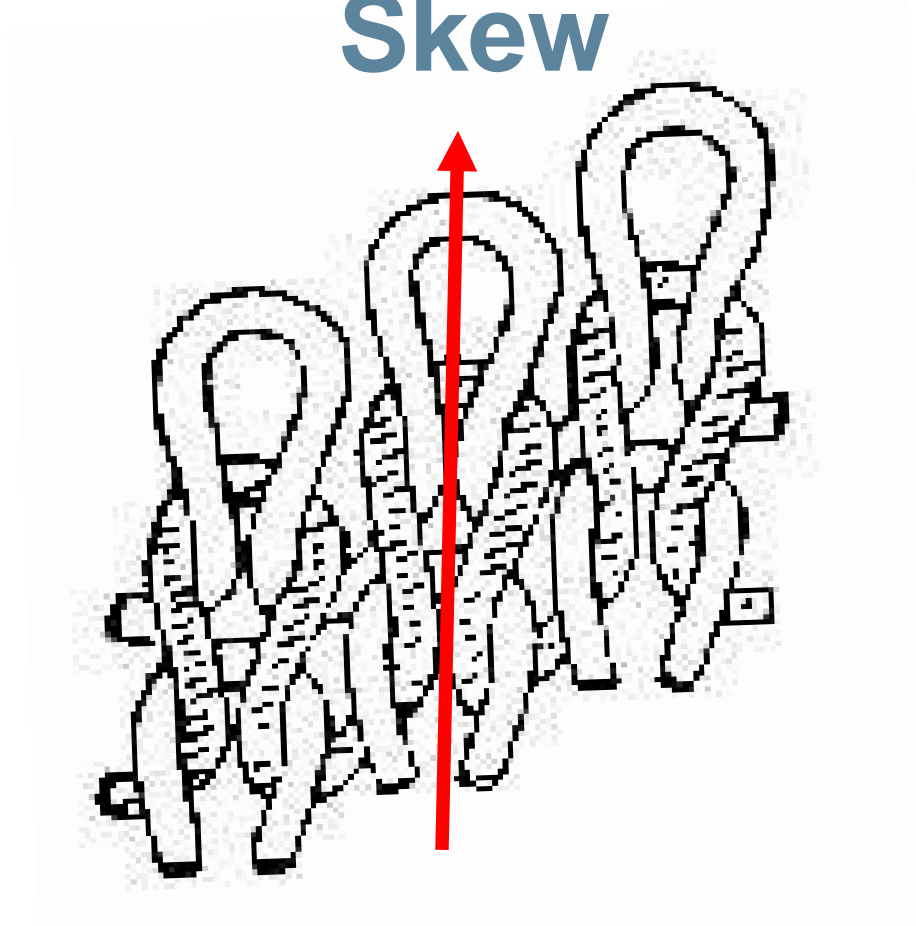
Course Skew is mostly the result of the displacement of the courses due to the number of yarn feeders.

Skew



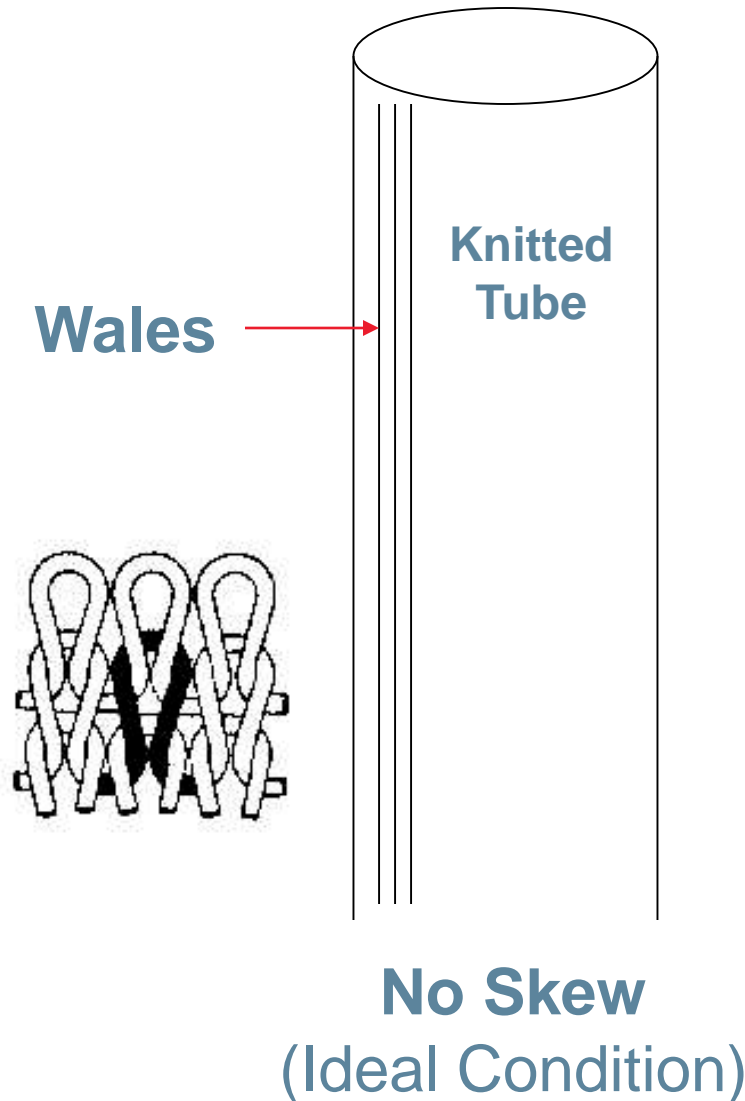
If the wales are held parallel to the selvage in finishing, then the torqueing of the fabric will appear as displacement of the courses.

Skew

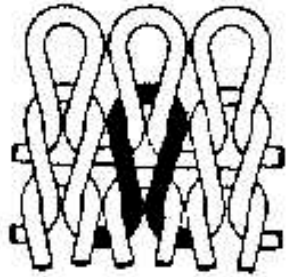


However, it is not course skew, but the displacement of the wales and the rotation of the structure appearing as course skew.

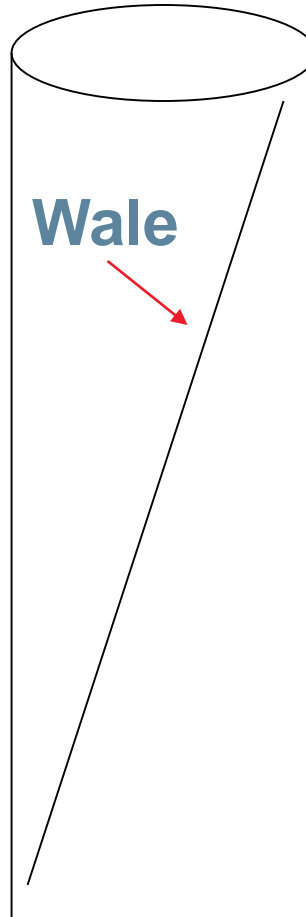
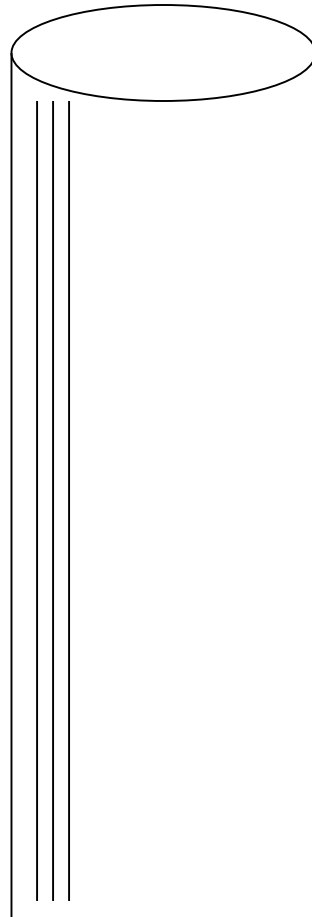
Wale Loop Distortion



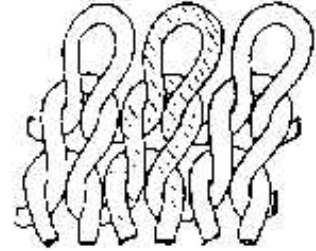
Wale Loop Distortion

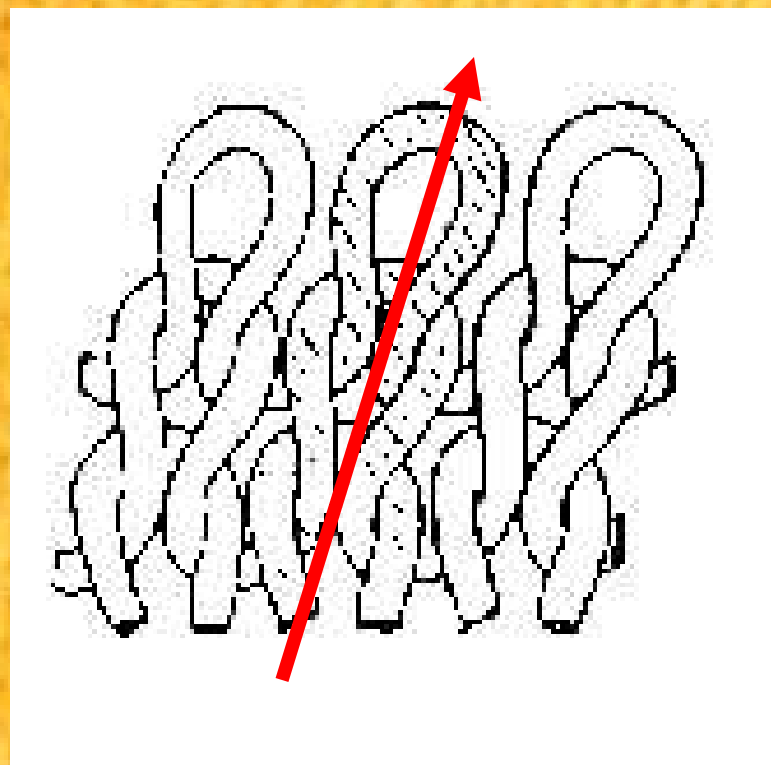


No Skew
(Ideal Condition)

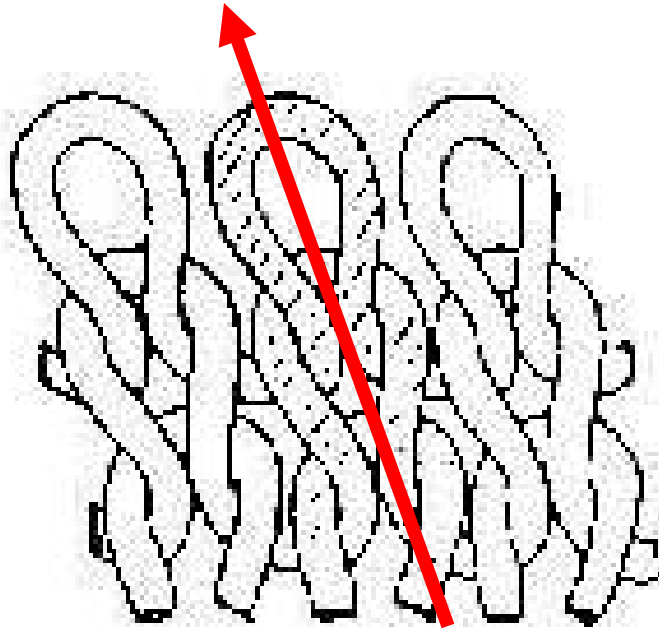


Wale Skew



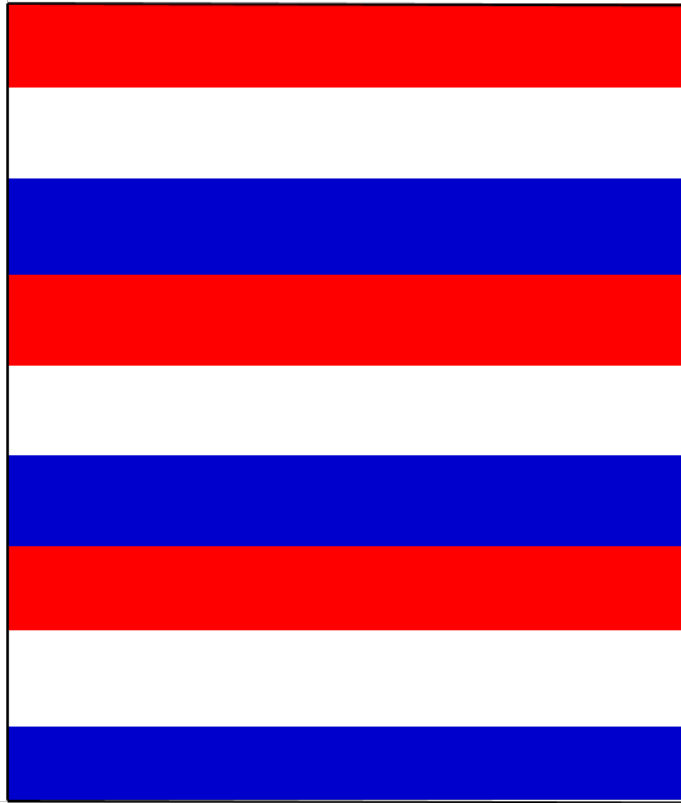


Right-Hand Wale Skew



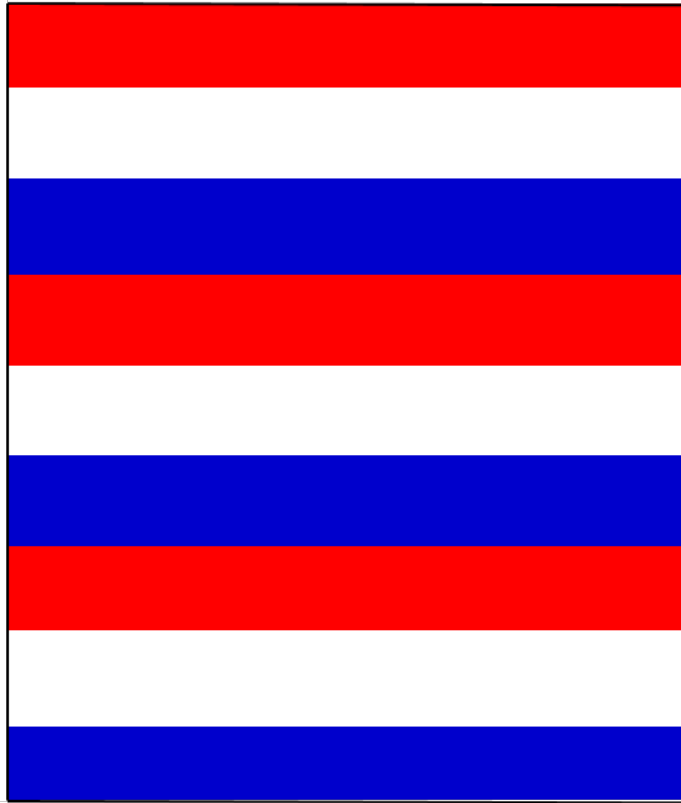
Left-Hand Wale Skew

Wale Skew in Striped Fabrics/Garments

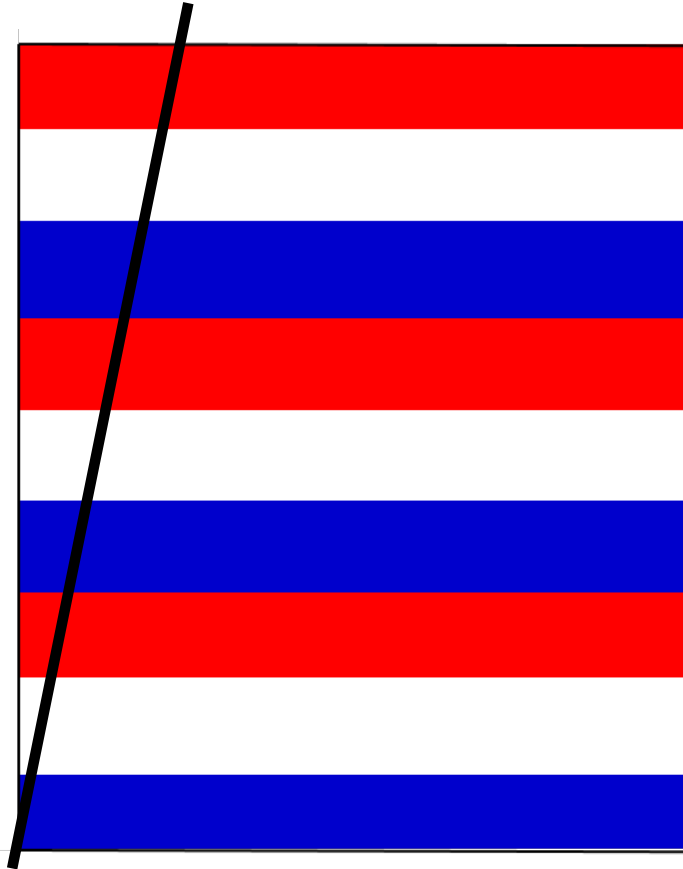


Ideal Condition

Wale Skew in Striped Fabrics/Garments



Ideal Condition

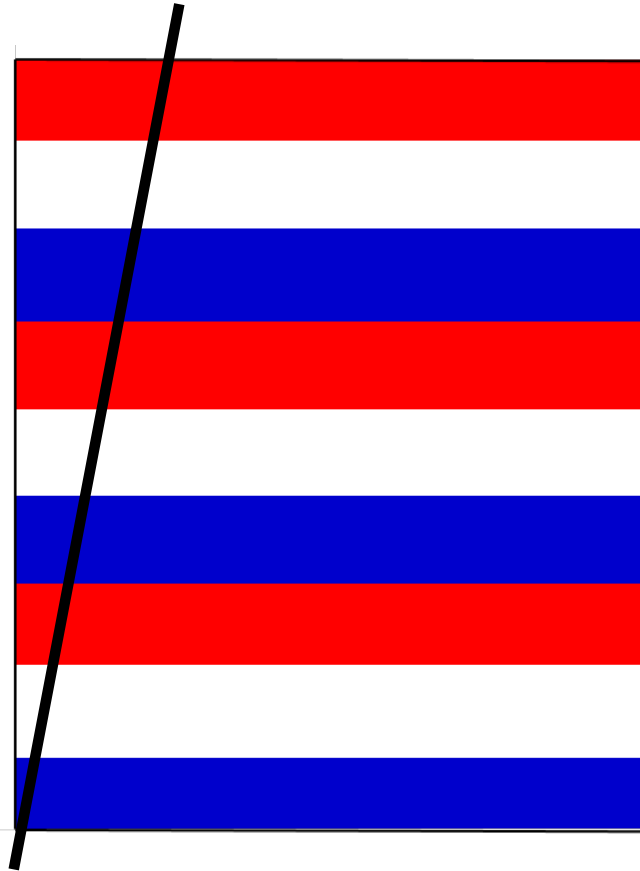


Wale Skew

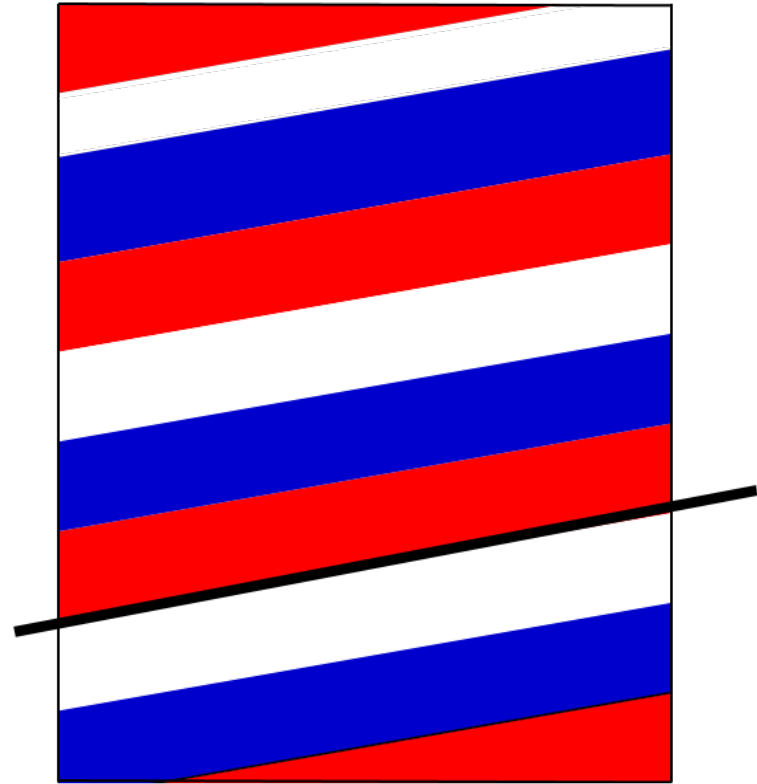


Displacement

Wale vs. Course Skew in Striped Fabrics/Garments

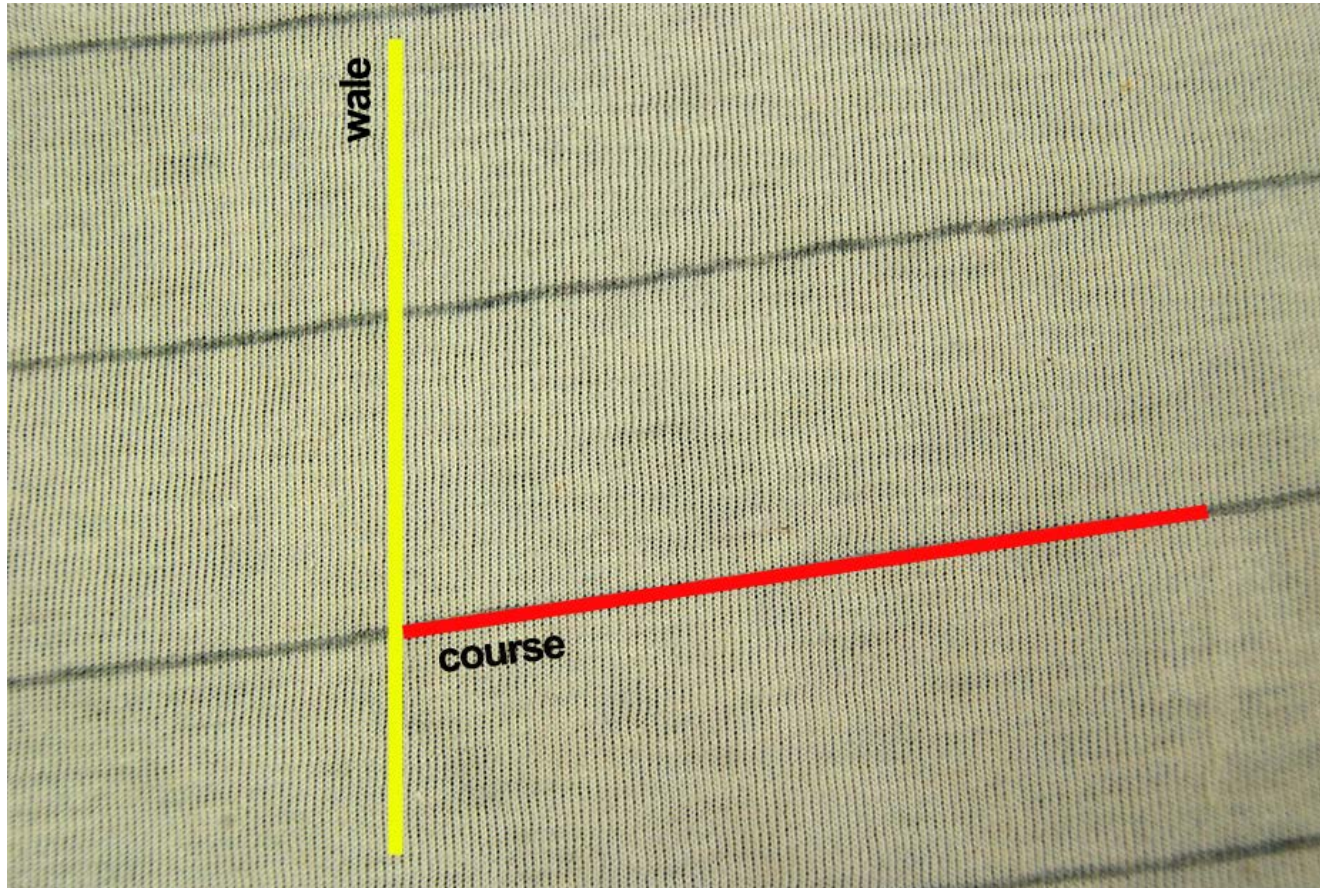


Wale Skew



Course Skew

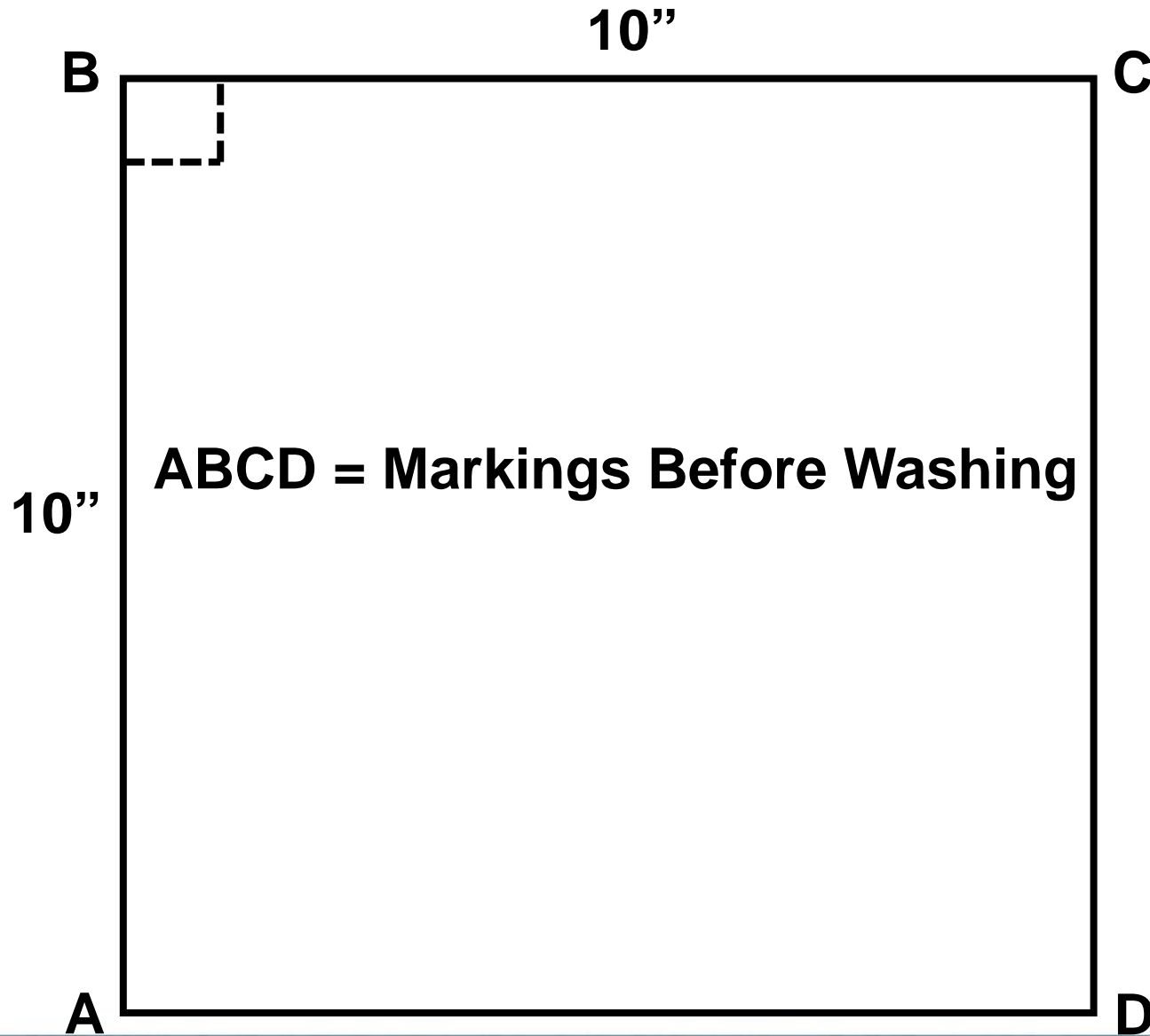
Wale vs. Course Skew in Striped Fabrics/Garments



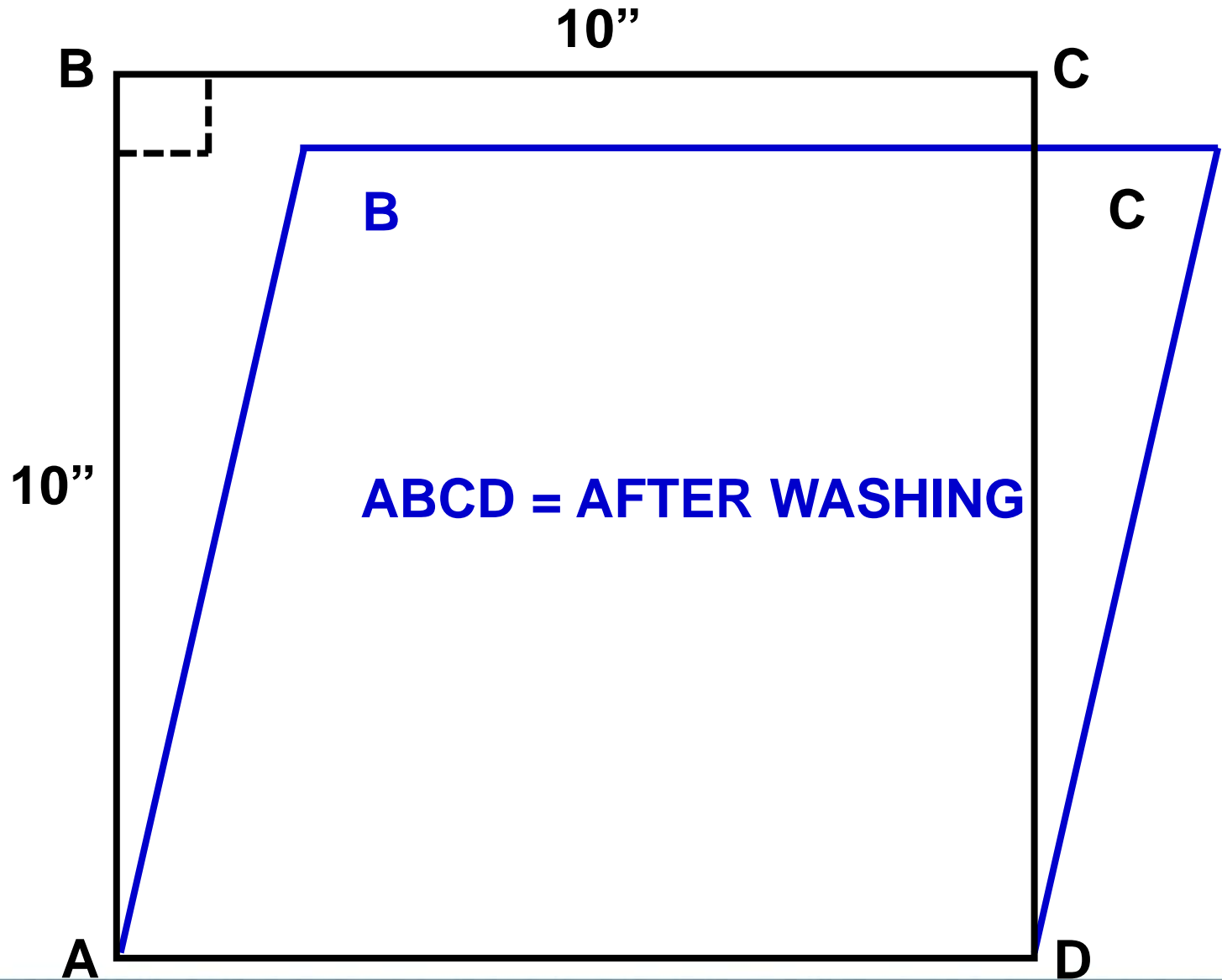
Skewness Testing

- AATCC Test Method 179, “Skewness Change in Fabric and Garment Twist Resulting From Automatic Home Laundering.
- This test method determines the percent change in skewness in woven and knitted fabrics or twist in garments when subjected to repeated automatic laundering procedures commonly used in the home. Washing and drying procedures used for shrinkage tests and other home laundering.
- Two methods are used, one for fabric and the other for garments or small samples.

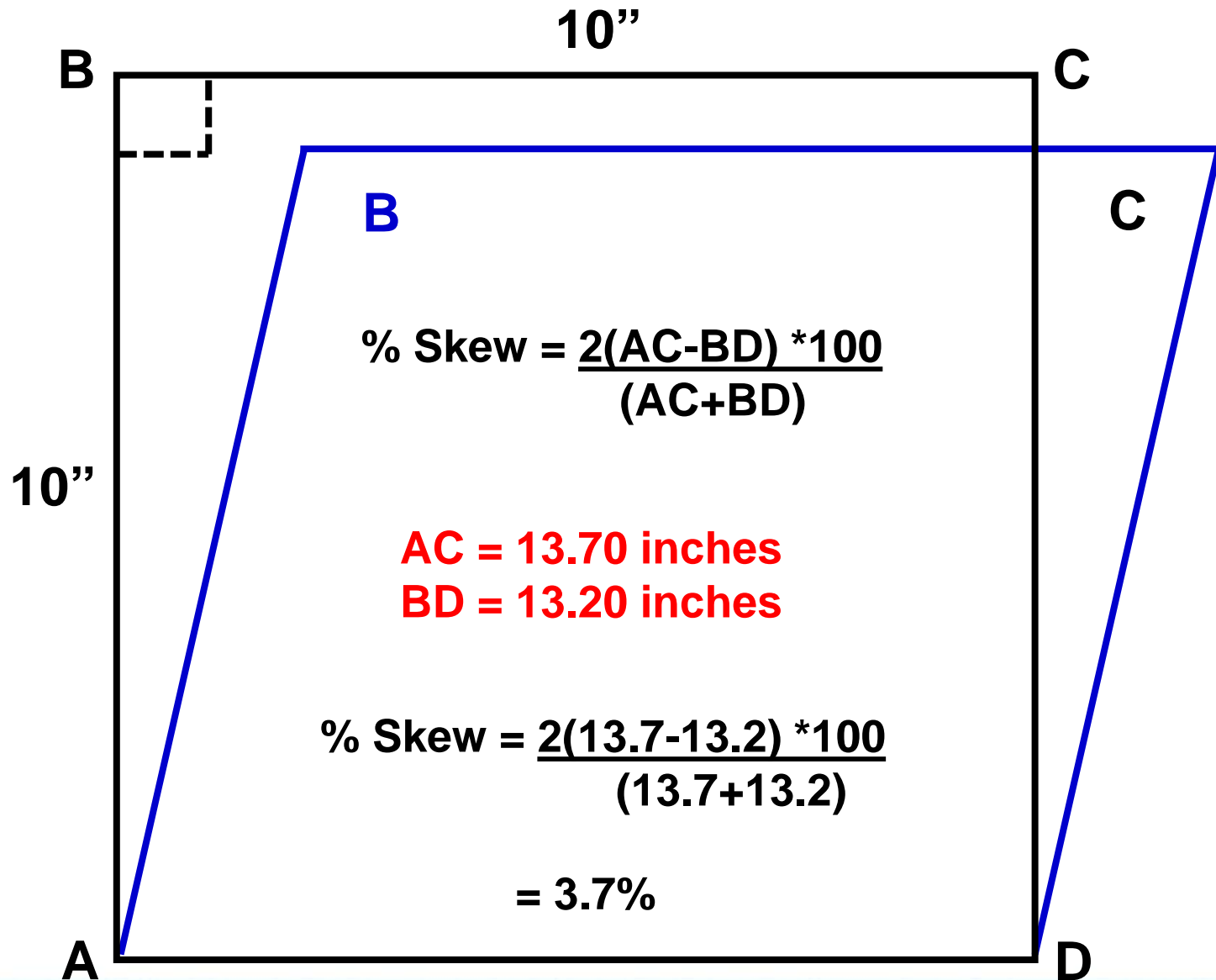
Method 1: Shear Distortion



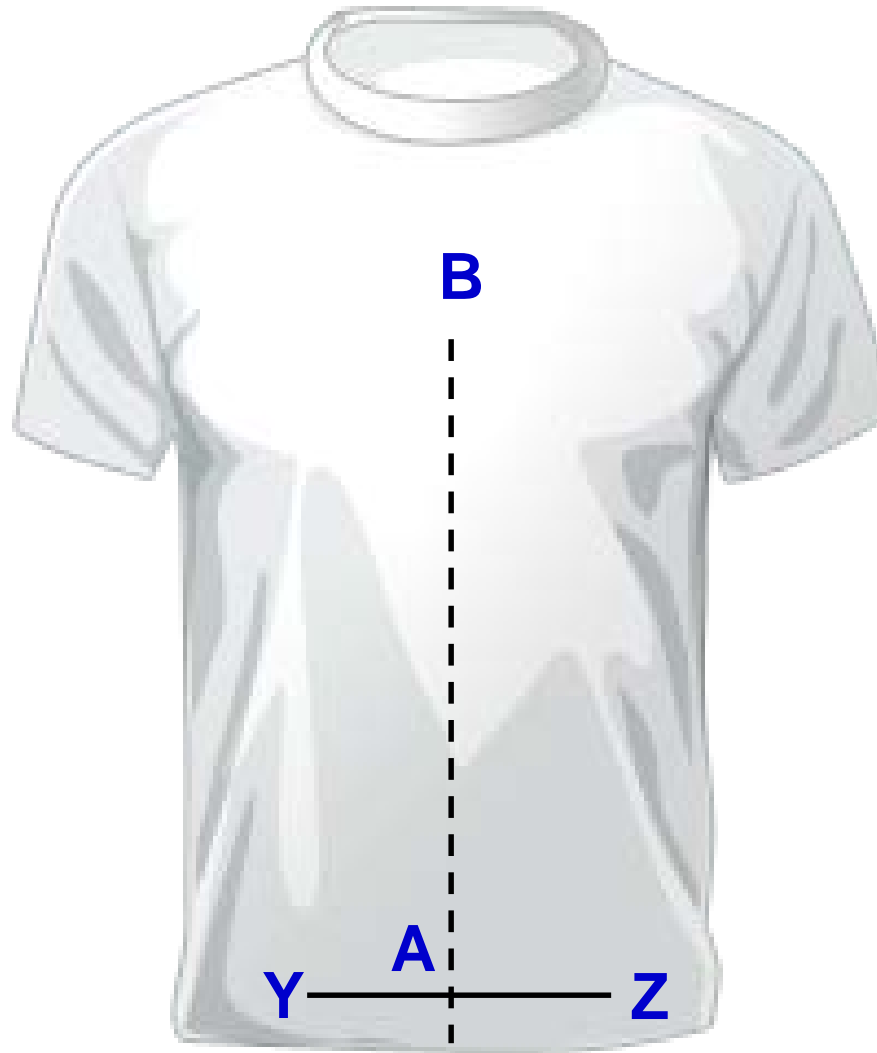
Method 1: Shear Distortion



Method 1: Shear Distortion



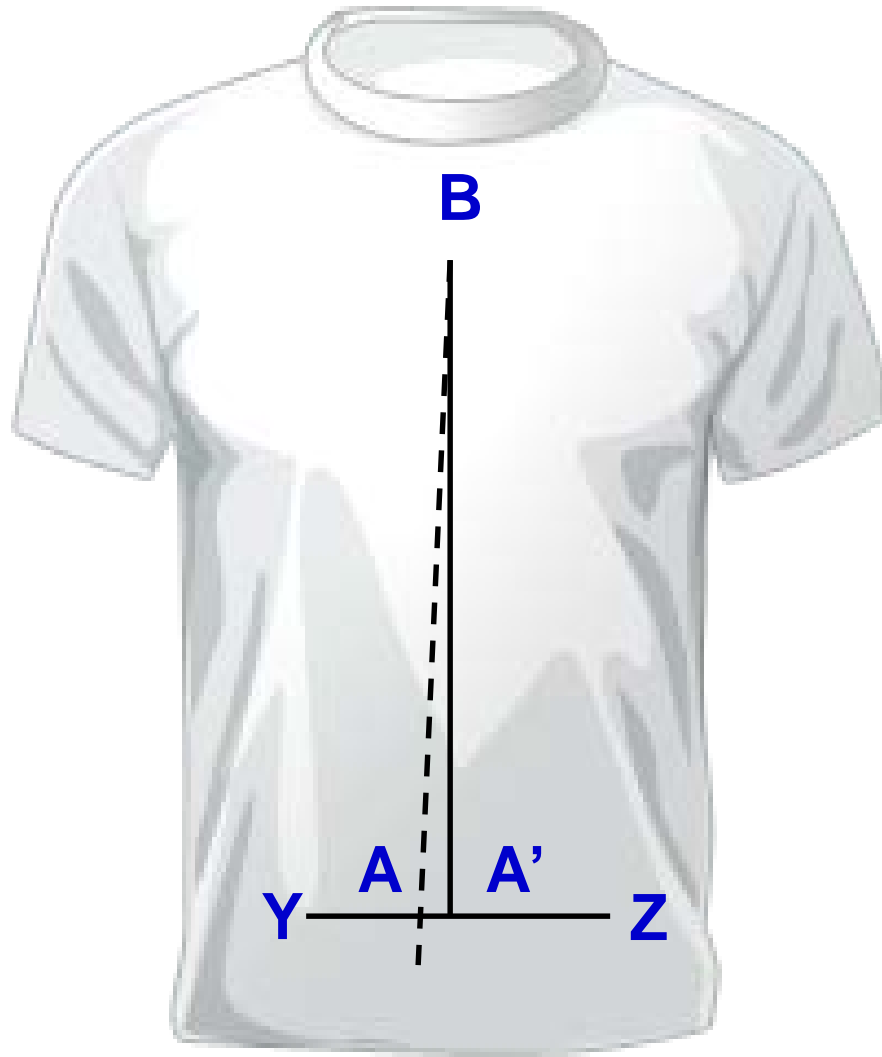
Method 2



AB = 19 ins.

Original Garment Markings

Method 2



$$\% \text{ Skew} = \frac{AA' * 100}{AB}$$

$$AB = 18.75 \text{ ins.}$$

$$AA' = 0.5 \text{ ins.}$$

$$\% \text{ Skew} = \frac{0.5 * 100}{18.75}$$

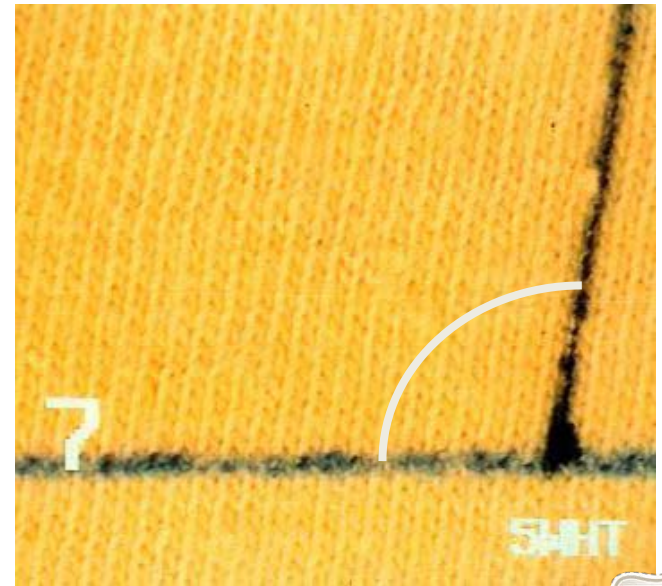
$$= 2.7\%$$

Garment Markings After Laundering

Total Skew

A common misconception about skew is that the test methods discover the entire amount of skew that a fabric experiences. The test only measures how much skew occurs during the test. Some fabrics have not had any skew removed when tested while others have experienced some level of skew.

To fully understand the propensity for a fabric to skew and to compare the differences in fabric construction as related to skew, one must measure and compare the total skew.



SKEW – Cause and Effect

- Yarn Parameters
- Knitting Parameters
- Finishing Parameters

Yarn Parameters

- Spinning System
- Twist Multiple
- Twist Direction
- Plying
- Greige, Scoured, or Dyed

Effect of Yarn Type*

<u>Spinning System</u>	<u>% Total Skew After 5 HLTDS</u>
<i>Ring Spun (3.5 TM “Z”)</i>	12.6% Right
Open End (3.5 TM “Z”)	6.2% Right
Air Jet (TM “Z”)	12.3% Right

*18 cut single jersey 18/1 100% cotton - greige

Twist Multiple

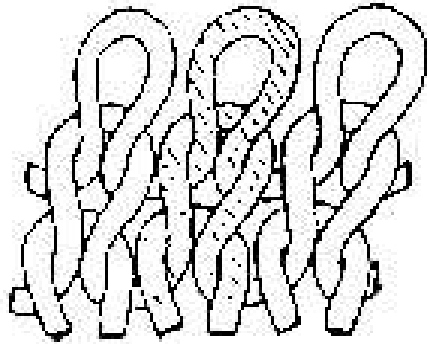
Twist multiple is a mathematical factor that allows yarns of different size to be compared to each other. The higher the twist multiple, the more the twist in the yarn. The higher the twist in the yarn, the stronger, the less hairy, the stiffer, the higher level of elongation, and unfortunately, the higher the skew.

Effect of Twist Multiple*

Condition	%Total Skew After 5 HLTDs
<i>Ring Spun “Z”</i>	
3.0	10.5% Right
3.5	12.6% Right
4.0	18.5% Right
Open End “Z”	
3.0	3.5% Right
3.5	5.2% Right
4.0	8.7% Right

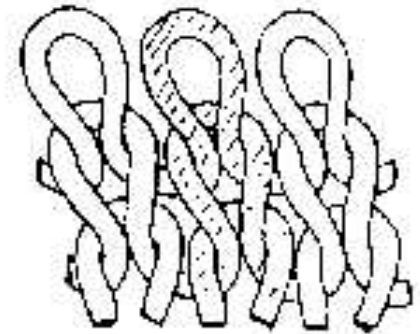
*18 cut single jersey 18/1 100% cotton - greige

Effect of Twist Direction (S or Z)



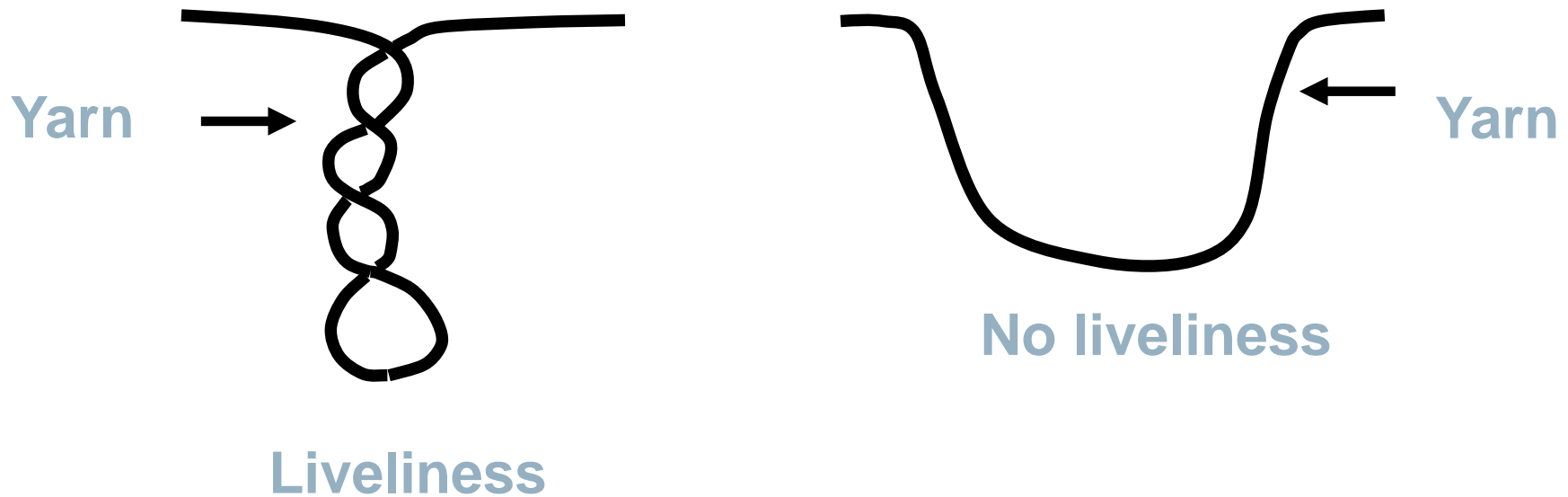
“Z” twist yarns exhibit a “right-hand” skew where the wales lean to the right.

“S” twist yarns exhibit a “left-hand” skew where the wales lean to the left.



Effect of Yarn Plying

Singles Spun Yarns have Twist Liveliness

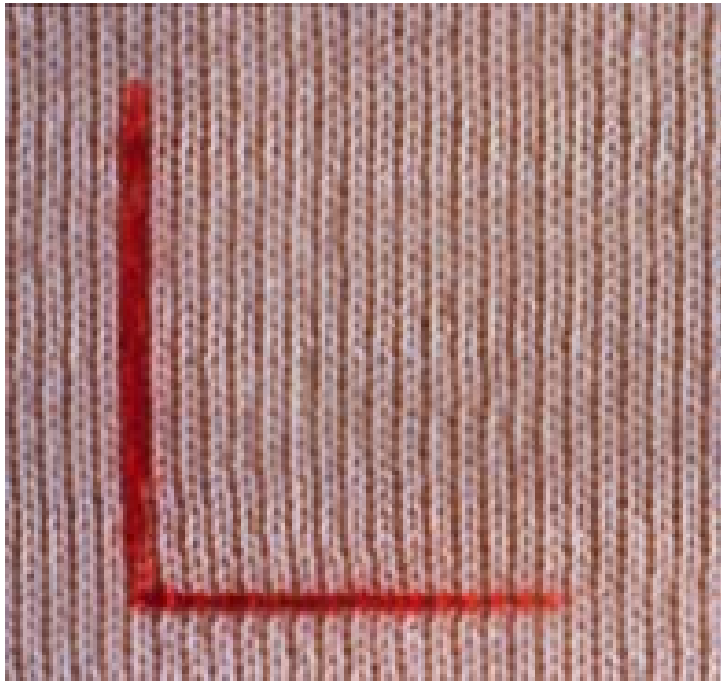


After knitting, the singles spun yarn tries to untwist causing the loops to deform and the fabric to skew. When two 'Z' twist singles are plied together in the 'S' direction, the twist liveliness can be removed.

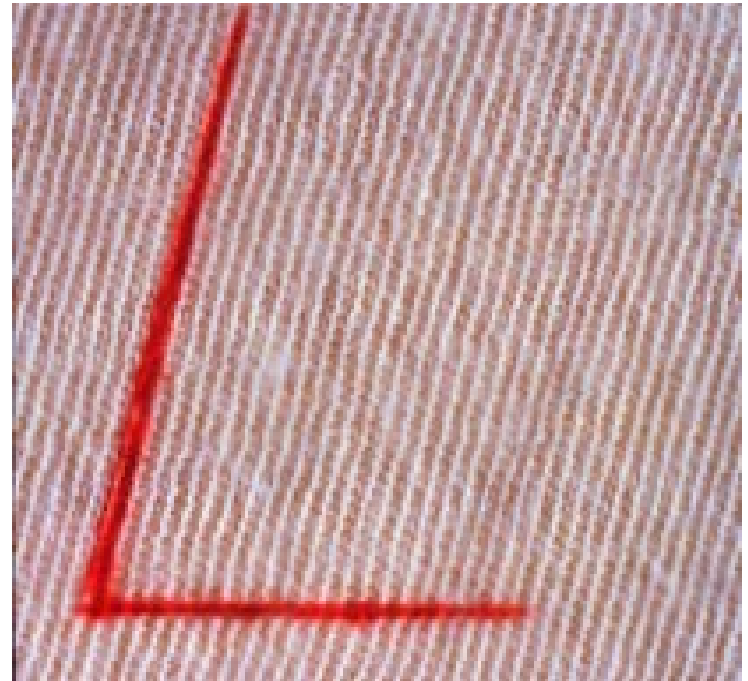
Effect of Knitting Singles Yarns

Knitting 2 Ends of 40/1 Parallel

Greige

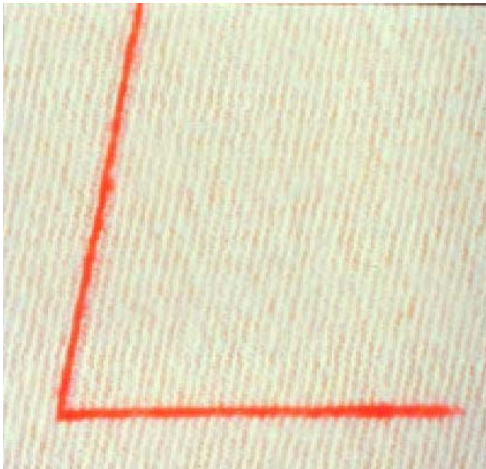


Washed

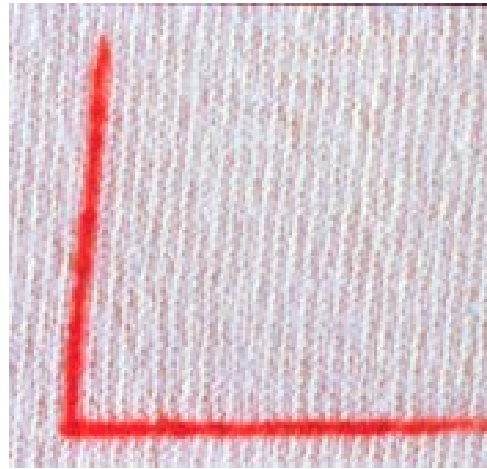


Effect of Plying Yarns

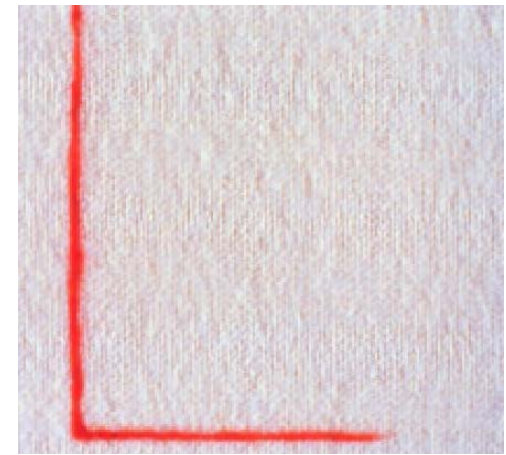
40/2 – 2 ends of 40/1 (Z-twist) Plied S-twist



**2.5 TPI
Washed**



**6.5 TPI
Washed**



**12.5 TPI
Washed**

SKEW – Cause and Effect

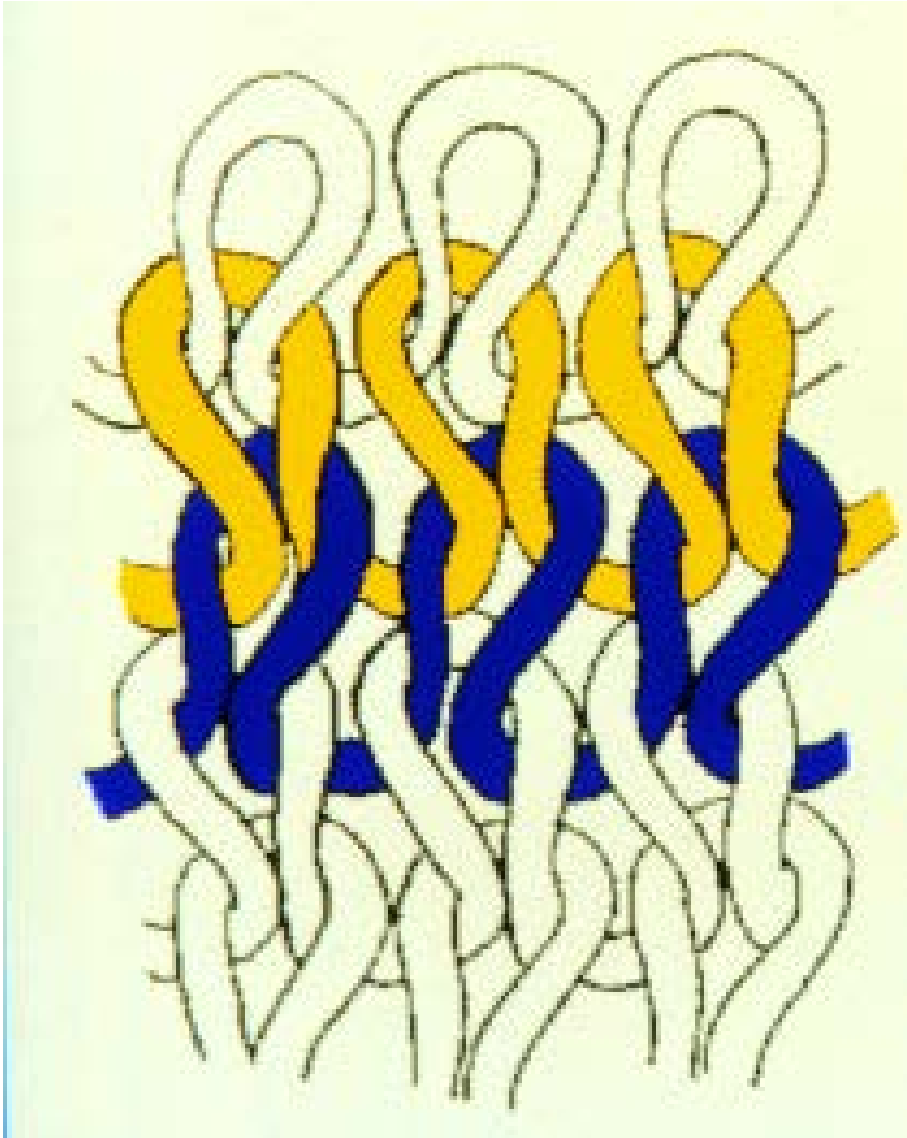
- Yarn Parameters
- **Knitting Parameters**
- Finishing Parameters

Knitting Parameters

- Alternating Feeds of S & Z Yarns
- Tightness of Stitch

Effect of Alternating “S” and “Z” Twisted Yarns in Knitting

ALTERNATING COURSES OF “S” AND “Z” TWIST YARNS



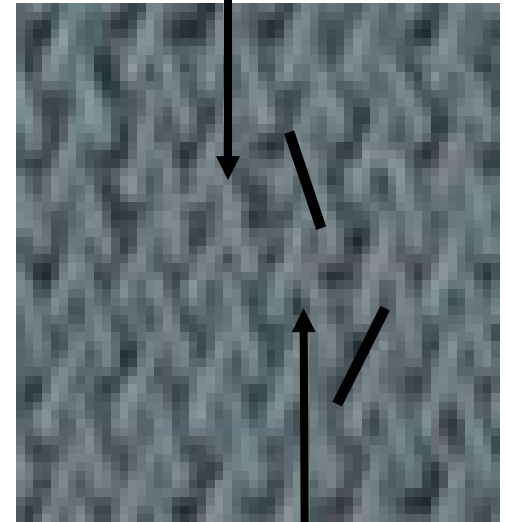
← “S” TWIST YARN

← “Z” TWIST YARN

Alternating Courses of “S” and “Z” Twist Yarns



“S” Twist Yarn



“Z” Twist Yarn

Alternating Course Bands of “S” and “Z” Twist Yarns



} “Z”
Twist 6-Courses

} “S”
Twist 6-Courses

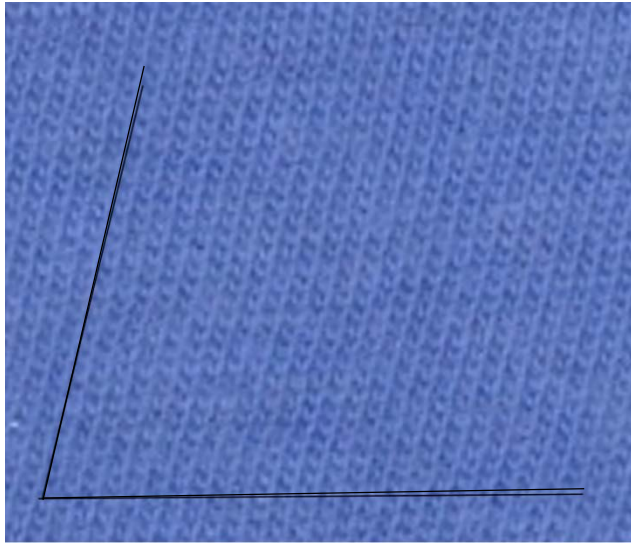
Effect of Stitch Tightness on Skew

Effect of Stitch Tightness on Skew*

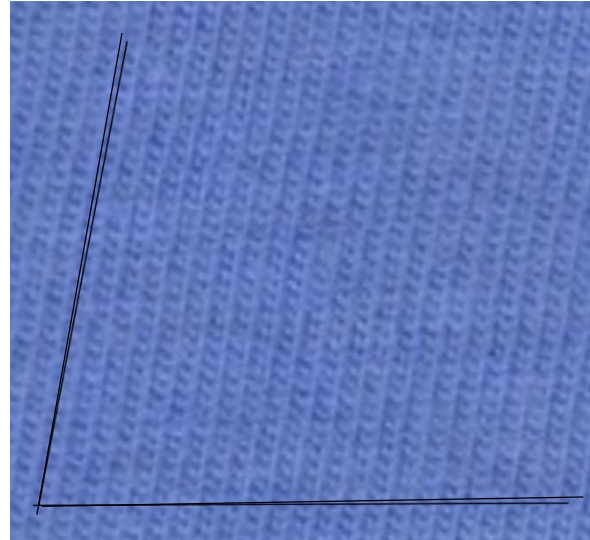
Course Length (in.)	% Total Skew Greige	% Total Skew Dyed After 5 HLTD's
Tight – 243"/rev.	8.6	8.1
Medium Tight - 257"/rev.	12.3	9.5
Medium Loose - 269"/rev.	17.1	15.2
Loose – 282'/rev.	17.8	17.2

*28 cut single jersey - 30/1 CP RS 100% cotton

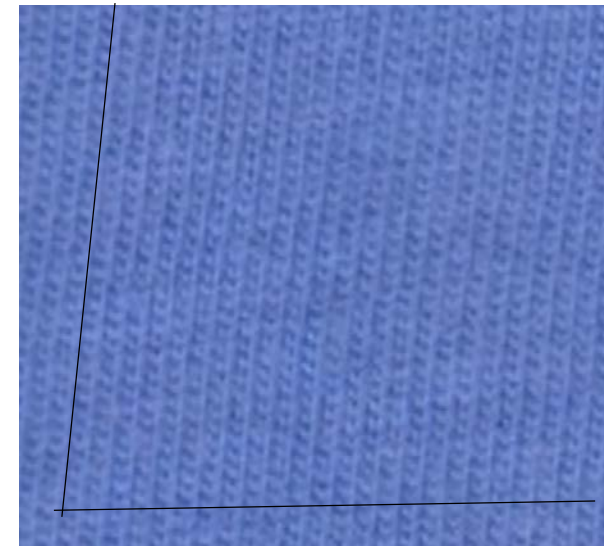
Effect of Stitch Tightness on Skew*



Loose Stitch
26.8% Total Skew



Medium Stitch
21.4% Total Skew



Tight Stitch
15.2% Total Skew

*18 cut single jersey - 18/1 CP RS 100% cotton

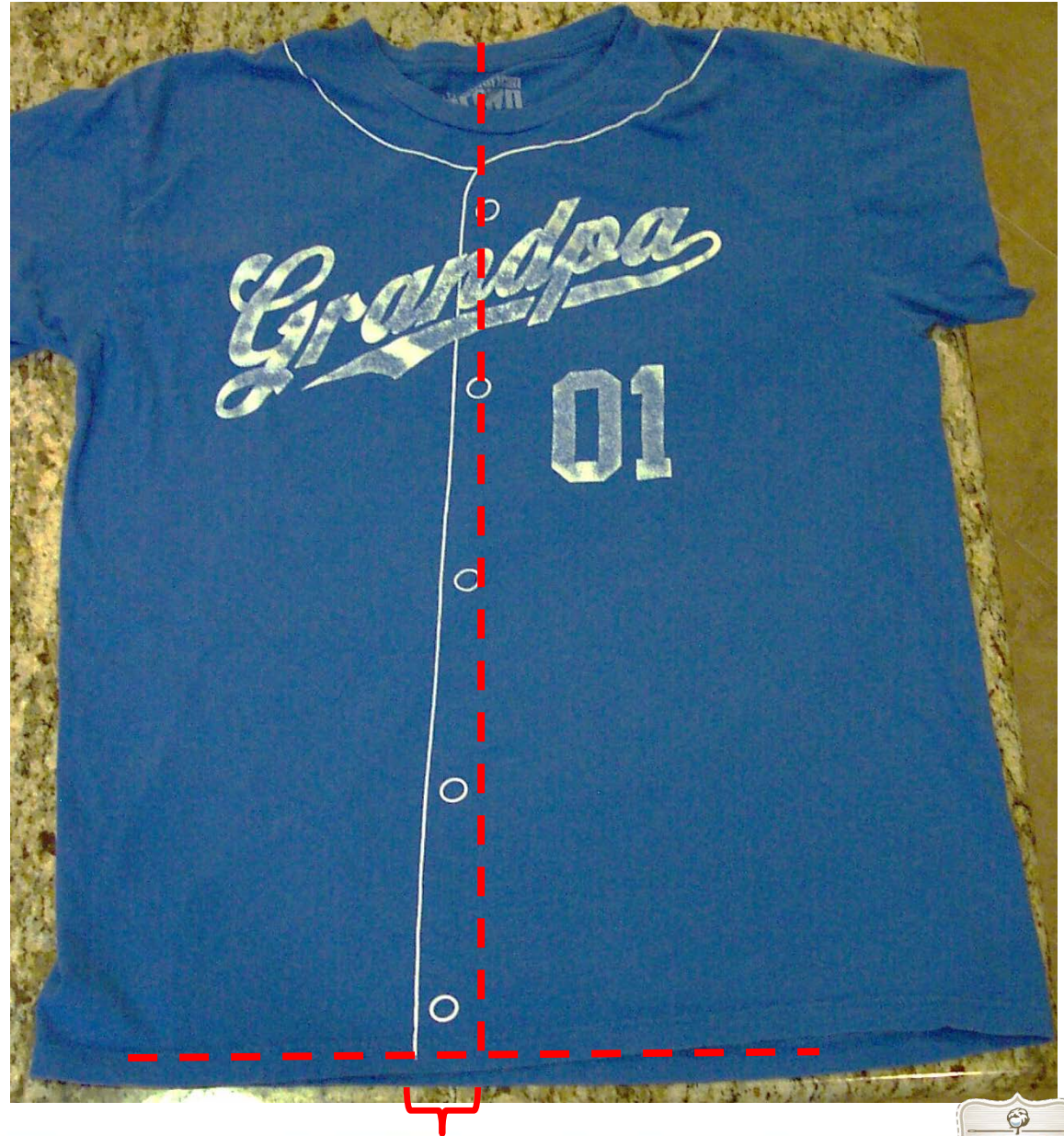
SKEW – Cause and Effect

- Yarn Parameters
- Knitting Parameters
- **Finishing Parameters**

Printed t-shirt
that skewed
due to
laundering.



Printed t-shirt
that skewed
due to
laundering.



Displacement

With respect to the control of skew, there are several considerations:

- Resin finishing can relieve the twist liveliness for most fabrics by crosslinking.
- Without resin, the fabrics have 'DNA' to skew, so the finisher must allow the fabric to skew without the skew being apparent.
- With striped fabrics, plaids, and geometrics, the use of resin or plied yarns must be considered.

PRODUCT CASE STUDY

- A garment dyer was experiencing problems with extreme variations in skew in a garment dyed t-shirt style. His company was making t-shirts from single jersey fabric supplied by two mills in the prepared-for-garment-dyeing business.
- The specifications for knitting was:
 - 20 gauge Single Jersey
 - 18/1 Ne Open End 100% Cotton
 - Stitch length of 0.139 inches.
 - Slit and dried at 60" cutting width.
- Skewness of the side seams ranged from acceptable to more than 20%.

CASE STUDY

20 Cut Single Jersey
18/1 Ne OE - 0.139" SL.

A

B

C

Skew



Total Skew of a fabric is the displacement of the fabric in it's fully relaxed state. It is the aftereffect of all parameters that relate to skewness.

Fabric Skewness is a residual effect of all previous processes and can be different from the *Total Skew*.

Variance in Stitch Length in Shirts*

Stitch Length (inches)		Total Skew %
A	0.139	9.3
B	0.141	13.7
C	0.142	14.9
D	0.146	22.9

*20 cut 100% cotton single jersey - 26" diameter with 1633 needles knitting an 18/1 Ne open end yarn.



Skew Control by “Pre-skew” Finishing*

Sample ID	Total % Skew Before Dyeing	Total %Skew After Dyeing ⁺	% Garment Skew Realized by Dyer
Pre-skew	13.7	13.7	0.0
2	9.6	11.5	1.9
3	6.7	9.3	2.6
4	4.5	9.4	4.9
No Pre-skew	0.0	14.2	14.2

*20 cut 100% cotton jersey - 18/1 OE yarn - stitch length of 0.146 inches.



Garment Skew Improvement

- Knit as tight as possible without causing appearance and processing problems.
- Choose a yarn size that will allow knitting as tight as possible without causing yield and dyeing problems.
- Use open end yarns wherever possible.
- Use “S” twist yarns on “clockwise” rotating machines and “Z” twist yarns on “counterclockwise” rotating machines.
- Knit with “two-ply” yarns of balanced twist.
- Knit with alternating feeds of “S” and “Z” twist yarns.
- Allow for the fabric wales to “pre-skew” during wet processing and drying when possible.
- Use crosslinking chemicals in finishing if feasible.

Skewness Reduction in Dyeing and Finishing

- Fabric should be allowed to skew early in the dye house processing.
- Allow for relaxation in preparation and dyeing.
- It is preferred to not use a slit line for solid shade and non-patterned designs. This allows the wales to skew and leave the courses perpendicular to the edge.
- Work with the knitter to get the best combination of yarn count and stitch lengths to meet weight and shrinkage standards.

TECHNICAL BULLETIN



COTTON INCORPORATED

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KNIT FABRICS AND THE REDUCTION OF TORQUE

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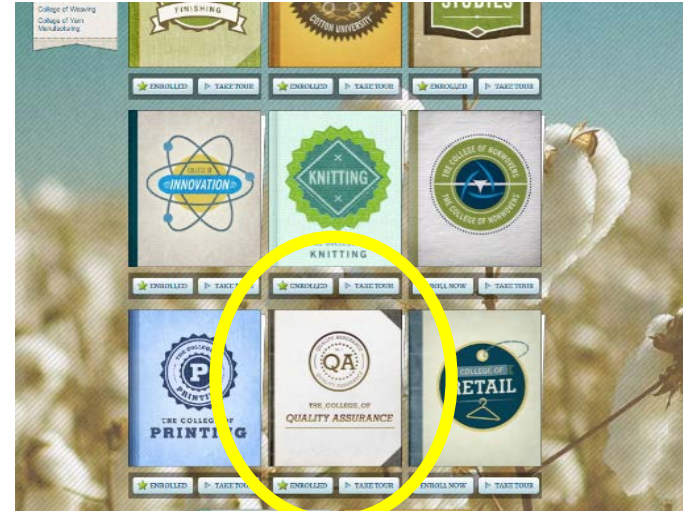




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