

Yarns

From fibers to yarns

Definition of Yarn

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- A yarn is a constructed assemblage of textile fibers which acts as a unit in fabric formation.

Classification:

Yarns may be:

- Staple or Filament
- Single or Plied
- Simple or Complex

In addition, Filament yarns may be:

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Types of Yarn

1. **Staple** or
(Short fibers)
2. **Single** or
(One Strand)
3. **Simple** or
(Same appearance along length)
Filament
(Continuous Filaments)

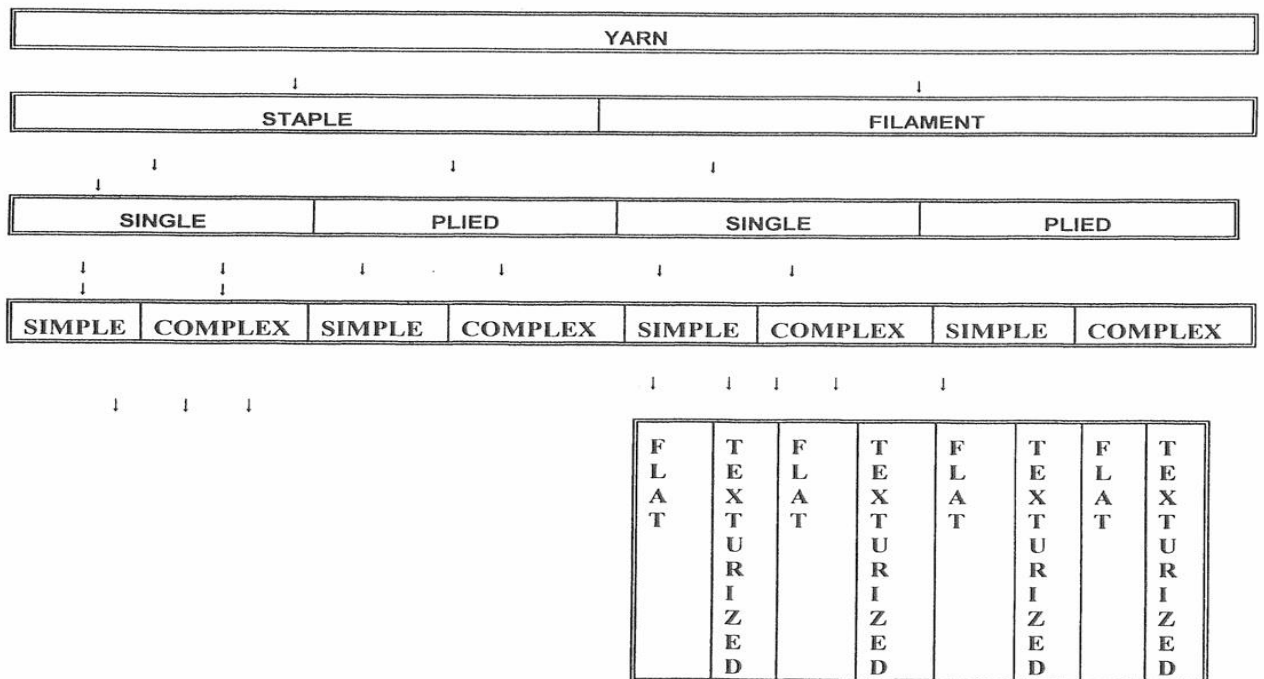
Plied *Cord(Cabled)
(Two or more strands, twisted)
Complex


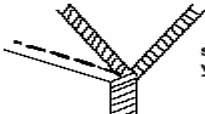
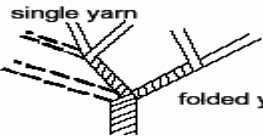
(Variable appearance along length)

Filament Yarns may be

- Flat or Texturized
- A T-shirt would probably be knit from a SIMPLE,
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- Fabric for a slip would probably be knit from a FLAT,

SCHEME FOR YARN CLASSIFICATION



Definition	Explanation
 <p data-bbox="456 411 586 428">Single yarn</p>	<p data-bbox="802 306 1024 359">Spun yarn or Filament yarn</p>
 <p data-bbox="578 764 651 795">single yarn</p> <p data-bbox="415 856 626 879">Folded (plied yarn)</p>	<p data-bbox="802 751 1308 831">Two or more components one twisting operation similar or dissimilar components</p>
 <p data-bbox="391 915 513 936">single yarn</p> <p data-bbox="558 999 688 1020">folded yarn</p> <p data-bbox="448 1066 591 1089">Cabled yarn</p>	<p data-bbox="802 961 1317 1041">Two or more components more than one twisting operation similar or dissimilar components</p>

Examples

- Staple Fibers twisted together
- Filament fibers laid side by side, with some twist applied
- Single filament fiber
- Strips made by lengthwise division of a sheet of material

The direction and amount of twist

- Twist in staple (spun) yarns is given in units of turns of twist per unit length, either turns per inch (U.S.) or turns per centimeter (Europe, Asia).
- tpi=
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- Yarn properties are affected by the degree of twist, but not by the direction (S or Z) of twist.

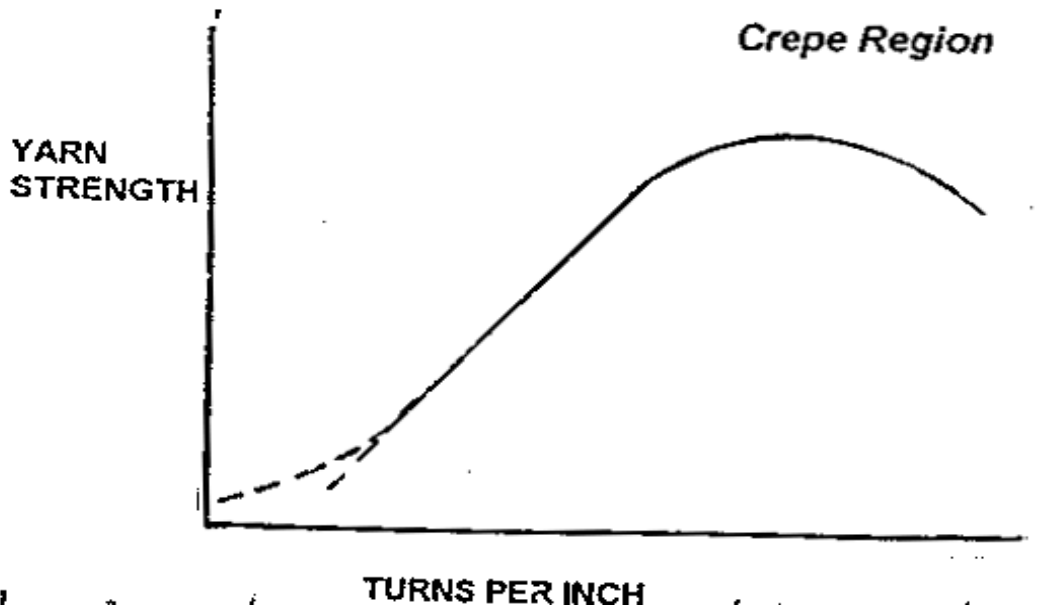
Effect of Twist on Staple Yarn Properties

- As twist increases, yarn strength and yarn stiffness increase up to a point, level off, then begin to fall at very high twist levels.
- Yarns with extremely high levels of twist are called "crepe yarns"; these yarns possess a high degree of torque
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- Woven fabric containing these yarns have a pebbled surface texture.

Yarn Twist Staple Yarns

- Yarns with lower twist
 - Harrier
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 - More comfortable skin contact
 - Less cost

Crepe yarns, have a high tpi (turns per inch)



Low:

Moderate:

Crepe:

Continuous Filament Yarns

- Continuous filament yarns are assemblies of continuous filament fibers twisted together; each individual fiber runs through the entire length of yarn.
- For flat (not texturized)
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- Texturizing
- Fabrics made from flat continuous filament yarns exhibit specular reflectance (shine) and are smooth with minimal surface friction.
- Continuous filament yarns are often texturized, in order to produce fabrics with spun-yarn aesthetics:
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- **Texturizing**
- Texturizing processes all increase yarn bulk, and most increase yarn stretch. Texturizing continuous filament yarns are often referred to as BCF yarns (bulked continuous filament yarns).
- The rationale behind texturizing is that all manufactured yarns are made in continuous filament form. Many of these are then cut into staple lengths and put through the complete spinning process, restoring them to a continuous strand of twisted staple fibers to be woven or knit.

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Characteristics Texturized Filaments

- More absorbent
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- Better bulk, cover, elasticity
- Not pill or shed

Texturizing Processes

- The most common texturizing process is the false-twist process
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- Twist is inserted in a heated zone, then removed in an unheated zone. When the yarn is relaxed, it reverts to its twisted state. 50 to 60 tpi can be inserted at very high production rates.

Texturizing Processes

- Stuffer box texturizing was originally used for BAN-LON™ products. Filaments in stuffer box yarns have a highly irregular 3-D crimp. Filaments jammed into heated box to create random crimp.
- Knife edge texturizing (Agilon™) increases yarn stretch and bulk. Filaments have a spiral 3-D crimp;
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- Filaments are run across a heated knife edge, like curling ribbon
- Other processes include twist-heatset-untwist (Helanca™) and knit-deknit.

Texturizing Processes

- Air-jet texturizing (Taslan™, Rotofil™) increases yarn bulk moderately but does not increase stretch. Air-jet texturizing ranks behind false-twist texturizing in use.
- FALSE-TWIST 75%
- AIR-JET 20%
- ALL OTHERS 5%
- All texturizing processes except Air-Jet require that the filament fibers may be _____ (e.g. polyester, nylon). Any fiber type may be used in Air-Jet texturizing.

Yarn properties Effect Fabric

- Spun Yarn = more spaces between fibers = better insulation
- Lower twist yarn = more air space
- High twist yarn = more wind resistant

Yarn Size or Yarn Number

- We want to be able to tell someone what the size of a yarn is, and make these numbers comparable for different materials. If we just reported the diameter of the yarn, we would not be able to give accurate numbers because the edges of a yarn are fuzzy, and yarns can be extended so they would be narrowed or distorted. To give us a measure of yarn size that is comparable for different materials, we use linear density or reciprocal of linear density, because the length and mass of the yarn can each be accurately measured.

Direct Systems- Used for Filament Yarns

- Terms of weight per unit length
- Denier-

- Tex- weight in grams of 1000 meters of yarn
- Decitex- weight in grams of 10,000 meters of yarn, A dtex is close in value to a denier.
- Can be reported as A/B
- Example 1000/200 which means this is a 1000 denier yarn with 280 filaments present

Direct Systems

- These are direct systems. The **higher the number the coarser the yarn**. So if 9,000 meters of yarn weighs 50 grams, it is a 50 denier yarn.
- If measured out 900 meters, the yarn would weigh only 5 grams. To calculate the denier for this yarn, you would calculate $5 \text{ grams} / 900 \text{ meters} = X \text{ grams} / 9000 \text{ meters}$
- If the denier is 1, then 9,000 meters weigh 1 gram. If the denier is 2, then 9,000 meters weight 2 grams

English yarn count system

- English numbering system;
It is often symbolized by Ne (the number in the English system).
- Uses **fixed weights** of yarn where the direct system used fixed lengths. This is a reciprocal linear density measure, **length is measured per unit of mass**.

Yarn Count

- The yarn count, also called yarn number, of a yarn is the number of hanks of yarn needed to make up one pound of yarn. It is an _____ system.
- This is not to be confused with the number of yarns in an inch of fabric called thread count.

Indirect System

- In the English numbering system, we count how many lengths, called a

hank, weigh one pound.

- Thus if there are 10 hanks of cotton yarn that weigh one pound, this is 10s yarn. Each of the hanks is 840 yards long, so the total length of the yarn is 8,400 yards.
- So, if you have a coarser yarn it will take fewer hanks, and less length to make up a pound. **On the other hand, the higher the number, the finer the yarn.** It takes more of the finer yarns to make up one pound.
- If the cotton count is 1, then 840 yards \times 1 weighs one pound.
- If the cotton count is 2, then 840 yards \times 2 weighs one pound.

Indirect System

- The length of a hank depends upon the spinning system:
 - Cotton system: 1 hank = 840 yards
 - Worsted system: 1 hank = 560 yards
 - Woolen cut system: 1 hank = 300 yards
 - Woolen run system: 1 hank = 1600 yards

Indirect System, the English system

- The yarn number is thus a measure of the number of yards in a pound of yarn.
- **The higher the yarn number, the more yards per pound, hence the finer the yarn.**
- Coarse: 12 or less Medium: 12-40 Fine: 50 and up

<u>Yarn Count</u>	<u>Spinning System</u>	<u>Yards/lb</u>	<u>Fabric End Use</u>
10s	cotton	8,400	woven denim
35s	cotton	29,400	knit T-shirt
60s	cotton	50,400	woven batiste blouse
80/2	cotton	33,600	woven pin point oxford
35s	worsted	19,600	woven suited
60s	worsted	33,600	woven tropical suiting
8s	worsted	4,320	carpet
10s	woolen	3,000	woven overcoat
35s	woolen	10,500	knit sweater

Yarn Size

- Singles yarns have an "s" following the yarn number; plied yarns have a "/n" following the yarn number, where the yarn number given is the yarn number of the individual ply, and n is the number of plies. e.g.70/4

DENIER, DIAMETER ILLUSTRATION

Denier - weight in grams of 9000 m of yarn
 Tex weight in grams of 1000 m of yarn

