

Yarns

YARN IS A CONTINUOUS, usually plied, strand of textile fibers twisted together. Long yarns are created from either natural or synthetic (human-made) fibers or filaments used to weave or knit fabrics. Cotton fiber yarns produce abrasives, awnings, clothing, geotextiles for military armor and roadways, hosiery, luggage, rugs, shoes, upholstery, explosives, and tents. The outdoor furniture and ceiling treatments shown here are produced from textiles that are both durable and beautiful.



Objectives:



1. Explain how fibers are made into yarn.
2. Explain various types of yarn.

Key Terms:



absorbency	multifilament yarn	staple yarns
blended yarns	pills	thread
cord	ply	tight-twist yarn
elasticity	S-twist	two-ply yarn
extrusion	sheen	wrinkle resistance
filament yarns	single-ply yarn	yarn
low-twist yarn	spinneret	Z-twist
monofilament yarn	spun yarn	

Fibers to Yarn

Yarn is a continuous, usually plied, strand (or thread or cord) of textile fibers twisted together. Yarn is used in the production of textiles, abrasives, awnings, concert venue backdrops, gloves, luggage, rugs, upholstery, shoes, explosives, tents, and others products. Long strands of yarn, created from fibers or filaments, are used to weave fabrics for numerous consumer and industrial purposes. Fibers are natural or synthetic filaments capable of being spun



FIGURE 1. The roadway fabric pictured is a geotextile that is placed between gravel and sand prior to a road surface application. The awnings shown are in a downtown area of Madrid, Spain, where preparation is underway for a summer festival.



FIGURE 2. This is an antique spinning wheel.

into yarn. Filaments are long, thin, and flexible fibers. Threads, yarns, and cords are made by twisting (winding and intertwining) two or more fibers around a central core to make a single strand called a ply. Twisting gives yarn strength and makes the fibers cling together. Spinning (where twisting occurs) is the final process in making textiles.



FIGURE 3. Bobbins of cotton yarn are ready to be woven into material in a textile factory.



FURTHER EXPLORATION...

ONLINE CONNECTION: The Yarn-Making Process

The spinning wheel was invented between AD 500 and 1000 in India and was first used in Europe in the Middle Ages (1066 to 1485). A circular band connected a horizontal spindle, powered by a hand-driven wheel. With a spindle and bobbin attached to the wheel, yarn was wound and twisted simultaneously. About 150 years later, the Saxon wheel was invented. It was operated by a pedal, freeing both hands to work the fibers at the same time. This machine was followed in 1766 by James Hargreaves' spinning jenny; in 1768 by Richard Arkwright's spinning frame; and in 1779 by Samuel Crompton's spinning mule, which combined the moving carriage of the spinning jenny with the rollers of a water frame. Spun yarn was produced in one continuous operation. Still used today is the ring machine invented in 1828 by American John Thorp. This system utilizes hundreds of spindles mounted vertically inside a metal ring. Fibers are spun by the open-end system, where they are drawn up by air into a rapidly rotating cup and are pulled out the other side as finished yarn.



In 1828, American John Thorp invented the spinning machine used today. Hundreds of spindles are mounted vertically to simultaneously produce large quantities of yarn.

YARN CLASSIFICATIONS

Plies

Yarns are made of a number of twisted spun fibers. A **ply** is one of the strands in a yarn. **Single-ply yarn** is numerous individual fibers and/or strands plied or twisted together. **Two-ply yarn** is two or more single-ply yarns twisted together.

Staple yarns (e.g., wool and rayon) are short fibers that when spun and twisted together form a yarn rather than a filament. Natural staple fibers are spun to make staple yarns in a multistep process that includes mixing, blending, separation alignment, drafting, and the twisting of fibers. Silk yarn is a continuous-filament yarn (derived from silk cocoons). Most synthetic yarns require no additional spinning to form yarns.



FIGURE 4. Are these ship ropes constructed of single- or two-ply yarns?

Extrusion (forcing of a synthetic liquid or semi-liquid or polymer through small openings in a spinneret) is the process to form synthetic yarns. A

spinneret is an extrusion die with multiple small holes or openings through which the synthetic liquid or semi-liquid or polymer flows and is shaped.

Filament yarns are long, continuous fibers twisted together—a single thread. Filament yarns may be classified as monofilament or multifilament yarns. Silk yarn, for instance, is a continuous-filament yarn derived from silkworm cocoons.



FIGURE 5. Extruded synthetic yarns may be manufactured in virtually any shape, similar to those pictured here. Can you see how different synthetic yarns, depending on the shape of the die, could enhance the surface features of a garment or industrial fabric? Imagine squeezing toothpaste onto your toothbrush; that's how extrusion works.

Yarn Construction

Complex or novelty yarns are constructed from single or plied fibers that can combine varied sizes of yarn, different twist effects, or irregularities of slub yarn. Slub yarn is a defect, which can be considered a liability in fabric that must be durable (e.g., car seats and upholstery). However, it can be utilized as a design element to add texture and style to table linens and draperies.

Metallic yarns are monofilament flat yarns made by lacquering aluminum pigment or by laminating aluminum foil between layers of plastic (synthetic fibers). Metallic yarns are made of metallic polyesters, acrylics, and rayon. They are woven into natural fibers to appear as stripes, variegated colors, shimmer, and sparkle.

Textured yarns are produced by the physical, chemical, or thermal manipulation of fibers and yarns so they are no longer straight and uniform. Air texturing combines synthetic-filament yarns to create the appearance of spun yarns.

Bulked or lofted yarns have added texture. Bulkied yarns are

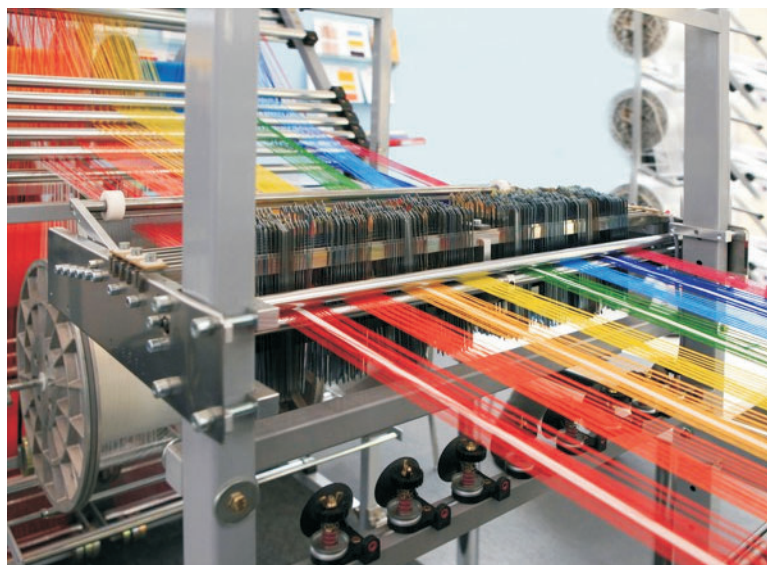


FIGURE 6. A warping machine in a textile factory is used to weave colorful strands of yarn into fabric.

subjected to additional crimping, looping, curling, and crinkling processes to produce the bulk or loft.

Stretch yarns can be made from natural and synthetic fibers. The stretch properties are added by chemical or mechanical means. Yarns used in knitted fabrics are usually soft and of low twist, making the fabrics somewhat elastic.

Cord

Cord is two or more ply yarns twisted together with the final twist usually applied in the opposite direction of the ply twist to make the cord thicker and stronger. There are two types: SZS and ZSZ.

SZS types are S-twisted singles made into Z-twisted plies that are then combined with a S-twist.

ZSZ types are Z-twisted singles made into S-twisted plies that are then combined with a Z-twist.

THREAD

Thread is a filament or group of filaments twisted into a continuous strand. Thread is usually made with two or more plies and from cotton or silk fibers. Thread is:

- ◆ Coated with chemicals to make it easy to use (to pass through fabric)
- ◆ Used in home and industrial settings
- ◆ Used in the weaving process
- ◆ Used to sew sections of garments and products together

Yarn Types

FILAMENTS

Monofilament yarn is a single, untwisted synthetic thread. It is found in fishing line, plastic thread used to hem garments, and hosiery.

Multifilament yarn is two or more synthetic or natural threads twisted together.

SPUN YARNS

Spun yarn is thread constructed from short staple fibers wrapped around a core fiber. Spun yarns produce a nubby texture, such as that in ropes. Short fibers protrude, making spun yarn appear fuzzy. Spun yarns are prone to snagging and have a bulkier, rougher feel. They pill

more than filament types. Some spun yarns fall apart when untwisted. Fibers used in spun yarn include natural fibers (cotton, wool, silk) and synthetic fibers.

BLENDYARNS

Blended yarns are a combination of natural and synthetic fibers constructed at the fiber stage rather than at the ply stage. Blended yarns are constructed in a number of combinations: polyester and viscose, acrylic and polyester, acrylic and cotton, polyester and linen, cotton and nylon, cashmere and wool, and cashmere and silk. The properties and performance of blended yarns combine the qualities and features of the natural and synthetic fibers. Blended yarns:

- ◆ Have abrasion resistance
- ◆ Have wrinkle resistance
- ◆ Have soil resistance
- ◆ Have increased strength
- ◆ Are easy to spin and weave
- ◆ Are less expensive to produce
- ◆ Result in improved hand and texture in fabrics
- ◆ Create improved fabric appearance (smoother **sheen**—i.e., brightness and/or shine; bulkier textures; rougher textures)

TWIST DIRECTION

The twist direction refers to how plies are twisted around each other. An **S-twist** is a left-turning rotation. Woolen and worsted yarns are usually S-twists. A **Z-twist** (often called zet) is a right-turning rotation. A Z-twist is used to make most yarns, especially cotton and flax. Twist binds fibers together and determines the yarn strength.

EFFECT OF TWIST ON YARNS

A **tight-twist yarn** is a close, compact, and smooth strand. A tight twist keeps fibers from shifting and decreases the diameter of the yarn. It also increases **elasticity** (the ability to stretch), allowing yarn or fabric to return to its original shape and size almost immediately after the removal of stress caused by stretching. Because of its smoother surface, a tight-twist yarn sheds soil. As a result, it decreases **absorbency** (the ability to take up moisture). In addition, it increases **wrinkle resistance** (the ability to resist creases and wrinkles). It also retains heat and resists abrasion or damage caused by friction or wear to the yarn's surface.

A **low-twist yarn** is an open, fluffy, and loose strand. Therefore, the fibers shift easily. A low-twist yarn has a rougher surface, and it wrinkles more easily than a tight-twist yarn. The fibers may pull and snag. A low-twist yarn releases heat and stretches out, not returning to its

original shape. It also **pills** (becomes rough and forms small balls of fibers caused by abrasion and wear).

Summary:



Yarn is a continuous, usually plied, strand (or thread or cord) of textile fibers twisted together. Yarn is used in the production of textiles, abrasives, awnings, concert venue backdrops, gloves, luggage, rugs, upholstery, shoes, explosives, tents, and others products. Long strands of yarn, created from fibers or filaments, are used to weave fabrics for numerous consumer and industrial purposes.

Natural and synthetic yarns are made of a multitude of plies and combinations. Metallic, textured, bulked, and stretchable yarns add features to apparel, durable household furnishings, luggage, and concert venue backdrops.

The twist given to fibers binds them together to give yarn strength and varied character. Yarn is made into thread and cord in multiple thicknesses and textures to be used by industry for manufacturing and for consumer goods.

Checking Your Knowledge:



1. What single process is always needed to create yarn, thread, and cord?
2. How do metallic, textured, bulked, and stretchable yarns enhance apparel?
3. How are spinnerets used in yarn production?
4. What is produced by extrusion?
5. Differentiate between various forms of yarn: monofilament and multifilament, spun yarn, and blended yarn.

Expanding Your Knowledge:



The composition of industrial yarn may be different from that of yarns used for garments and shoes. Geotextiles—strong synthetic fabrics used in civil engineering—are permeable (porous; needle-punched). They allow water and other liquids to drain, filter, or separate; prevent erosion; and reinforce roadways. Fiberglass yarns have high tensile strength (are stretchy) and are used to resist abrasion and high heat. Window treatments, such as E-Glass, and ceramic product surfaces are some of the uses of fiberglass yarns. An Illinois company—Fabric Images, of Elgin—is a worldwide producer of fabric structures for commercial interiors, museums, events, and exhibitions. Review the company's product gallery at <http://www.fabricimages.com/gallery.html>. Think of other ways fabric could be used to enhance daily life and work.

Web Links:



Cotton Fibers

<http://www.engr.utk.edu/mse/pages/Textiles/Cotton%20fibers.htm>

Using Fabric to Create a Retail Store of the Future

<http://blendconcepts.com/2014/02/using-fabric-to-create-a-retail-store-of-the-future/>

How to Make Yarn

http://www.ehow.com/how_6395701_make-yarn-out-wool.htmlvarieties

Yarn Fiber

<http://suite101.com/article/yarn-fiberanimal-fiber-in-yarn-a136143>

Synthetic Yarns

<http://www.filspec.com/synthetic-yarns.com/>