FEATURED EBOOK

Webbing 101:

Properties, Materials, and Techniques

BRM
Bally Ribbon Mills

What is Webbing?

Webbing is a woven fabric that comes in a variety of material compositions, widths, strengths, and fibers. Often used in place of rope, webbing is a versatile component found in everything from daily applications like backpack straps, automobile safety, and towing, to extreme equipment for climbing, parachuting, and intense military operations.

This adaptable component can be either flat or tubular, with each form offering unique properties. Flat webbing, such as a car seatbelt, consists of strong, solidly woven fibers. A flat tube of webbing, found in climbing and industrial gear for example, is more flexible than standard flat webbing.

Webbing appears in a multitude of operations and industrial sectors. Some common applications and associated industries include:

- Military soft goods including parachutes, packs, cargo, and harnesses
- Fire safety gear for fire fighters
- Seatbelts and harnesses for automotive
- Hiking and backpacking gear for sporting good retail apparel
- Personal protective equipment for oil and gas workers and electrical line workers

Types and Properties

The two common styles of webbing are flat (solid) and tubular, each offering different functions.

Flat webbing, which consists of solidly woven fibers, is available in varying degrees of thickness and width. This style can achieve different breaking strengths depending on its weave and is able to carry out many basic applications. Among them, the flat shape is suited well for applications where material can be sewn into a larger product, like backpack straps, seatbelts, and reinforcement bindings. It is often stiffer than tubular fabrics.

Tubular webbing is generally thicker and more flexible than flat webbing. It works well in filters, coverings, and hoses where a tube is needed, although it too, can lie flat. Tubular webbing's soft and pliable nature allows for different uses than its flat counterpart. A flat tubular is less susceptible to wear and tear and therefore able to handle dynamic functions such as holding knots and is used in climbing, safety harnesses, and certain parachute applications.

Common Webbing Materials

While traditional webbing used to be made of natural materials like cotton or flax, modern types are now more frequently made from synthetic fibers such as nylon. For extreme applications, webbing can even consist of high-strength materials like Kevlar® or Dyneema®.

Some of the most common webbing material compositions include:

- **Nylon** — Both high strength and flexible, nylon has good elongation properties as well as good chemical and environmental resistance characteristics. Nylon can be dyed to virtually any color.
- **Polyester** — Durable with similar aesthetics to nylon, polyester is suitable for applications that require lifting heavy loads. It has high abrasion resistance, mildew and rot resistance, and low water absorption. This material is commonly used for race harnesses and seatbelts.
- **Kevlar®** — A high strength synthetic fiber, Kevlar® is often used as a reinforcing agent for high impact applications such as military equipment and protective gear.

Types of Weaves

Weaving refers to the method by which two sets of textile threads are interlaced perpendicularly, typically on a loom, in order to create a fabric. The lengthwise threads are called the warp and the crosswise threads are called the weft. The interlacing between the warp and weft is referred to as the weave pattern.

Different weaving patterns, types of yarn, and warp to weft proportions lend distinct properties to the finished cloth. The most basic weaves include the following:

Plain

The simplest and most common weave pattern is the plain weave. With this method, warp and weft yarns are woven to form a simple crisscross or over-under pattern. Plain weaves are inexpensive, durable, flat, and have a tight surface that lends itself to printing and other secondary finishes. Used in many binding applications, it is generally stronger than other weaves because it has the most interlacement.

Satin

A bit more complicated yet more flexible than plain weaves, satin weaves typically have a glossy surface and dull back, with the high luster coming from the high number of floats on the fabric. Satin weaves are soft and drapeable, but are more susceptible to abrasion than plain or twill weaves.

The name of this weave style is subject to change depending on the materials used. It's referred to as satin when weaving filament fibers such as silk or nylon, and sateen when weaving short-staple yarns such as cotton.

Twill

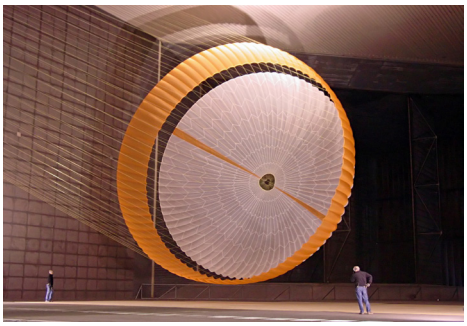
Unlike plain and satin weaves, twill weaves have a more complex pattern of diagonal parallel ribs, and are softer than plain weaves. This style is heavier, more durable, and more flexible than a plain weave, as well as wrinkle and soil resistant, making it useful for more complex binding applications like high-strength slings, harnesses, and seatbelts.

Twill weaves can be classified from four points of view:

- Way of construction (warp-way or weft-way)
- Direction of twill lines on fabric face (left-hand twill weave or right-hand twill weave)
- Face yarn (warp face twill weave, weft face twill weave, double face twill weave)
- Nature of the produced twill line (simple twill weave, expanded twill weave, multiple twill weave)

Basket

Basket weaving is a variation of plain weaving that is stronger and more flexible but less stable than the original method. Used throughout the composites industry, basket woven fabrics have a loose construction and a flat look.



If the designer uses advanced weave architecture, the most complex 3-dimensional weaves are possible; these are often used in the highest performance space and aerospace applications.

Processes of Weaving

Naturally achieving a diverse range of weaving patterns requires different weaving processes and techniques.

Common fabric production methods include:

- **Shuttle Loom** — capable of precise uniformity, this method manufactures seamless tubular material.
- **Needle Loom** — also known as a shuttleless loom, this is a newer, high-speed loom that uses manufacturing efficiency and economies of scale to reduce costs for larger runs.
- **Jacquard Loom** — utilizing a computer controlled CAD design system; this method allows for almost endless weave design capabilities producing the most advanced webbing on the market. Jacquard looms can also weave designs or logos into fabrics using different colored yarns, and are considered more durable than if they were printed onto the fabric.
- **Braiding** — specialized braiding capabilities include engineered flat braids, collapsed and assembled biaxial and triaxial braided tubular fabrics, "T" and "J" shapes for non-planar surface applications, and mandrel over-braids.
- **Specialty Broadcloth** — this method is most often utilized for R&D and special projects.

Testing

During every stage of production, various properties of narrow woven tapes and webbing must be tested to meet strict guidelines, specifications, and standards.

Common specifications include:

- **Mil-Spec/PIA Spec** — Nylon, Kevlar®, and Nomex are a few of the many fibers used to manufacture the highest-quality and highest performance woven narrow fabrics for critical use applications. For Military and Parachute Industry Association (PIA) specifications, Class 1, 1a, and 2 weaving methods are typically used.

- **UL Specifications** — Safety webbing and tapes meet the strict demands for fire, industrial, military, and commercial applications. Specifications for the safety industry include NFPA 1977-2016, NFPA 1971-2013, and more.

There's a variety of tests done to ensure a production lot meets desired specifications. Each test report is uniquely designed to match the appropriate specifications, and the proper documentation is then issued to the customer after testing.

Some of these properties include:

- Tensile strength
- Weigh (in ounces per yard)
- Abrasion testing
- Color fastness
- Accelerated aging
- Density and/or porosity
- pH testing
- Thickness and width (to determine if the webbing needs to fit through buckles or other findings)
- Stiffness testing

About Bally Ribbon Mills

With almost a century of hands-on experience designing, developing, and manufacturing specialized webbing, tapes, and specialty fabrics for a broad range of industries, Bally Ribbon Mills has the expertise you need to succeed.

For more information about how we can help with your next specialty textile, **contact Bally Ribbon Mills** today.

Learn More About Our Narrow Woven Tapes & Webbing

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