**Denim Construction**

Denim is made from rugged tightly woven twill, in which the weft passes under two or more warp threads. Lengthwise, yarns are dyed with indigo or blue dye; horizontal yarns remain white. The yarns have a very strong twist to make them more durable, but this also affects the denim’s color. The yarns are twisted so tightly that the indigo dye usually colors only the surface, leaving the yarns center white. The blue strands become the threads that show on the outside of your denim, and the white are the ones that make the inside of your denim look white. This produces the familiar diagonal ribbing identifiable on the reverse of the fabric. Through wear, the indigo yarn surface gives way, exposing the white yarn underneath which causes denim to fade. Jeans are basic 5 pockets pants, or trousers, made from denim. The word comes from the name of a sturdy fabric called serge, originally made in Nimes, France. Originally called serge de Nimes (fabric of Nimes), the name was soon shortened to denim (de Nimes). Denim was traditionally colored blue with natural indigo dye to make blue Jeans, though “jean” then denoted a different, lighter cotton textile; the contemporary use of jean comes from the French word for Genoa, Italy, where the first denim trousers were made. Jeans transcend age, economic and style barriers. Washes, embellishments, leg openings and labels fluctuate with fashion whims, but jeans themselves have reached iconic status.

**Common terminology used in Denim fabric construction and processing**

**ANTI-TWIST** is a step in the finishing process, before sanforization, that corrects denim’s natural tendency to twist in the direction of the diagonal twill weaves. It is also known as skewing.

**BLACK-BLACK DENIM** is a term used for denim where the warp yarn is black instead of blue and which is also dyed black after weaving. This makes the jeans truly black rather than gray.

**BROKEN TWILL** is a denim weave invented by John Neil Walker in which the direction produced by the weft thread is reversed after not more than two passages of the warp to create a sporadic design – a zigzag weave pattern.

**BULL DENIM** is a heavyweight denim weave (14oz. plus) with a typical 3x1 twill construction. An ecru fabric, bull denim is later printed or garment dyed.

**CROSSHATCH** is a unique type of denim that shows a square grid-like pattern in the weave. It is created by mixing uneven yarns in both the weft and warp directions.

**DENIM** is an indigo-dyed cotton twill fabric in which the weft passes under two or more warp fibers. The term derives from ‘Serge De Nimes’, the French city where it was produced; but denim and Serge De Nimes are in fact different fabrics.
**Denim – Common Terminology**

**Dips** are used to describe fabric or yarn when they are immersed in dye. Indigo yarns are usually dipped in an indigo bath six times.

**Dual Ring-Spun** is also called “ring X ring”. Signifies a denim weave in which both the warp and the weft threads are made of ring-spun yarn. It creates a much softer and textured hand than both open-end and regular (single) ring-spun denim. Due to higher production costs it is usually only used by higher end, premium denim labels.

**Hank Dyeing** is a very special dyeing process that very few people use. The yarns are loosely arranged in skeins or hanks. These are then hung over a rung and immersed in a dye bath being dipped in and out and left to oxidize in the air between each dip giving the yarns a natural irregularity of patina and caste. In this method, the color penetration is the best and the yarns retain a softer, loftier feel.

**Indigo** is common dye used for denim, initially taken from the indigo Fera Tinctoria plant. The majority of indigo used today is synthetically made. Natural indigo has a slightly red cast.

**Left-Hand Twill** is also known as an ‘S Twill’, this is a weave in which the grain lines run from the top left-hand corner of the fabric towards the bottom right. Usually in piece dyed fabrics, left hand twill fabrics are woven from single plied yarns in the warp. Left-hand twills will often have a softer hand feel to them after washing than right hand twills. This twill is also much more difficult to produce, since it requires more attention in the sanforization and finishing processes.

**Loop Dyeing** is one of the three major industrial methods of dyeing the indigo yarns. In the loop dyeing process, the yarn is dyed in a single bath instead of several. The desired depth of color is attained by passing the yarn through the vat several times. Subsequently as part of the same process, the yarn is sized.

**Mercerization** is an industrial process used on yarn or fabrics to increase its luster and dye affinity. For fabrics used in the denim industry, mercerization can be used for keeping dye on the surface of the yarns or fabrics and to prevent dyes from fully penetrating the fibers.

**Natural Fibre** can be any hair like raw material directly obtainable from an vegetable, animal, or mineral source that can be converted, after spinning, into yarns and then into woven cloth.

**Natural Denim** is a type of ring-ring denim which is naturally uneven in warp and weft.

**Natural Dye** is natural dye made from vegetable origin. Natural indigo is one of the most important dyes for denim fabric.

**Open End Denim** is so called when Open End or OE spinning was introduced in the 1970s, reducing costs by omitting several elements of the traditional spinning process. The cotton fibers are ‘mock twisted’ by blowing them together. Open End denim is bulkier, coarser and darker, because it absorbs more dye, and wears less well than Ring Spun denim.

**Organic Blue** is a name given to an indigo dye that has a slightly reddish tint.

**Over Twisted Denim** is made from yarn that is over twisted, giving the fabric a particular crinkled surface.

**Polycore Denim** is often found in replica jeans, offers the best mix of strength of polyester core and vintage aesthetic of cotton top thread layer.
OXIDATION occurs when oxygen and another substance chemically react. This occurs when indigo yarn comes out of the bath between dips.

PIGMENT DYES do not have an affinity for fiber and must therefore be held to the fabric with resins. They are available in almost any color and are used extensively in the denim industry by fabric dyers who want to create fabrics that fade more easily.

PLY- All yarns are single ply unless twisted with another yarn. Plied yarns are used to make yarns stronger. In the denim industry, it has become important to ply yarns in piece dyed fabrics that are intended to endure a long stone wash cycle. The method of twisting and length of each yarn is a major determinant in the ultimate look and feel of the finished fabric.

PRINTED DENIM is that has been printed with a pattern—a batik, stripe, floral or special graphics, for example—often in contrasting colors and aimed at response to the fashion trend.

QUARTER DIP is a shortened dyeing process normally used for chambray and lightweight denims, in which the number of indigo dips is reduced to two or four, instead of the usual six to eight, resulting in a lighter shade of blue.

RAPID SKYING is a patented oxidation process developed by Tessitura di Robecchetto Candiani in 1992 that speeds up the skying step of the indigo dyeing process and therefore shortens the indigo dyeing technique.

RED INDIGO is a special synthetic dyestuff that’s a lighter shade of blue originally used as an alternative to real indigo when there was a shortage of the natural dye. Had a peak period in the ‘60s, and resurfaced as a selling attraction in the ‘90s. It is also known as Hydron Blue.

REVERSE DENIM is a novelty use of denim when it is turned inside out to give jeans a really different look.

RING-SPUN DENIM—Ring spun yarns were traditionally used in denim up until the late 1970s, but were later exchanged by using cheaper Open End yarns. This is a spinning process in which the individual fibers are fed onto the end of the yarn while it is in the ‘twisting’ stage. The process consists of a ring, a ring traveler and a bobbin that rotates at high speed. The ring-spun yarn produced by this method creates unique surface characteristics in the fabric, including unevenness, which gives jeans an irregular authentic vintage look. Ring-spun yarns add strength, softness and character to denim fabric.

RING-RING DENIM or double ring-spun denim uses ring-spun yarn for both warp and weft. This is the traditional way to produce denim. It’s possible to combine a ring-spun warp fabric with an Open End weft, to get much of the strength and look of the traditional ring/ring denim at lower cost.

RING DENIM is a traditional type of denim fabric, revived in the late ‘80s and early ‘90s, using ring-spun yarn for the warp. It is characterized by a softer hand and an uneven surface appearance.

RING DYEING is a process which describes a characteristic unique to indigo dye in which only the outer ring of the fibers in the yarn is dyed while the inner core remains white.

ROPE DYEING is considered the best possible method to dye indigo yarns. The threads of denim yarn are twisted into a rope, which is then fed through sequence of being dipped into a bath of indigo dye, followed by exposure to air, multiple times. The frequency determines the ultimate shade of blue.
SANFORIZATION is a pre-shrinking fabric process that limits residual fabric shrinkage to less than 1%. The process includes the stretching and manipulation of the denim cloth before it is washed. Raw, un-sanforized jeans will shrink 7-10% after the first wash, and continue to shrink slightly up to the third wash. Developed in the late 1920s by the Sanforize Co. and patented in 1928.

SELVAGE or selvedge came from ‘SELF-EDGE’ is also referred to as ‘Redline’ or ‘AkaMimi’. Selvage is the narrow tightly woven band on either edge of the denim fabric, parallel to the warp. A selvage end prevents the edge of the denim from unraveling. In some fabrics selvages are closed, whereas on larger modern weaving machines, the weft yarn is cut on every pick, creating what is called a ‘fringe’ selvage.

SHRINKAGE- Traditionally before denim is woven, the threads it’s made of are treated with wax or resin to stiffen them and make them easier to weave (although with most repro denim starch is used instead.) When dry/raw/unwashed denim is washed for the first time the fibers constrict and the denim shrinks. Raw denim can be Sanforized (treated with a sanforizing process that lessens shrinkage) but all raw denim will shrink to some degree upon immersion in water, up until its third wash.

SLASHER DYEING is one of three main methods of dyeing indigo yarn.

SPANDEX is generic name for man-made fibers derived from a resin called segmented polyurethane. It has good stretch and recovery properties. Special attention is required during denim washing in order to maintain their properties.

SULPHUR BOTTOM is a term used when manufacturers apply a sulphur dye before the customary indigo dye; this is known as Sulphur Bottom dyeing. This can be used to create a grey or yellow ‘vintage’ cast.

VENETO is a northern Italian region considered the cradle for some of the most successful names of the International jeans industry. Denim brands such as Diesel, Replay, Gas and Seal Kay were all born and raised here as were famous laundries such as Martelli.

VINTAGE is from the past; old or second hand. Vintage jeans can either be previously worn or never worn and sorted in their original state.

WEIGHT of denim is traditionally graded by its weight per yard of fabric called as oz.

YARN DYE refers to fabric in which the individual yarns are dyed prior to weaving- denim is a yarn dyed fabric as the warp yarn is dyed with indigo.
Denim Jeans – Fits and Types

Jeans based on cuts and shapes
High rise, Regular rise, Low-rise, Super or Ultra-low-rise for different fits.

<table>
<thead>
<tr>
<th>RISE OPTIONS</th>
<th>HIGH RISE</th>
<th>REGULAR RISE</th>
<th>LOW RISE</th>
<th>SUPER LOW RISE</th>
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<tbody>
<tr>
<td><strong>11” RISE OR MORE</strong></td>
<td>11” RISE OR MORE sits above natural waist (waistband covers the navel), approx. 6 1/2 - 8” zipper</td>
<td>9 1/2 - 11” RISE sits at navel (waist sits just below the navel), approx. 4 1/2 - 6” zipper</td>
<td>7 - 9 1/2” RISE sits below navel (waistband sits 2-3” below the navel), approx. 2 1/2 - 4” zipper</td>
<td>7” RISE OR LESS sits several inches below the navel (waistband sits 4-5” below the navel), approx. 1 - 2” zipper</td>
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Jeans based on leg style types
Skinny, Straight, Boot-Cut, Flare and Fuller Leg for body and leg style types

<table>
<thead>
<tr>
<th>LEG STYLE OPTIONS</th>
<th>SKINNY snug in the seat, thigh and leg</th>
<th>STRAIGHT same width at thigh, knee and leg opening</th>
<th>BOOT-CUT slightly flared to fit over boots</th>
<th>FLARE narrower at knee with flared opening</th>
<th>TROUSERS fuller leg from hip down, wider hem</th>
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Denim – Jeans Manufacturing and Washes

Introduction
Jeans can be made in both small scale for very rare custom made highly priced types or bulk and mass produced at large factories which are able to produce about 2-3,000 pairs per day. Usually these big factories are fully equipped for cutting, printing, embroidery, sewing, washing and finishing processes.

Pre-Production and Cutting
Designers start designing Jeans keeping in mind the brand aesthetics, current fashion trend and merchant’s feed back on customer requirement. Jeans are designed for a certain type of denim, with a pattern created for that particular variety of textile keeping in mind wash process to be used while finishing the jeans. Stretch denim will need a different sort of construction than non-stretch denim, so patterns must be specific to the fabric to get the desired fit. Shrinkage during washing of jeans is a very important factor kept while making paper pattern to ensure that the final product fits well. After the pattern is produced and sloped to make a whole range of sizes, cutting marker (all parts of jeans along with other required sizes) is made which goes to the cutting floor. At cutting room, marker layering is done which could be anything from 5 to 100 depending on the method used for cutting. Some factories cut the layers using hand held straight knife cutting machine or fully computerized automatic cutting tables. Cutters must be careful to follow the lines, or cut parts will be unusable. These layers of fabric are cut into pieces for legs, pockets, yoke, waistband etc. The pieces are numbered, bundled together ready to go.

Sewing and Finishing
The jeans cut pieces head over to the sewing machines, where they’re sewn by workers on industrial sewing machines. At sewing floor skilled sewing machine operators sew according to predefined seams and seam allowances. An industrial machine can sew very fast so these employees must be highly skilled to avoid injury and can handle production properly during fast sewing. Afterward, the stitched jeans undergo dry processes like grinding, scrapping or resin pleating etc, washed in industrial machines and processed for tinting etc. This can mean bleaching, dyeing or stone washing, as well as other embellishments. When this step is completed, workers apply branding labels and hangtags price tickets, adhesive size strips, ending the process by bagging the finished garment in a poly bag or box as requested by buyer.

Common production, washes and special dry finishing terms for Denim wear
ABRASION is a process of making garments look worn and aged by scraping or rubbing the surface of the fabric causing abrasion. Pumice stones are most frequently used by industrial laundries.

ACID WASH is also called as Marble or Moon or Snow Wash. This finish gives indigo jeans sharp contrasts. The process is achieved by soaking pumice stones in chlorine and letting these stones create contrast. The process was created in Italy and patented in 1986.

AGED is a kind of wet processing that gives the garment an artificial worn look and a softer feel through prolonged abrasion

ATARII is a Japanese term describing the selective fading of the ridges of creases. The most common areas for ‘Atari’ are along side seams, on the front and back of the knees, the upper thigh, along the hem, on belt loops and along pocket seam.

BLEACH is a chemical used to make denim fade. Liquid bleach is usually an aqueous solution of sodium hypochlorite, and dry powdered bleaches contain chloride of lime commonly known as calcium hypochlorite.

BOLD AUTHENTIC is jeans wear term used to describe both original jeans qualities and stone and enzyme wash optics. It became a marketing buzzword in the early 90’s. Characteristics of authentic jeans are traditional fabric weaves and styling details.
Denim – Washing and Finishing Processes

**DESIZING** is a rinse process used to soften denim. During the de-sizing step, the amylase enzyme attacks the starch and removes it from the fabric. Although this process reduces color slightly, it is primarily used to give softness and draping ability to denim.

**ENZYME** is a biological chemical compound that reduces complex organic compounds to simpler compounds. It is organic, non-toxic and is readily broken down thus environment friendly. Due to its natural origins it is biodegradable and does not last long in the water supply in the environment.

**ENZYME WASH** is a fabric finish that uses cellulose enzyme to remove surface fuzz from cellulotic fabrics. The celluloses are used because they loosen up the indigo dye in the denim. Making the denim appears worn, rugged, broken in and used. Although this wash “eats away” at the fabric, it does not jeopardize its strength to hold up; it creates a great vintage look without damage.

**GARMENT DYE** is a dyeing process performed on finished garments, as opposed to a yarn dye, which takes place prior to the weaving of yarn.

**GRINDING** creates the look of age and wear. It is generally applied to hems, seams, belt loops, pockets and waistbands.

**HAND** is a description of the way a fabric feels. A subjective judgment of the feel or handle of a fabric used to help decide if a fabric is suitable for a specific end use. The hand can be described as crisp, soft, drapable, smooth, springy, stiff, cool, warm, rough, hard, limp, soapy etc. Finishing and garment wash will affect the final hand of a fabric.

**LAUNDRY** in ‘Denim Industry’ is a Laundry is as well as a manufacturing company that takes unwashed jeans and processes them to achieve the desired effect. This processing includes washing, stone washing, sandblasting, garment dyeing, finishing, use of special machines with abrasive bristles, applying enzymes to simulate a ‘whisker’ effect and sand papering by hand. Laundries today are critical in making jeans look commercial and wash development has become as important as fabric development in the denim industry.

**MICROSANDING** is a fabric treatment process, which is used to create a soft, seeded hand with a raised surface finishing. Some color reduction is experienced.

**MILLWASH** is a term referring to denim fabric that is delivered already washed to cutters or garment manufacturers.

**OVERDYING** is a process that can take many forms. The blue yarn can be over dyed black, known as black change blue. Blue or black denim can also be over dyed with contrasting brilliant colors, for unusual shade effects. Or indigo jeans can be bleached to neutral and then over dyed with a vivid bright color.

**PETROLEUM WASH** is a denim finish developed in 1992 by the U.S. brand Willi Wear. Left-hand denim is enzyme-washed until it has lost most of its color. It is then over dyed and put through a silicone wash, which gives it an oily coating, and, in turn, a super-soft, butter-like hand.

**PLACED** is a term used to describe sanding that is concentrated in certain areas, such as the bottom, knees and pockets, to create a natural worn out look, also known as localized abrasion.

**PLATED** is a form of finishing that gives a stonewashed appearance to Jeans wear using natural earth pigments. It looks real, but it’s a trompe l’oeil.

**PUMICE STONES** are volcanic stone used for stone washing garments. Pumice is popular because of its strength and light weight. Before the use of pumice, rocks, plastic, shoes and just about every other material was used to wear down and soften denim during the laundry process.

**RESIN BAKE CREASES** is a relatively new finishing treatment. The process seeks to replicate the look of permanent creases which normally would occur only after repeated wear and abuse heaped on specific areas.
**RIVET** is a metal tab that is placed at stress points to be used for reinforcement to prevent tearing as well as nonfunctional ornamentation.

**RIVER WASHING** is a washing process using a combination of pumice stones and cellulose enzymes to give denim a vintage, worn hand. The washer is loaded only with stones and fabric for the first cycle. Enzymes are introduced for the second stage in combination with the stones and they are tumbled until a naturally aged look is produced.

**SHADE BLANKET** is a common term used by denim jean manufacturers. It is a process when fabric is cut from each roll of fabric and sewn together with roll numbers on the back of each roll. This is an important tool in cutting apparel made from denim to ensure that garments from the same shade group are cut.

**SHADE BATCHING** is a process of selecting batches of fabric into homogeneous shade lots to obtain consistent color continuity in garment making.

**SANDBLASTING** is a laundry process performed before washing in which jeans are shot with guns of sand in order to abrade them and cause a worn appearance. While originally done by hand this process is now automated at most large laundry houses.

**SHRINKAGE** - Traditionally before denim is woven, the threads it's made of are treated with wax or resin to stiffen them and make them easier to weave (although with most repro denim starch is used instead.) When dry/raw/unwashed denim is washed for the first time the fibers constrict and the denim shrinks. Raw denim can be Sanforized (treated with a sanforizing process that lessens shrinkage) but all raw denim will shrink to some degree upon immersion in water, up until its third wash.

**STONEWASHING** is a process that physically removes color and adds contrast. Jeans and stones are rotated together for a set period of time. The washing time dictates the final color of the fabric - the longer the denim and stones are rotated the lighter the color becomes and more abrasion and contrast is achieved. The denim is then rinsed, softened and tumble dried.

**TINTING** is a dyeing process in which additional color is applied to the fabric or garment to create a different shade or cast. ‘Dirty Denim’ is often created by applying a yellow over dye to denim. By localizing the application of the tint, you can create specific areas that look dirtier than the surrounding areas.

**USED WASH** is a term referring to a type of placed abrasive effect or sandblasting, made individually on each garment in special areas like the knees, pockets, thighs, bottom etc.

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**WASH** is so called when the color and texture produced by the finishing process of washing the jean; creates varying results, such as an aged appearance or enhanced softness and can include applying colored dye and resin.

**WHISKERING** is a manual process of creating fading of the ridges in the crotch area and back of the knees, which gives the appearance of aged denim. It can also be inverted - dark creased in faded denim.