

DENIM **Processing**

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The History of Denims

Denim jeans woven by traditional American cotton textiles is the cloth with diagonal warp striped {blue or black} contrasting with undyed white threads to form a woven pattern. This cloth was mentioned as Hickory cloth. Hickory is a characteristic of rugged as it was made out of the nickname of RICHARD. Records of a group of Networkers headed for the California gold fields in 1849 revealed that they used along four hickory shirt pieces and this is used in fatigue pantaloons and shirts in the American Civil War.

Introduction

The denim refers to a “strong cotton twill textile material “which is formed by the weft yarn passes under two or more warp yarns and the reverse of the denim fabric resembles like a diagonal ribbed structured fabric.

After weaving of the denim fabric, it must be treated mechanically and chemically to give it a correct dimensional stability, pleasant and soft handling in both warp and weft directions to prevent shrinkage in further washing and finishing. The denim garment washing and finishing mainly focuses on the importance of warp yarn.



Terms of Denim:

Atari: A term describing the selective fading of ridges and creases on a pair of jeans.

Iro-ochi: A term referring to the fading of indigo dye in the exposed areas of denim.

Tate-ochi: A term referring to the occurrence of fading and forming in vertical lines in vintage denim.

Pretreatment of the Denim:

The raw denim garment is first lightly singed and scoured with a blend of phosphate esters. Then the fabric is subjected to two types of washings i.e. open width and rope washing. In open width washing the percentage of starch and other non-fibrous materials that present on the fabric will go off. In case of rope washing whatever the rope marks and creases present on the fabric will be removed by dyeing the fabric by placing it under great tension then the fabric is softened and lubricated using wetter and softeners. Finally at the end undergoes compressive shrinking (sanforizing). After

sanforizing denim fabric is subjected to finishing process. Then the fabric is pre-shrunk so that it will maintain its shape and remain the shrinkage in the range of 0 to 2 %.

Denim Washing:

Denim washing is a type of finish which is given to the denim fabric to enhance the



good appeal and also to provide strength. There are two types of denims like dry

denim and wet denim. The dry denim is not washed after being dyed during its production whereas the wet denim is washed and finished.

Types of Denim Washing:

Laundry is a manufacturing company which is a part of denim industry which takes the un washed jeans and process them to improve the hand feel of the denim and also recreate the naturally occurring wear patterns like whiskers (on the thigh and crotch), stacks (on the ankles), honeycombs (on the back of the knees) when it is rubbed or creased. There are different types of laundry techniques which are used for washing and finishing of denim they are.....

1. Chemical washes: Enzyme washing, Denim bleaching, Acid washing.
2. Mechanical washes: Stone washing, Micro sanding.

Chemical Washes of Denim:

1. Enzyme washing:

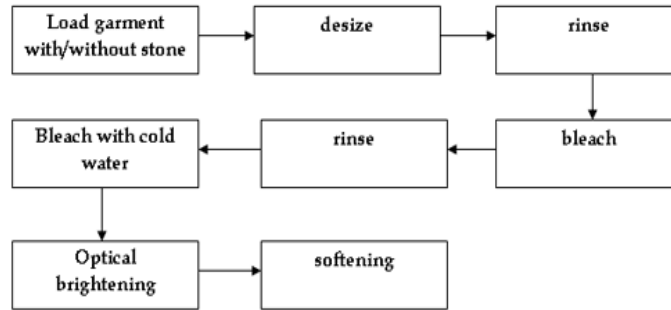
It is an eco friendly washing, involves the application of organic enzymes that eat away the cellulose of the fabric. The alkalinity of the bath and its temperature can be stopped whenever the desired color is achieved. After washing, fabric goes for final rinsing and softening. Use of cellulosic enzymes causes color contrast, seams, hems, pockets noticeable. Acid cellulose enzymes produce less color contrast than neutral.

2. Denim bleaching:

It uses sodium hypochlorite or $Kmno_4$ during washing with or without addition of stones produces discoloration effect depends on the strength of bleach liquor quantity, temperature, time. After bleaching, the fabric is anti chloride or after washed with peroxide to minimize yellowing.



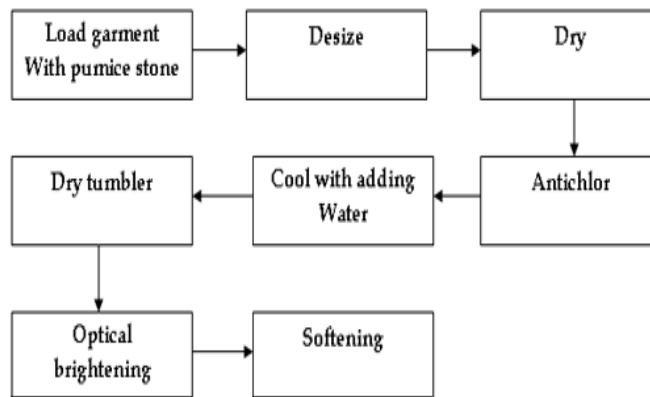
Process cycle:



3. Acid washing:

It uses sodium hypochlorite or $Kmno_4$ for localized bleaching which results non uniform sharp blue/white and color contrast can be enhanced by optical brightening agent. It doesn't require water for processing.

Process cycle:



Chemicals used on denim:

Bleach fast indigo, anti-depositing agent, dyestuffs with softener, anti-creasing agent, wrinkle forming agent and white pigment.

Other Chemical Process: Rinse washing, cellulose washing, ozone fading, snow washing, salt water denim, flat finish, over dye, sun washing, super dark stone method and quick wash denim.

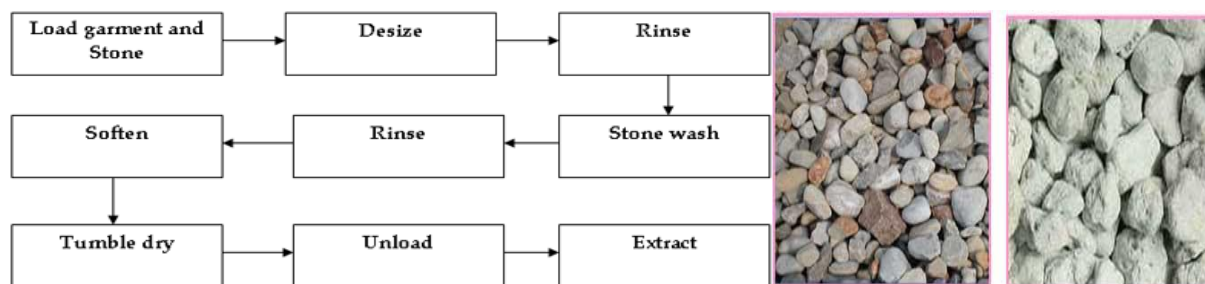
2. Mechanical Washes of Denim:

1. Stone washing:

It is done by loading the garments and tumbling with pumice stones. Variations of stones such as composition, hardness, size, shape, porosity which gives additional effects of a faded look or worn look as it gives a sandpaper look and removes some dye particles from its surface. Selection of stone is important as for a heavy fabric uses hard and large stones where as for light weight fabric uses delicate stones.

Stone weight/fabric weight=0.5-3. It depends on the degree of abrasion required to achieve the desired result.

Process cycle:



2. Micro sanding: Sand blasting

It is purely mechanical process gives distressed or abraded look by blasting an abrasive granular, powdered material through a nozzle at very high speed and pressure on the desired area of the fabric where we need design. It is water free so no drying required and we can obtain many designs through this technique.

Other Mechanical Processes: Water jet fading, super stone washing, ice washing, thermo denim and laser technology finish.

Some uncommon Denims:

Whiskering: It produces wrinkles near the crotch and knees which looks like white lines done by laser, sand blasting, machine sanding, hand sanding, and abrasive rods.



Batching: A batch is attached on the denim fabric firmly usually seen in kids wear jeans and school jackets.

Crushing: Denim jeans gives a goffer look when it is washed that is obtained by using over twisted weft yarn with a textured effect through wet processing, then it subjected to bleaching and stone washing.

Dirty washing: It gives a finish that resembles like stains on jeans.

Embroidered jeans: It replaces the printed jeans by means of embroidery mostly used in high-end denim of Japan.

Tearing and ripping: Denim jeans that are purposely ripped or tore and not prior repaired to sale.



Frayed jeans: It is a finish which is given at the waist band and hems of denim jeans to create a “worn” effect.



Bubble gum denim: Denim which contains 35-50% stretch.

Coloured denim: Jeans which is woven with dyed yarn either warp or weft .It can also be obtained by piece dyeing method.

Denim from fox fibre: This type of denim is woven by coloured cotton fibre that has developed and patented by California cotton breeder Sally Fox.It is also available in “Coyote brown” with red and green shades grown in California ,Arozona ana Texas.

Ecrudenim: The denim which is not having dyed yarn that is only grey yarn in warp and weft.

Printed denim: Floral or batik pattern is printed on the denim often in contrasting colours mainly for adolescens.

Reverse denim: The denim which looks like similar on both the sides.

Short gun denim: Denims that have been shot with a gun and sometimes washed to the extreme condition resulting in small holes.



Petroleum washed denim: The denim which is enzyme washed ,then over dyed again and washed with silicon in order to give oily coating and in turn a super soft ,butter like handle.

Pinto wash denim: Millions of yards of denim fabrics were soaked with water, then dried it results in uneven dyeing effect on the fabric, the denim is called as pinto washed denim.

Peach skin denim: This denim is produced by the formation of fine protruding, hair like covering similar to the surface of a peach. The extent of this effect depends on the fabric used as well as on the cellulose dose and treatment time.

Denim Finishing: Objectives

1. Control of shrinkage within a range of 0-4% within the fabric rolls and between the fabric rolls.
2. To provide lubrication for quality Sanforizing-improves the stability in garment cutting by the application of stiffening agent.
3. To reduce the damage from needle burn using sewing lubricant.

Why fabric shrinks?

During the weaving of a fabric under tension, the yarns in the fabric are stretched beyond their natural length. When the denim garment is washed and agitated the relaxation of yarns take place and turns to minimum length .Due to variation in tension at weaving process produce variations in the shrinkage of the fabric.

Finishing Recipes:

1. Sanforizing Lubricants: To maintain consistent shrinkage it is required .The shrinkage of the fabric reduces when the sanforizer mechanically pushes the weft yarns together with high degree of friction between the rubber belt and the denim.
2. Sewing Lubricants: During the formation of a garment sewing needles subjected to friction with the fabric it results in heat. This heat causes damage to the needle and also produces holes in the fabric. This lubricant reduces the needle costs, improves garment cutting and results in better quality of a garment.
3. Stiffening agent: It is also called as hand-builders, required to maintain the stability of the fabric during cutting to avoid “snapback”. Snapback occurs when the weft yarns are stretched during cutting, causes the garment panel shrinks to a width less than the actual width and produces distorted garments.
4. Finishing chemicals: The best Sanforizing (8 grams of 100% softener per kilogram of fabric) is produced by a non ionic, fatty acid softener based on stearic acid. Poly ethylene (2 grams of 100% per kilogram of fabric) is the best as sewing lubricant and 40 or 90 fluidity tapioca starch is the best hand builder used for denim fabric.

Finishing Procedure: Sanforizing

In finishing of the denim the chemical application should be uniform and which should not penetrate in to the fabric .Wet pick-up of the fabric should be at least 70%. In sanforizing it is necessary to maintain four variables which are required for shrinkage, fabric defects and elongation they are temperature, Moisture, quantity of pressure and time of pressure.

1. Critical temperature: There are three critical temperatures:

- ❖ The temperature (105-125) in steam heated cylinder heats the rubber belt; it should not be too high or too low to provide consistent compression. It will be 140 degrees for heavy weight denims (12-15% potential shrinkage)
- ❖ The temperature required for drying the denim in the Palmer Unit.
- ❖ The temperature of the fabric when it enters the (80 degrees) 14% moisture provide a adequate fabric elasticity, gives better control of the moisture when we spray the cooling water at the sanforizer, followed by heating before the rubber belt.

2. Sanforizing moisture control:

1% moisture should be applied for each oz/square yard. This moisture is controlled by drying cylinders then the fabric passes directly to the sanforizer. Finally 4-5 % of moisture is required to stabilize the fabric compression. If it is high leads the fabric to elongate which increase final shrinkage. If it is low leads to elongate after absorbing moisture from the air. In separate sanforizing process the denim is dried about 6% moisture, which provides better control.

3. Pressure (% of compression):

Sanforizing is a form of mechanical shrinkage .When the 10 % compression is applied by the rubber belt will result in the weft yarns being pushed together which decreases the shrinkage by 10 points.

4. Time of compression:

There is 15% of shrinkage in a denim fabric as it arrives from weaving. The time of pressure is determined by the speed of sanforizing should be low for better control of shrinkage. The heat, moisture and time of pressure determine the control of shrinkage.

Conclusion:

Denim washing and finishing is the most difficult of all apparel fabrics. Control of fabric quality requires a higher level of control which begins at weaving of fabric. In each step of garment treatment all the conditions like moisture, temperature, time etc should be monitor and controlled. With the invention of washing and finishing of denim garments it has become very easier to the textile industry. By this invention the cost and time required is less for producing and manufacturing denim garments and also saves the money gives better quality denim garments at a more affordable price.

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