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## 1. The history of denim

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A popular conception of the etymology of the denim is that it is a contraction or derivative of the French term SERGE DE NIMES. Denim was traditionally coloured blue with 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, (Genes), from which the first denim trousers were made.

Similarly woven traditional American cotton textile is the diagonal warp-striped hickory cloth that was once associated with railroad men's overalls, in which blue or black contrasting with undyed white threads from the woven pattern. Records of a group of New Yorkers headed for the California gold fields in 1849 show that they took along four "hickory shirts" apiece. Hickory cloth would later furnish the material for some "fatigue" pantaloons and shirts in the American civil war.

### A) Introduction

Denim is a rugged twill textile, in which the weft passes under the two or more warp yarns, producing the familiar diagonal ribbing identifiable on the reverse of the fabric.

### B) Characteristics of denim fabric:

- Warp yarns are coloured (usually with indigo, vat, blue or sulphur black)
- Structure: right hand or left hand twill, i.e. z/s-twill of 2/1 or 3/1 construction
- Usually made of cotton yarns of coarser count (7<sup>s</sup>, 10<sup>s</sup>, 14<sup>s</sup>, 16<sup>s</sup>, etc )
- Coarser cloth (weight lies between 6-14 oz/sq.yds ) and used for pant and warm jackets
- Rotor yarn are usually used.

## 2. TERMINOLOGIES:

- A) **Jean:** comes from French word "Genes" used to describe the pants sailors from Genoa, Italy, once wore. While the historical definition implied that all jeans were made of denim, jeans today usually refer to a garment that has five pockets (two in the front, two in the back and small change pocket on the front right pocket) and this style can be made using any kinds of fabrics be it corduroy, twill, or bull denim.
- B) **Denim:** A cotton twill fabric characterised usually by 3x1 warp faced weave traditionally made with indigo dyed warp and natural yarn for the weft.
- C) **Indigo:** The dyestuff which gives the blue color in the denim fabric. Originally natural dyes were used and currently synthetic dyes are used.
- D) **Inseam:** The seam on the inside of the pant leg.
- E) **Out Seam:** The side seam of any pant.
- F) **Stretch Fabric:** Fabric made with a percentage of Elastane fiber in the weft giving a body fitting stretch quality
- G) **Warp:** The yarns that run along the length of the fabric
- H) **Weft:** The yarns that run across the fabric – normally undyed in denim
- I) **Cross Hatch:** An effect of the denim weave created by using uneven yarn in the weft direction, combined with uneven yarns in the warp direction.
- J) **Rigid Denim:** Describe unwashed denim. Most denim garments are typically prewashed before going to retail.

- K) Hand feel:** The way the fabric feels when it is touched. Terms like softness, silkiness, crispiness, dryness etc is used to describe the hand feel of the fabric.

### 3. Denim washing - Introduction

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Denim washing is aesthetic finish given to denim fabric to enhance the demand and to provide strength. Dry denim as opposed to washed denim is a denim fabric that is not washed after being dyed during its production.

Much of the appeal of dry denim lies in the fact that with time fabric will fade in a manner similar to that which artificially distressed denim attempts to replicate. With dry denim however such fading is affected by the body of the person who wears jeans and the activities of their daily life. This creates what many felt to be more natural, unique look than pre distressed denim.

It is a new technology by which outlook, size, comfort ability and fashion of a garment are changed or modified. This technology was first appeared in Bangladesh in 1988. Before that washing was carried out only in Hong Kong and Singapore, i.e. after sewing garments were sent to abroad for washing and again brought here back for finishing, tagging and packing. As a result, extra overhead cost (freight, washing charge, time consumptions) was drawn in.

#### A) The changes occur due to the following actions:

1. Mechanical / rubbing / abrasion between garments to garments.
2. Garments to machine; and
3. Chemical action.

#### 4. Objectives of garments washing

- **To develop softness in garments:** Size materials applied during manufacturing present in the fabric are removed which enhances soft hand feel. Additional softness may be attained by using softener.
- **To introduce fading effect:** Dyes or pigments are present in the fabric, used during coloration, are washed out locally or partially which result fading or worn out effects in the garments.
- **To create new fashion:** Washing Process of garments bring different outlook (faded, color tinted etc) thus creating new fashion for the new generation especially for teenagers.
- **To satisfy the consumer:** As the contraction or extraction (shrinkage) occur due to washing, the wearer can use the garments after purchase is satisfactory

#### 5. Advantages of garments washing:

**The following advantages are obtained could be gained from the garments washing—**

- Removal of starch or size materials make the fabric soft hand feel.
- Softness could be increased by the addition of softener just at the last stage of washing.
- Dirt, spots, impurities, gum etc, if accumulated in the garments during manufacturing could be removed.
- During washing shrinkage may takes place, therefore after washing there is no possibility to create such problem.
- Washed garments could be worn directly after purchase.

- Faded or worn out effect could be introduced to the garments which creates new fashion
- Similar outlook can be obtained by different washing techniques.
- Comparatively lower capital is required to set up a washing plant.
- Lower land space and least manpower cost are required to run a washing plant.

#### 6. **Unavoidable changes / limitations of garments washing:**

Like other processes the garments washing is also not without some limitations. They are as follows.

- **Garments size change:** Size change takes place due to shrinkage properties of fabric. The amount of shrinkage properties of fabric determine the size change of the garments.
- **Size material is partly removed:** Unfixed dyes may remain on the surface of the garments and it is necessary to remove completely after washing.

## **7) PROCESSES INVOLVED IN WASHING**

### **A. Wet Process**

1. Washing process
2. Hydro extractor
3. Drying process

### **B. Dry Process**

1. Whiskering process
2. Hand Scrapping process
3. Grinding Process
4. Tacking Process

### **C. Spraying**

### **D. Crinkling**

1. Crinkling Process
2. Curing Process

## **8: Wet Process**

### **1. Wet Washing process**



- **Definition:**

It is a process of washing the garments in washing machines with water and chemicals to get different shades, cast, abrasion levels, hand feel, etc.

- **Requirements:-**

- Washing Machine
- Water, Steam, Air and Electrical supply.
- Chemicals
- Jeans in Trolleys.
- Required Lighting.
- Safety accessories.
- Quality reference sample with additional hanger.

- **SET-UP / PREPARATION:-**

- Set the required air pressure to operate the machine.
- If required set, set the flow rate of water and steam pressure.
- Set the process time, rpm with time, volume of water, temperature, volume of jeans pant etc.
- Note down garment lot number.
- Wear safety shoe, gloves, apron.
- Hang the production quality reference sample.

▪ **PROCESS START:-**

- Turn on the Machine and open the Door.



- Load the volume of Jeans according the capacity of the Machine.



- Close the main Door, turn on the process start cycle.
- Fill the volume of water corresponding Machine capacity and type of wash.



- Add the chemicals as per required Ratio and check the variation with reference sample.



- Compare the garment with the sampling piece.





- After completion of the process cycle, open the door & unload the garments in trolley.



- **SAFETY:-**
- Don't stand in front of the door OR hold the door accessories during opening / closing.

## **2. Hydro extractor**



- **Definition and Importance:**
  - Hydro extractor is the process of removing water from the Garments.
- **REQUIREMENTS:-**
  - Hydro extractor
  - Electrical & Air supply
  - Jeans pant with trolley
  - Safety shoe & Apron

- Lighting
- Trolley
- **SET-UP / PREPARATION :-**
  - Wear the safety shoe & apron.
  - Note the garment lot number.
- **PROCESS START:-**
  - Open the Door / lid of the hydro extractor.



- Load the garments / Jeans in to the Drum according to the capacity



- Check and set the garment on top of the drum.



- Close the Door / lid and Lock.



- If required set the cycle time & RPM and Turn on the Machine switch.
- After completing the extraction process, apply the brake to reduce speed gradually and to stop the machine.
- Release the lock and open the Door.



- Unload the garments / Jeans in to the trolley and cycle repeats.



- **Safety :-**
  - Don't try to open the lock / Door during the operation.

### 3. Drying process





- **Definition and Importance:**

- Drying is the process where the liquid portion is evaporated from the fabric by the application of heat.

- **REQUIREMENTS:-**

- Drier
- Electrical, Air supply and Temperature.
- Jeans with Trolleys.
- Safety hand gloves.

- **SET-UP / PREPARATION :-**

- Jeans with trolley..
- Note down the lot number.

- **PROCESS :-**

- Load the volume of Jeans according the capacity of the Machine.



- Close the main Door, turn on the process start cycle.



- After completion of the process cycle, open the door & unload the garments in trolley.



- **SAFETY :**

- Don't try to open the lock / Door during the operation.
- Don't forget to wear hand gloves during opening of the door and unloading the garments

## **9: Dry Processing**

### **1. Whiskering Process**



Whiskering

- **Definition and Importance:**

- Whisker is nothing but the worn out line / impression generated by natural wearing on hip / thigh area.

- **REQUIREMENTS:-**

- Work station (one is fixed firmly and other left open for inserting Garment) Fitted with pant leg shaped strong wooden flat.
- Designed Pattern made up of Rubber material.
- Adhesive tape to fix pattern on wooden flat.
- Sand Paper for scrapping.
- Face Mask and hand gloves.
- Marking Pencil.
- Quality Reference sample.
- **SET-UP / PREPARATION :-**
  - Place the Prepared pattern on the Leg shaped wooden Flat.
  - Set and Fix the pattern & wooden Flat by using adhesive Tape.
  - Prepare sand paper with support Material to hold Tightly by hand during scrapping.
  - Hang the quality Reference sample either side of the work station.
  - Wear Face Mask and Hand gloves.
- **PROCESS START:-**
  - Insert / Load the Jeans Pant into the work station.



- Insert / push the inside pocket bag under the bottom side pattern.
- Check and Set the desired / designated area to be whiskered.
- Hold the sand paper on right / left hand & Start the scrapping to get required whiskering effect.

***Emery paper used for whiskering process***



- Remove / pull the inside pocket bag from bottom of the pattern.
- Remove / Unload the Jeans pant from work station.
- Start the same procedure for next Garment and cycle repeat.
- **Safety:-**
  - Don't forget to insert / removal of inside pocket bag.
  - Hold tightly the Jeans Pant during Scrapping.



## 2. Hand sanding Process



**Hand Sanding**

- **Definition and Importance:**
  - Hand sanding is the step which is generally being done in rigid form of garments to get the used look.
- **REQUIREMENTS:-**
  - Work station Mounted Horizontal to the surface level - Fitted with Two M.S.pipe, each pipe per leg of the Jeans pant and both end of each pipe covered by the Rubber tube / sheet & tighten by suitable clamping. (one is fixed firmly and other left open for inserting Garment) complete set is attached to the semi-rotary mechanism.
  - Compressed air with pressure.
  - Electrical supply.
  - Sand Paper for scrapping.
  - Face Mask and hand gloves.
  - Quality Reference sample.
  - Gum tape.
- **SET-UP / PREPARATION :-**
  - Set the required air pressure for both legs of work station as per pressure required for the garment.
  - Cover / wrap the ends of the pipes / Rubber tube by gum tape to arrest air leakage.
  - Prepare sand paper with support Material to hold tightly by hands during scrapping.
  - Hang the quality Reference sample either side of the work station / front side of the work station.
  - Wear Face Mask and Hand gloves.

- **PROCESS START:-**

- Insert / Load the Jeans into the work station.



- Open the air valve to fill the air at required pressure equally in both legs.
- Turn the pocket bag to opposite side.
- Turn on the air switch / lever, the supporting plate comes up & holds the both legs of the Jeans / Mannequin at the bottom of the work station placed at center.



- Hold the sand paper on right / left hand or both & Start the scrapping to get required effect at designated area on front / back side with referring the sample.



- Release the center support, by turning off air switch.
- Operate the air switch to turn the mannequin to half rotation / opposite side for scrapping.
- Repeat the operation 3, 4 & 5.
- After completion of the process, Release the air.
- Unload the Jeans and cycle repeat.



- **Safety:-**
  - Don't forget to turn the inside pocket bag.
  - Fill the air into the mannequin as per requirement, over filling may lead to damage the Jeans and don't fill less pressure to avoid wrinkle effect.
  - Don't touch the sharp pointed material to the rubber mannequin during scrapping action / Mannequin filled with air

### 3. Grinding process



**Grinding**

- **DEFINITION:-**
  - Grinding is the fraying of edges or the worn out effect of the fabric on the surface by running against Grinding stone.
- **REQUIREMENTS:-**
  - Grinding machine.
  - Grinding Wheel
  - Electrical / Air supply.
  - Garment with trolley.
  - Safety accessories.
  - Quality reference sample.
- **SET-UP / PREPARATION :-**
  - Do the marking as per the requirement with laser or hand.
- **PROCESS START:-**
  - Turn on the grinding machine.
  - Wear the face mask and hand gloves.
  - Hold the garment and grind the designated area as per the requirement.



- With reference to the sample, check and verify depth of cutting / removing of layer.



- After completing the process, place the garment in trolley.
- **Safety:-**
  - Don't hold loosely the garment, during operation.
  - Keep fingers away / take care of fingers during grinding

#### 4. Tacking process



- **Definition:**
  - Tacking is a process which is being done by tacking machine with the help of plastic or nylon tag pins in rigid form of garment to get very heavy contrast.
- **REQUIREMENTS:-**
  - Tacking machine / Hand Tacking gun.
  - Nylon staples.
  - Electrical connection.
  - Safety accessories.
- **SET-UP / PREPARATION :-**
  - Collect the Nylon staples and set in the machine.
  - Label, Tag, etc.
- **PROCESS START:-**
  - Turn on the machine switch.
  - Fold the garment that have to be tacked as per the requirement / marked area.
  - Place the folded garment in the tacking machine and press the bottom lever.





- For the hand tacking Place the tacking gun on the folded area and tacked it.
- After completion of tagging , place the garment in the trolley
- **Safety:-**
  - Do not tack unless the garment is folded properly.
  - Keep the finger away from the tacking needles.

### 10: Spraying Process



**Spraying**

- **Definition:**
  - PP Spray is the activity of spraying PP on denim garment to achieve local abraded area to appear whiter than back ground indigo color shade.
- **REQUIREMENTS:-**
  - Work station mounted vertically hanging to the surface level and covered 3 sides & top by s.s.sheet - Fitted with Two M.S.pipe, each pipe per leg of the Jeans pant and both end of each pipe covered by the Rubber tube / sheet & tighten by suitable clamping. (one is fixed firmly and other left open for inserting Garment) complete set is attached to the Rotary mechanism.
  - Compressed air with pressure
  - Spray gun as per requirement.

- Pressure tank for spraying, fitted with pressure indicator & Regulator.
  - Face Mask, apron, safety shoe, glass.
  - Electrical supply.
  - Water with circulation system.
  - Rubber mat.
  - Quality Reference sample.
- **SET-UP / PREPARATION :-**
    - Cover / wrap the ends of the Rubber tube up to the clamp over the pipe by the gum tape to arrest air leakage.
    - Place the rubber Mat in front of work area to avoid slippage.
    - Set the air pressure to the Mannequin (for both legs) as per the requirement by turning the regulator Open the air valve to fill the air at required pressure equally in both leg.
    - Prepare the Chemical Mixture as per the required concentration & fill to the Additional pressure tank Turn on the air switch / lever, the supporting plate comes up & holds the both legs of the Jeans Pant / Mannequin at the bottom of the work station placed at center.
    - Fill up the compressed air to the pressure Tank as per requirement
    - Check and set the Spray discharge for the operation.
    - Switch on the water circulation system and Exhaust mechanism.
    - Wear the safety accessories.
    - Hang the quality Reference sample either side of the work station.
  - **PROCESS START :-**
    - Insert / Load the Jeans Pant on to the Mannequin / both legs of the Jeans Pant and hold.





- By holding the Jeans Pant, Fill up the Compressed air into the Mannequin equally as per requirement.



- Turn the pocket bag to opposite side / from thigh area.
- Turn on Mannequin Rotation switch as per required revolution or rotate the Mannequin by hand.
- Hold the Spray gun and start spraying to the designated area / full with referring the quality sample.



- Compare the sprayed garment with the Quality sample



- **Safety:**
  - Wear the safety accessories like Mask, Gloves, Apron.
  - Don't forget to switch exhaust blower and water circulation system
  - Don't touch the sharp pointed material to the rubber mannequin during spraying action / Mannequin filled with air.

## **11. Crinkling:**

### **1. Crinkling Process**



- **DEFINITION:**
  - Crinkling is the activity of making 3 –D Effect on the jeans to give a natural crinkled appearance.
- **REQUIREMENTS:-**
  - Work station / Machine.
  - Compressed air with pressure.
  - Steam pressure as per requirement.
  - Electrical supply.
  - Quality reference sample
- **SET-UP / PREPARATION :-**
  - Set the required air pressure for both legs of work station as per required for the garment.
  - Cover / wrap the ends of the pipe/ Rubber tube by gum tape to arrest air leakage.
  - Set the temperature at 90 deg c.
  - Check the mannequin lock, air filling of front & back tubes.
  - Hang the quality reference sample either side of the work station/ front side of the work station.
  - Check the Deflation & Inflation of mannequin by using pedal switch

- **PROCESS START:-**

- Insert / Load the Jeans on to the Mannequin / both legs of the Jeans Pant and hold.
- By holding the Jeans, Fill up the Compressed air into the mannequin equally as per requirement.
- Turn the pocket bag to opposite side / from thigh area.
- Do the 3-d structure as per the reference standard with hand.



- Press the start push button in operator panel.



- After completion of the process release the air & un-load the garment.



- **Safety :-**

- Don't forget to turn the inside pocket bag.
- Fill the air into the mannequin as per requirement, over filling may lead to damage the Jeans pant and don't fill less pressure to avoid wrinkle effect
- Don't touch the sharp pointed material to the rubber mannequin during spraying action / Mannequin filled with air.

## **2. Curing process**



- **DEFINITION AND IMPORTANCE:**

- Curing is the thermal process taking place mostly in either a steam atmosphere or in a dry heat environment for the garment to get Harder, Tougher etc.

- **REQUIREMENTS:-**

- Work station / Machine.
- LPG, Electrical supply.
- Hanger stand with hangers.
- Mask , hand gloves

- **SET-UP / PREPARATION :-**

- Set the curing temperature as per the requirement.
- Set the curing time / speed of the conveyor.
- Keep hangers are ready with garments.
- If required, check LPG pressure.

- **PROCESS START:-**

- Load the garment in the Hanger of the conveyor.



- Start the burner switch on & wait till curing temperature reaches required value.
- Press the conveyor start button.



- Conveyor starts carrying the garments in to the Oven.
- After completion of the cycle time.
- Remove the garments from hanger and placed in the trolley



- **Safety :-**
  - Don't start the conveyor until the temperature reach the set temperature
  - Don't enter in to the oven during operation.
  - Wear heat proof hand gloves.



**12. Personal Protective Equipments:**



**Masks**



**Rubber Shoes**



**Rubber Gloves**



**Wet process Apron**



**Cotton Gloves**



**Safety goggles**



**Dry process Apron**



**Mask used in Spraying**



**Metal Gloves**