Indistrial Attachment at "**Amber Denim Mills Limited**"

Course Title: Industrial Attachment

Course Title: TE- 431

Supervised By

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Amber Denim Mills Ltd.

Bangla-Bazar, Mirzapur, Joydevpur, Gazipur, Dhaka

Front View of Amber Denim Mills Limited

Acknowledgement:

Firstly, I would like to thank the Almighty Allah for giving me patience to conclude my internship program & finally this industrial attachment. Preparing the internship report based on "Fabric Manufacturing Technology (Denim)", I have understood that it is very difficult to find out the basic and fundamental aspects of fabric manufacturing are largely distant from the theoretical knowledge.

Now, we wish to take this excellent opportunity to thank a lot of people who have assisted inspired us in the completion of our training period.

We would like to express our deepest sense of gratitude to our supervisor Prof. **Dr. Md. Mahbubul Haque & Head of the Department of Textile Engineering**, Daffodil International University, for his continuous advice, encouragement and guide to make the industrial attachment.

Preparing this report on Amber Denim Mills Limited we have learnt a lot about Denim Fabric. We express our heartful gratitude to **MD. Kamruzzaman, GM (Plant) Sir**. Our deepest appreciation goes to **Engr. Md. Nazmul Hasan, Sir Deputy** Manager (Planning**) & MD. Shakil Hasan Sir**, Senior Production Officer, Amber Denim Mills Ltd. for his permission to conduct our industrial training without which it would be uncompleted.

We thank to the management of Amber Denim Mills Ltd. for giving me the opportunity to undergo Industrial Training there. Thus, all in all it can be said that without their help it would not be possible for me to prepare this internship report. So, I would like to convey thanks notation to all who directly or indirectly contributed and inspired me to time to time in preparing the report. My gratitude also goes to all the employees of Amber Denim Mills Ltd. for their sincere cooperation, support and valuable advice which they have provided me during the training period.

Executive Summery

The internationally recognized Buyers or clients are looking for those countries for producing their apparel products where different type of mills have established as a one stop source for global apparel market, safety & meet customers expectation by developing and providing products and services on time, which offer value in terms of Quality, Price, Safety & Environmental impact. And also assure complete compliance with the international quality control standards and also to provide the employees internationally acceptable working condition. In Bangladesh, there are different types of textile industries those are producing high quality textile and apparel product. Amber Denim Mills Limited. is one of them. Amber Denim Mills Limited. has different types of Ball Warping, Dyeing, Long Chain Beamer, Sizing, Weaving, Finishing, Sewing, m/c. Which are so modern and latest? This company has high production capacity at least 50000 meter per day. The production is controlled by technical persons. All the decision makers of production sector in Amber Denim Mills Limited. are textile graduates. All the chemical and dyes use for dyeing & finishing are well brand. They produced their product for their buyer and client those are coming from international market like Turkey, China, Germany. There major buyer is H&M.

In this report, I have tried to give some information about Amber Denim Mills Limited. and I have observed that they produce high quality denim fabric & fulfill the special requirements for the different types of buyers by following different internationally recommended standard method.

Declaration

We hereby declare that the work which is presented in this thesis entitled **"study on the difference between Rope and Sheet Denim on the basis of quality"** has been done under the supervision of **professor Dr. Md. Mahbubul Haque**, Head of TE, Daffodil International University. We also declare that this project has not been presented in any other universities and all the resource of information are totally acknowledged.

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Chapter – 1

Company Profile

1.1 About Amber Group:

Mr. Showkat Aziz Russell

Chairman of Amber Group

Amber Group was established in 1996 and began its journey with Amber Cotton Mills Limited. The group flourished with its gradual demand in the market. In this Apart from cotton, other successful areas where the group operates include denim, board and doors, Internet gateway, radio, lifestyle shopping outlet and leisure resort etc. The process of establishing a television channel in ongoing. Backed by a high density of advanced technology and sophisticated manufacturing facilities, Amber group is being managed by highly qualified technical and management professionals. The excellence of the technology and blooming genius of its personnel are the strength of the organization. Amber Group with its various interests is rolling ahead with drive and determination to be the best in all the areas it operates.

1.2 Enterprises of Amber Group:

- Amber Cotton Mills Limited
- Amber Denim Limited

- Amber Denim Mills Limited
- Amber Rotor Spinning Mills Limited
- Amber Rotor Mills Limited
- Amber Board Ltd.
- Amber Lifestyle
- Amber Radio
- Amber IT
- Bhawan Resort

1.3 Amber Denim Mills Ltd.:

Amber Denim Mills Ltd. is one of the major concerns of Amber Group. It is a premium denim fabric producing company. It has started its journey in 2012 with the best and latest machinery available in the world. The current capacity is two million yards of finished fabric per month.

Figure: Front View of Amber Denim Mills Limited

On the fabric side, product range of ADML includes weights from 4.5 oz. up to 14.5 oz. Using multi count, multi-twist ring, open-end yarn using CAIPO technology. It has a world's best MORRISON Indigo dye range from USA, which is capable of doing color like bottoming, topping, reactive colored denim, Sandwich and very deep indigo shades.

Figure: Weaving section

Figure: Dyeing Section

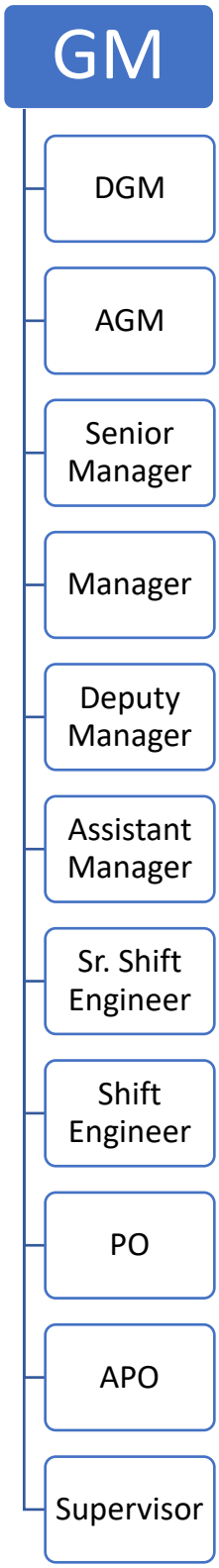
Weaving is done on machines from Picanol from Belgium. ADML uses the most modern weaving machine in air-jet version to get good productivity and to make trouble free fabric even if it is made with coarser slubs or spandex. The loom shed is totally humidified and temperature controlled with enough air circulation and sufficient pressure to help machine and yarn to make better fabric and always make the shed clean. On the finishing side, ADML has machine from MORRISON textile co. of USA, which is the most modern finishing range introduced in Bangladesh for the first time by Amber. Sufficient brushing, singeing in both side, high quality skew device, bigger padded, Sanforizer and compacting device to make the fabric cleaner and maintain shrinkage properly. Amber was the pioneer of starting Flat finish fabric commercially in Bangladesh and is capable of doing a variation in flat quality as per the buyer's requirement. They can make Soft Finish, Flat Finish, and Super Flat as well. This machine was specially designed as per Amber 's requirement. Amber gives importance to inspection machines also. To control proper tension and easy handling Amber uses most modern machines with conveyer belt with auto wrapping and packing. On the quality side, Amber uses most modern and efficient lab instruments from Atlas UK which is operated by trained technicians. The verified Light box, Spectrophotometer, rubbing tester, Washing Fastness, Tensile strength etc. gives accurate results and helps to keep quality good and more consistent. The R&D department is independent and equipped to promptly invent new designs for new fashion and develop buyer 's requirement timely. This department keeps all documents from dyeing recipe to fabric construction and keeps master roll to keep shade in same consistent even over a longer discontinuity. Amber always researches to develop new fashion as per the world requirement as well as to maintain comfort & durability. Amber is manufacturing all kinds of denim fabrics in rigid and stretch in the following versions: Non flat, Flat Super Flat, Resin coated, Pigment Coated, Over Dyed, PU Coated, Ash Colored, Reactive Colored, ECRU & RFD Denim. Amber always researches to develop new fashion as per the world requirement as well as to maintain comfort & durability. Amber is manufacturing all kinds of denim fabrics in rigid and stretch in the following versions.

1.4 Company Profile:

Company Name	Amber Denim Mills LTD
Company Status	Private Limited Company
Owner	MD. M. A. Hashem
Managing Director	MD. Show at Aziz Russell
Factory Location	Bangla bazar, Mirzapur, Jadavpur, Gazipur-1700
Corporate Office	Road -09, Block-G, Banani, Dhaka
Type of Factory	Fabric Manufacturing
Product	Denim Fabric

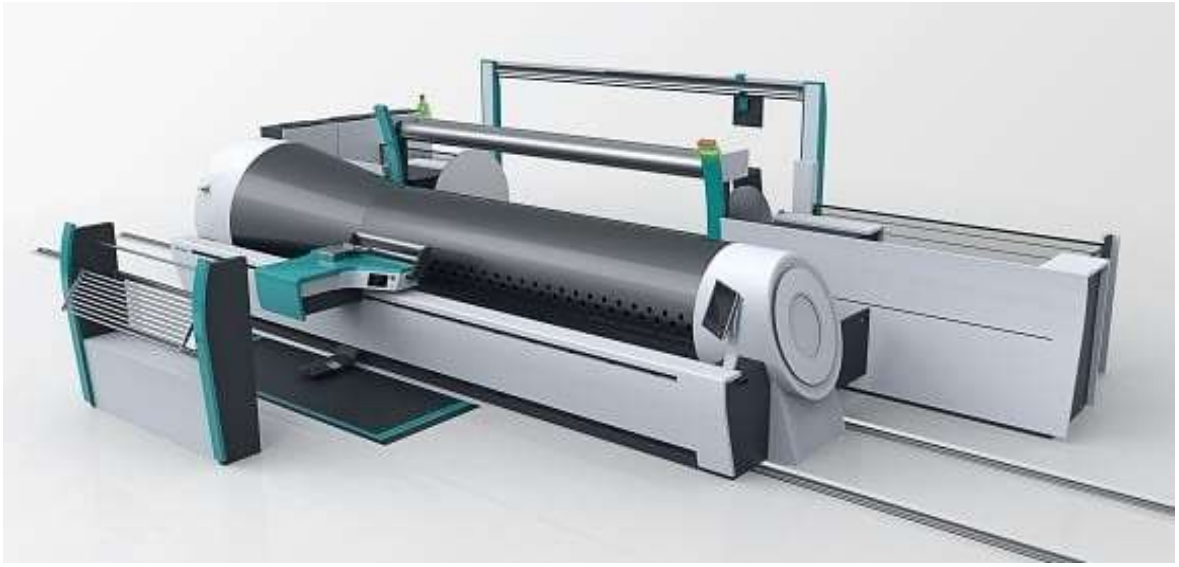
1.5 Production Process Flow Chart:

1.6 Organogram of Production:



Chapter:2

Warping



2.1 Warping: Warping is the process of transferring single or multiple yarns from cone, cheese or other yarn packages onto another beam or log as a single package assembly. Normally, yarns are collected in a sheet form where the yarns lie parallel to each other and in the same plane onto a beam, which is a cylindrical barrel with two side flanges. But for denim, ball warping process is used. In ball warping the yarns are wound on a log as ropes forms that facilitates the dyeing process.

2.2 Objects of warping:

1. Winding a lot of cone packages together on a single beam
2. Maintain the parallel formation of the yarns.
3. Making the ball compact by means of proper tension
4. Wound a pre-determined length of yarns on a beam
5. Facilitate the next process

2.3 Types of warping:

There are two types of warping. The followings are…

1. Direct warping or ball warping
2. Indirect warping or sectional warping

2.4 Direct warping:

Direct warping is process where the yarns are wound on beam directly from the single cone packages placed on the creel at a high speed. In direct warping the yarns are wound on number of beams individually and then the beams are assembled together.

2.4.1 Ball warping

Ball warping is a process that is used in the denim fabric production. The wounded ropes on the beam appears like ball is the reason to call it ball warping.

Ball warping is the process of winding multiple yarn or a large number of warps ends on a beam barrel in rope form that facilitate the next processes.

2.4.1.1 Ball Warping Machine:

In terms of rope dyeing process Amber Denim Mills Ltd. Uses two types ball warping machine.

1. Morrison
2. Karl Mayer

2.4.1.1.1Machine Description (Morrison):

Machine Name	: Ball Warping Machine
Brand Name	: Morrison Denim System
Origin	: USA
Model	: MDS-450 BW
Serial	: 109/111
No. of machine	: 04
Manufacturing Date	: 2011
Average Machine Speed	:300-350 m/min
Max Machine speed	: 450 m/min
Maximum creel capacity	: 456
No. of Programmable tension control unit	:1
No. of Yarn Guide	: 456
No. of active Spindle	: 456
No. of idle Spindle	: 456
Max length of yarn	: Around 15000m
Yarn type	: both ring and open End yarn
Ball width	: 1200 mm

2.4.1.1.2 Karl Mayer

Machine Name	: Ball warping machine
Brand Name	: Karl Mayer
Origin	: Germany
Model	: GM-SP

Machine No : 117138

Construction Year : 2015.8

No. of machine : 01

Specification:

Average Machine Speed : 300-350 m/min

Max Machine Speed : 400 m/min

Maximum creel capacity : 528

No. of Programmable tension control unit :1

No. of Yarn Guide : 528

No. of active Spindle : 528

Max length of yarn : Around 15000m

Yarn type : both Ring & open End yarn

Ball width : 1600 mm

2.4.1.1.3 Name of units in the machine:

1. Creel unit
2. Suctioning unit
3. Reed
4. Trumpet
5. Head stock

2.4.1.1.3.1 Creel unit:

Creel unit is the largest unit in the ball warping machine. Creel unit is the unit where the yarn cones are set onto the cone stand.

2.4.1.1.3.2 Creel unit is divided in three sections.

1. Jog – when the speed of the machine is less than 100 mpm then it is called jog.
2. Rear
3. Front

2.4.1.1.3.3 Creel stand consists of following parts,

1. Cone holder
2. Disc guide
3. Yarn guider
4. Tensioner
5. Blowing fan
6. Tension controlling device
7. Sensors
8. Stop lights

Tensioner and disc guide

2.4.1.1.3.4 Task of creel unit:

1. To hold the cone packages
2. To remove the dust and other dirt by blowing fan
3. To provide uniform tension to all the ends

2.4.1.1.4 Suctioning unit:

This is the device where the flying dust from the yarn surface are removed. These flying dusts affects the quality of the yarn and fabric in further.

2.4.1.1.5 Reed:

The yarns pass the reed unit after suctioning. In the reed unit lease is done. Lease is done to maintain the parallel formation of the yarns. Leases are done at a fixed intervals. Leases are done after every 300/500/700/1000 meters. In the reed unit the yarns are separated individually.

2.4.1.1.6 Head stock:

Head stock is an important section of ball warping machine. In the head stock section the ropes are wounded on a log in ball formation.

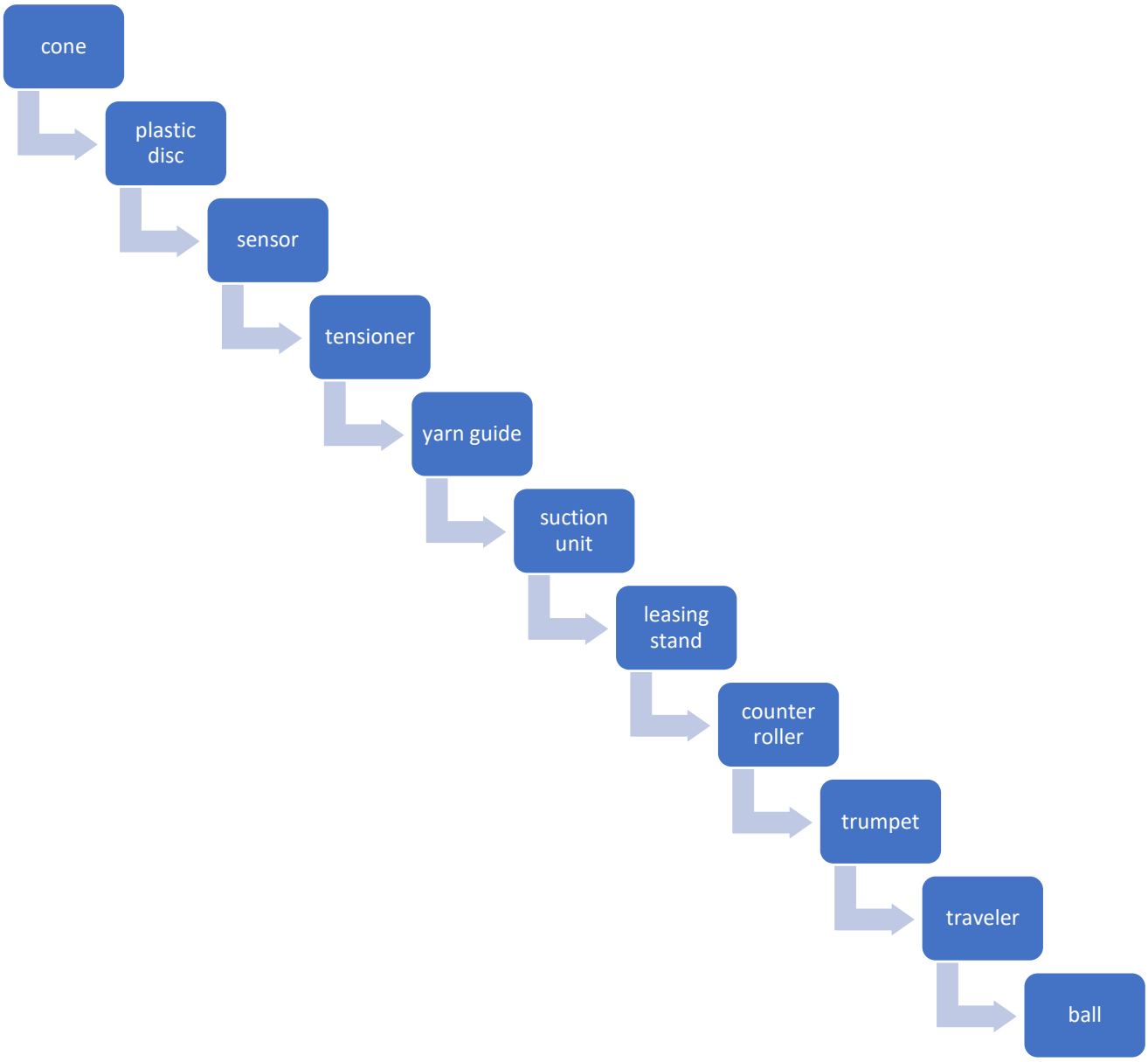
2.4.1.1.6.1 Main components of head stock section:

1. Log
2. Traverse
3. Driven
4. Driving motor
5. Counter roller

2.4.2 Working procedure of ball warping section:

1. Taking the program sheet from the planning department
2. Collecting required amount of yarn from the store section
3. Placing the yarn packages onto the creel stand
4. Checking the stop sensors if these are working fine
5. Checking the yarn count, no. of cones before starting machine
6. Checking the tension on front, jog, and rear side of the machine.
7. Setting the yarn count, tension, length according to planning sheet into the machine by help of a digital monitor
8. Set the lease interval, speed of winding, traverse ratio also
9. Set a log over the rollers
10. Starting the machine with the help of an expert
11. If any yarn breaks during winding the machine will automatically stop and we need to knot the broken yarn and run the machine again
12. We need to give lease at a fixed interval

2.4.3 Yarn path of ball warping:



2.4.4 Calculation:

2.4.4.1 Package length

7-9 count 33300m

10-12 count 49990 m

16 count 66600 m

24, 30 count Above 70000 lakhs (Use 75000 m)

Package length:

We know,

$$Ne = \frac{L * w}{W * l}$$

$$L = \frac{Ne*W*l}{w}$$

Example:

Count = 10

Package weight = 2.5 kg

Package length =?

We know,

$$L = \frac{Ne*W*l}{w}$$

$$= \frac{10*2.5*2.2046*840}{1}$$

= 46296.6 m

2.4.4.2 Ball weight:

Ball weight = log weight + (total ends × length) / (840 × 2.204 × count × 1.090)

Suppose,

Log weight = 75 kg

No. of ends per rope = 379

Length = 11000 meter

Count = 12

ball weight =?

Ball weight = log weight + (total ends × length) / (840 × 2.204 × count × 1.09) kg

= 75+ (379*11000) / (840*2.204*12*1.09) kg

=247.160 kg

2.4.5 Some important parameters:

2.4.5.1 Tension:

Tension is one of the most important factors in ball warping. During warping tension should be controlled properly otherwise various problems may occur on the ends. During warping the tensions are controlled by a tension measuring device.

Below the variation of tension on different side of the machine according to count and yarn type,

count	Types of yarn	Tension % Jog	Tension % Front	Tension % Rear
6,7	OE/MS/RS/RC	94	89	94
8	OE/MS/RS/RC	82	77	82
9, 10	OE/MS/RS/RC	77	72	77
12	OE/MS/RS/RC	62	57	62
14, 16	OE/MS/RS/RC	52	47	52
20	OE/MS/RS/RC/R, Combed	42	37	42
24, 26, 28	OE/MS/RS/RC/R, Combed	37	32	37
30, 32	OE/MS/RS/RC/R, Combed	32	27	32
34,40	OE/MS/RS/RC/R, Combed	22	17	22

2.4.5.2 Atmospheric condition:

The atmospheric condition of the ball warping section is carefully controlled. Humidity, moisture and temperature is controlled to reduce the end breakage problem.

Moisture = 6-7%

Temperature =25◦c±2

Relative humidity = 65±2

2.4.5.3 Machine Speed:

Machine speed largely depends on the yarn count. Speed is kept high for lower count yarn and low for higher count yarn. Speed also depend on no. of ends and type of yarn. The general speed of the machine is 300-350mpm.

2.4.5.4 Lease:

Lease is done while warping of the rope. The function of the lease is to maintain the parallel formation of the ends. Lease is given after a fixed interval of length. Lease also improve the quality of the ends.

2.4.5.5 Knot pass:

Knot pass is the process of knotting new cone packages with the old ones by knotting the ends. It takes almost 20 minutes to complete the process.

2.4.5.6 Breakage:

Breakage of the yarn depends on yarn count, speed of the machine, and tension on the ends. Yarn breakage is less in the start of ball warping with new cones. As the cones tends to end the rate of breakage increase due to tension variation on the ends.

Breakage of 9898 meters length of yarn-

Ball no.	No. of breakage
1st	4
2nd	5
3rd	5
4th	20

2.4.5.7 Traverse:

Traverse is the path of the traveler which wound the rope around the log.

Traverse ratio is 15 times per 100 meters.

2.4.5.8 Breakage per million:

Breakage per million is the rate of end breakage per million meters.

B/M is 0.3-0.5 %

2.4.5.9 Wastage:

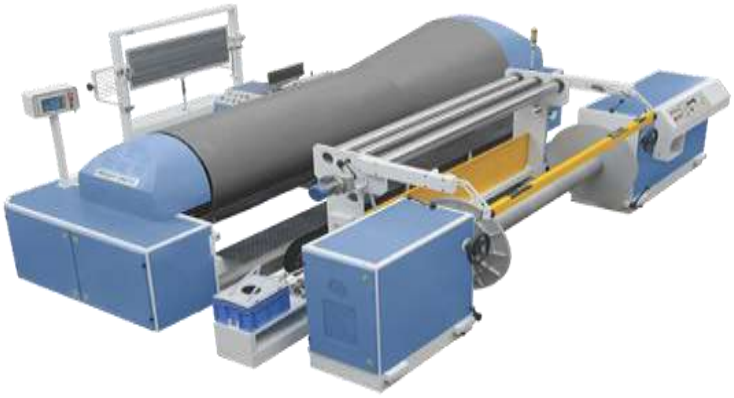
The wastage in ball warping section is around 1.5%. Around 60-65 meters of yarns are wasted in warping section. This wastage takes place due to knot pass of the new cones.

2.4.6 Faults:

1. Count mixing
2. Lot mixing
3. Lease missing
4. Twist problem
5. Slub opening
6. Cone damage

2.5 Indirect warping

Indirect warping or sectional warping is a process where a section of beam is produced first. This is also called drum warping. The drum is tapered at one side. The warp yarns are wound in sections in the drum. Each section has multiple ends that are traversed together slowly during winding along the length of the section to form the angle. It is important that each layer on the beam contain the same number of yarns. The same length of yarn is wound on each section. After all the sections on the beam are wound completely, then the yarn on the beam is wound on to a regular beam with flanges, before slashing. This process is called re-beaming.



2.5.1 Machine specification:

Machine Name	sectional warping machine
Brand	Karl Mayer
Type	Ergotech-M 2000/1000
Machine No.	115882
Construction year	2014
Origin	Germany
Input	Cone package
Output	warp beam
Capacity	720 cone packages (45 stand, 8 packages on each stand)

2.5.1.1 Creel:

Type	GW-SP
Machine No.	115491
Year	2014.09

2.5.2 Speed:

Maximum speed of the machine is 1000mpm (creel to drum), general speed is 400-450 mpm. Drum to beam speed is 150mpm.

2.5.3 Production:

Daily production is almost 5000m.

2.5.4 Parts Name:

1. Creel
2. Yarn guide and tensioner
3. Ceramic yarn guides
4. Balloon breaker
5. Auto warp stopper
6. Adjustable v-reed
7. Measuring meter
8. Tapering drum
9. Yarn cleaner
10. Lease rod
11. Head stock
12. Control panel

2.5.6 Objectives:

1. To form a pre-determined number of single yarn packages.
2. To get the pattern warp sheet at regular intervals on weaver's beam
3. The individual ends in the sheet should uniform across the full width
4. All the ends in the sheet should be wound at almost uniform tension

Chapter-3
Dyeing Section

3.1 Dyeing:

Dyeing is process by which textile materials are changed chemically and physically by means of coloration chemicals. All commercial textile dyeing processes take place by the application of a solution or a dispersion of the dyes to the textile material followed by some type of fixation process. The dye solution or dispersion is almost always in an aqueous medium. A major objective of the fixation step is normally to ensure that the colored textile exhibits satisfactory fastness to subsequent treatment in aqueous wash liquors.

Dyeing normally depends on the types of fabric, fabric structure and properties of dyes.

3.2 Objective:

1. To make fabrics attractive
2. To increase the usage of the fabric
3. To add different type of color to fabric
4. To color the fabrics uniformly
5. To make textile materials suitable for decorative purposes

3.3 Dyes:

Normally there are two types of dyes for denim.

1. Vat dye
2. Sulphur dye

3.3.1 Vat dye:

Vat dye is one of the oldest types of dye. The word vat means "*vessel".* It is mainly suitable for cellulosic fiber for best overall fastness properties. They are water insoluble. So, it is reduced by fermentation in wooden vessel. The vat dyes are naturally obtained coloring materials from the ancient time and kept into wooden vat and make soluble in vat by the process of fermentation- so it is called vat dyes. They can't be used directly & requires vatting. They are insoluble in water but become soluble from by vatting process. The process of converting insoluble vat dye by strong reducing agent in called *vatting* process.

3.3.1.1 Properties of Vat Dye:

1. vat dye is insoluble & can't be directly applied to textile material. Before dyeing they need vatting.
2. vat dyes are insoluble in water, solubilized by treatment with caustic soda and reducing agent, usually hyposulphite, the resulting leuco compounds have affinity for textile fiber, on exposure to air leuco compound impregnated fiber re-oxidizes to the insoluble parent dye.
3. Mainly used or cellulosic fiber but for protein fiber pH should be control properly.
4. Most valuable for dyeing and printing cotton, wool and silk.
5. Applied in alkaline condition pH 12-14
6. Various shade is found
7. Dyeing process is difficult & different such as Sulphur or indigo dyeing process.
8. Costly
9. Particle size is very small. So poor rubbing fastness.

3.3.1.2 Vatting:

The step in which the reduction of the dyestuff into its leuco-form takes place is called vatting. It is the process of converting insoluble dye to soluble vat dye. They are reduced to soluble leuco compound & this process is called vatting.

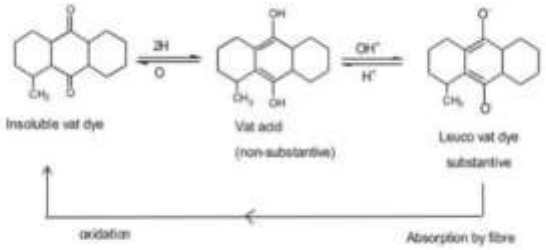
Vat dyes are generally more difficult to reduce than Sulphur dyes. Various reducing agents are used. Sodium dithionite (hydrosulphite) is still the most widely employed for vatting.

In this stage insoluble vat dye is reduced to produce weak acidic leuco from. A strong reducing agent hydrosulphite, $Na_2S_2O_4.2H_2O$ or hydrose is used for vatting. Vatting is carried out in strong alkali condition.

Decomposition of hydros occurs rapidly in acidic solution .so during dyeing material should not be over exposed to air.

3.3.1.3 Re-oxidation of Vat:

After absorption by the fiber, the dye in its soluble leuco form is converted to the original pigment by oxidation. This process is carried out in the course of wet treatment (washing) by addition of oxidants such as hydrogen peroxide, perborate to the liquor or exposed to open air.



3.3.2 Sulphur dyes:

These dyes are so called because they contain Sulphur molecules in their atoms. Normally natural and man fibers are mostly dyeing with Sulphur dyes. Sulphur dyes are cheap and easy to with.

They have good to excellent wash fastness and good light fastness in dark shades. Sulphur dyes are usually dull in shade since the molecular structures are complex. As a class, the Sulphur dyes are not resistant to chlorine containing bleaches.

3.3.2.1 Dyeing with Sulphur dyes:

1. Sulfur dyes are a form of vat dyes. **They are water-insoluble** and in order to apply to fibers must be made water-soluble through the process of reduction.
2. Reduction is a chemical process in which hydrogen is liberated. The hydrogen reacts with the dye and permits a water molecule to attach to the dye. The dye is transported into cotton fiber by the water.
3. This reduced dye must then be oxidized. Oxygen reacts with the hydrogen producing water. Removing the hydrogen makes the dye insoluble, which results in the dye becoming physically trapped inside the fiber.
4. Sulfur dyes are applied to cellulosic fibers and blends of cellulosic with polyester, nylon and acrylics.
5. Sulfur dyes can be applied with little difficulty and with **excellent results at a relatively low cost.**

Initially the goods are wet out in the bath. Sulphur dyes require less salt than reactive dyes and usually have reasonable exhaustion. Low sulphide leuco dyes require more salt and no polysulphide. They do not give good exhaustion in heavy shades and the use of a low liquor ratio is recommended. For popular shades such as black, it has long been common practice to use a standing bath. This is a dye bath that is re-used for subsequent dyeing after addition of more reduced dye. Any free sulphur that tends to accumulate is dissolved by addition of sodium sulphite to give thiosulphate. This prevents it sticking to the goods. The actual dyeing temperature can vary. At higher temperatures around the boil, the bath exhaustion is less but penetration of the leuco dye into the fibers is better than at lower temperatures.

3.4 Flow chart of dyeing:

Goods Preparation

↓

Dye Solution preparation

↓

Dyeing

↓

Oxidation

↓

After treatment

↓

Dyed Goods

3.5 Dyeing process:

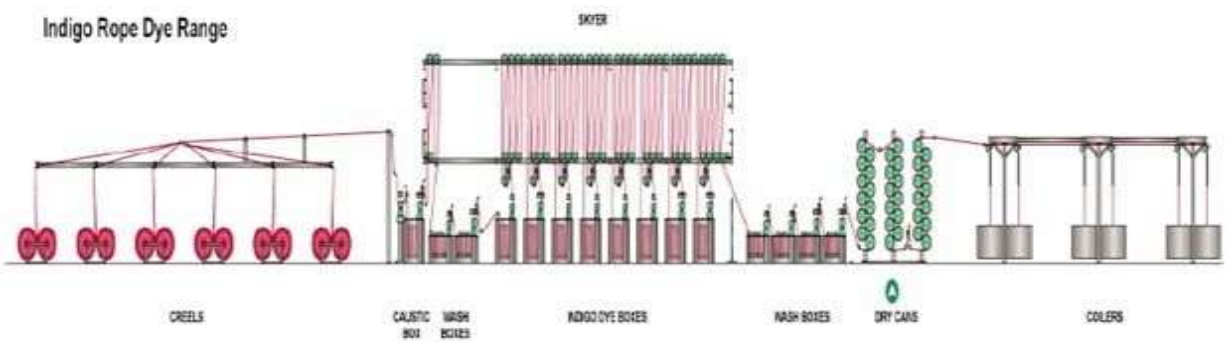
In Amber Denim Mills Ltd. there are two types of dyeing process.

1. Rope dyeing
2. Slasher dyeing or sheet dyeing

Among these rope dyeing is the superior dyeing method.

3.5.1 Rope dyeing:

Rope dyeing consists of twisting the yarns into a rope that is then quickly dipped into indigo baths. It is considered the best method for dyeing denim. In rope dyeing better uniformity of dyeing is achieved than other Indigo dyeing technologies like slasher dyeing.



In Amber Denim Mills Ltd. Rope dyeing process is used this is due to higher productivity, greater shade matching, modern process.

3.6 Used shades:

1. Pure indigo
2. Pure Black
3. Topping (Indigo bottom sulfur top)
4. Bottoming (sulfur bottom indigo top)
5. Bromo Indigo

Black color types:

1. Powder black
2. Liquid black

Red (50%) +Green (50%) = Black

3.7 Machine Description:

Machine Name : Rope dyeing machine

Brand : Morrison-open bath

Model : MDS-

Origin : USA

Capacity : 37 ropes

Speed : 5-35mpm (25mpm general)

3.7.1 Types of rollers:

1. Guide roller
2. Dancer roller-16
3. Sky roller
4. Padder roller-16
5. Bypass roller
6. Squeezing roller

3.7.2 Sections in machine:

1. Creel
2. Pre-wash
3. Dyeing (8 dye box)
4. Post wash (3 box)
5. Dryer (36)
6. Coiler

3.7.2.1 Creel:

The input of balls is called creel. In the dyeing machine there is capacity of 37 balls. The rope goes to the machine by tension rollers.

3.7.2.2 Pre-wash:

After creel the ropes enters to the pre wash box. The rope is first passed through the mercerized Box for scouring. Then the rope goes through the consequent wash box.

3.7.2.3 Dyeing:

Then the ropes go to the dyeing boxes. There are 8 dye baths in the Morrison machine. The dyeing is on room temperature and oxidation is done by air. Sodium hydrosulphite is use to reduce the indigo as indigo insoluble in water also Caustic is used to control the pH. For pure black shade bath no.8 is used and others remain off.

3.7.2.4 Post wash:

After dyeing the ropes go to the post wash box. There 1st one is cold wash and the other two boxes are hot wash. Then there is one softener box for softening the ropes.

3.7.2.5 Dryer:

There are 36 dry cylinders in the machine. 12 cylinders are Teflon coated and rests are normal. Dry cylinders dry the yarns and also control the moistures.

3.7.2.6 Coiler:

After drying the ropes coiled in the cans and the cans are sent to the LCB section.

3.7.3 Machine flow chart:

Ball/logs

↓

Creel

↓

Draw nip

↓

Scouring

↓

Washing -1

↓

Washing-2

↓

Dye box-1

↓

Dye box-2

↓

Dye box-2

↓

Dye box-3

↓

Dye box-4

↓

Dye box-5

↓

Dye box-6

↓

Dye box-7

↓

Dye box -8

↓

Washing-1

↓

Washing -2

↓

Washing-3

↓

Softening

↓

Drying

↓

Coiler

↓

Can

3.8 Chemicals used in dyeing:

1. Indigo powder
2. Indigo blue powder
3. Caustic soda
4. Hydro
5. Black Sulphur (MKS)
6. Sodium Sulphide
7. Decal 1097
8. Sulfate Black
9. Acetic Acid
10. Pensoft M-8610
11. Hydrogen per Oxide
12. Euro Soft
13. Diresul Black
14. Reducing Agent
15. Benwet RD-999

3.8.1 Function of chemicals:

3.8.1.1 Wetting agent:

1. Reduce surface tension of water.
2. Improve wet ability of the yarns.

3.8.1.2 Dispersing agent:

1. Ensure level dyeing of the yarns.
2. Ensure proper distribution of dye molecules.

3.8.1.3 Sequestering agent:

1. Improve wet ability.
2. Remove hardness of water.

3.8.1.4 Reducing agent:

1. The main function is to reduce dye to make it soluble.

3.8.1.5 Acetic Acid:

1. Acetic Acid is used to neutralize the garments from alkaline condition.
2. Control the pH value in wash bath.

3.8.1.6 Hydrogen per Oxide:

1. Hydrogen peroxide is used in scouring, bleaching bath for white/ready for dyeing of gray fabric garments
2. It is used also neutralized the garment from alkaline condition.

3.8.1.7 NaOH:

1. Used as a fixing agent.
2. Control PH of solution.

3.9 Temperature:

color	Temperature
indigo	30°c
Black	85-90°c

Scouring: 60°c-75°

3.10 Temperature sensor:

Wash box-01

Dye box-08

3.11 Tanks:

Tank 01 : Light Indigo

Tank 02 : Light Blooming L. Indigo

Tank 03 : liquid Indigo

Tank 04 : pure/ topping Indigo

Tank 05 : Hot water

Tank 06 : Mercerize liquid Indigo

3.12 Cooking Tank:

1. D-Black Box
2. Mercerize
3. Pure light Black
4. Pure dark Black
5. D.P Black
6. Diresul Black

3.13 Equipment used:

3.13.1 Spectrophometer:

Used to determine GPL of Black color

Company: LANGE

Origin: USA

Model: LIC0690

3.13.2 Metrohm:

To measure the pH and hydro

Brand: Metrohm

Origin: Switzerland

3.13.3 Color assessment cabinet:

To check the shade or color of the dyed materisals.

Brand: verivide-UK

3.13.4 ORP:

For Measure Oxidation Reduction Potential

Brand: HANNA-Italy

3.13.5 Metrohm pH meter:

Used for pH measurement

Brand: Metrohm-Switzerland

3.13.6 Digital balance:

To measure weight

Brand: A&D-USA

3.14 Various parameters:

1. PH
2. Temperature
3. Hydrose
4. Padder pressure
5. Dosing parameter
6. Tension
7. Oxidisng time

3.14.1 Caustic Soda or pH value:

The pH of the dye bath should be around 10.5 - 11.5. At higher pH, dye penetration is less and leads to poor wash down effect.

Indigo PH ---- 11.5-11.8

Black PH ----- 12.5-13

High pH or Caustic Concentration -- Redder and lighter

Low pH or caustic concentration -- greener and darker

Dye concentration is an important parameter in indigo dyeing.

High Indigo Concentration -- Shade is greener and lighter.

Low Indigo Concentration -- Shade is dull and Red.

3.14.2 Dipping Time:

The dipping time of the ropes in the dye bath plays an important role in indigo dyeing. Dipping time varies from 15-22 seconds. Longer the dipping time, better will be the penetration, too long dipping time may dissolve the previously oxidized indigo.

3.14.3 Squeeze Pressure:

At rope dyeing, squeeze pressure may be between 5-10 tones. Squeeze roller hardness should be about 70-75 deg. Shores. The squeezing pressure should be optimum.

3.14.4 Airing Time:

The airing time should be 60- 75 seconds. Longer airing time leads to high tension on the yarn, whereas low airing time leads to poor oxidation.

3.14.5 Drying:

The dyed ropes should be properly dried. It also controls moisture. Insufficient or uneven, over or less dried yarns will result in poor opening and high end breakages in re-beaming.

3.14 Dyeing Faults:

1. shade variation
2. Dyeing patta
3. Dyeing stop mark
4. Undyed yarn

Chapter - 4

LCB Section

4.1 Long Chain Beam (LCB)

After dyeing the rope formation of the yarns are eliminated in the LCB section by changing the alignments of the yarns and make it individual and parallel to facilitate the next process called sizing. The individual yarns are wound on a beam and that's why this process is called long chain beamer.

4.2 Machine description:

There are two types LCB machine in Amber Denim Mills Ltd.

1. Morrison
2. Karl Mayer

4.2.1 Morrison

Machine Name	Morrison LCB machine
Brand	Morrison
Model	MDS-550RB
Origin	USA
No. of Machine	12
Speed	550mpm (maximum), 300mpm-350mpm (general)
No. of Dents	468

4.2.2 Karl Mayer

Machine name	Karl Mayer warp preparation
Brand	Karl Mayer
Type	LCB Titan
Origin	China
Machine No.	117096
Construction	20154-2016
Machine width	1800mm
No. of Machine	2
Speed	500mpm (maximum), 350mpm-300mpm (general)
No of Dents	450

4.2.3 Parts name:

1. Dyed can
2. Reserving drive accumulator
3. Sky roller
4. Tension stand
5. Dancer roller
6. Steamer
7. Reed
8. Measuring roller
9. Beam
10. Foot suit
11. Monitor
12. Dust blow back fan
13. LCB beam output

4.3 Yarn path:

Coiler Tub → Accumulator → Tension Stand → Tension Control Dancer → Tension Stand → Head Stock Task

4.4 Task of different parts:

4.4.1 Coiler tube:

To hold the dyed ropes and feed to the LCB machine

LCB floor

4.4.2 Sky roller:

The ropes from canes go to the sky roller with a certain amount of tension.

4.4.3 Tension stand:

1. To separate the yarns which are in rope form
2. To establish necessary warp tension to the ropes

4.4.4 Accumulator:

1 to repair broken end

To find out broken end

4.4.5 Dancer roller:

1. Create tension to the ropes
2. Make the yarns in sheet form by eliminating rope form

4.4.6 Reed:

The individual yarns go through the dents of the reed.

4.4.7 Measuring roller:

Measures the length of the total yarn passed.

4.4.8 Foot suit:

Used for running or stopping the machine

4.4.9 Monitor:

To control the whole system of the machine. The total program of the machine is controlled by the monitor. It also shows the running function of the machine.

4.4.10 Beam:

To wound the individual yarns on beam.

Chapter - 5

Sizing Section

5.1 Sizing

The process of which the yarns are subjected to treat with many kinds of adhesive coatings for the protective purpose due to friction generated by various processes is called sizing. sizing is done to attain maximum weaving efficiency.

5.2 Objective of sizing:

1. To increase the tensile strength of the cellulose yarns.
2. To improve the weave efficiency of the yarns.
3. To make the yarns suitable for weaving.
4. To provide a coating around the yarns so that it doesn't break due to friction while weaving.
5. To maintain the good quality fabric.
6. To remove electrolytic formation of the blended and synthetic yarns.
7. To increase elasticity.

5.3 Machine Description:

There are two types of sizing machine in Amber Denim Mills Ltd.

1. Ukil
2. Karl Mayer

5.3.1 Ukil

Machine Name	: Sizing Machine
Brand	: Ukil Machinery Co. Ltd
Model	: GSSM-100 expert sizer
Manufacturing Date	: 9/12
Serial	: USS-1102
No. of size bath	: 02
Speed	: 100mpm (maximum), 50mpm-60mpm (general)

5.3.2 Karl Mayer

Machine Name : Sizing Machine

Brand Name : Karl Mayer

Model : CSB 21180

Serial : 115889-4 (2014)

Origin : Italy

No. of Size Bath : 02

Speed : 150mpm (maximum), 70-80mpm (general)

No. of machine : 01

Reed : 33 sets

Creel Capacity : 16/18

No of Cylinder : 18

5.3.3 Cooking Tank and Reserve Tank:

Reservoir or Reserve tank : 2000L

Cooking tank : 1500L water or 1300L chemical

5.4 Units in the machine:

1. Creel unit
2. Sizing unit
3. Leasing unit
4. Head stock

5.4.1 Parts of creel:

1. Creel stand
2. Break belt
3. Guide roller
4. Teflon wheel
5. Crane system for loading and unloading of beam
6. Beam holder

5.4.2 Drying unit:

No. of cylinder is 18. First 14 is horizontal & 4 vertical. Working steam pressure is 5bar.

Loom Beam Winder

Doffing	: Automatic
Comb	: Zig-Zag, Motorized Movement
Reed count	: 16 (Total reed -33; comb-32/reed)
Barrel diameter	: 150 mm
Press roller	: 2 pairs of press rollers are included.

5.4.3 Leasing unit:

Leasing unit separates the yarn sheets coming from different beam.

1. Bust rod-01
2. Split rod-14

5.4.4 Head stock:

1. Comb, Zig-Zag
2. Beam
3. Monitor

5.5 Viscosity:

Courser count: viscosity ↓

Finer count: viscosity ↑

Binder ↓ viscosity ↑

Binder ↑ viscosity↓

Viscosity range : 12-25 S

Moisture : (6-7)%

5.6 Chemical Used In Sizing:

K-200 (modified starch), B-120 (modifies starch), E-850 (acrylic polymer binder), B-60 (artificial Wax)

Example: for 1000L size material preparation,

K-200 --- 26kg

B-120 --- 60kg

E-850 --- 2.5kg

B-60 --- 1.5kg

Wastage: Around 30-45m due to set processing

Wet pick up percentage: 110-120%

5.7 Faults of sizing section:

1. Line mark
2. Loose warp
3. Tight warp
4. Beam stain
5. Sizing spot
6. Line mark
7. Hard size

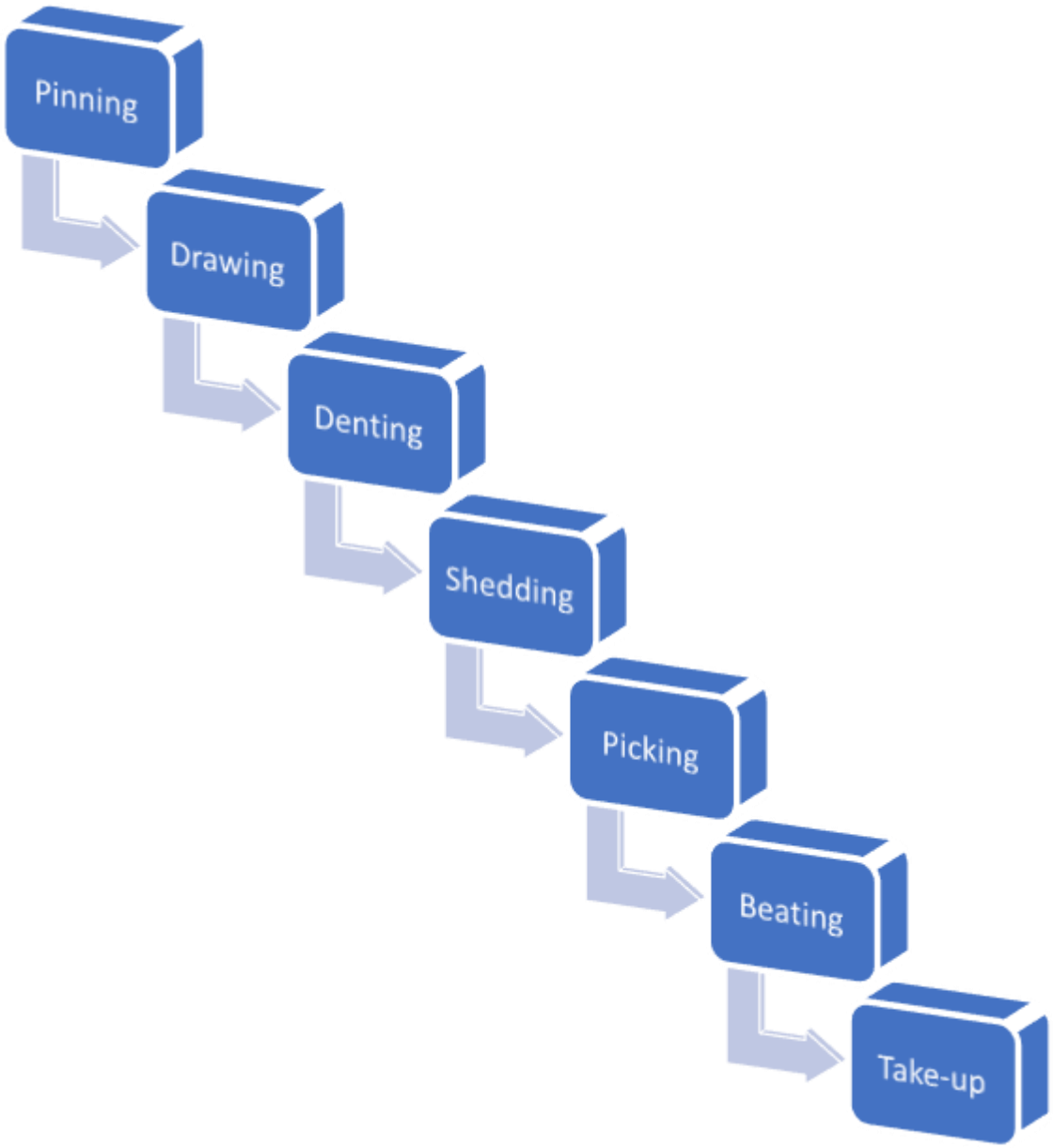
Chapter – 6

Weaving

6.1 Weaving:

Weaving is the interlacing of warp and filling yarns perpendicular to each other. There are practically an endless number of ways of interlacing warp and filling yarns. Each different way results in a different fabric structure. The warp yarns are stored on a beam called a weaver's beam or warp beam (also called a loom beam) and they flow to the front of the machine where the fabric beam is located. The filling yarn is withdrawn from a single package and inserted between the sheets of warp yarns which are perpendicular to the filling yarn.

6.2 Flow chart for weaving –



6.3 Different Types of Motion in Weaving:

6.3.1 Primary Motion

a) **Shedding:** Dividing warp thread into two group.
b) **Picking:** Insertion of weft through the passage created.
c) **Beating:** Pushing the newly inserted weft yarn into the cloth fell.

6.3.2 Secondary Motion

a) **Let-off:** Causes unrolling of warp from the warp beam.
b) **Take-up:** Causes rolling of the cloth roller and cloth.

6.3.3 Tertiary Motion

a) **Warp stop motion:** To stop the loom when a warp thread breaks or get excessively loosened.
b) **Weft stop motion:** To stop the loom when a weft thread breaks or runs out of the pin or weft package.
c) **Feeler Motion:** To indicate whether the weft yarn in pin is almost used up or not.
d) **Weft replenishment Motion:** This motion provide uninterrupted filling insertion by switching from a depleted to a full package.

6.4 Weaving Loom in Amber Denim Mills Limited:

In Amber Denim Mills Limited there are **15 lines**. Every line has **12 weaving looms**.

Total loom = 12×15

= **180**

6.5 Machine Specification:

Machine Name:	: Weaving machine
Brand Name:	: Piconol
Model NO:	: Omni 800 plus (OMP-800-2-P)
NO of Heald frame:	: 16 (maximum)
Origin:	: Belgium
Machine speed:	: 800-1000 RPM
Drop wire stand:	: 6
Reed width:	: 2085mm & 1742mm
Machine width:	: 1960mm
Machine Length:	: 1960mm
Heald frame length:	: 11 inches (pitch:12mm)
Color selection:	: 2 color (maximum useable color 4)

Shedding motion: : positive

Machine drive: : Sumo motor

Pick insertion system: : Air jet

6.7 Air-Jet Weaving:

Air-jet weaving is a type of weaving in which the filling yarn is inserted into the warp shed with compressed air. Air-jet weaving utilizing a multiple nozzle system and profiled reed which is the most common configuration in the market. Yarn is drawn from a filling supply package by the filling feeder and each pick is measured for the filling insertion by means of a stopper. Upon release of the filling yarn by the stopper, the filling is fed into the reed tunnel via tandem and main nozzles. The tandem and main nozzle combination provides the initial acceleration, where the relay nozzles provide the high air velocity across the weave shed. Profiled reed provides guidance for the air and separates the filling yarn from the warp. A cutter is used to cut the yarn when the insertion is completed. Air-jet filling insertion is the simplest way of inserting the filling yarn which probably explains why air-jet weaving machines are one of the most popular machines in the market today. The major components of the insertion system are the tandem and main nozzles, ABS brake system and relay nozzles which are relatively simple in design. The insertion medium mass to be accelerated is very small, relative to the shuttle, rapier or projectile machines, which allows high running speeds. Unlike rapier or projectile insertion systems, there are not many mechanically moving parts to control and insert the filling yarn.

6.7.1 Advantages of Air-Jet weaving machine:

- high productivity
- low initial outlay
- high filling insertion rates
- simple operation and reduced hazard because of few
- moving parts
- reduced space requirements
- low noise and vibration levels
- low spare parts requirement
- reliability and minimum maintenance

6.7.2 Yarn Passage:

The path of yarn through the machine. Weaving means interlacement of two yarn.

- Warp
- Weft

6.7.2.1 Warp yarn passage:

Beam (Flanged Beam)

Backrest roller (Double backrest)

Drop wire

Heald frame

Reed

Fell of the cloth

6.7.2.1.1 Beam:

Warp beams are made of sections. The width of the sections can be changed. Now-a-days most popular trend in weaving is towards large warp beam of 1600mm diameter.

6.7.2.1.2 Backrest Roller:

This roller used for creating tension on warp yarn.

6.7.2.1.3 Drop wire:

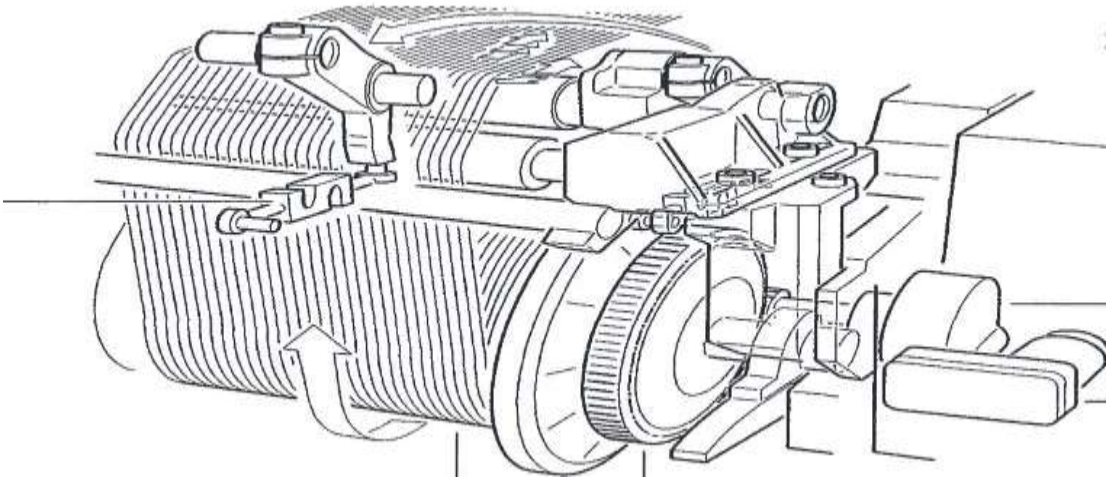
Drop wire used for warp breakage. This mechanism is electrical drop wire mechanism. If a warp is severed drop wire falls on contact bar and complete the circuit which stop the machine.

6.7.2.1.4 Warp Let-off:

The warp beam is turned at a rate which depends on the yarn length between the warp beam and cloth fell. A separate mechanism is used to apply constant tension on the warp yarns as the warp is depleted. The power warp let-off can handle a wide weft density range. The weft density range depends on the warp beam flange and tube diameters as well as on the machine speed.

6.7.2.1.4.1 Let-off mechanism:

- Force sensor
- Servo motor
- Reduction gear
- Warp beam gar
- Warp beam



6.7.2.1.5 ***Shedding:***

Shedding is the movement of some warp yarns up and some down to make an angled opening for the filling yarn to be inserted through. This opening is called "shed". Before the insertion of the next filling yarn, the warp sheet has to be rearranged according to the fabric design pattern so that the required fabric structure is produced. The requirements for the shed opening are determined by the filling insertion and beating motions. Maximum shed opening

$$H = B\ tan\ \alpha$$

H = Shed opening

B = Distance between the heald eye to cloth fell

α = the angle between the warp yarns and fabric plane

6.7.2.1.5.1 Shedding Parameter:

- Shed Angle
- Harness frame Hight
- Back-rest depth
- Drop wire bar Hight
- Back rest Hight

6.7.2.1.5.2 There are four systems of shedding:

1. Crank shedding
2. Cam (tappet) shedding
3. Dobby shedding
4. Jacquard shedding

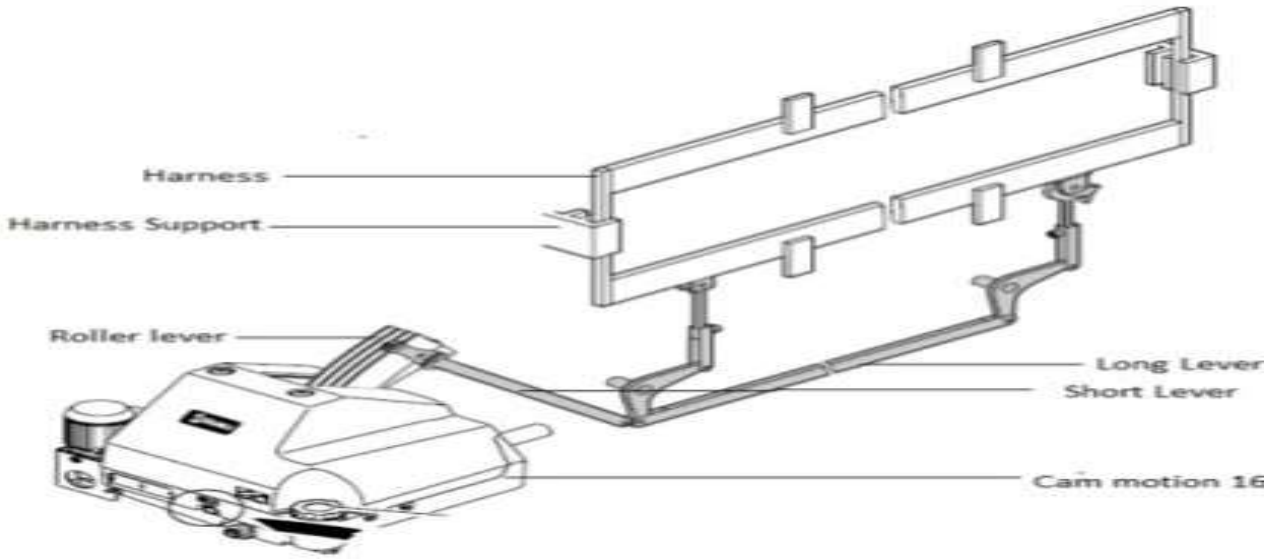
6.7.2.1.5.2.1 Cam Shedding:

Cams with weave pattern profiles rotate to deliver lifting and/or lowering instructions to harnesses. A typical cam system can handle weave patterns with up to 14 different harnesses. Cam shedding mechanisms are relatively simple and inexpensive to design and maintain, they are more reliable for producing fault free fabric and they do not restrict the weaving machine speed. Cam shedding are 2 types:

1) Positive cam shedding
2) Negative cam shedding

6.7.2.1.5.2.1.1 ***Positive cam shedding:***

In positive cam shedding, the harnesses are both raised and lowered by the cams. There are two main types of positive cams. In the first type, a frictionless roller follows a groove machined in the face of the cam. The cam follower which is attached to one end of a lever, moves up and down and the lower end of the lever moves back and forth in the horizontal direction. Then the motion is carried to the harness frame with various levers. This type of mechanism is not used much anymore. In the second type of positive-cam shedding, a pair of matched cams are used for each harness. The frictionless rollers, which are in contact with the cam faces, oscillate the lever about its fulcrum. As a result, a reciprocating movement is obtained in the lever. This type of mechanism is common in modern weaving machines.



6.7.2.1.5.2.1.2 Mechanism of Cam shedding:

- Sumo Motor
- Bevel gear
- Repeat gear
- Cam shaft
- Cam
- Bowl
- Wheel lever
- Short gear
- Long gear
- Harness frame

6.7.2.1.5.2.2 **Dobby shedding:**

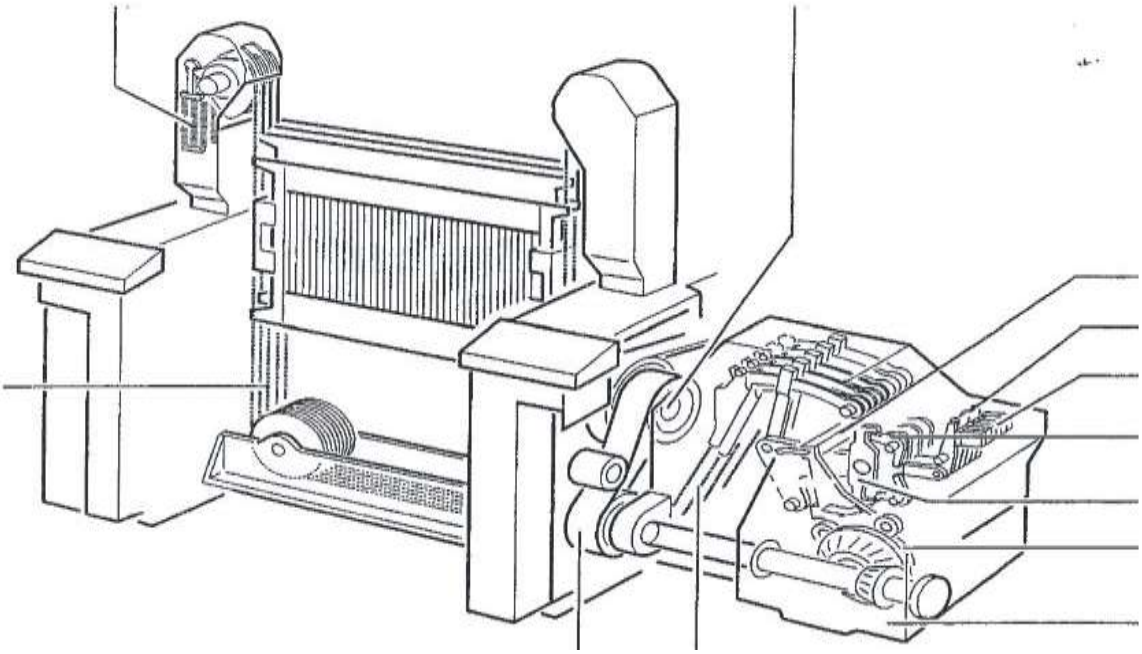
Dobby mechanisms are more complicated than cam systems. They usually have higher initial and maintenance costs. They are normally built to control up to 30 harnesses. Picks per repeat are virtually unlimited in dobby shedding. Due to their complexity, dobby mechanisms are more liable to produce fabric faults than cam systems.

Dobby shedding are 2 types:

1) Positive dobby shedding
2) Negative dobby shedding
3) Rotary dobby shedding

6.7.2.1.5.2.2.1 Positive dobby shedding:

In positive dobby shedding, the harnesses are both raised and lowered by the dobby mechanism which eliminates the need for a spring under motion. Therefore, in any positive dobby some kind of mechanism is necessary to return the ends of the baulks to their stop bars and to hold them there. A locking bar is used for this purpose.



6.7.2.2 Weft yarn insertion system:

6.7.2.2.1 Creel:

To hold the yarn package.

6.7.2.2.2 Disc Tensioner:

To add tension on yarn for compactness

6.7.2.2.3 Bobbin break sensor:

Detects yarn breakage between creel and pre winder

6.7.2.2.4 Balloon Breaker:

Prevent large balloon formation.

6.7.2.2.5 Pre-winder:

Type: Can plus 2231
Brand: Piconol

6.7.2.2.5.1 Parts name:

1) Yarn guiding tube
2) Measuring band
3) Stopper pin
4) Sensor

6.7.2.2.5.2 Features: -

- The weft yarn is drawn off the package and wound onto measuring bands by the rotating motion of yarn guiding tube
- The pick length depends on the fabric width
- The pick length is set by adjusting the measuring bands and the number of coils.
- The electromagnetically controlled stopper pin 3 releases the weft yarn at the machine angle set
- A sensor controls the number of coils to be unwound.

6.7.2.2.5.3 Storage system:

a) yarn supply package
b) Drum feeder
a) measuring feeder
b) Auxiliary nozzle
c) Storage pipe
d) Clamp
e) Main nozzle
f) Yarn

6.7.2.2.6 Insertion Configuration system:

Three different systems have been used mainly on commercial air-jet weaving machines:

1) Single nozzle, confessor guides and suction on the other side
2) Multiple nozzles with guides
3) Multiple nozzles with profiled reed

In picanol this weaving machine used multiple nozzles with profiled reed

6.7.2.2.7 Main Nozzle:

The filling yarn threaded into nozzle tubes is accelerated by the concentrated air-jet and inserted into the shed. The amount of air needed depends on the yarn structure and the yarn count. It is controlled by means of pressure control valve. To keep the motionless pick tensioned, a weak air stream is blown onto the yarn lying in the main nozzle. The air volume needed for this purpose can be individually controlled. To reduce the weft insertion time, a tandem nozzle is used, which is the equivalent of two main nozzles positioned one behind the other. The tandem nozzle has the job of unwinding the weft yarn from the drum feeder.

6.7.2.2.7.1 Parts of main nozzle:

1) Main nozzle tube
2) Weft yarn
3) Pressure control valve
4) Tandem nozzle

6.7.2.2.8 Relay Nozzle Unit:

Relay nozzles mounted in slay are connected in groups to electromagnetic valves. The air-jet is started by the electromagnetic relay nozzle valve. The length of time the valve is opened depends on the reed width and relay valve spacing as well as on the yarn. The compressed air is distributed from compressed air tank via the valves to the nozzles. If the stretching nozzle is not used, the last relay nozzles can be supplied from a separate compressed air tank, thus keeping the weft yarn tensioned until the shed is closed.

6.7.2.2.8.1 Parts of relay nozzle:

1) Sley
2) Relay nozzle
3) Electromagnetic valve
4) Compressed air tank

*Total number of relay nozzle 28

6.7.2.2.9 Relay valve:

Each valve control 1 or 2 or maximum 3 relay nozzle

6.7.2.2.10 Filling cutter:

To cut the yarn after each filling and start a new cycle.

6.7.2.2.11 Weft stop motion:

Breakage detection is done by filling detector. It has been described in picking mechanism.

6.7.2.1.6 Beat-up:

When the filling yarn is inserted through the shed, it lies relatively far from its final position. This is because the insertion device (air-jet, projectile, rapier, etc.) cannot physically fit at the acute angle of the shed opening. This final position is called fell which is the imaginary line where the fabric starts. Therefore, the newly inserted filling yarn needs to be brought to its final position by pushing through the warp sheet. Beat-up is the process of pushing the last inserted filling yarn to the cloth fell by using a device called reed. the fabric is not formed until beat-up occurs.

6.7.2.1.6.1 Beat-up are two types:

1) Open shed beat-up
2) Closed shed beat-up

6.7.2.1.6.2 Beat-up mechanism:

- Motor gear
- Drive wheel gear
- Beat-up cam
- Sley
- Sumo motor
- Reed

6.7.2.1.6.2.1 **Reed:**

Reed is a closed comb of flat metal strips (wires). These metal strips are uniformly spaced at intervals that correspond to the spacing of warp ends in the fabric; therefore, the reed is also used to control warp yarn density (closeness) in the fabric. Warp density is expressed as either ends per inch (epi) or ends per centimeter (epic), which affects the weight of the fabric. The spaces between the metal strips are called “dents”. The reed holds one or more warp yarn(s) in each dent and pushes them to the cloth fell. After beating up the filling, the reed is withdrawn to its original

rest position before the insertion of the next pick. Profiled reed is used in air-jet weaving machines.

Reed count = $\frac{Dents\ per\ inch\ in\ known\ system}{Dents\ per\ inch\ in\ required\ system}$ × Count in known system

6.7.2.1.6.2.1.1 System based on the number of dents

Name of system	**Basis of Numbering**
Stockport	Number of dents per 2 inches
Radcliff	Number of dents per 1 inch
Rhodesfield	Number of dents per 1 inch
Metric	Number of dents per 1 deck

6.7.2.1.6.2.1.2 System based on the number of groups

Name of system	**Basis of numbering**
Bolton	20 dents per 24.5 inches
Bradford	20 dents per 36 inches
Blackburn	20 dents per 45 inches
Irish	100 dents per 40 inches
Leeds	19 dents per 9 inches
Bakersfield	100 dents per 36 inches

6.7.2.1.7 Fabric take-up:

Take-up mechanism are two types.

a) Mechanical take-up: The weft density is determined by the change and standard wheels in the fabric take-up gear.

b) Automatic or servo motor take-up: The weft density is determined by the frequently controlled servo motor.

6.7.2.1.7.1 Take-up mechanism:

- EUT motor
- Gear train
- Spreading roller
- Cloth take-up roller
- Press roller
- Guide roller
- Double press roller
- Batcher

6.7.3 Leno selvages:

Air-jet weaving machines typically produce cut selvages reinforced with leno. The trimmed ends of filling yarn on the receiving side may be fixed with additional yarns fed from a special creel and the cut off edge is fed into a waste box. High quality of selvages is assured by various selvage forming units such as full and half leno selvage devices and mechanical-pneumatic tucking units.

6.7.3.1 Leno unit:

1) Leno thread
2) Spool holder

Phase A: Pick has been inserted and is lying ready for cutting in front of tucking unit cutter.

Phase B: Pick weft is beaten up by the reed. Cutter support moves forward with tucking unit cutter and cuts pick . The weft end is lying ready below the catch hole. Rotary valve opens. The air streams through lower nozzle and blows the tip of pick into the catch hole. Tucking needle dips into the shed.

Phase C: The eye of tucking needle is exactly below the catch hole. Rotary valve opens. The air current of upper nozzle blows the west end into the eye of tucking needle. Tucking needle moves back.

Phase D: The west end is tucked in. Cutter support returns to its basic position and the west end is beaten up with the next pick. Selvage formed by tucking unit.

Wastage winder: wind the wastage and store into wastage box. Wastage winder connected with let-off mechanism.

6.7.4 Special Feature in Piconol:

6.7.4.1 SEPARATE AIR TANK PER WEAVING CHANNEL:

Air tanks built into the machine side frame: enables optimal setting by means of an electronic pressure regulator for each individual weaving channel

6.7.4.2 DEDICATED SLEY CAM VERSIONS:

Dedicated slay cam versions make it possible to weave the most demanding fabrics and yarns. Also available for larger-width applications, thanks to optimization of the available insertion time

6.7.4.3 ROBUST STRUCTURE:

Proven Picanol design. Two solid side frames connected by large-section cross bars, with the sley driven at both sides by conjugated cams. This configuration offers the required machine stability and the highest beat-up force, making it possible to weave any kind of fabric successfully

6.7.4.4 FIXED AND MOVABLE MAIN NOZZLES:

The most efficient nozzles for all yarn types, adaptable with nozzle clamps for heavy stretching yarns. Jet funnel for guiding multiple channels into the reed tunnel.

6.7.4.5 E-LENO:

Independent setting of crossing timing left to right. A guarantee of maximum flexibility in setting. Easy repositioning for flexibility in weaving widths.

6.7.4.6 BUILT-IN PRESSURE SENSOR:

Indication of pressure levels throughout the machine. Machine behavior adjusted according to the air supply pressure.

6.7.4.7 ELECTRONIC PRESSURE REGULATORS:

Significantly improved pressure build-off time in the main nozzles thanks to the new configuration of the air preparation. Result: reduced impact on the filling yarn, bringing a real advantage when handling delicate or weak yarns

6.7.4.8 UNIQUE TRIPLE AIR TANK CONFIGURATION:

Lower air pressure on center air tank, minimizing impact from the relay nozzles on the fabric. Enables the user to set the machine with lowest possible pressure and reduce air consumption by up to 15% without compromising on fabric quality.

6.7.4.9 ELECTRONIC LENO SYSTEM (ELSY):

With individual programming of the weaving pattern. Creating unlimited possibilities for weaving the fabric selvedge.

6.7.4.10 SMART ARGUS:

Continuous monitoring of correct weft yarn number. Possible to check the position of the filling yarn in the reed channel at the end of insertion and make corrections.

6.7.4.11 TWIN STRETCH NOZZLE:

Add that extra stretch to prevent flip-backs throughout the fabric and increase productivity with kinky fabrics. Simple but universal mounting solution for a wide range of products

6.7.4.12 UNIQUE PICANOL RELAY NOZZLE DESIGN:

Pianol has developed relay nozzles that offer an optimal performance/consumption ratio. One of the main reasons why air consumption is fully under control on the OMNI plus Summum. Different types of nozzles are available for a wide range of yarns.

6.7.4.13 Multi-hole:

Offers the highest traction force and is the choice when no compromises can be made on the weaving speed.

6.7.4.14 Eco-One:

Designed to achieve the best balance between speed, air consumption and maintenance, capable of weaving even under the most dusty and fluffy conditions.

6.7.4.15 SUMO MAIN MOTOR:

Fastest and most stable machine start-up. Reduced power consumption thanks to reduced drive train (fewer gears, less friction). Integrated machine concept fully synchronized with all the other electrically driven motors: Electronic Take-Up (ETU) and Let-Off (ELO). Common power supply: real-time speed adjustment and recuperation of braking energy.

6.7.4.16 ELECTRONIC PRESSURE REGULATORS:

Full control over pressure settings for main and relay nozzles. All settings can be optimized from the machine terminal.

6.7.4.17 ARVD II PLUS:

Automatic optimization of relay nozzle blowing timings, saving up to 20% on air consumption.

6.7.4.18 AIRMASTER:

Monitors and manages air consumption. Automatically checks the consumption of each individual insertion component by means of an automated diagnostic procedure

6.7.4.19 PICANOL BLUEBOX SYSTEM:

Future-proof platform with optimal microprocessor speeds, increased memory capacity and modular circuit board setup. Network connectivity allows for remote monitoring and service. Picanol Blue Box is the electronic platform to keep up with increasing requirements for modern weaving mills and be ready for future developments.

6.7.4.20 AUTOMATIC CROSSING MOMENT:

Direct, unique mechanical configuration – all machines have full pick finding as standard. The crossing timing of the shedding motion can be set from the machine display – no tools required.

6.7.4.21 SPEED ADJUSTMENT:

Machine speeds can be set and adjusted on the machine display. Changing the speed can be done in real time using Multispeed or automatically following a pre-programmed speed pattern, for which Opti speed is needed. Makes it very easy to set the best speed for a given style on a running machine.

6.7.4.22 AIR TUCKING-IN FOR CONTINUOUS REEDS:

Unique! Great ease of setting and maintenance. Tucking-in no longer puts limitations on machine speeds, unlike mechanical tucking-in.

6.7.4.23 PICK REPAIR AUTOMATION (PRA II PLUS):

In case of a machine stop (filling stop), the new PRA II Plus system automatically removes the filling from the shed and starts the machine again if conditions allow this. The new PRA II Plus system combines pneumatic and mechanical actions for removing the yarn, making it unique in its kind. A guarantee of the highest possible success rate and lowest load for the weavers.

6.7.4.24 AUTOSPEED:

Adapts the machine speed to the behavior of the filling yarn. Information from the filling detector is centrally processed and if conditions allow it, the microprocessor changes the machine speed and adapts the other machine settings to this new situation – all fully automated. Meanwhile, the machine stop level is constantly monitored, to make sure that limits set by the user are not exceeded. Auto speed can result in an average speed increase up to 5 %.

6.7.4.25 QUICK STYLE CHANGE (QSC):

Unique system with split frame concept. Preparation of new styles can now be done outside the weaving room. A prepared module makes it possible to change the style on a machine in a very short time. Significantly increases the efficiency of the entire weaving room.

6.7.4.26 WEFT FEEDERS:

Picanol offers a range of weft feeders with mechanical or electronic adjustment of the yarn length. The Blue22 weft feeder simplifies the adjustment of the waste by means of a single mechanical screw. The Blue22 Easy set function is entirely controlled via the terminal and eliminates the hassle of mechanical adjustments with special calibration tools.

6.7.4.27 CORDLESS:

No more need for a catch cord on the right-hand side, thus affording higher speeds and improved filling tension. From an operational as well as a logistic point of view, the Cordless system reduces the workload significantly. This unique feature is compatible with cut reed.

6.7.4.28 CENTRALIZED LUBRICATION:

High-pressure oil pump brings oil from the central reservoir to machine parts that require constant lubrication. The oil is constantly filtered and the pressure constantly monitored, assuring long lifetime of crucial machine parts. Centralized lubrication is far more reliable than splash lubrication. Less maintenance: changing oil can be done very quickly as all the oil can be taken from the central oil reservoir.

6.7.4.29 INTERACTIVE DISPLAY:

A high-quality color touchscreen allows easy access and navigation during setup and weaving. All settings combined in easy-to-understand screens.

6.7.4.30 PRESSURE FOR MAIN AND RELAY NOZZLES SET FROM DISPLAY:

Thanks to the unique configuration of the pressure regulators, air pressure is displayed in Bars - a direct and easily understandable reading. Pressure for the main and relay nozzles is managed completely digitally from the machine’s terminal. The pressure settings can easily be monitored by a central system or transferred to another machine weaving the same style.

6.7.4.31 PC SUITE:

Full set of tools to run a weaving shed in the most efficient way: manage machine settings with Picanol Style Administration, create new designs using Picanol Pattern Editor, get access to the production monitoring figures from a central computer using Loom Gate and much more.

Chapter – 7

Finishing

7.1Finishing:

The term finishing covers all those treatments that serve to impart to the textile the desired end use properties. These can include properties relating to visual effect, handle and special characteristics such as waterproofing and non-flammability.

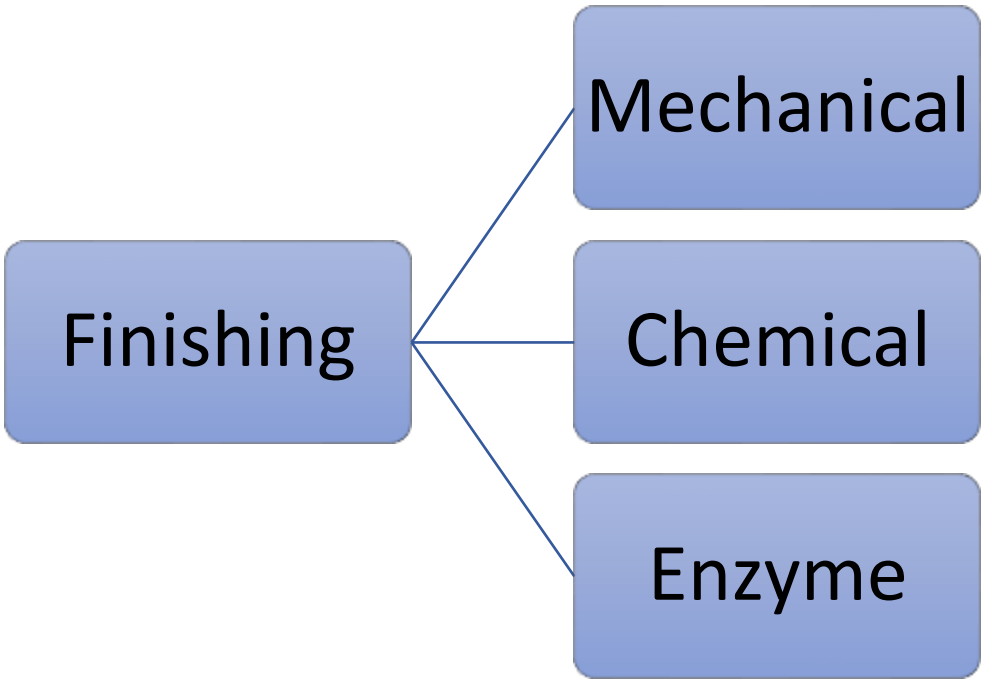
Finishing is applied on after weaving. Finishing is a series of processing operations applied to gray fabrics to enhance their appearance and hand, properties and possible applications. Play a fundamental role for the commercial excellence of the results of textiles.

7.2Objective:

- To change the surface characteristics of fabric
- To increase life and durability of fabric
- To enhance the suitability of the fabric for end use
- To improve the appearance of the fabric.
- To improve the feel of the fabric.
- To cover faults in the original fabric.
- To improve wearing qualities of fabric by making it shrink or crease resistant.

7.3Types of Finishing:

Finishing are mainly three types. These are



7.3.1 Mechanical Finish:

This finish done by machine Involving the application of physical principles such as friction, temperature, pressure, tension and many others.

Examples: Calendaring, Embossing, Napping, Sanforizing etc.

7.3.2 Chemical Finish:

The finishes applied by means of chemicals of different origins, a fabric can receive properties otherwise impossible to obtain with mechanical operation.

Examples: Softening, Mercerizing, Desizing, Anti-static, Absorption, Plasma etc.

7.3.3 Enzyme Finish:

Enzyme finish also known as Bio-polishing finish. Enzyme is a finishing process applied to cellulosic textiles that produces permanent effects by the use of enzymes. Bio-finishing removes protruding fibers and slubs from fabrics, significantly reduces pilling, softens fabric hand and provides a smooth fabric appearance, especially for knitwear and as a pretreatment for printing.

7.4 Machine in ADML:

In Amber Denim Mills Limited, there are use 3 type of finishing machine for 4 type finishing process.

Finishing process are:

1) Normal Finish
2) Mercerization
3) Desizing
4) Heat setting

Machine used in Finishing process:

1) Finishing machine
2) Mercerization machine
3) Heat setting machine

7.4.1 Finishing machine Specification:

Machine Name: Finishing machine

Brand Name: Morrison

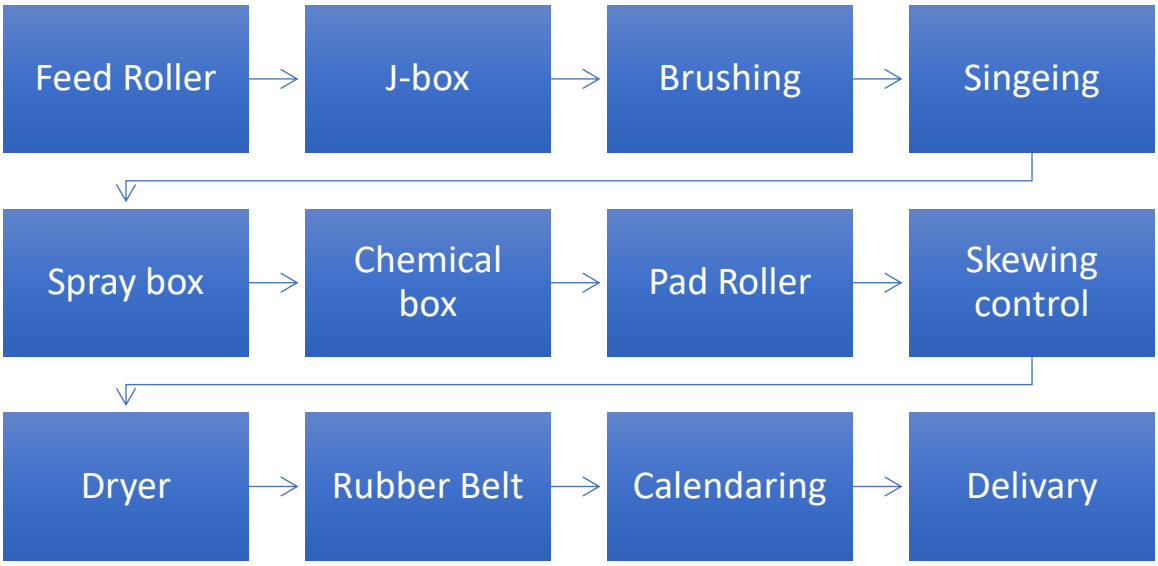
Origin: USA

Machine speed: 30-38 mpm

No. of Bath: 1

No. of dryer: 20

7.4.2 Flow Chart for finishing:



7.4.2.1 Feed roller:

To unwind the fabric from fabric roll.

Specification:

Brand: Morrison

Serial no: T-553/M-2011

Origin: USA

7.4.2.2 J-Box:

Where the fabric assembles. To store the fabric for continuous flow of fabric in the machine.

Speed: 34 mpm

7.4.2.3 Brusher:

To remove extra foreign material. the grey fabric is brushed to remove the loose lint and loose fluff from the fabric surface. It also raised the protruding fibers on the fabric surface which are removed in the next stage of singeing process.

7.4.2.4 Singeing:

A process where loose fibers and fuzz is burned away to yield a clear and clean fabric surface. It is generally carried out on gray pieces and the residues are removed by a further washing process. An oxidizing flame, which does not leave any trace of sooty residue on fibers, is used to carry out this operation. The flame can be perpendicular to the fabric, and only rarely tangential; the fabric is positioned at a distance of 1.5 - 4 mm from the end of the flame and the machine is

equipped with a suction device under the fabric, which attracts the flame and concentrates the heat on the fabric. The fabric speed can range from 60 to 120 meters per minute.

Singeing are two types:

1) Direct or gas singeing
2) Indirect or Cylinder singeing

Specification:

Brand; Morrison

Type: 80S101

Year: 2010

7.4.2.5 Spray Box:

To spray steam to eliminate fire on selvedge.

7.4.2.6 Chemical wash box:

The fabric is subjected to a chemical pad treatment. Softeners are often used in the chemical treatment in order to impart soft feeling of the fabric. Three types of softener are used.

1) Anionic softener
2) Cationic softener
3) Non-ionic softener

7.4.2.6.1 Anionic Softener:

Anionic softeners are produced by the condensation of fatty acids. They have good characteristics as lubricating softening agents and give the fabric a full hand. They are unstable in hard water and acid environment. Anionic finishing agents have negatively charged hydrophilic group. Examples: oil, fat, wax, soap, sulphated and sulphonated oils and sulphated fatty alcohol.

7.4.2.6.2 Cationic softeners:

They are usually quaternary ammonium salts, amino-esters and amino-amides. They are recommended for all types of fiber, and can be also applied with exhaustion process in acid environment (pH 4-5). These are also called molecular finishing agents because they form bonds with the cationic group on the surface of the fiber generally with negative electric potential.

7.4.2.6.3 Non-ionic softeners:

These are generally ethers and polyglycol esters, ethoxylated products, paraffins and fats. These softening agents are generally less efficient than anionic and cationic ones but they withstand the effects of hard waters, acid or basic environment and also stable in presence of cations and anions.

7.4.2.7 Pad roller:

Squeeze the fabric and release chemical from fabric.

Speed: 30.4 mpm

Temperature: 45°C

7.4.2.8 Skewing control:

In twill weave creates a serious problem in subsequent garment manufacturing and its washing. Skewing is the condition in which the filling yarns in a fabric do not lie perpendicular to the warp yarns throughout the width of fabric is called as "skewing".

7.4.2.8.1 Causes of Skews:

- Fabric can become skewed during its manufacture if it is placed on the stenter guide pegs in such a way that the weft yarns are not perpendicular or at right-angles to the direction of travel.
- Even if the fabric is correctly aligned on the stenter, problems can still occur if the parallel stenter drive pegs do not run at precisely the same speed as each other,
- Fabric will become bowed during manufacture if it is wound under high tension and the pull on the middle is greater than that at the outer edges. The problem will be worse if the selvages are thicker than the main body of the cloth.

7.4.2.9 Dryer:

In dried section, wet fabric dries by cylinder. 20 cylinders contain this section. 10 Teflon coated cylinder and 10 uncoated.

Teflon coated: This cylinder used for moisture. Speed of machine is 30 MPM.

Uncoated: This cylinder used for drying fabric. Speed of dryer is same

7.4.2.9.1 Adjustment of the moisture content in the drying process:

The drying speed is determined by the difference between the tension of water steam on the textile surface and the tension of the water steam in the drying unit: it increases proportionally to the decrease of the moisture content in the air of the unit. In order to keep this content on low levels it is necessary to blow in the drying units' huge quantities of heated air at the same temperature of the drying unit, which leads to huge energy consumption. When setting the desired moisture degree of the air in the drying unit, it is worth considering that the best degree results from a correct proportion between efficient output speed and cost-effective energy consumption.

7.4.2.9.2 Heating of the drying unit:

The drying units are usually heated by means of steam with an average thermal efficiency of about 64%. Better thermal efficiency is granted by dryers heated with thermal fluid (about 80%). Highly efficient heating is obtained by means of direct gas combustion, with an efficiency of almost 95%. The operating temperature can be reached in very short times and heating can be stopped simultaneously with the machine.

7.4.2.10 Sanforizer:

Mechanical compacting is one method of reducing residual shrinkage. The process forces yarn closer together and the fabric becomes thicker and heavier. As a result of this, the net yardage yield is reduced. A Sanforizer is a fabric compactor developed by Cluett Peabody.

7.4.2.10.1 Condition in Rubber belt:

Speed: 30MPM

Temperature: 130-135°C

Specification:

Serial: T-367

Manufacture: Morrison (2011)

Origin: USA

7.4.2.11 Calendaring:

Calendaring is a process of passing cloth between rollers (or "calendars"), usually under carefully controlled heat and pressure, to produce a variety of surface textures or effects in fabric such as compact, smooth, supple, flat and glazed. The process involves passing fabric through a calendar in which a highly polished, usually heated, steel bowl rotates at a higher surface speed than the softer (e.g. cotton or paper packed) bowl against which it works, thus producing a glaze on the face of the fabric that is in contact with the steel bowl. The friction ratio is the ratio of the peripheral speed of the faster steel bowl to that of the slower bowl and is normally in the range 1.5 to 3.0. The normal woven fabric surface is not flat, particularly in ordinary quality plain weave fabrics, because of the round shape of the yarns, and interlacing's of warp and weft at right angles to each other. In such fabrics it is more often seen that even when the fabric is quite regular, it is not flat. During calendaring, the yarns in the fabric are squashed into a flattened elliptical shape; the intersections are made to close-up between the yarns. This causes the fabric surface to become flat and compact. The improved planeness of surface in turn improves the glaze of the fabric. The calendar machines may have several rollers, some of which can be heated and varied in speed, so that in addition to pressure a polishing action can be exerted to increase luster.

Condition:

Temperature: 135-140°C

Speed: 25.1 MPM

7.4.2.12 Delivery:

Foddering fabric in trolley and delivery for inspection.

7.4.2 Mercerization:

Caustic treatment of cellulosic fabrics improving luster, water absorbance, dye yield and fiber strength. This treatment is carried out using caustic soda (28 - 30° BÈ), which determines the contraction and swelling of the fibers; they become translucent and increase their tensile strength, but reduce their flexural and torsion strength. The bean-like section of the fiber becomes first elliptic and then circular, allowing a better reflection of light with a consequent increase of luster. The treatment is usually carried out under tension, with caustic soda at 28°-30° BÈ (approx. 270- 330 g/l).

Objective:

1) To improve the lustier
2) To improve the tensile strength
3) To improve luster
4) To improve dye affinity
5) To improve dimensional stability

7.4.2 Machine Specification:

Machine Name: Mercerization machine

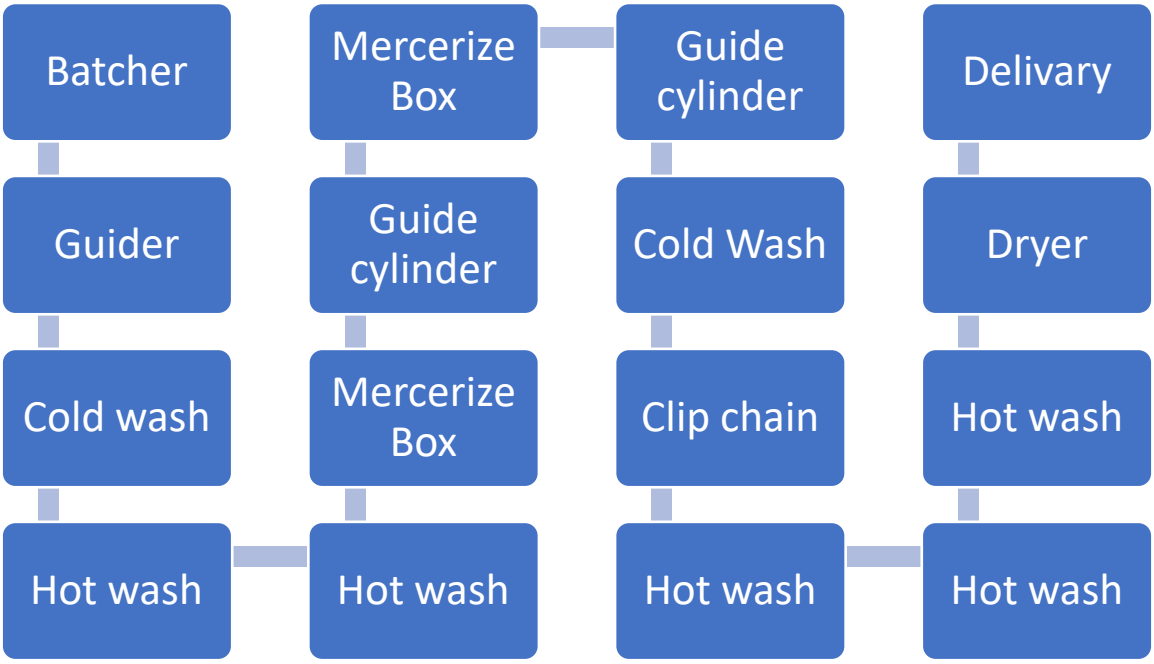
Brand Name:

Origin: China

Model: LM082B (12)-200

Speed: 25-40 MPM

7.4.2.1 Flow chart for Mercerization:



7.4.2.1.1 ***Batcher:***
To feed fabric in mercerization machine.

7.4.2.1.2 ***Guider:***
Control selvedge and width of fabric.

7.4.2.1.3 ***Cold wash:***
Fabric immersed in normal water

7.4.2.1.4 Hot wash:
Fabric immersed in hot water. Temperature for hot water 70°C.

7.4.2.1.5 Mercerize Box:

Recipe: Caustic – 166gpl or 20 Baumc

Wetting agent

Baumc means concentration of caustic

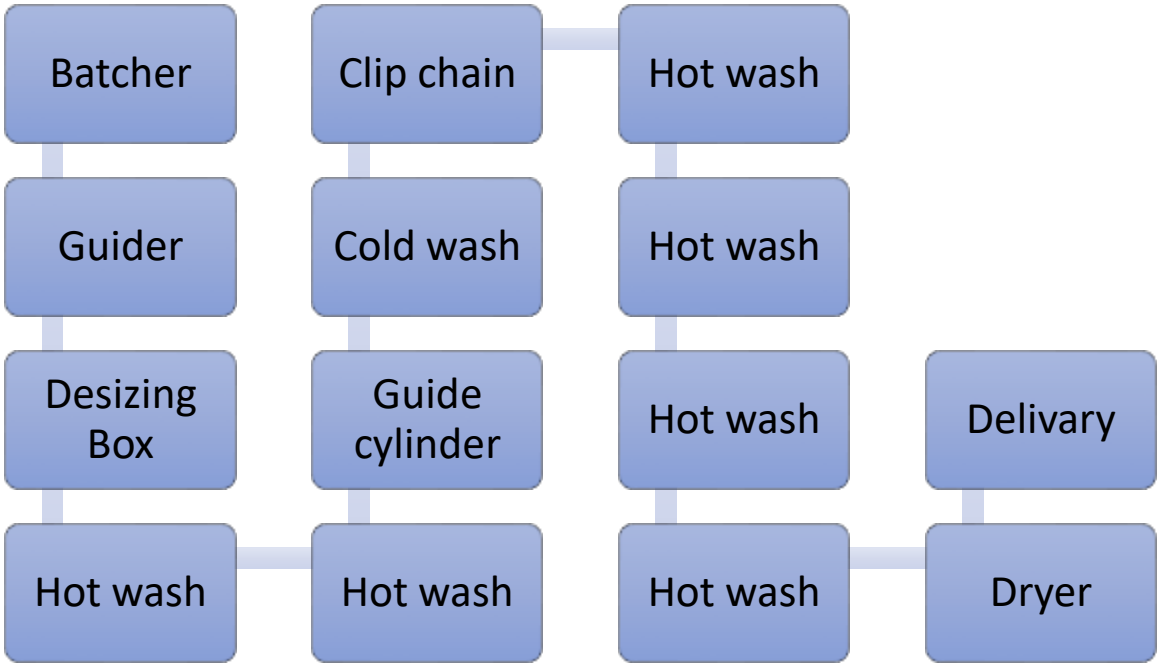
7.4.2.1.6 Guide cylinder:
Guide cylinder using for aeration

7.4.2.1.7 ***Clip chain:***
To control fabric width up to 2-3cm. 5 different hot water spray in fabric. And 5 suction below fabric which remove water.

7.4.2.1.8 Acetic Acid:
To control P^H of fabric. Acetic acid P^H (4.5-5)

7.4.2.1.9 ***Dryer:***
10 Teflon coated dryer use for and 10 uncoated dryers use for drying. Temperature 140-150°C

7.4.2.2 Flow chart for Desizing:



7.4.2.2.1Batcher:
To feed fabric in mercerization machine.

7.4.2.2.2 ***Guider:***
Control selvedge and width of fabric.

7.4.2.2.3 Desizing Box:
To remove starch material.

Recipe: Enzyme – 2gpl

Wetting agent: 1.5 gpl

7.4.2.2.4 Hot wash:
Fabric immersed in hot water. Temperature for hot water 90°C.

7.4.2.2.5 Guide cylinder:
Guide cylinder using for aeration

7.4.2.2.6 ***Clip chain:***
To control fabric width up to 2-3cm.

7.4.2.2.7 ***Dryer:***
10 teflon coated dryer use for and 10 uncoated dryers use for drying. Temperature 140-150°C

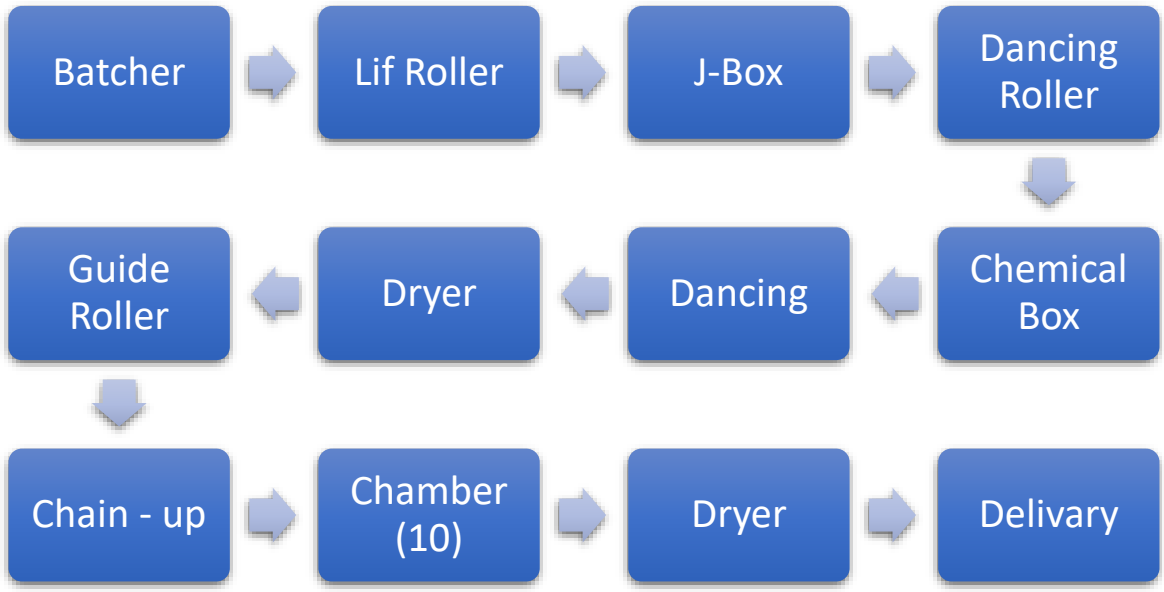
7.4.3 Heat-setting:

This operation is crucial for fabrics made of synthetic fibers (PE, PA, elastomers), for triacetate, and partly for PAC fibers (setting), since it grants excellent dimensional stabilization and crease proof properties, maintained till the fabric is exposed (by air blowing) to temperatures exceeding the heat setting one (after being treated with water at a temperature above the second order glass transition temperature, i.e. 80-85°C for acrylics). Heat setting is carried out on gray fabrics (scarcely applied), on scoured fabrics (frequently applied) and on dyed fabrics (scarcely applied).

Objective:

1) To excellent dimensional stability
2) To crease-proof properties.

7.4.3.1 Flow Chart for Heat setting machine:



7.4.3.1.1 Batcher: To hold fabric

7.4.3.1.2 Lif Roller:
To unwind fabric from batcher

7.4.3.1.3 ***J-Box:***
Where the fabric assembles. To store the fabric for continuous flow of fabric in the machine.

7.4.3.1.4 Chemical Box:
Only wetting agent use for reduce surface tension of water.

7.4.3.1.5 ***Dryer:***
To dry for fabric. Path of drying zone is 44m.

7.4.3.1.6 ***Chamber:***
Use for producing heat from gas. No of heat chamber is 10.

7.4.3.1.7 ***Dryer:***
Two-cylinder use for drying fabric.

Chapter – 8
Inspection

8.1 Inspection:

Inspection can be defined as the visual examination of raw materials (such as fabric, buttons, zippers, sewing threads, trims etc), partially finished components of the garments and completely finished garments in relation to some standards, specifications or requirement as well as measuring the garments to check if they meet the required measurements.

8.2 Objective:

1. Detection of Defects
2. Correcting of defect or defective garments as early as possible in the manufacturing process so that time and money are not wasted later.

8.3 Machine Specification:

Machine Name: Inspection machine
Brand Name: Sun-Tech Textile
Model: ST-KFL1-111-130
Origin: China (2011)
Speed: 5 – 60 M/min

8.4 Fabric Inspection Method:

Fabric is inspected to determine its acceptability from a quality view point.
There are various fabric inspection system such as-

- 4- point system
- 10- point system
- 2.5- point system etc.

8.4.1 4 – point system:

The 4- point system is widely used for fabric inspection, in the united states it is known as AAMA point grading system (AAMA- American Apparel manufacturers association).

a standard established under **ASTM D5430 – 07(2011)**, is a standardized Test Methods for fabric Visually Inspecting and Grading. Four-Point System is widest acceptance in fabric inspection due to its practical, impartial, and worldwide recognized.

8.4.1.1 Defect Classification:

The 4-Point System assigns 1, 2, 3 and 4 penalty points according to the size, quality, and significance of the defect. No more than 4 penalty points is assigned for any single flaw. A defect can be measured either length or width direction; the system remains the same. Only major errors are considered. No penalty points are assigned to minor defects. Whenever errors are recognized during fabric inspection under 4 points system and defect must be assigned a number of points depending on the severity or length.

Criteria for penalty point:

Size of defects	Penalty point
Defects up to 3 inches	1
Defects > 3 inches < 6 inches	2
Defects > 6 inches < 9 inches	3
Defects > 9 inches	4

*** Upon the number and the size of the imperfections in the given yard, a maximum of 4 points can be given to one linear yard.**
*** Four points can be given for each linear yard when a defect is running continuously along the length of the fabric.**
*** Hole point may be evaluated by size.**

Holes and openings (largest dimension)	Penalty point
1 inch or less	2
Over 1 inch	4

8.4.1.2 General Inspection Procedures:

1. Fabric inspection is done in suitable and safe environment with enough ventilation and proper lighting.
2. Fabric passing through the frame must be between 45-60 degree angles to inspector and must be done on appropriate Cool White light 2 F96 fluorescent bulbs above viewing area. Back light can be used as and when needed.
3. Fabric speed on inspection machine must not be more than 15 yards per minute.
4. Standard approved bulk dye lot standards for all approved lots must be available prior to inspection (if possible)
5. Approved standard of bulk dye lot must be available before starting inspection for assessing color, construction, finish and visual appearance.
6. Shade continuity within a roll by checking shade variation between centre and selvage and the beginning, middle and end of each roll must be evaluated and documented.

7. Textiles like knits must be evaluated for weight against standard approved weight.
8. Fabric width must be checked from selvage to selvage against standard.
9. All defects must be flagged during inspection
10. The length of each roll inspected must be compared to length as mentioned on supplier ticketed tag and any deviation must be documented and reported to mill for additional replacement to avoid shortage.
11. If yarn dyed or printed fabrics are being inspected the repeat measurement must be done from beginning, middle and end of selected rolls.

No penalty points are recorded or assigned for minor defects. Only major defects are considered.

8.4.1.3 Calculation of total points per yards:

In 4 point system fabric quality is evaluated by unit points/100 yd^2

$$Points/_{100\ Yd^2} = \frac{Total\ points\ in\ roll \times 36 \times 100}{Fabric\ length\ in\ yds \times Fabric\ width\ in\ inches}$$

8.4.1.4 Acceptable Level:

Many used to say that up to 40 points per 100 square yards is acceptable. In the apparel and textile industry, textile mills, apparel brands and buyers set their own standards for acceptable points. A standards level is set by ASTM.
Many mills grade fabrics as first quality and second quality instead of just Pass/Fail the fabric roll or fabric lot. Again grading is done based number of penalty points per 100 square yards. One more thing you should remember that acceptable points can be defined as points per 100 linear yards as well as points per 100 square yards. Secondly, acceptable points for individual roll and acceptable average points of all roll are set at different level.
An international buyer that explains something like following
any running defect more than 4 continuous yards will cause the roll to be rejected.

1. Fabric width up to 64-66 inches shall be classified as first quality if number of penalty points there in does not exceed 50 points per 100 linear yards.

2. For fabric width wider than 64-66 inches acceptable penalty points should be proportion of 50 points per 100 linear yards. (Use 64 inch for such calculation)

In general, acceptable level of 'points per 100 linear yards' or 'points per 100 square yards' are different for different fabric types. For example:
For **Cotton Twill/Denim** 28 points per 100 square yards (23 points per 100 square meters) for individual fabric roll
For **All synthetic fabrics** 20 point per 100 square yards (16 points per 100 square meters) for individual fabric roll

8.4.1.5 Types of defects:

Major Yarn defects	Coarser warp and weft, Finer warp & weft, Dirty warp & weft, Slubbyness, Contamination, warp ball formation
Major Dyeing defects	Shade variation, Stain, Stop mark, S.S.V, Dyeing Patta
Major Sizing defects	Beam stain, size spot, Bad selvage, Less width, warp knot, Loose, Tight
Major Weaving defects	Broken pick, Double pick, Miss pick, Lashing pick, Starting mark, Reed mark, Weft knot, Snarl, Smash, Oil spot, Floating ends, Double end, wrong drawing, Slack end, Hole, Wrong rolling
Major Finishing defects	Crease mark, up singed, width variation, Machine stop, Fabric stain, Torn, Sleeve Mark, E.H. Mark, Wave

8.4.1.6 Minimum acceptable width:

This width is excluding selvedge. Fabric width will be checked minimum of three times during the inspection of a piece (beginning, middle and end of a piece). Pieces having a width of measurement of less than the specified purchased width shall be graded as second quality.

8.4.1.7 Defects Rules:

1. A continuous of defect shall be assigned four points for each linear meter or yard in which it occurs.

2. Any piece having a running defect through more than three continuous linear meters or yards shall be rejected. Regardless in point count.
3. Any piece with a full width defect over six inches in length shall be rejected.
4. Any piece that contains more than three full width defects per one hundred linear meters or yards shall rejected.
5. No piece shall be accepted that contains a full width defect in the first and last three meters or yards.
6. A hole or torn is considered to be a major defect and shall be penalized four
7. Fabric construction and weight, No tolerance will be allowed.
8. The distance between major defects should be more than 20 meters.
9. All major and full width defects should be seemed a polyester thread at the selvedge.
10. Waviness, tightness, ripples, puckering in body of fabric which would prevent the fabric from lying flat when spread in a conventional manner is not acceptable.

8.4.1.8 Following defects will be penalized penalty points as per rules:

Kinks, Knots, slub, contamination, spot, and half/double pick, cockled yarn, coarse pick. Heavy weft bar below 6" in length, set mark, rapping, broken pick, out mark, holes & float up to ¼ "

8.4.1.9 Following defects are cut table and will be rejected:

1. Frequent kinks, knots, slub, contamination, spots etc
2. Any continuous defect
3. More than one meters broken end, double end, wrong draw reed mark
4. Holes torn and float above ¼ "
5. Irregular selvedge, light weft bar, count variation, Lecco, shade variation
6. Heavy weft bar above 6: in length
7. The most commonly used system is the American 4 point system.

8. The ASTM D5430 standard explains how to assign points to each defect–mostly based on its size.
9. The overall result consists of two numbers (and they are all most buyers want to know regarding defects):
10. The average number of points (on a 100 meters basis) of all inspected rolls,
11. The proportion of rolls above acceptance limit.

Maximum Acceptable Points = 20 points per 100 sq. yards or 22 points per 100 sq. meters.

Chapter - 9

Denim Wash

9.1 Denim Washing:

Denim washing is a finishing treatment of denim products which change the denim products outlook. Washing is not only make the denim product attractive but also increases its strength. Nowadays hundreds of denim wash are available to cope up with the present fashion trend. Although every washing process has some advantages and limitations also but they used for wash the denim garments.

9.2 Types of denim wash:

Denim wash can be classified into two types. i.e.

- Mechanical Wash
- Chemical Wash

9.2.1 Mechanical Wash:

Mechanical denim wash is a kind of denim washing process where various mechanical components are used instead of chemicals. During mechanical wash micro sanding, stones, laser and various elements are used to get the required wash outlook.

In general three types of micro sanding are used. i.e.

- Sand blasting
- Hand Sanding
- Machine Sanding

Different types of mechanical denim wash are available. i.e.

- Brushing
- Whickering by Emery paper.
- Grinding or physical distraction
- Destroy wash (distraction of warp only)
- Tint wash
- Tagging
- Tie (wet process in hosiery style)
- Potassium permanganate spray
- Laser finish
- Thermo denim wash
- Super stone wash
- Ice wash
- Water jet wash

- Shot gun denim etc.

9.2.2 Chemical Wash:

Chemical denim wash is the process of denim washing by various chemical process. In this process, the denim product is changed chemically to give required outlook.

Different types of chemical denim washes are available. i.e.

- Desizing wash
- Enzyme wash
- Bleach wash
- Softening wash
- Over dye wash
- Acid wash
- Super dark stone wash
- Rinse wash
- Sun wash
- Snow wash
- Ozone fading
- Flat finish
- Salt water wash
- Cellulosic wash

9.3 Denim washes available in Amber Denim Mills Limited:

In Amber Denim Mills Limited the buyer provide a small piece of washed sample. Then the expert persons investigate the sample and find out the type of washing and required chemicals to obtain the required shade or outlook. So it is very important to wash the sample fabric to justify his assumption and take proper steps to create exact recipe for the fabric. Amber Denim Mills Limited only wash sample fabric not bulk and share the recipe with buyer for mass production.

Some denim wash recipes used by Amber Denim Mills Limited:-

9.3.1 Desizing:

Desizing is a denim washing process which is carried out to remove the sizing materials from fabric to get required properties or outlook.

- Recipe 1:
    - Chemicals: Gzime Ultra plus (desizing agent)
        - Anti-staining agent

- Time: As required
- Temperature: 50-55°C
- Rinse wash : 2 times
- Extraction: 3 times
- Drying: 25 min

- Recipe2:
  - Chemicals: Soda Ash (desizing agent for heavy effect)
    - Anti-staining agent
    - Hydrogen Peroxide (H_2O_2)
  - Time: As required
  - Temperature: 50-55°C
  - Rinse wash : 2 times
  - Extraction: 3 times
  - Drying: 25 min
- Recipe 3:
  - Chemicals: Caustic (desizing agent for bluish effect)
    - Anti-staining agent
    - Hydrogen Peroxide (H_2O_2)
  - Time: As required
  - Temperature: 50-55°C
  - Rinse wash : 2 times
  - Extraction: 3 times
  - Drying: 25 min

- Recipe 4:
  - Chemicals: Detergent (Normal desizing agent)
    - Soda Ash
    - Anti-staining agent
  - Time: As required
  - Temperature: 50-55°C
  - Rinse wash : 2 times
  - Extraction: 3 times
  - Drying: 25 min

9.3.2 Enzyme Wash:

Enzyme wash is a denim washing process which is carried out to remove the hairy fibers, protruding fibers and neps of the fabric.

- Recipe1: For Bluish effect

- Chemicals: Bio polishing Enzyme
    - Acetic Acid
    - Anti-staining Agent
    - pH=4.5-5
  - Time: 25 min (Approx.)
  - Temperature: 45-50°C
  - Rinse wash : 2 times
  - Extraction: 3 times
  - Drying: 25 min

- Recipe2: For Reddish effect

  Chemicals: Neutral Enzyme Powder

  Anti-staining Agent
    - pH=4.5-5
  - Time: 25 min (Approx.)
  - Temperature: 45-50°C
  - Rinse wash : 2 times
  - Extraction: 3 times
  - Drying: 25 min
  -
- Recipe3: For heavy effect
  - Chemicals: Bio polishing Enzyme

    Neutral Enzyme

    Washing stone

    Anti-staining Agent

    pH =4.5-5
  - Time: 25 min (Approx.)
  - Temperature: 45-50°C
  - Rinse wash : 2 times
  - Extraction: 3 times
  - Drying: 25 min

9.3.3 Bleach Wash:

Bleach wash is a denim washing process which is carried out to remove the natural color or fade the dyeing color of the fiber in the fabric.

*** Bleaching booster is used to increase the power of bleaching agent for heavy effect.

- Recipe1: For bluish effect
  - Chemicals: Iclon 65 (Japanese bleaching agent)
  - Time: As required
  - Temperature: 50-60°C
  - Rinse wash : 2 times
  - Extraction: 3 times

- Drying: 25 min

- Recipe2: For reddish effect
  - Chemicals: KCl (bleaching powder)
  - Time: As required
  - Temperature: 50-60°C
  - Rinse wash : 2 times
  - Extraction: 3 times
  - Drying: 25 min

- Recipe3: For black only
  - Chemicals: Potash & Caustic Peroxide
  - Time: As required
  - Temperature: 50-60°C
  - Rinse wash : 2 times
  - Extraction: 3 times
  - Drying: 25 min

9.3.4 Softening Wash:

Softening wash of denim fabric is carried out to make the fabric soft and comfortable. For softening process various types of chemicals are used. i.e.

Softener GT: This softening agent is used to make the fabric softer by remaining the shade unchanged.

Silicon: It is a softening agent which not only make the fabric soft but also increase the shade percentage or make the shade deep.

Powersoft: This softening agent is used to make the fabric softer by remaining the shade unchanged.

9.3.5 Neutral wash:

Neutral wash of denim is carried out to make the fabric neutral chemically. Various recipes are used to neutral denim fabric after each wash.

9.3.5.1 Bleach neutral:

- Chemicals: Meta bi sulfide
  - PPCon
  - Hypo
- Time: 20 min (Approx)
- Temperature: 50-60°C
- Rinse wash: 2 times
- Extraction: 3 times
- Drying: 25 min

9.3.5.2 Potassium neutral:

- Chemicals: Meta bi sulfide
    - PPCon
- Time: 20 min (Approx)
- Temperature: 50-60°C
- Rinse wash: 2 times
- Extraction: 3 times
- Drying: 25 min

9.3.5.3 Caustic peroxide neutral:

- Chemicals: Acetic Acid
- Time: 20 min (Approx)
- Temperature: 50-60°C
- Rinse wash: 2 times
- Extraction: 3 times
- Drying: 25 min

9.3.5.4 Black color neutral :

- Chemicals: PPcon
- Time: 20 min (Approx)
- Temperature: 50-60°C
- Rinse wash: 2 times
- Extraction: 3 times
- Drying: 25 min

9.4 Machines for Washing Lab in Amber Denim Mills Limited:

In Amber Denim Mills Ltd., there are various types of machines and mechanical equipments are used. The specifications and details about those machines are given below:

9.4.1 Digital Washing Machine

Machine name: Digital Washing Machine

Brand: Yilmak

Model: HBM 250 S

Origin: Turkey(2013)

Drum volume:250 ltr

Drum speed:0-40 rpm

Power consumption: 1.5KW, 400V, 50 Hz, 3.2 A

Maxmium Temperature:95°C

9.4.2 Blanket matching Machine

Machine name: Blanket matching machine
Brand: JIANYE Group Co. Ltd
Model: CX-120
Origin: China
Drum volume:400 ltr
Drum speed:0-40 rpm
Maximum Temperature:95°C

9.4.3 Hydro Extractor

Origin: China
Model: Kz-20A
Loading capacity: 20 kg
Speed: 1310 rpm
Power consumption: 1.5 KW, 50 Hz
Wight: 450 kg

9.4.4 Dryer:

Brand: Yilmak

Model: HBM 250 S
Origin: Turkey(2013)
Drum volume:20 ltr
Drum speed:0-40 rpm
Power consumption: 1.5KW, 400V, 50 Hz, 3.2 A
Maxmium Temperature:95°C

9.5 Some common denim washes:

9.5.1 Flat Finish:

Flat finish is a common denim fabric wash by which mercerization and calendaring processes are carried out to achieve the flat surface. It imparts an even wash down effect

and clean surface. The mercerization process swells up the cotton fibers which is pressed in calendaring to achieved a flat surface.

9.5.2 Super Dark Stone Wash:

n this type of denim wash inserts an extra dark indigo color which is obtained from a

double-dyeing technique. Sometimes, a softening process of Silicon is carried out to get this type of shade.

9.5.3 Destroy:

It is mechanical denim washing process where only warp yarns of the denim fabric is destructed physically to get the required design or effect. It is a very common and mostly

used denim wash which is very much preferable by young people.

9.5.4 Super Stonewash:

Super Stonewash is a common type of denim wash treatment in which the denim garments is subjected to prolonged stonewash treatment for more than six hours. Soda ash and soap are used for hard wash. Steam is used up to 60-80°C for one hour to finish the washing process. It is followed by acetic acid wash treatment, then the garments are neutralized and rinsed.

9.5.5 Ice Wash:

Ice wash is a type of denim wash in which almost half the dye is removed during washing. Mainly this type of washing is carried out to get very light shade.

9.5.6 Laser finish:

Laser finish is a very common and mostly used denim process where laser light is used to get desire destruction finish of denim fabric. By this process different patterns or designs, such pictures, images, lines, text etc. can be developed on denim garments.

9.5.7 Grinding:

It is mechanical denim washing process where the denim fabric is destructed physically to get the required design or effect. It is a very common and mostly used denim wash which is very much preferable by young people.

9.5.8 Potassium permanganate spray:

Potassium permanganate spray or monkey spray is a stylish denim wash where Potassium Permanganate ($KMnO_4$) spray is used to get desired printing effect on the denim fabrics

or garments.

9.5.9 Thermo denim wash:

It is a uncommon denim wash which is carried out by the use of heat in a certain place of denim fabric to the desired outlook on that space specifically.

9.5.10 Water jet wash:

It is the most ecofriendly denim washing process where only water is used. In this method water is sprayed in one or both side of fabric by using a specific pattern to get the exact designed wash.

9.5.11 Over dye wash:

Over-dyeing or tinting of denim is an additional dyeing treatment which is normally carried out on denim garments. Normally denim garments is over-dyed with yellowish dye for appearing dirty look. Tinted/ over- dyed denim garments shows a used or vintage& muddy look to the garments.

9.5.13 Ozone fading:

In this technique of denim washing, the garment is bleached with ozone dissolved in

water in a washing machine or in a closed chamber by using ozone gas.

9.5.14 Cellulosic wash:

This is the denim washing process of denim fabric composed of blended fiber. In this process, the cellulose part of cotton yarns is broken and all other parts are remains same.

Chapter – 10

Research & Development (R&D)

10.1 Research & Development (R&D) Department:

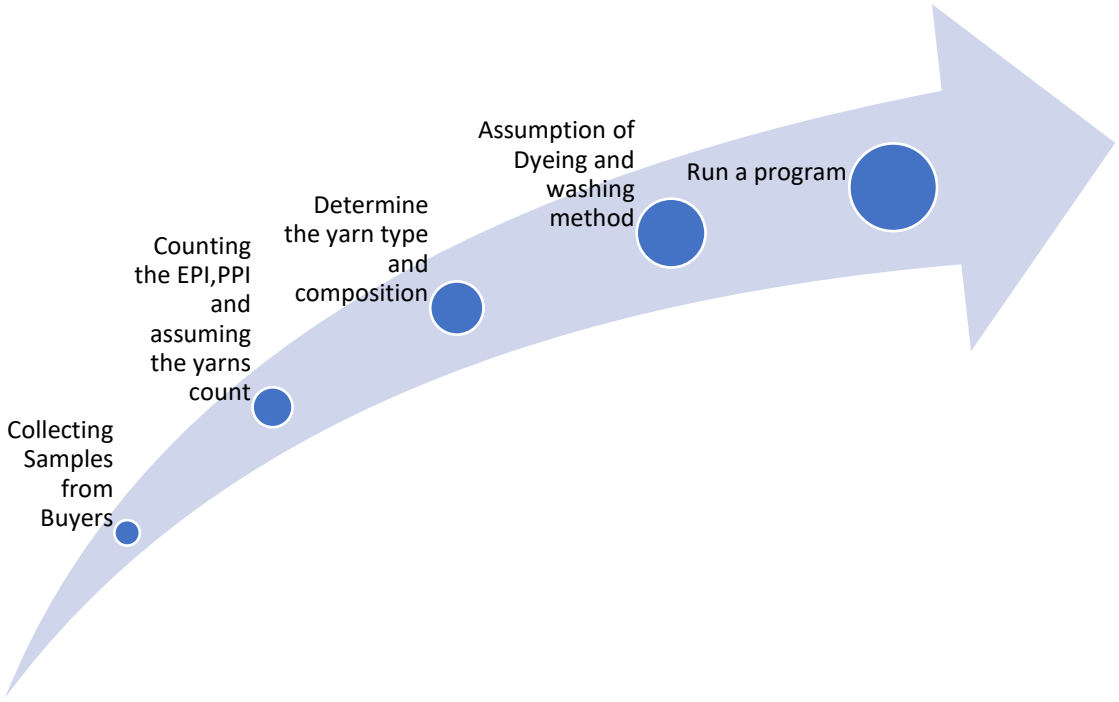
Research & development department is the most important department for any textile industry nowadays. This plays a direct role on developing a product from the raw material as per buyer's requirement with optimum quality

Amber Denim Mills Ltd. has a modern and dynamic Research & Development (R&D) department with modern amenities which correlates very well with the upcoming new product. Besides the buyers product they run continuous research program, which is completed by product development. The R&D department is independent and equipped to promptly invent new designs for new fashion and develop buyer's requirements timely. This department keeps all documents from dyeing recipe to fabric construction and keeps master roll to keep shade in same consistent even over a longer discontinuity. Amber always researches to develop new fashion as per the world requirement as well as to maintain comfort & durability. Most often this department creates new product on the basis of new design & structure by their own creativity according to the current market demand and then give it to the buyer. If this design is approved by the buyer then it is stored. They already developed over 6000 samples.

When an order comes from buyer in form of washed sample. The technical person determines the shade percentage, amount and type of washing to that fabric to get the appearance like the sample. So it is very important to wash the sample fabric to justify his assumption. For this purpose a small washing unit is established in the factory.

Every order firstly comes into R&D department via marketing peoples by mail or swatch. The R&D experts analyze these samples and match it with their developed samples. If they find similar samples then this is sent to buyers for approve. If buyers approve it then the R&D section

for production.



The R&D department also performs different testing solutions. Most modern and efficient lab instruments from Atlas, UK which is operated by trained technicians. The variable light box, Spectrophotometer, rubbing tester, Washing Fastness, Tensile strength tester etc. gives accurate results and helps to keep quality good and more consistent.

Lab reports of a running lot are constantly maintained. After each process a sample for testing is sent by the production staff usually after many meters of run. Lab reports contain information about various tests performed according to buyer requirements and their results with remarks of responsible staff about the fabric.

Research and Development (R&D) department of Amber Denim Mills Limited already developed around 6000 samples.

10.2 Samples developed by weave plan are mainly:

- 3/1 RHT
- 3/1 LHT
- 2/1 RHT
- 2/1 LHT
- 1/1 plain (chembarry)
- 4/1 sateen, Dobby etc.

10.3 They mainly works for following buyers or vendors:

- H&M
- M&S
- George
- C&A
- Inditex
- OVS
- IVS
- Daven Hales
- Sainsbuyers
- S. Oliver
- Springwomen
- Tusuka
- Standard Group
- Windy
- T.M. Fabrics
- Kanpark BD.
- Ananta Jeans Ltd.
- Rezency Apparel
- Natural Denim

Chapter – 11

Textile Testing & Quality control

11.1 Quality:

According to the standard ISO 9004-2, quality is the essential nature of something, an inherent or distinguishing characteristic or property, superiority, excellence, or perceived level of value. Exact characteristics experienced as quality features vary between people. Each person has their own references of quality, some people find good durability and functionality as good quality, for others, attractive design and brand status is good quality. Costumers rely on a wide variety of aspects to decide if the product meets their quality references. The quality characteristics of a product have to be incorporated so that the customer's desire and will to purchase the product can be cost-effective.

The broad concept of quality can be divided into three subcategories:

- Intrinsic: Intrinsic quality is created during product development and production and is depending on materials, methods and processes.
- Extrinsic: Extrinsic quality is not a part of the specific product; it is everything around the product like brand, shop, price, merchandising, marketing and reply of retailers.
- Perceived: Perceived quality is the intrinsic and extrinsic quality together.

11.2 Denim Quality:

The intrinsic qualities of jeans are affected by two main groups: material and production. By dividing into these two groups when researching quality, it will be easier to analyze possible improvements.

The material category holds fiber, yarn and fabric structure whilst production consists of the production phase with pre-treatment, making (cutting, sewing, trimming) and finishing. Several different finishes or washes can be applied to jeans to achieve different looks. Many of the washes aim to give the jeans a worn and torn look.

11.3 Quality Testing:

Denim fabrics were tested considering five durability aspects: abrasion resistance, tear strength, color fastness to rubbing, color fastness to washing and dimension stability. The tests resulted in quantified data that was put together and analyzed. On four out of five tests; abrasion resistance, color fastness to rubbing, color fastness to washing and dimension stability the result are subjective judged by the authors.

The selection of tests to perform and what denim styles to test were based on the claim statistics of the company. The chosen denim styles were some of the most frequent styles in the claim statistics, and some of the styles were available on the market at the moment.

11.4 International Standards:

The International Organization of Standardization (ISO) is an international institution with an aim to simplify and improve the quality management of companies and organizations. By establishing standards, routines can be simplified, money saved and quality improved. Most of the 16 000 standards of today are international. The benefit of international standards is that the common base of information will simplify trade and production across the world. The standards make it easier to compare and to assess capacity, quantity, content, extent, value and quality. Standards are

optional, but by deciding to follow them there are certain rules to meet. Many standards are used as regulations and also to guide or define properties that may secure material and products to be sufficient for its end use.

11.5 AQL – Accepted Quality Level:

Accepted Quality Level (AQL) is a quality control tool for inspection of products. As earlier mentioned, products (in this case jeans) can be inspected in several different ways. For evaluations, tests or other types of comparisons, AQL is a good tool to control how well the products stand in relation to the quality requirements. The AQL will tell the amount of products that should be inspected and how many defects are accepted, rather than dictating what tests should be made. Based on the AQL, randomized inspections are made, which gives the company a result that indicates the status for a majority of the products. The amount of products that will get inspected and how many faults that are accepted are determined by a combination of the AQL-level, the inspection level and the size of the order. Each company chooses what levels they want to work with. An AQL of 1.5 will not accept faults in more than 1.5 % of the inspected lot. There are three inspection levels; I, II and III. Inspection level II is most commonly used, but at less comprehensive inspections level I is used, and at more comprehensive inspections level III is used.

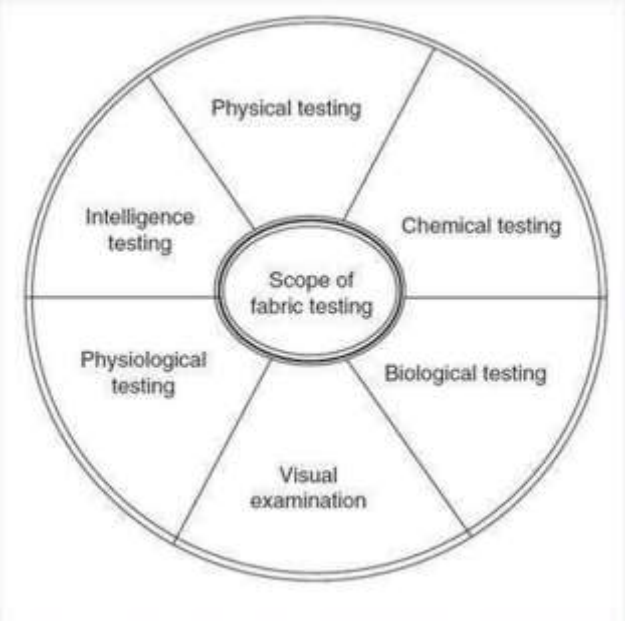
Defects are classified by their severity; minor, major or critical. Three minor defects are equal to one major defect. If the amount of defected products in the inspected lot exceeds the AQL, the order should be rejected, otherwise it can be accepted.

11.6 Textile Testing & Quality Control:

Textile Testing & Quality Control (TTQC) is very important work or process in each department of export oriented industry. Buyers want quality but not quantity. In every department of textile industry quality maintained of each material. Because one material's quality depend on another's quality. For example, if qualified fiber is inputted then output will be good yarn.

11.7 Scope of Fabric Testing:

The performance of a fabric is ultimately related to the end-use conditions of a material. The physical, chemical, physiological and biological influences on fabrics affect their end- use performance. Although all agents affect textile performance at the fiber, yarn and fabric levels, emphasis is generally given to fabrics since they represent the largest class of textile structures in a variety of applications. Thus, a fabric is usually the most complex and representative form of a textile structure that is subjected to these agents and influences in most end uses. Testing of fabrics and quality control is broad in its scope. It can include, for instance, the means for determining and controlling the quality of a manufactured product. It can be used to measure the outside factors that influence the test results. Testing of fabrics to the above influences of a physical, chemical and biological nature would be of great help to manufacturers in adjusting their process control parameters to produce the right material.



11.7.1 Physical Testing:

The first broad class of factors that affect the performance of fabrics are factors that influence the test results. Testing of fabrics to the above influenced physical agents and influences. These may be further subdivided into mechanical deformation and degradation, tactile and associated visual properties of fabrics (such as wrinkling, buckling, drape and hand) after their use and manufacture, and their response to heat, liquids and static charge. The testing of fabrics to mechanical deformation is very important and refers to fabrics that are subjected to variable and complex modes of deformation. They include tensile behavior, compression, bending or flexing, shrinkage, abrasion resistance, frictional rubbing, torsion or twisting, and shear.

11.7.2 Chemical Testing:

Chemical and photochemical exposure of textiles may lead to yellowing or discoloration of undyed fabrics, to fading of dyed fabrics, and/or to degradation of dyed and undyed fabrics. These adverse results are due to de-polymerization of the polymer chain in the fiber that may occur by hydrolysis, oxidative processes and/or crosslinking. Textile fabrics have varying degrees of resistance to chemical agents such as water and other solvents, to acids, bases and bleaches, to air pollutants and to the photochemical action of ultraviolet light. Resistance to chemical agents is dependent on fiber type chemical nature of the dyes, additives, impurities, finishes present in the fiber, and to a lesser extent on the construction and geometry of the fabric.

11.7.3 Biological testing:

Textile fabrics may be adversely affected by various microorganisms and insects. The effect of biological agents on textile fabrics is important for enhancing their end-use performance in many

areas. Testing of fabrics and evolution of specific test methods for the above biological influences would help manufacturers, retailers and users of fabrics to develop strategic ways to maintain and protect their fabrics in storage and transportation. These tests would be useful for rapid screening of various modified and unmodified fabrics for their ability to withstand biological attack.

11.7.4 Visual Examination:

Visual examination of fabrics includes evaluating the texture, surface characteristics, dye shade variations, design details, weave patterns, construction particulars, pilling assessment, etc. Defect analysis is another major area today and is widely discussed in the textile industry. Defects are bound to occur in fabric during manufacture for a number of reasons.

The complex problem of fabric quality control through defect analysis may be solved by means of computer vision using advanced digital signal and image processing tools. Many of these image processing applications aim at detecting textural characteristics and textural defects of fabrics, including color detection and dye shade variations.

11.7.5 Intelligence Testing:

In the last decade, research and development in smart/intelligent materials and structures have led to the birth of a wide range of novel smart products in aerospace, transportation, telecommunications, homes, buildings and infrastructures. Intelligent textiles are fibers and fabrics with a significant and reproducible automatic change of properties due to defined environmental influences.

11.7.6 Physiological testing:

Three important physical parameters that are instrumental in the physiological processes of fabrics are heat transmission, moisture transport and air permeability. The physiological properties of fabrics relate to what the fabric or garment feels like when it is worn next to the skin, such as too warm, too cold, sweaty, allergic, prickly etc.

Therefore, in the assessment of a fabric or garment for a particular end use, the comfort of that product is considered to be very important. Fabric testing therefore needs to address the comfort properties of fabrics.

11.8 Test and their procedures:

In Amber Textile Service Ltd the following tests are carried out. i.e.

11.8.1 Test Name: Martindale pilling test

- Objectives: To determine the pill formation tendency of fabric during rubbing by the same fabric.

- Standard: ISO 12945-2
- Equipment used: Martindale pilling and Abrasion tester
- No. of specimen required: At least 3 pairs.
- Specimen size: 140 mm in dia
- M/C speed: 50 rpm

11.8.2 Test Name: ICI pilling test

- Objectives: To determine the pill formation tendency of fabric during rubbing by the other material.
- Standard: ISO 12945-1
- Equipment used: ICI Pilling Tester
- No. of specimen required: At least 4
- Specimen size: 200mm*120 mm
- M/C speed: 60 rpm

11.8.3 Test Name: Martindale Abrasion test

- Objectives: To determine the pill formation tendency of fabric during rubbing by different fabric.
- Standard: ISO 12945-2
- Equipment used: Martindale pilling and Abrasion tester
- No. of specimen required: At least 2 pairs.
- Specimen size: 38 mm in dia
- M/C speed: 50 rpm

11.8.4 Test Name: Martindale Tear strength

- Objectives: To determine the strength of fabric to tear.
- Standard: ISO 13936-1
- Equipment used: Tinnitus Olsen Universal Strength Tester
- No. of specimen required: At least 5
- Specimen size: 140mm*100mm
- M/C speed: 50 rpm

11.8.5 Test Name: Elmendorf Tear Strength

- Objectives: To determine the strength of fabric to tear.
- Standard: ISO 13937-1
- Equipment used: Elmendorf Tearing Tester
- No. of specimen required: At least 5
- Specimen size: 75*100
- M/C speed: 50 rpm

11.8.6 Test Name: Tensile Strength test

- Objectives: To determine the ultimate strength of fabric.

- Standard: ISO 13936-1
- Equipment used: Tinius Olsen Universal Strength Tester.
- No. of specimen required: At least 5
- Specimen size: 140mm*110mm
- M/C speed: 50 rpm

11.8.7 Test Name: Seam Slippage and Seam Strength

- Objectives: To determine the strength of seam.
- Standard: ISO 13936-1
- Equipment used: Tinius Olsen Universal Strength Tester.
- No. of specimen required: At least 5
- Specimen size: 260mm*110mm
- M/C speed: 50 rpm

11.8.8 Test Name: Martindale Stretch and Recovery test

- Objectives: To determine the stretch and recover% of fabric.
- Standard: ISO 13934-2
- Equipment used: Tinius Olsen Universal Strength Tester.
- No. of specimen required: At least 5
- Specimen size: 200mm*100mm
- M/C speed: 50 rpm

11.8.9 Test Name: Elmendorf Stretch and Recovery test

- Objectives: To determine the stretch and recover% of fabric.
- Standard: ISO ASTM D3107
- Equipment used: DUPONT Tester.
- No. of specimen required: At least 3
- Specimen size: 600mm*100mm

11.8.10 Test Name: GSM measurement

- Objectives: To determine the weight of fabric.
- Standard: N/A
- Equipment used: GSM cutter and Digital Balance
- No. of specimen required: At least 3

11.8.11 Test Name: Fabric Count

- Objectives: To determine the EPI and PPI of fabric.
- Standard: N/A

- Equipment used: Counting glass and needle
- No. of specimen required: At least 3
- Specimen size: 1”*1”

11.8.12 Test Name: Color Fastness to commercial Wash

- Objectives: To determine the color fading by wash of fabric.
- Standard: ISO 105C06
- Equipment used: Launder-O-Meter
- No. of specimen required: At least 2
- Specimen Size: 100mm*40mm
- Multifiber Size: 100mm*40mm
- Recipe: ECF Phosphate Ref. Detergent B- 4 g/l
  Sodium Perborate – 1 g/l
  Multifiber: DW
  Liquor volume: 150ml
  Temperature: 40°C
  Time: 30 min
  Wash: Rinse wash

11.8.13 Test Name: Color Fastness to household Wash

- Objectives: To determine the color fading by wash of fabric.
- Standard: ISO 6330-1
- Equipment used: Washing machine
- No. of specimen required: At least 2
- Specimen Size: 50mm*50mm
- Recipe: TAED(Tetra Acetylene Ethylene Dyamin) – 3%
  Sodium Perborate – 20%
  Detergent: 77%
  Liquor volume: 150ml
  Temperature: 40°C
  Time: 30 min
  Wash: Rinse wash

Test Name: Color Fastness to perspiration

- Objectives: To determine the color fading of fabric by sweating.
- Standard: AATCC 15
- Equipment used: Perspiration kit, electric oven etc.
- No. of specimen required: At least 5

- Specimen Size: 6mm*6mm
- Multifiber : DW
- Recipe: L histidine mono hydrocholaride mono hydrate: 0.25 g/l
  Sodium Chloride: 10 g/l
  Di sodium hydrogen phosphate and hydrose: 1 g/l
  Lactic acid: 1 g/l
  Wetting time: 30 min
  Oven temperature: 38°C
  Time: 6hrs

11.8.14 Test Name: Color Fastness to Water

- Objectives: To determine the color fading by water of fabric.
- Standard: AATCC 107
- Equipment used: Washing machine
- No. of specimen required: At least 8
- Specimen Size: 6mm*6mm
- Recipe: TAED(Tetra Acetylene Ethylene Dyamin) – 3%
  Sodium Perborate – 20%
  Detergent: 77%
- Procedure: as per perspiration test.

11.8.15 Test Name: pH test-1

- Objectives: To determine the potential of hydrogen (pH) of fabric.
- Standard: AATCC 81
- Equipment used: Conical flask, digital balance, Shaker machine pH meter.
- No. of specimen required: 10 gm.
- Specimen Size: 1”*1”
- Distilled water: 250 ml
- Time: 10 min

11.8.16 Test Name: pH test-2

- Objectives: To determine the potential of hydrogen (pH) of fabric.
- Standard: ISO 3071
- Equipment used: Conical flask, digital balance, Shaker machine pH meter.
- No. of specimen required: 2 gm.
- Specimen Size: 5mm*5mm
- Distilled water: 100 ml
- Time: 10 min

11.9 Machine in ADML Testing Lab

Machines Specification: In Amber Denim Mills Limited, they have a modern and dynamic lab in their factory. The lab is full of modern machines and equipment’s. i.e.

11.9.1 Machine name: Tumble dryer

- Brand: Electrolux
- Model: T 5130
- Origin: Sweden
- No of machine: 02

11.9.2 Machine name: Automatic dryer

- Brand: Whirlpool
- Model: N/A
- Origin: China
- No of machine: 01

11.9.3 Machine name: Launder-O-Meter

- Brand: James heal
- Model: Gyrowash^2
- Origin: German
- No of machine: 01

11.9.4 Machine name: Miele Washing Machine

- Brand: Miele
- Model: N/A
- Origin: China
- No of machine: 01

11.9.5 Machine name: Front loading washcator

- Brand: Electrolux
- Model: CLS 71
- Origin: Sweden
- No of machine: 01

11.9.6 Machine name: Washer Extractor

- Brand: Electrolux
- Model: W 555H
- Origin: Sweden
- No of machine: 01

11.9.7 Machine name: Top Loading Washing Machine

- Brand: Whirlpool
- Model: N/A
- Origin: China
- No of machine: 01

11.9.8 Machine name: Lab Water Purification System

- Brand: Millipore
- Model: N/A
- Origin: N/A

- No of machine: 01

11.9.9 Machine name: Laboratory Padder

- Brand: Gester International CO. Ltd.
- Model: GTD 19B
- Origin: China
- No of machine: 01

11.9.10 Machine name: Electronic Balance

- Brand: Mettler Toledo
- Model: ME 204 E
- Origin: N/A
- No of machine: 04
- Capacity: 0.0001-200 gm

11.9.11 Machine name: Digital pH meter

- Brand: Trans Instruments
- Model: BP 3001
- Origin: N/A
- No of machine: 02

11.9.12 Machine name: Electric oven

- Brand: Panasonic
- Model: G209A
- Origin: Korea
- No of machine: 02

11.9.13 Machine name: Dupont tester

- Brand: Unknown
- Model: N/A
- Origin: China
- No of machine: 04

11.9.14 Machine name: ICI Pilling Tester

- Brand: SDL Atlas Textile Testing Solutions.
- Model: M 227
- Origin: N/A

11.9.15 Machine name: Elmendorf tearing tester

- Brand: SDL Atlas Textile Testing Solutions.
- Model: M008HE
- Origin: N/A

11.9.16 Machine name: Tensile strength tester

- Brand: Tinius Olsen
- Model: N/A
- Origin: German

11.9.17 Machine name: GSM Cutter

- Brand: SDL Atlas Textile Testing Solutions.
- Diameter: 140mm, 38mm etc.
- Origin: N/A
- No of machine: 04

11.9.18 Machine name: Martindale Abrasion and pilling Tester

- Brand: SDL Atlas Textile Testing Solutions.
- Model: N/A
- Origin: N/A
- No of machine: 01

11.9.19 Machine name: Shaker Machine

- Brand: JEIO-Tech
- Model: SK-300
- Origin: Korea
- No of machine: 01

Chapter – 12

Utilities

12.1Utilities:

Utilities is the features that generates transmits and/or distributes electricity, water and/or gas from facilities that it owns and/or operates. A utility system used in industrial facilities. This area includes boilers, chillers, cooling towers, air compressors, and their associated fluid distribution systems.

12.2 Utility department of Amber Denim Mills Ltd. is related to the following things:

- Electricity: Gas Generator, Rural electrification Board (REB)
- Water: Deep Tube well
- Gas: TITAS
- Steam: Boiler
- Compressed air: Air compressor
- Chiller
- Effluent Treatment Plant (ETP)
- Water Treatment Plant (WTP)

12.2.1 Water Supply:

Water is supplied by deep tube well. They use 5 water pump for meet their water demand. There are two tank main & reserve tank for water storage. The level of water is monitoring continuously and reading is taken in every hour. A daily report is prepared for that and this water is supplied to many sections like dying, boiler, generator, compressor etc.

12.2.2 Boiler:

A steam generator or boiler is usually a closed vessel made of steel for supplying steam. Boiler function is to therefore the heat produced by the combustion of fuel (here gas is used) to water and ultimately to generate steam. The steam produced in the boiler section supplied to different section of mill. Supplied sections for steam:

- Sizing
- Finishing
- Dyeing unit
- Washing unit
- Chiller

12.2.2.1 Machine Specification :

Brand: MecHMar
Origin: Malyasia
Model:AS2400/150
Const. Year: 2012
Working Pressure:1050/50 n/mm2/psi
Design Pressure:1069/155 n/mm2/psi
Test Pressure:1604/233 n/mm2/psi
Insurance Authority: LLOYD'S REGISTER
Steam Capacity:7-8 kg

12.2.3 Generator:

An electrical generator is a machine, which converts mechanical energy into electrical energy. The energy conversion is based on the principle of the production of dynamically induced e.m.f.

Features:

❖ 12 cylinders turbocharged and intercooled

❖ Fully integrated engine diagnostic and control system including:

- Spark timing control
- Turbocharger control
- Speed governing
- Individual cylinder knock detection
- Air/Fuel ratio control

❖ Fuel tolerance

❖ High altitude capability

❖ Low Btu option

12.2.3.1 Machine Specification :

- Brand: Jenbacher Gas Engines
- Origin: Waukesha
- Model: J320GS LEANOX
- Const. Year: 2012
- Total Machine: 04
- Capacity 1060 KW
- Fual: Gas

12.2.4 Air Compressor:

Compressed air along with gas, electricity and water is essential to most modern industrial and commercial operations. It runs tools and machinery, provides power for material handling system and ensures clean breathable air in contaminated environment. In Amber Denims rotary screw compressor is used.

Features:

With one-to-one drive, the air end is directly connected to the motor via a maintenancefree coupling that eliminates transmission losses. Direct drive screw compressors deliver outstanding performance and increase energy savings. It uses oversized air ends specifically selected to produce the required output in flow and pressure. Compared to compressors using small, high-speed, gear-driven air ends, the one- to- one drive provides significant savings. No-loss power transmission. Lower power consumption. Reduced maintenance and related downtime costs.

12.2.4.1 Machine Specification :

- Brand Name: BOGE
- Origin: German
- Model: S271
- Const. Year: 2012
- Rate of Flow: 30.50 m3/min
- Max Service Pressure: 10 bar
- Motor Speed: 1500 min
- Motor Power: 200+750 KW

12.2.5 Dryer:

The atmospheric air drawn into a compressor is a mixture of gases that always contains water vapors. However, the amount of water vapor that air can carry depends on the temperature. As air temperature rises – which occurs during compression – the air's ability to hold moisture increases also. When the air is cooled its capacity to hold moisture reduces which causes the water vapor to condense. Removing the moisture from the compressed air not only prevents costly breakdowns and production downtime, but also keeps maintenance and repair costs to a minimum. Refrigeration drying is usually the most efficient solution for the majority of compressed air applications

Features:

- Low pressure drop, non-fouling heat exchanger.
- Low pressure drop filtered separator with microprocessor controlled filter monitor removes liquids and particulates to 3 microns.
- "No-loss" electronic Eco-Drain for reliable condensate removal.
- On/off load digital scroll refrigeration compressor (Dual Control models only).
- Hot gas bypass control (Demand Manager models only).
- Optional cold coalescing oil removal filter eliminates oil aerosols to 0.008 ppm.

12.2.5.1 Machine Specification:

- Brand Name: BOGE
- Model: DS460
- Capacity: 46

12.2.6 Chiller:

A chiller can be generally classified as a refrigeration system that cools water. Similar to an air conditioner, a chiller uses either a vapor compression or absorption cycle to cool. Once cooled, chilled water has a verity of application from space cooling to process use.

12.2.6.1 Chiller Tower Specification:

- Name: Absorption Chiller
- Origin: Korea
- Model: WCS-S036
- Const. Year: 2012
- Cooling Capacity: 325 USRT
- Chilled Water Flow Rate: 19.6 m3/h
- Chilled Water Temp.: 13-8 c
- Cooling Water Flow Rate: 358 m3/h
- Cooling Water Temp: 32-37 c
- Heating Source Type: Steam
- Steam Pressure: 8 kg/cm2
- Electric Power: 3.0-400 V, 50 Hz

12.2.7 Humidification Plant:

Humidifier is a system to provide proper humidity and temperature in a working space. To maintain the proper humidity and temperature in a weaving mill is very important. Different electrical circuit board of weaving machine cannot work for a long period without proper temperature and humidity. Proper humidity helps to remove the producing static electricity due to friction of different machine parts.

Chapter – 13

Conclusion

13.1 Conclusion:

By the grace of almighty we have completed our industrial attachment from Amber Denim Mills Ltd which is known as one of the most renowned company in Bangladesh textile sector. Amber Denim Mills Ltd. Is a totally export oriented Denim company and we are flattered that we have completed our 2 months of industrial attachment from such a company. In this completion time we have gained practical knowledge about textile sector that will facilitate us in our future. Is a modern industry which has all the utilities and equipment to run the production for 24hours. This industry has its own ETP and WTP plant beneficial for the environment by not disposing the chemical and waste water directly on environment.

13.2 Our Apology:

1. We are very grateful to the management that they gave us the chance to complete our industrial attachment from an industry like Amber Denim Mills Ltd.
2. We are also grateful to our seniors who have monitored us from the very beginning and their guidance helped us successfully complete our industrial attachment.
3. Amber Denim Mills Ltd is the best place for acquiring practical knowledge about textile sector and the people working here make this process more advance and easier with their care and guidance.