



Industrial Attachment Report on
“Sinha Denim Ltd & Sinha Rope Denim Ltd”
(An Enterprise of Sinha Textile Group)

Course Code: TE 431

Course Title: Industrial Attachment

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DECLARATION

I am hereby declare that, this industrial attachment have been done by me under the supervision of **Prof. Dr. Md. Mahbubul Haque; Head of TE Dept.** Daffodil International University. I am also declare that neither of this attachment nor any part of this attachment has been submitted elsewhere for achieving award or any degree or diploma.

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Subject: Letter for Approval

Dear Sir,

I am very glad to submit this Industrial Attachment titled “**Study on Sinha Denim Ltd. & Sinha Rope Denim Ltd.**” I have tried to put my best effort to make this attachment report properly according to your instruction.

I hope that you would kindly consider any mistake on my part in preparing this attachment report.

Sincerely yours

Signature of the
Supervisor

Md. Injamamul Idris Akib

ID: 113-23 2653



ACKNOWLEDGEMENT

At first I would like to thank Almighty Allah to give me strength and ability to complete the industrial training and to write this report.

A number of people have made significant contributions to make my training successful. Their advice and suggestions helped me a lot.

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I would like to thank the Chairman, Managing Director, General Manager, Deputy General Manager, Manager, Assistant Manager, Senior Production Officer, Production Officer, Assistant Technical Officer, Technical Officer and a lot of respective persons who gave me scope & helped me for doing industrial attachment in the factory as well as for giving scope to work in their respective section.

Being involved with them is such a pleasure that I can't express. I have not only earned valuable knowledge but also inspired by their innovativeness which helped me to enrich my experience to a greater extent. I believe this report could not be finished if they did not help me continuously.

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Finally I want to give thanks for all the workers, supervisors who have assisted, helped & inspired me to complete this report.



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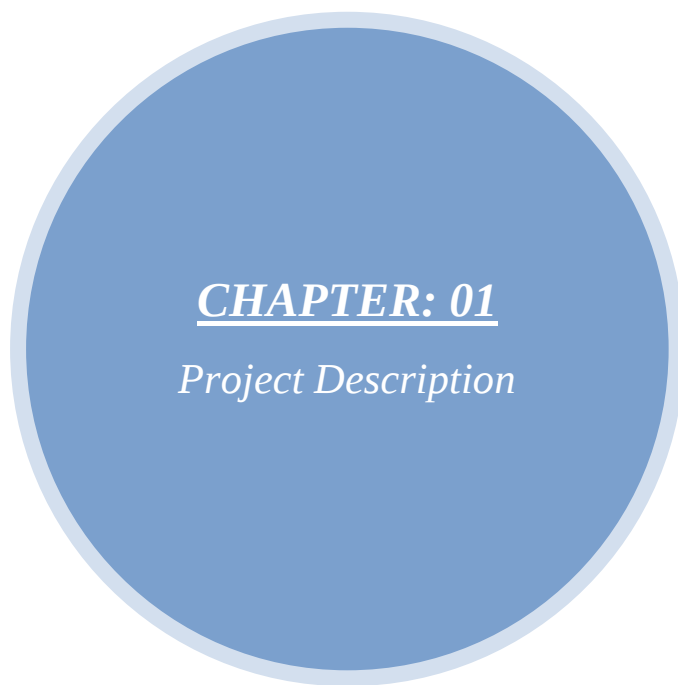
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1.1 Basic Information:

Name of Factory: Sinha Textile Group

Date of establishment: 1984

Owner and investors: Mr. Anisur Rahman Sinha

Location and address: Kanchpur, Narayanganj





Head Office: Mohakhali Tower 82, Mohakhali C/A, Dhaka-1212

Certification: OEKO-TEX standard 100

Sister concerns: Sinha Denim Ltd and Sinha Rope Denim Ltd

Opex Sinha (RMG)

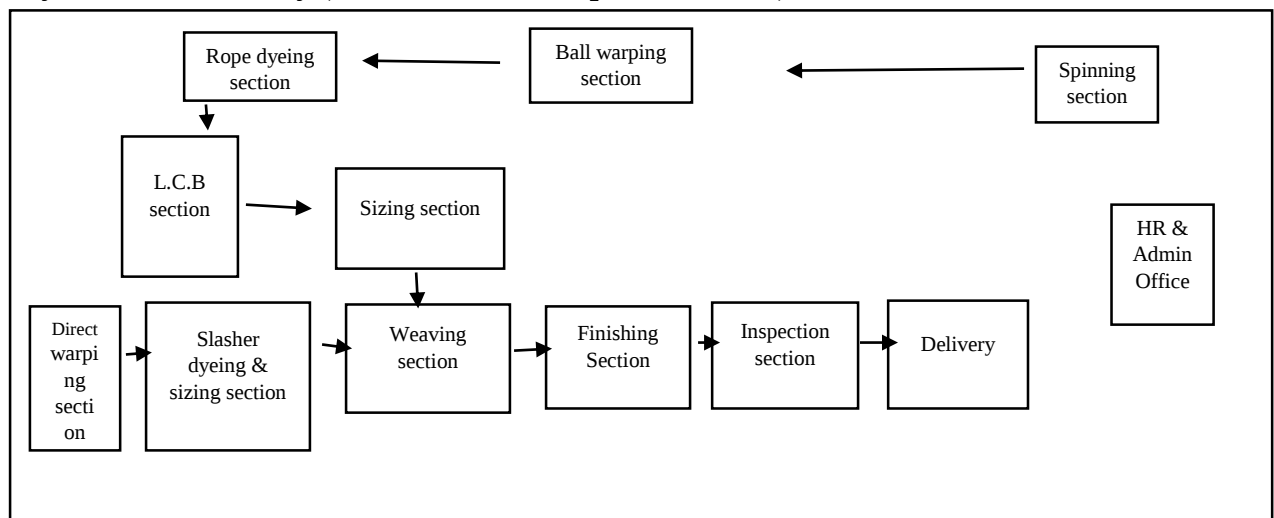
Sinha Dyeing Ltd

Sinha Spinning Ltd etc.

Export growth by graph: About 50 million yds/year in RMG sector and
About 30-40 million yds/year in other sectors

1.2 General Information:

Layout Plan of factory (Sinha Denim & Rope Denim Ltd):



Total Land Area: 43 acres

Number of Buildings (SDL & SRDL): 5 buildings

Total sections: 10

List of Buyers and customers: Levi's, Haddat, Hybride, Sajib Fashion, JC Penny, Academy (in house), Rezaul & Brothers, Big Boss, TCP, Apetch, Pantaloon, VF Asia, Rio Fashion

Transport facility: Own Lorry, Trucks etc.



CHAPTER: 02

*Human resource and
Organization structure*



2.1 Organogram of the company:





2.2 Total number of departments: 9

2.3 Name of the departments:

1. Ball warping
2. Direct warping
3. Rope dyeing
4. L.C.B
5. Sizing
6. Slasher dyeing and sizing
7. Weaving
8. Finishing
9. Inspection

2.4 Works-Time Schedule of the Factory:

The Factory Runs 24 Hour A Day. It Maintains A Tight Work Schedule. That Is Shown In The Chart.

2.5 Section Number of Shift Duration:

Section	No of shift	Duration
Top Management	General Shift	9 a.m. – 5 p.m.
Stuff & Commercial	General Shift	9 a.m. – 5 p.m.
Warping	2	12 hours each
Dyeing	3	8 hours each
Weaving	3	8 hours each
Finishing	2	12 hours each
Utility	3	8 hours each
Security	3	8 hours each



CHAPTER: 03

*Description of Denim
section*



3.1 Denim

3.1.1 Evolution of Denim: The term ‘Denim’ comes from the city of Nimes in France where ‘Serge de Nimes’ was made. The term ‘Jeans’ came from the cotton workpants worn by sailors in Italy, who were known as ‘Genes’.



Fig: Denim fabric

3.1.2 Peculiarity of Denim: Denim is made from Indigo dye, a vat dye, which is attached to cotton fabric in loosely held from layers. When washed, it fades differently, which gives its characteristic washed down appearance.

3.1.3 Definition of Denim: Denim is a rugged cotton twill textile in which the weft passes under two or more warp fibers. This produces the familiar diagonal ribbing identifiable on the reverse of the fiber, which distinguishes denim from cotton duck. It is a 3/1 warp faced twill fabric made from a yarn dyed warp and an undyed weft yarn. Traditionally the warp yarn is indigo dyed.



3.2 Manufacturing of Denim

The warp yarn (length-wise) used in denim fabrics is uniquely prepared for denim manufacturing compared to conventional woven fabrics. The yarn goes through numerous processing steps before it is placed on the weaving machine. Unlike the warp yarn, most filling yarn (width-wise) is put onto yarn packages and delivered directly to the weaving machine where it is inserted into the fabric without any further preparation in the same manner as the conventional woven fabrics.

The following flow chart reveals the necessary steps in the manufacture of denim fabrics:





3.3 Warping

3.3.1 Definition: Warping is the first step of fabric manufacturing process. After winding, warping process is done for making a weavers beam. Weavers beam is produced from a set of yarns of same yarn count or different.

In textile language; warping is defined as the parallel winding of yarn from cone or cheese package on to a warp beam. It is needed to confirm that warp beam is made from good warp yarn otherwise weaving performance will be hampered. So it needs to require to provide a good warp beam. Faulty weavers beam is one of the causes of wastage in weaving section.

3.3.2 Objects of warping: Followings are the most common objects of warping:

- . To wound up fixed length of yarn on to a warp beam.
- . To increase the weave ability of yarn.
- . To increase the quality of yarn.
- . To make re-useable small package.
- . To make convenient yarn sheet for next process.
- . To increase the production.
- . To make dynamic next process.

3.3.3 Importance of warping: Warping process plays an important role in fabric manufacturing. Followings are the most common importance of warping.

- . Warp beam are constructed by warping.
- . Parallel yarn sheets are constructed by this process.
- . Predetermined yarns are wound from the yarn package.
- . Small packages are combined by this process.
- . Long length of warp yarns is found in this process.
- . Various yarn faults like thick and thin place. Larger knots are modified by this process.
- . Small packages become re-useable by this process.
- . Warping accelerates the next process.

3.3.4 Types of warping: There are four types of warping, which are as follows:

1. Direct Warping
2. Indirect or Sectional Warping
3. Ball Warping
4. Draw Warping

Denim is produced by ball warping and direct warping method.

3.3.5 Ball warping: This is the first step for manufacturing denim. This is an intermediate process for storing yarn for transport, dyeing or reserve; it does not produce a beam. The usual form is a cross wound cheese in which multiple ends are wound.

In Sinha Rope Denim, 300-400 yarn ends are pulled from the creel, but mostly 365 yarn ends are pulled from the creel. The yarn then pass through a comb like device (sometimes called a hack or reed), which keeps each warp yarn separate and parallel to its neighboring ends. At intervals of every 500 meters a lease string is placed across the sheet of warp yarn to aid yarn separation for the re-beaming operation, which will occur later. The yarn then go through a funnel shaped device called a trumpet or condenser, which collapses and condenses the sheet of yarn into rope form. This device is located at the base of the warper head and traverses back and forth, guiding the newly formed rope of yarn onto a log. The rope must be wound at a constant tension to keep the yarns from tangling.

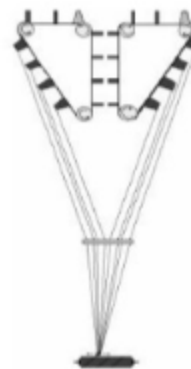


Figure 3. Ball Warping
(Rope)

Fig: Ball warping machine



3.3.6 Machine Description:

Name	Ball Warping Machine
Brand	Morrison
Origin	U.S.A
Machine speed	Min: 350 r.p.m & Max: 400 r.p.m
Production	About 8000-8500 meter/day
Name of creel	Stand creel
Creel capacity	Max: 448 & Min: 320-350
No of spindle	448×2=896
No of yarn guide	32
No of stand	32
No of Ends	About 350-370
Length	About 11000-14000 meter
Yarn	Cotton (Both Ring and Open end)
Count	About 6.5-11
Tension	For 6.5 count- 70,70,75 For 7 count- 70,70,75 For 8 count- 60,60,65 For 9 count- 60,60,65 For 10 count- 50,50,55 For 11 count- 50,50,55

3.3.7 Machine parts:

1. Cone
2. Ball
3. Creel
4. Spindle
5. Stand
6. Sensor
7. Reed dent
8. Tension pulley
9. Travel set
10. Headstock
11. Monitor
12. Blower
13. Yarn guide
14. Tension meter



3.3.8 Working procedure in SDL & SRDL:

1. Setup program according to plan.
2. Received yarn from the store according to program.
3. Put the machine power switch on present of electrical person.
4. Make the count wise parameter setting on the machine, viz tension, speed, lease ends.
5. Then clean the machine carefully.
6. Creel loading by the yarn
7. Do the reed denting in
8. Complete the yarn passage from creel to headstock trumpet via tension stand & guide roller
9. Load the ball on the headstock
10. Put the safety guard on place
11. Firstly run the machine with slow speed and then slowly increase the machine speed
12. Run the machine high speed
13. Manual tension check
14. Cut the ball after required program length is completed
15. After finished 12 balls, 1 program will be completed & the production data should be filled up in the relevant production sheet.

3.3.9 Direct Warping: In direct warping, the yarns are withdrawn from the single-end yarn packages on the creel and directly wound on a beam.

Direct warping can be used to directly produce the weaver's beam in a single operation. This is suitable for strong yarns that do not require sizing and when the number of warps on the warp beam is relatively small. This is also called direct beaming. It can also be used to make smaller, intermediate beams called warper's beams. These smaller beams are combined later at the slashing stage to produce the weaver's Beam. This process is called beaming.



Fig: Direct warping Machine



3.3.10 Machine description:

Name	Direct warping machine
Brand	Moenus Sucker
Origin	Germany
Machine speed	Max 800 r.p.m
Production	Around 28000 meter/day
Creel name	Mobile creel
Creel capacity	Max- 432 & Min- 240
No of ends	Around 4500 or above, depend on requirement
Yarn	Cotton (Ring slub, Rotor)
Count	Generally 6.5-12 but often 26
Beam length	Around 26000-35000 meter, depend on requirement
Cone length	Around 40000-45000 meter, depend on requirement
No of guide stand	60
No of tension pulley	432
No of creel rod	432
Tension	Varies because of yarn count

3.3.11 Machine parts:

1. Bobbin stand/ Package stand
2. Holder
3. Balloon breaker
4. Yarn tensioner
5. Stop motion
6. Yarn guide
7. Motor
8. Clean section
9. Headstock
10. Control board
11. Beam clamping & De-clamping zone
12. Pressure roller
13. Blower



3.3.12 working procedure in SDL & SRDL:

1. Setup program according to plan
2. Received yarn from the store according to program.
3. Put the machine power switch on present of electrical person.
4. Make the count wise parameter setting on the machine, viz tension, speed, ends.
5. Then clean the machine carefully.
6. Creel loading by the yarn
7. Do the reed denting in
8. Complete the yarn passage from creel to headstock via tension stand & guide roller
9. Load the beam on the headstock
10. Put the safety guard on place
11. Firstly run the machine with slow speed and then slowly increase the machine speed
12. Run the machine high speed
13. Manual tension check
14. Cut the beam after required program length is completed
15. After finished 12 beams, 1 program will be completed & the production data should be filled up in the relevant production sheet.

3.3.13 Machine components:

Warping machine is a simplest machine. It's have different components and they have own functions which is required to know for better operation. Warping machine components are mainly divided into two types; they are-

1. Creel
2. Head stock

Now I like to give a short description about creel and head stock parts and their functions.

3.3.14 Components of creel and their functions:

- i. **Yarn cleaner:** Different yarn faults like slubs, neps are removed.
- ii. **Stop device:** This device help to stop the machine when yarns are broken.
- iii. **Indicator:** To indicate yarn breakage in the package.
- iv. **Tensioner:** To keep the yarn in a uniform tension.
- v. **Yarn guide:** It helps the yarn to pass in a specific way.
- vi. **Flanged bobbin or cone or cheese base and stand:** To hold the yarn package.
- vii. **Blower or suction fan:** To remove dart and dust from the yarn.



3.3.15 Components of head stock and their functions:

- i. **Adjustable or Variable V-reed:** Warp beam weigh is controlled by this device.
- ii. **Measuring and Marking device:** It measures the amount of warp yarn on the beam and marks the yarn for definite use.
- iii. **Yarn speed controlling device:** To control the speed of yarn provided with a meter.
- iv. **Pneumatic or Hydraulic pressure unit:** To press the warp beam with the surface contact of driving drum.
- v. **Break assembly:** It stops the machine instantly in case of yarn breakage.
- vi. **Driving drum:** Driving drum control the beams and placed in contact.
- vii. **Stop motion:** When required length is wound on beam then it used to stop the machine.
- viii. **Building device:** To control space between driving drum and beam while dyeing or sizing.
- ix. **Beam bracket:** It used to give support and hold the beam.
- x. **Lease rod:** It is used for separation of individually.



3.4 Dyeing

3.4.1 Definition: Dyeing is the process of adding color to textile products like fibers, yarns, and fabrics. Dyeing is normally done in a special solution containing dyes and particular chemical material. After dyeing, dye molecules have uncut chemical bond with fiber molecules. The temperature and time controlling are two key factors in dyeing.

3.4.2 Objects of Dyeing:

- The textile goods are dyed uniformly with single color.
- To increase the attractiveness of the textile goods.
- To make the fabric suitable for various usages.
- To make the textile goods suitable for decorative purposes.

3.4.3 Theory of Dyeing:

The procedure by which dye stuff enters into the textile goods is called theory of dyeing. It is essential to have certain degree of fastness properties when a dye particle is applied on textile goods.

The whole process of dyeing is completed by four steps as follows:

1. Dye molecules come to the fabric surface from the dye bath.
2. Fiber absorbs the dye molecule from the outer surface of the fiber to the internal surface of the cellulose.
3. Migrates the dye molecules everywhere of the fiber molecules.
4. Anchoring or fixing the dye molecules to the fiber molecules by hydrogen or covalent bond.

3.4.4 Types of Dyeing for Denim making: There are basically three types of dyeing used for manufacturing denim. These are-

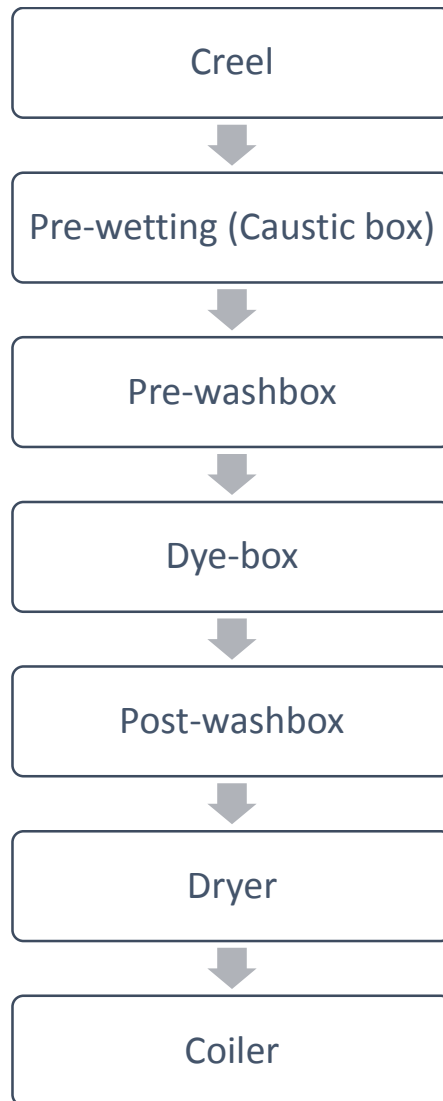
- i. Rope dyeing
- ii. Slasher dyeing
- iii. Loop Dyeing

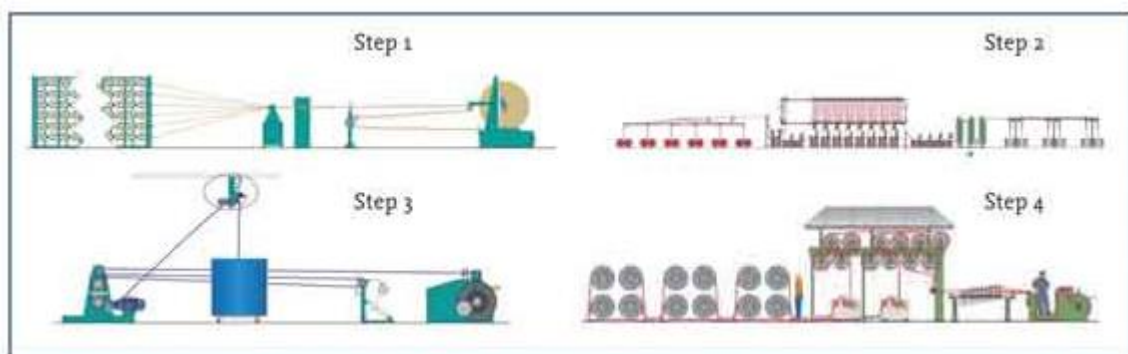
In SDL & SRDL Denim is manufactured by Rope & slasher dyeing process.



3.4.5 Rope Dyeing: Warping and dyeing are done in the form of rope and dyeing, sizing is done separately.

3.4.6 Flow chart of Rope dyeing:





3.4.7 Machine description:

Name	Rope dyeing machine
Brand	Morrison
Origin	U.S.A
Creel capacity	24
No of pre-wetting box	1
No of pre wash box	3
No of dye box	10
No of post wash box	4
No of dryer	36
Production	30000-40000 meter/day
Machine speed	Max 45 r.p.m
Steamer temp.	About 30° c
Caustic box temp.	About 85° c
Air pressure required	6-8 bar
Steam pressure required	6 bar
Water pressure required	2 bar



3.4.8 Slasher Dyeing: Dyeing and sizing are done in form of sheet or slasher simultaneously and that is why the process is called sheet dyeing and the denim is called sheet denim.

3.4.9 Flow chart of Slasher Dyeing:





3.4.10 Machine Description:

Name	Slasher dyeing and sizing machine
Brand	Moenus Sucker
Origin	Germany
Production capacity	30000 meter/day
Machine speed	Max 45 r.p.m
Creel capacity	16
No of pre- wetting box	1
No of pre dryer	6
No of post dryer	8
No of dye bath	8
Air pressure required	6-8 bar
Steam pressure required	6 bar
Water pressure required	2 bar



3.4.11 Difference between Slasher and Rope Dyeing:

Slasher dyeing	Rope dyeing
Required Space is less	Required Space is more
Mercerizing is easy	Mercerizing is difficult
Broken end repairing is not possible	In rope dyeing there is a possibility to repair broken end in LCB (Long Chain Beamer)
More flexible. It can produce denim in different colors and small quantities	Less flexible. Difficult to change colors.
Extra ends Required.	No extra ends.
Different colour mixing is not possible	Possible to mix ends of different colors. One can get stripe design at re-beaming.
Advantages for lighter yarn. Can use Ne 1-30 without major change.	Large numbers of yarns are difficult To open at re-beaming. Hence it is Not suitable for fine yarn. Can use Ne1-16 without major change. In latest machines even higher yarn Count can be dyed.
Rear view characteristics of fabric is less thin / thick & knot points	Rear view characteristics of fabric is high thin / thick & knot points
Production capacity- Approx. 9 to 11 mill. Mt. in case of normal capacity. Approx. 10 to 22 mills. Mt. in case of double capacity.	Production capacity-12 ropes = 9 to 11.5 mill. Mt., 24 ropes = 18 to 23 mill. Mt., 36 ropes = 27 to 34.5 mill. Mt.
Cost of production is lesser compared to Rope Dyeing	Cost of production is more compared to sheet Dyeing

3.4.12 Dyes use in Denim:

1. Vat Dyes
2. Sulphur Dyes

3.4.13 Vat dyes: Vat dyes are different from reactive dyes. Disperse dyes, basic dyes, acid dyes or azoic color but its application process is near similar as sulphur dyes. Vat dyes are used for coloring cellulosic fiber specially cotton fiber. It is widely used for run the dyeing process of cotton yarns which is used for producing jeans or denim product. The word vat is come from vessel; vat dyes can be applied in a vat for coloration textile products. Vat dyes are natural coloring materials which are solubilized in a vat by the fermentation process called vatting. Vat dyes are insoluble in



water but it becomes in soluble form by vatting process. The process of converting insoluble vat dyes into soluble form is known as vatting.

3.4.14 Sulphur Dyes: These dyes are so called because they contain sulphur atoms in their molecules. The fibers most readily colored with sulphur dyes are the natural and man-made cellulosic fibers.

3.4.15 Types of shade: There are several types of shade available in denim. But in SDL & SRDL 4(four) types of dyeing processes are used:

- i. Pure Indigo
- ii. Topping or Indigo Bottoming
- iii. Sulphur Topping (IBST) Bottoming or Sulphur Bottoming
- iv. Indigo Topping (SBIT) Pure Black/Sulphur

3.4.16 Pure Indigo: Indigo dye is an important dyestuff with a distinctive blue color (see indigo). The natural dye comes from several species of plant, but nearly all indigo produced today is synthetic. Among other uses, it is used in the production of denim cloth for blue jeans. The form of indigo used in food is called "indigo tine", and is listed as FD&C Blue No. 2.

3.4.17 Topping or Indigo Bottoming Sulphur Topping:

In this method two type dyes are used for developing the required shed. In the topping method the Indigo dyes are used to develop the blue in the bottom part of the yarn sheet or slasher whereas the Sulphur dyes are used to develop the black color shed in the top part of the yarn sheet or slasher.

3.4.18 Bottoming or Sulphur Bottoming Indigo Topping:-

In this shed of sheet or slasher dyeing process, two dyes are also used to develop color in the sheet or slasher which finally wound in the weaver's after sizing done in the continuous process of the production of the weaver's beam. Here Sulphur dyes are used to develop the black color shed in the bottom part of the sheet whereas the Indigo dyes used to develop the blue in the top part of the sheet. To do this 10 to 12 warp beams are organized in proper way. Each of the warp beams contains 366 to 401 ends of yarn which varies according to the ends required in the final fabric as well as the design of the fabric.

3.4.19 Pure Black: Sulfur black dyes are low-intensity dyes that require large amounts for dark shades. The amount of sulfur black that will produce the darkest shade when applied properly is



4% of a 100% powder or 18% of a 20% liquid. It is difficult for cotton to easily absorb that quantity of dye in a way that produces a very dark shade.

One method that has been used to produce darker, more colorfast sulfur blacks on yarn is to apply 50% of the dye, then dry the cotton, air oxidize and without washing, proceed to a second dye-box where the dye is applied again, dried oxidized with air again and washed.

3.4.20 Recipe sheet sample in SDL & SRDL:

SINHA ROPÉ DENIM LTD.
Kanchpur, Sonargoon, Narayanganj
ROPE DYEING PROCESS

Buyer: 4258
Style: 4258
PO: 9700 X 2 mtr
Qty: 9700 X 2 mtr

Prog. No.	222+23	Count	7P+7R	Length	9700	Moisture	77	Start time	4:30 A.M	End		Date	16/4/15
Ref. No.	4258	T. Ends	4356	T. Rope	24	Speed	25	Wt/min		Lot		Supp.	Sinha

Box	PW	W-1	W-2	2 in 1	Stermer	DY-1	DY-2	DY-3	DY-4	DY-5	DY-6	DY-7	DY-8	DY-9	DY-10	W-3	W-4	W-5	Softner
Operation	P.W	W	W	W					In	In	In	In	W	TOP	W	W	W	W	
S.Pres.	60	75	75	75					70	70	70	70	70	75	65	75	75	75	70
Temp.	80	70	70	30					30	30	30	30	30	30	85	35	35	35	40

Pre-wetting/Dyeing				Indigo Dyeing				Topping/Black				Dossing			
Operation P.W. (10/14)				Box% 1.7-1.8				Operation 35/360				Indigo			
PH/Be				PH 12.0				PH				Hydro			
Temp. 30°C				Hydro 0.4-0.5				ORP Value				Black			

Indigo				Black				Softner			
Length	Indigo G/L	Hydro G/L	PH	Black G/L	PH	MV	Indigo	Hydro	Black	Softner	Hydro
000	2.08	0.43	12.05	2700	12.55	-660	3.6	3.0			
500	2.78	0.37	11			-640	11	2.5			
1500	2.79	0.60	11.9	11	12.5	-620	11	11			
3000	1.61	0.77	11.8	2800		-635	11	2.0			
4000	1.57	0.57	11.81	11			11	11			
5000	1.20	0.595	11.85	2700			11	11			
6500	1.30	0.51	11.85	11	12.41	-632	11	11			
8000	1.34	0.53	11			-628	11	11			
9000	1.31	0.47	12.90	11			11	11			

Note: Indigo & Topping box is pre-prepare from previous prog of same Ref.

Indigo circulation rate: 1365 l/min

Shift In Charge	A	B	C	Wastage
Length				
Name				
Signature				

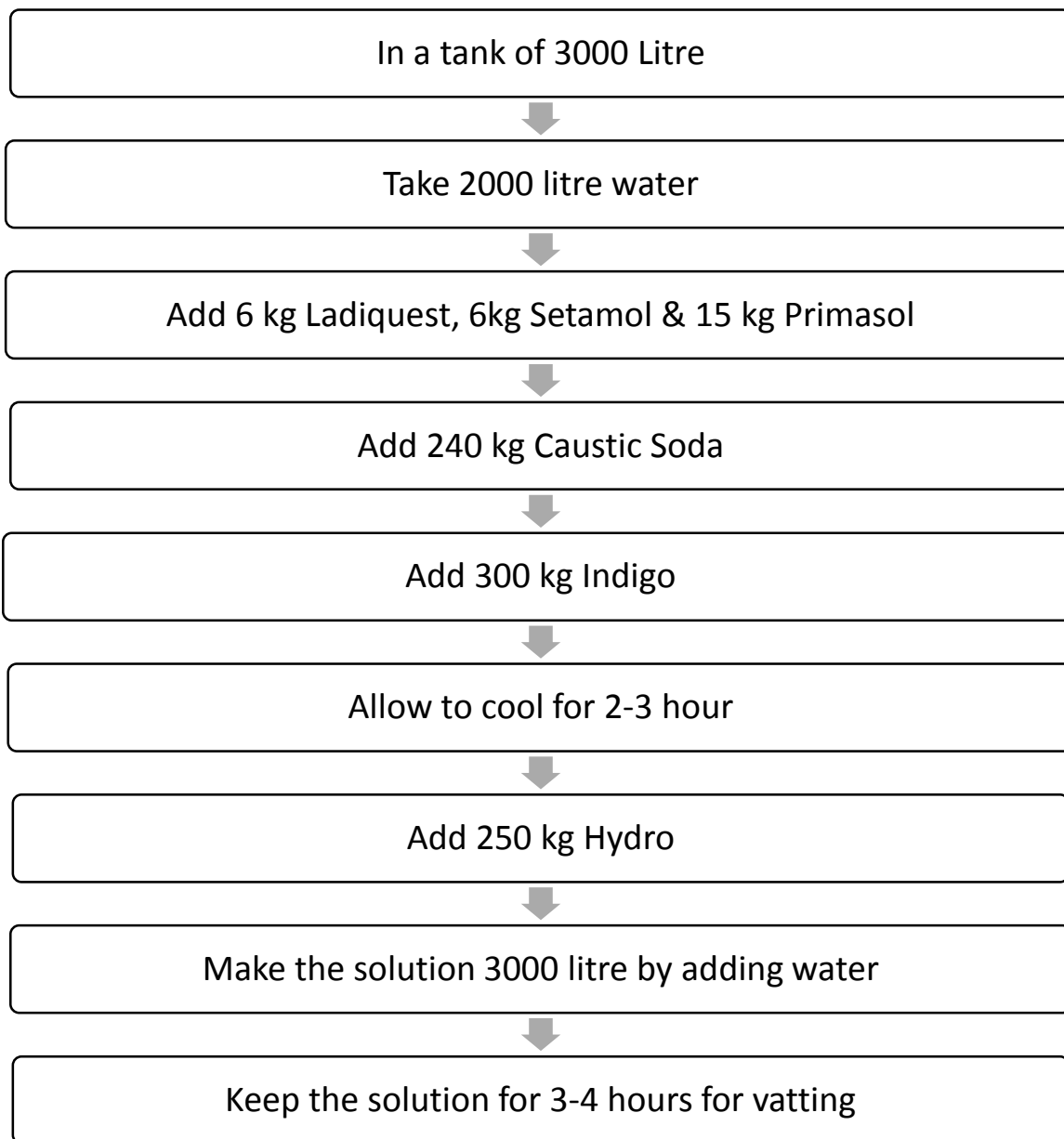
3.4.21 Indigo Stock solution recipe in SDL & SRDL:

Chemicals	Concentration (gm/ltr)	Quantity (Kg)
Indigo	100	300
Hydrosol	85	255
Caustic soda	80	240
Setamol	2	6
Primasol	5	15
Ladiquest	2	6

Total Volume	3000 liter
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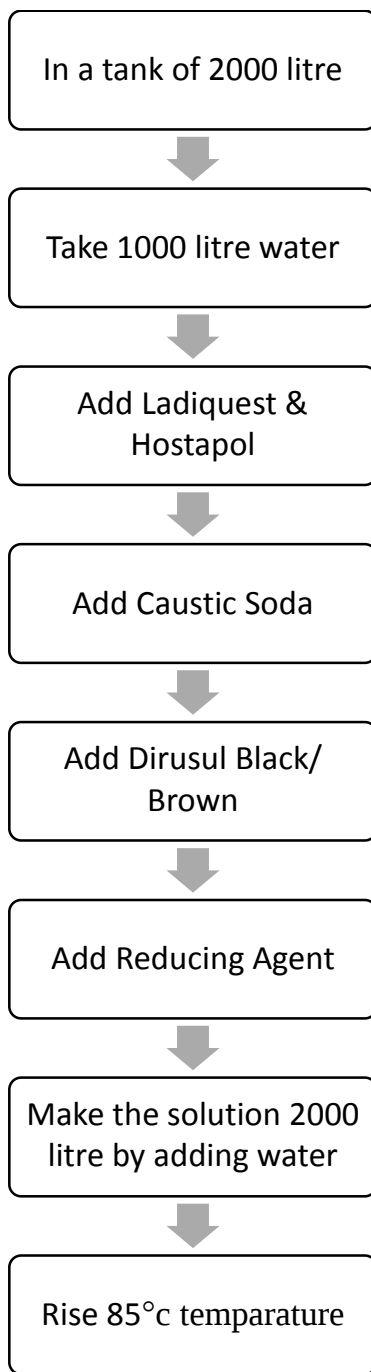


3.4.22 Indigo Preparation Sequence in SDL & SRDL:



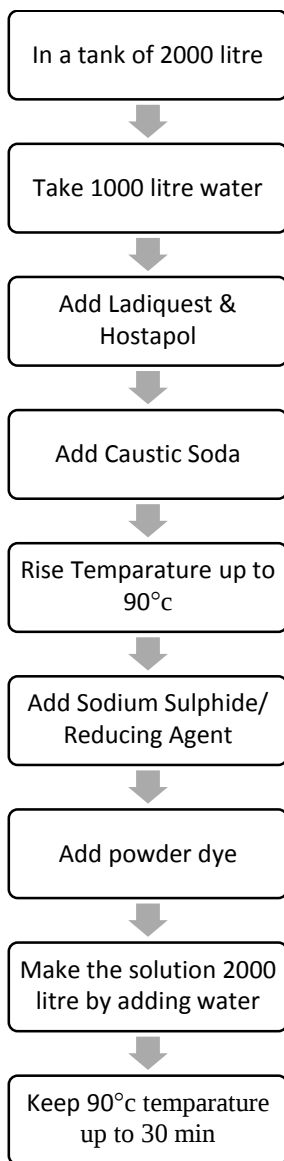


3.4.23 D. Black/ D. Brown Preparation Sequence in SDL & SRDL:





3.4.24 Sulphur Dye (powder) Preparation Sequence in SDL & SRDL:





3.4.25 List of Feed Tank in SDL & SRDL:

Tank No	Name	Volume	Height	Per inch volume
1	Pre-treatment -01	2000 litre	60 inch	33.33 litre
2	Pre-treatment -02	2000 litre	60 inch	33.33 litre
3	Color Dye Mix-01	2000 litre	60 inch	33.33 litre
4	Color Dye Mix-02	2000 litre	60 inch	33.33 litre
5	Hydro-Caustic-01	600 litre	50 inch	12 litre
6	Hydro-Caustic-02	600 litre	50 inch	12 litre
7	Indigo Feed-01	2000 litre	60 inch	33.33 litre
8	Indigo Feed-02	2000 litre	60 inch	33.33 litre
9	Indigo Mixing Tank	3000 litre	80 inch	50 litre
10	Topping Feed-01	2000 litre	60 inch	33.33 litre
11	Topping Feed-02	2000 litre	60 inch	33.33 litre
12	Softener-01	1000 litre		
13	Softener-02	1000 litre		
14	Dye Box	3000 litre	54 inch	55.55 litre



3.4.26 Density and Caustic Soda Content of Rayon/Membrane Grade Caustic Soda Solutions at 60°F in SDL & SRDL:

Technical Data								
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Table 1 Density and Caustic Soda Content of Rayon/Membrane Grade Caustic Soda Solutions at 60°F								
WT% NaOH	% Na ₂ O	SPECIFIC GRAVITY	DEGREES BAUMÉ [AM STD]	NaOH G/L	NaOH LB/GAL	SOLUTION LB/GAL	TOTAL WT NaOH LB/CU FT	TOTAL WT SOLUTION LB/CU FT
1.0	0.775	1.0120	1.706	10.118	0.084	8.437	0.084	63.113
2.0	1.550	1.0230	3.259	20.457	0.171	8.529	1.277	63.624
3.0	2.325	1.0342	4.782	31.019	0.259	8.622	1.935	64.135
4.0	3.100	1.0453	6.274	41.803	0.349	8.715	2.606	64.646
5.0	3.874	1.0564	7.736	52.811	0.440	8.807	3.295	65.157
6.0	4.649	1.0676	9.170	64.042	0.534	8.900	3.995	65.668
7.0	5.424	1.0787	10.580	75.496	0.630	8.993	4.710	66.179
8.0	6.199	1.0899	11.960	87.174	0.727	9.087	5.438	66.690
9.0	6.974	1.1010	13.310	99.076	0.826	9.180	6.181	67.201
10.0	7.748	1.1122	14.630	111.210	0.927	9.273	6.937	67.712
11.0	8.523	1.1234	15.930	123.550	1.031	9.366	7.707	68.223
12.0	9.298	1.1345	17.200	136.130	1.136	9.459	8.492	68.734
13.0	10.080	1.1457	18.440	148.920	1.242	9.552	9.290	69.245
14.0	10.850	1.1569	19.660	161.930	1.351	9.645	10.110	69.756
15.0	11.630	1.1680	20.850	175.170	1.461	9.738	10.930	70.267
16.0	12.400	1.1791	22.030	188.630	1.573	9.830	11.770	70.778
17.0	13.180	1.1902	23.170	202.300	1.687	9.923	12.620	71.289
18.0	13.950	1.2013	24.300	216.200	1.803	10.020	13.490	71.800
19.0	14.730	1.2124	25.400	230.310	1.921	10.110	14.370	72.311
20.0	15.500	1.2234	26.480	244.640	2.040	10.200	15.260	72.822
21.0	16.280	1.2344	27.530	259.180	2.162	10.300	16.170	73.333
22.0	17.050	1.2454	28.570	273.940	2.285	10.390	17.090	73.844
23.0	17.830	1.2563	29.590	288.910	2.409	10.480	18.030	74.355
24.0	18.600	1.2672	30.580	304.090	2.536	10.570	18.970	74.866
25.0	19.370	1.2781	31.550	319.470	2.664	10.660	19.930	75.377
26.0	20.150	1.2889	32.510	335.070	2.794	10.750	20.910	75.888
27.0	20.920	1.2997	33.440	350.870	2.926	10.840	21.890	76.399
28.0	21.700	1.3105	34.350	366.870	3.060	10.930	22.890	76.910
29.0	22.470	1.3212	35.250	383.070	3.195	11.020	23.900	77.421
30.0	23.250	1.3317	36.120	399.450	3.331	11.110	24.920	77.932
31.0	24.020	1.3424	36.980	416.070	3.470	11.200	25.960	78.443
32.0	24.800	1.3529	37.830	432.860	3.610	11.280	27.010	78.954
33.0	25.570	1.3634	38.650	449.850	3.751	11.370	28.070	79.465
34.0	26.350	1.3738	39.450	467.010	3.895	11.460	29.140	79.976
35.0	27.120	1.3842	40.240	484.370	4.039	11.540	30.220	80.487
36.0	27.900	1.3944	41.020	501.910	4.186	11.630	31.310	80.998
37.0	28.670	1.4046	41.770	519.630	4.333	11.720	32.420	81.509
38.0	29.450	1.4148	42.510	537.520	4.482	11.800	33.530	82.020
39.0	30.220	1.4248	43.230	555.590	4.633	11.880	34.660	82.531
40.0	31.000	1.4348	43.940	573.830	4.785	11.970	35.800	83.042
41.0	31.770	1.4447	44.640	592.240	4.939	12.050	36.950	83.553
42.0	32.550	1.4545	45.310	610.810	5.094	12.130	38.110	84.064
43.0	33.320	1.4643	45.980	629.530	5.250	12.210	39.270	84.575
44.0	34.100	1.4739	46.630	648.420	5.407	12.290	40.450	85.086
45.0	34.870	1.4835	47.260	667.450	5.566	12.370	41.640	85.597
46.0	35.650	1.4930	47.880	686.640	5.726	12.450	42.840	86.108
47.0	36.420	1.5023	48.480	705.970	5.887	12.530	44.040	86.619
48.0	37.200	1.5116	49.080	725.440	6.049	12.610	45.260	87.130
49.0	37.970	1.5208	49.650	745.040	6.213	12.680	46.480	87.641
50.0	38.740	1.5298	50.220	764.780	6.377	12.760	47.710	88.152
51.0	39.520	1.5388	50.770	784.640	6.543	12.830	48.950	88.663
52.0	40.290	1.5476	51.310	804.630	6.710	12.910	50.200	89.174



3.4.27 Density and Caustic Soda Content of Diaphragm Grade Caustic Soda Solutions at 60°F in SDL & SRDL:

Technical Data									
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Table 2 Density and Caustic Soda Content of Diaphragm Grade Caustic Soda Solutions at 60°F									
WT% NaOH	% Na ₂ O	% NaCl	SPECIFIC GRAVITY	DEGREES BAUMÉ [AM STD]	NaOH G/L	NaOH LB/GAL	TOTAL WT SOLUTION LB/GAL	LB/CU FT	TOTAL WT SOLUTION LB/CU FT
1.0	0.775	0.020	1.0121	1.726	10.120	0.084	8.438	0.631	63.122
2.0	1.550	0.040	1.0233	3.300	20.463	0.171	8.532	1.277	63.823
3.0	2.325	0.060	1.0346	4.842	31.032	0.259	8.626	1.936	64.525
4.0	3.100	0.080	1.0459	6.351	41.827	0.349	8.719	2.610	65.227
5.0	3.874	0.100	1.0571	7.829	52.846	0.441	8.813	3.297	65.930
6.0	4.649	0.120	1.0684	9.282	64.095	0.535	8.908	3.999	66.636
7.0	5.424	0.140	1.0797	10.710	75.568	0.630	9.002	4.714	67.341
8.0	6.199	0.160	1.0911	12.100	87.269	0.728	9.096	5.444	68.047
9.0	6.974	0.180	1.1024	13.460	99.195	0.827	9.191	6.188	68.752
10.0	7.748	0.200	1.1137	14.800	111.350	0.928	9.285	6.946	69.458
11.0	8.523	0.220	1.1250	16.110	123.730	1.032	9.379	7.718	70.164
12.0	9.298	0.240	1.1363	17.390	136.340	1.137	9.474	8.505	70.870
13.0	10.080	0.260	1.1476	18.650	149.170	1.244	9.568	9.305	71.575
14.0	10.850	0.280	1.1589	19.880	162.220	1.353	9.662	10.120	72.279
15.0	11.630	0.300	1.1702	21.090	175.500	1.464	9.756	10.950	72.983
16.0	12.400	0.320	1.1815	22.270	189.000	1.576	9.850	11.790	73.685
17.0	13.180	0.340	1.1927	23.430	202.730	1.691	9.944	12.650	74.387
18.0	13.950	0.360	1.2040	24.560	216.680	1.807	10.040	13.520	75.088
19.0	14.730	0.380	1.2152	25.670	230.840	1.925	10.140	14.400	75.787
20.0	15.500	0.400	1.2263	26.760	245.230	2.045	10.230	15.300	76.485
21.0	16.280	0.420	1.2375	27.830	259.830	2.167	10.320	16.210	77.180
22.0	17.050	0.440	1.2486	28.870	274.660	2.291	10.410	17.140	77.874
23.0	17.830	0.460	1.2597	29.900	289.690	2.416	10.510	18.080	78.566
24.0	18.600	0.480	1.2708	30.900	304.930	2.543	10.600	19.030	79.255
25.0	19.370	0.500	1.2818	31.880	320.400	2.672	10.690	19.990	79.943
26.0	20.150	0.520	1.2928	32.840	336.070	2.803	10.780	20.970	80.628
27.0	20.920	0.540	1.3037	33.780	351.940	2.935	10.870	21.960	81.310
28.0	21.700	0.560	1.3146	34.700	368.020	3.069	10.960	22.960	81.988
29.0	22.470	0.580	1.3254	35.600	384.310	3.205	11.050	23.980	82.665
30.0	23.250	0.600	1.3362	36.490	400.800	3.342	11.140	25.010	83.338
31.0	24.020	0.620	1.3470	37.350	417.490	3.482	11.230	26.050	84.007
32.0	24.800	0.640	1.3576	38.200	434.370	3.622	11.320	27.100	84.673
33.0	25.570	0.660	1.3683	39.030	451.450	3.765	11.410	28.170	85.335
34.0	26.350	0.680	1.3788	39.840	468.720	3.909	11.500	29.240	85.994
35.0	27.120	0.700	1.3893	40.630	486.170	4.054	11.590	30.330	86.648
36.0	27.900	0.720	1.3997	41.410	503.820	4.201	11.670	31.430	87.299
37.0	28.670	0.740	1.4101	42.170	521.640	4.350	11.760	32.540	87.944
38.0	29.450	0.760	1.4204	42.920	539.650	4.500	11.850	33.670	88.586
39.0	30.220	0.780	1.4306	43.640	557.830	4.652	11.930	34.800	89.223
40.0	31.000	0.800	1.4407	44.360	576.190	4.805	12.020	35.950	89.854
41.0	31.770	0.820	1.4508	45.050	594.710	4.959	12.100	37.100	90.481
42.0	32.550	0.840	1.4607	45.740	613.400	5.115	12.180	38.270	91.103
43.0	33.320	0.860	1.4706	46.400	632.260	5.272	12.270	39.440	91.720
44.0	34.100	0.880	1.4804	47.060	651.270	5.431	12.350	40.630	92.330
45.0	34.870	0.900	1.4901	47.690	670.440	5.591	12.430	41.830	92.935
46.0	35.650	0.920	1.4997	48.320	689.760	5.752	12.510	43.030	93.535
47.0	36.420	0.940	1.5092	48.930	709.220	5.914	12.590	44.250	94.129
48.0	37.200	0.960	1.5187	49.520	728.830	6.078	12.670	45.470	94.716
49.0	37.970	0.980	1.5280	50.100	748.580	6.242	12.740	46.700	95.297
50.0	38.740	1.000	1.5372	50.670	768.460	6.408	12.820	47.940	95.872
51.0	39.520	1.000	1.5506	51.490	790.690	6.594	12.930	49.330	96.711
52.0	40.290	1.000	1.5604	52.070	811.250	6.765	13.010	50.610	97.317



3.4.28 Working Procedure in SDL & SRDL:

Before Starting the Machine

1. Turn on steam-Check supply.

- a) Dry Cans
- b) Pre-Wetting/ Bottoming Box
- c) Topping Box
- d) Wash boxes
- e) Softener box (if applicable)

2. Check all valves for proper position for “RUN”

Indigo Boxes and Circulation System

- a) Discharge Lines-Indigo Boxes-Open
- b) Levelling Lines-Open
- c) Indigo Feed Lines-Open
- d) Pump-Out line to Reserve Tank-Closed
- e) Return Line from Reserve Tank-Closed

3. Make sure prepared box mixes are transferred to the boxes and the box volumes are correct. Fill to the overflow.

- a) Pre-wetting/ Bottoming Box
- b) Topping boxes (if charging or replenishing)
- c) Topping Box
- d) Softener box (if used)

4. Recheck and Set Steam controls.

- a) Pre-wetting/ Bottoming Box
- b) Topping Box
- c) Softener Box
- d) Dry cans

5. Check circulation filter to make sure it is clean.

6. Check indigo and chemical metering pump filters.

7. Turn on power to Machine.

8. Turn on circulation pump (manual). Run 10 minutes then turn off.

9. Recheck for proper valve positions are correct for flow through desired filters and pumps.

10. Make sure all feed mixes are prepared and adequate volume is available for startup and beginning.

- a) Indigo Stock & Feed Mix
- b) Topping feed mix (if running chemical feed). Have pre-cooled caustic and water prepared and reducing weighed. Do not add Reducing to the chemical feed tank until just before the machine starts.



- c) Pre-wetting/ Bottoming Feed Mix
- d) Softener Mix (if used)
- 11. Check for proper position of valves on all feed tanks.**
 - a) Drain valves-closed
 - b) Valves to feed pumps-open
 - c) Valves to other auxiliary feed tanks-closed
 - d) Valves to indigo stock transfer-closed
- 12. Following tank valves are OPEN**
 - a) Indigo feed to metering pump-open
 - b) Pre-wetting/ Bottoming feed mix to box level control or transfer pump-open
 - c) Softener feed tank to metering pump or flow meter-open
 - d) Topping feed tank to metering pump-open
- 13. Make sure valves to metering pumps (at pump area) are in proper position.**
- 14. Check Indigo Box Conditions**

If addition is necessary, circulate 15 minutes and recheck conditions.
- 15. Wind lead-line slack onto the ball warps.**
- 16. Open tension bar (if closed)**
- 17. Recheck all feed line valves to metering pumps.**
- 18. Check indigo feed and topping feed (if used) pumps for specified delivery. Recheck and adjust if necessary.**
- 19. Lower all nip rolls and check for proper nip pressure.**
- 20. Set switches on circulating and feed pumps.**
- 21. Turn on and adjust water nip sprays at wash boxes.**
- 22. Recheck temperature and level in the pre-wetting/ Bottoming box, Topping box and Softener box.**

When Dyeing Machine Stops- End of Set

1. Adjust the tension bar at the stock draw roll to induce tension on the incoming lead lines. Do this before “pulling off” and plaiting leads.
 2. Turn off metering pumps and circulation pump.
 3. Turn off water and steam at nip sprays and boxes.
 4. Close valves from feed tanks.
 5. Raise all nip rolls.
 6. Drain wash boxes and pre-wetting/ Bottoming box. Remove any lapped up ends from rolls.
 7. Flush out lines and metering pumps. Left over chemical feed may be used if pump piping is appropriate.
- Note: Never leave indigo in the metering pumps for an extended period of time.



8. Clean metering pump and circulation pump filters.
9. Turn off power to machine.
10. Tie “bow ties” in lead lines at all accessible areas. This prevents fraying of lead lines, prevents laps.
11. Check and clean metering pump back pressure valves. Replace diaphragms if questionable. This should be practiced weekly.
12. Clean feed tanks that are empty.
13. If low volume is in the indigo feed tanks, transfer back to the indigo stock tank.
14. Small volumes of chemical feed mix may be pumped through the metering into the machine. This in many cases will avoid hydro addition to the boxes when the machine is restarted.
15. Check and remove any yarn lapped on sky rolls.
16. Clean machine area- floor, etc.
17. Dispose of any empty drums, bags etc.

3.4.29 Duty and Responsibilities while the machine is running in SDL & SRDL:

1. Start Machine

- a) Observe compensator positions and watch for slack
- b) Observe tracking and watch for problems with lead line.
- c) Recheck metering pump-only to see that they are pumping.
- d) Prepare to change lead line tubs to yarn tubs at coilers.
- e) Observe for any abnormal behavior of coiler operation.
- f) Recheck dry cans and condition of moisture in running yarn at coiler.
- g) Lay out end of rope at coiler position designed for “lay out” inspection.

2. During 1st 20 mintes of running

- a) Check water sprays at nip rolls on wash boxes.
- b) Check roll nip pressures.
- c) Check compensator arm positions. Trim Vernier rheostats if necessary.
- d) Make sure tension bar at front of machine (draw roll) is open o-no drag.
- e) Recheck for desired drying conditions-5 to 7% moisture left in the yarn.
- f) Observe running warps at each box-especially for laps on the sky rolls.
- g) Check dosification of metering pumps, record.
- h) Check flow and level in pre-wetting/ Bottoming (or sulphur bottom) box.

3. 1st 20 minutes of operation

- a) Check flow and temperature of softener box.
- b) Recheck machine speed.
- c) Check circulation pump operation.
- d) Observe coiler operation.



- e) Check indigo box conditions-record. Determine if conditions are satisfactory. Record data in log book or control monitor sheet.

Specific Duties While Machine is Running

Perform duties and record in log book

1. Check flow to softener box (if used)-also temperature.
2. Check Machine speed.
3. Check circulation pump operation. Observe pressure on discharge restriction valve (if applicable).
4. Clean circulation filters every 3 hours.
5. Check indigo box conditions hourly and record.
6. Check indigo and chemical feed metering pump delivery hourly and record.
7. Constantly patrol machine. Look for any abnormalities, Patrol and observe.
 - a) Lap-ups-sky rolls and other areas
 - b) Bearing noise-unusual metering pump noise
 - c) Interruption of metering pump delivery
 - d) Reduction problems (indigo squeeze nips)
 - e) Abnormal tension-compensators unbalanced
 - f) Incorrect water spray at nips
 - g) High or low level in indigo boxes
 - h) Drying conditions-too damp or too dry
 - i) Incorrect air pressure at nips
 - j) Motor overload
8. If machine stops, insure that circulation and metering pumps stop with machine.
9. If machine is necessarily slowed down, make sure metering pumps are adjusted.
10. Prepare new feed mixes prior to need. Keep chemical stock near preparation area.
11. Turn in new feed mixes just after old mix is exhausted. Wash dye tanks before new indigo preparation.
12. Check “wet out” of yarn in sample from pre-wetting/ Bottoming mix.
13. Observe warps for problems or lost ends.

3.4.30 Equipment's used in dyeing lab:

Name	Image	Functions
Color Assessment Cabinet		Color fastness and shade Match
Metrohm meter		pH, Indigo and Hydro Measurement
Portable Spectrophotometer		Black color measurement.
ORP		Measure Oxidation Reduction Potential



Digital Balance		Weight measurement
Desktop computer		Machine control and Dosing Command.
Micro oven		Drying

3.5 L.C.B (Long Chain Beamer)

3.5.1 Definition: After the rope dyeing of warp yarn in denim production, the next operation is the Long Chain Beamer (LCB). When the rope has been dyed and dried in the rope dyeing range, it is taken in large cans in coiler section. In rope dyeing range, if the machine has a capacity 24 ropes, then there will be 24 separate coilers which delivers 24 ropes in separate cans. These cans are transferred to the Long Chain Beaming area. The basic purpose of long chain beamer is to open the rope into a sheet form of yarn and wind onto a warper beam which in turn transferred to the sizing machine.



Fig: Long Chain Beamer

In Long Chain Beamer, the yarn alignment in the dyed rope is change from a rope form to a sheet form. In the Long Chain Beamer the rope pull from the can by moving them upward to a guiding device. The guiding device is mounted above the can, probably in the ceiling. The upward movement of the rope allows the ropes to untangle before nearing the beamer head and allow the rope to shake loose form from the rest of the rope in the can.



Fig: Morrison LCB

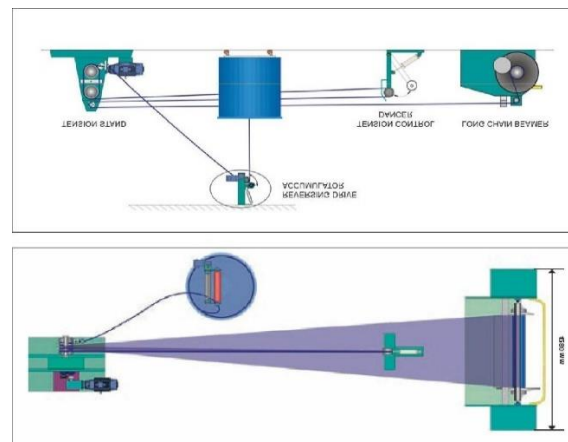


Fig: Passage of dyed yarn rope in Long Chain Beamer

3.5.2 Machine Description:

Name	Long Chain Beamer
Brand	Morrison
Origin	U.S.A
Machine speed	Max- 450 r.p.m & Min- 200 r.p.m
Production	About 40000-60000 meter/day
Tension	About 90-130

3.5.3 Machine Parts:

1. Roller
2. Reed
3. Tension Stand
4. Tension pulley
5. Headstock
6. Beam
7. Dancer
8. Foot switch

3.5.4 Description of machine components:

Tension stand: The Tension Stand motor is operated in a regeneration mode which provides power that is consumed by the beamer head

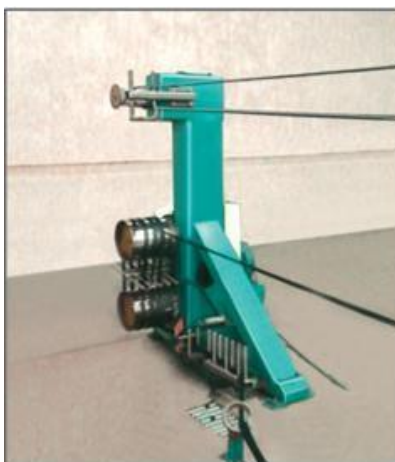


Fig.: Tension Stand

Tension control dancer: During re-beaming, the tension in the rope is maintained by means of Tension Control Dancer, which is equipped with a pressurized dancer and a feedback loop. This sends a reference signals to the tension stand AC motor continuously and ensures a consistent beam tension.



Fig: Tension control dancer

Accumulator:

An accumulator is a device which allows the rope to be accumulated in a controlled manner at the time of unwind the section beam on the Long Chain Beamer in order to find out and to repair a broken end. The accumulator is an important component on a Long Chain Beamer, as there is no stop motion device in the re-beamer and the operator observes the yarn sheet whether there is any broken end.

3.5.5 Some features of the Machine: The essential features are:

- Flange diameter of 1 meter at the highest speeds can be achieved. Head is equipped with either beams with journals or gear type heads.
- The machines are equipped with Semi-Automatic Beam Doffing system which facilitates for easy removal of LCB beams.
- Various functions like stop / jog / run, beam doffing, accumulator device, tension control system are incorporated.
- The machine is equipped with pneumatic / hydraulic double end Disc Brakes for immediate stops to minimize any missing ends in the beam.
- The Sheet strummer at comb helps in the web opening with variable speed AC motor. This also automatically lifts and lowers during machine stop / start.
- Optional features are Press Roll with kick back to prevent scuffing of yarn and Elevated Back Up Accumulator

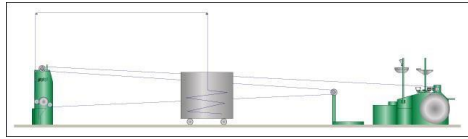


Fig: Passage diagram of Morrison LCB

3.5.6 Working Procedure in SDL & SRDL:

1. Received program from dyeing section
2. Put the power switch on present of electrical person
3. Make the count wise parameter setting on the machine, viz tension speed, lease, ends.
4. Then clean the machine carefully
5. Setup the load can under accumulator
6. Complete the yarn passage from rope can to head stock via accumulator, tension stand & dancer
7. Do the reed denting
8. Setup reed width
9. Load empty beam on the machine
10. Put the safety guard on place
11. Firstly run the machine at slow speed and then slowly increases the machine speed
12. Cut the beam after requirement program length
13. After finished 12 beams, 1 program will be complete the production data should be filled up in the relevant production sheet.



3.6 Sizing

3.6.1 Definition: Sizing is the most important terms for weaving technology. After winding and warping. Sizing of yarn is done during beam preparation. Sizing is done by applying various types of size materials on the yarn. During application of size materials steam is needed. Sizing is a protective process. The process of applying a protective adhesive coating upon the yarns surface is called sizing. This is the most important operation to attain maximum weaving efficiency especially for blended and filament yarns. Sizing is called the heart of weaving.

3.6.2 Objects of Sizing: Sizing is done during beam preparation for getting some advantage of weaving. Sizing has lots of objects which are given below:

- To improve the weave ability of warp yarn by making it more resistance to action of weaving like absorption, friction, tension etc.
- To maintaining good fabric quality by reducing hairiness, weakness and by increasing smoothness and absorbency of yarn.
- Tensile or breaking strength of cellulosic yarn is increased by sizing.
- Elasticity of the yarn is also increased.
- By adding size materials, yarn weight is increased.
- To increase the frictional resistance.
- Projected fibers are removed by this process.
- To reduce electrostatic formation.

3.6.3 Properties of sized yarn: Generally size ingredients are used for warp yarn but sometimes it applies on weft yarn. Anyhow, by applying size ingredients on the yarn, following properties are obtained. Properties of sized yarns are given below:

- Higher elasticity
- Higher yarn strength
- Lower flexibility
- Lower extension or elongation
- Lower frictional resistance
- Increased smoothness
- Less weakness
- Insensible to over drying
- Less hairiness

So, size ingredients change the physical properties of cellulosic fibers which is used for making a weavers beam.



3.6.4 Types of Sizing according to application:

- **Pure sizing:** When sizing is done in yarn which produces unbleached fabric is called pure sizing. So, ingredients are on the weight of yarn 7 to 10%.
- **Light sizing:** This is used for dyeing and printing. 11 to 15% sizing ingredients are used on the weight of yarn.
- **Medium sizing:** For increase of strength and weight of the yarn 16 to 40% sizing ingredients are used on the weight of yarn.
- **Heavy sizing:** It is used to increase the weight of yarn. Above 40% sizing ingredients are used on the weight of yarn.

3.6.5 Size ingredients and their functions: Different types of sized ingredients are used for sizing. Followings are the main size ingredients used for sizing.

- **Adhesive:** Generally starch of maize, corn, rice, potato and CMC. PVC are used as adhesive. Tamarine is used as adhesive on jute yarn, the adhesive is in granule form that is mixed with water and heated to form a paste which ultimately becomes viscose fluid.

Functions:

1. To increase strength.
2. To impart adhesion making the yarn less hairy.
3. To increase abrasion resistance.
4. To increase smoothness.
5. To increase elasticity a stiffness.
6. To reduce extensibility.

- **Lubricants/Softener:** Japan wax, Tallow, Mineral waxes. Vegetable waxes. Animal fats, Mineral oils and Vegetables are used as lubricants.

Functions:

1. It makes the yarn soft and slippery.
2. It reduces stiffness.
3. It increases yarn smoothness.
4. It increases elasticity.



- **Anti-septic or anti mildew agent** Salicylic acid, Carbolic acid. Zinc chloride, Phenol is used as anti-septic agent.

Functions:

1. It prevents mildew formation.
2. To preserve size materials for a long time.
3. It helps to store the yarn for a long time.
4. To protect yarn from bacteria or fungus.

- **Deliquescent or hygroscopic agent** Glycerin. Calcium chloride are used as deliquescent agent. Deliquescent agent is those substances which absorb moisture from air.

Functions:

1. It prevents excess drying of yarn.
2. It helps to absorb moisture from air.
3. To prevent the brittleness of size.

- **Weighting agent:** China clay, Sodium phosphate are used as weighting agent. These are used especially for those fabric or yarn that is to be solid or grey state.

Functions:

1. It increases the weight of yarn.
2. To impart fullness and fell to the fabric

- **Anti-foaming agent:** Pyridine. Benzene are used as anti-foaming agent.

Function: To prevent foam formation.

- **Tinting agent:** Blue is used as tinting agent.

Function: To increase lusture or brightness.

- **Wetting agent:** Sulphanol A, soap, avirol, magnesium chloride are used as wetting agent. The drawback of these substances is their high foaming ability and the foam is very stable.



Functions:

1. It increases size exhaust.
2. To obtain a uniform distribution of sizing solution on yarn surface.
3. It helps to wet yarn instantly.

3.6.6 Sizing in SDL & SRDL: In SDL & SRDL, Sizing is done in two ways-

After dyed rope is separated in LCB section then it transfer into sizing section and the second way is slashing. It is done in the slasher dyeing and sizing machine.

3.6.7 Machine Description:

Name	Sizing Machine
Brand	Jupiter
Origin	India
Machine speed	25-30 r.p.m
Size box width	80"
Saw box	Double saw box with size circulation pump
Creel capacity	Usually 12 is used
Drying cylinders	Multi drying cylinder
Working width	110"
Headstock width	110"
Main motor	40 hp
Dimmer	40 amp

3.6.8 Machine Features:

- Optimum and uniform size Pick-Up.
- Minimum loss in elongation.
- Minimum hairiness.
- Automatic tension Control in different zone through PLC.
- Automatic control of different parameters such as temperature in size box/ cylinder, squeezing pressure, beam pressure & pneumatic brake at creel.
- Higher production with good quality.
- User friendly HMI (Human Machine Interface)



Fig: Jupiter Sizing Machine

3.6.9 Machine Description:

Name	Slasher dyeing and sizing machine
Brand	Moenus Sucker
Origin	Germany
Machine speed	20-25 r.p.m
Production capacity	About 30000 meter/day
Squeeze pressure	8 or 10
No of squeeze roller	2
No of immersion roller	2
No of size dryer	12
Preparation tank temp.	100°C
Storage tank temp.	70°C or 80°C
Size box temp.	80-85°C
Cooking time	50-60 min
Capacity of size box	250 litre

3.6.10 Sizing Chemicals:

- i. 1 sort chemical
- ii. Hormosize NH 90
- iii. L size NH 90
- iv. JS 99
- v. Modify starch
- vi. Sisetex 5
- vii. Bevaloid (Binder)
- viii. Wax
- ix. P.V.A



3.6.11 Sizing Recipe: For Count 6, 7, 8 OE/OESL:

Ingredients	Quantity
Water	600 litre
Size-tex 5	65 kg
Bevaloid	15 kg
Wax	4 kg

Temperature	85/90°C
Cooking time	50 min

For Count 6, 7, 8 R/RSL:

Ingredients	Quantity
Water	600 litre
Size-tex 5	75 kg
Bevaloid	18 kg
Wax	5 kg

Temperature	85/90°C
Cooking time	60 min

For count 9, 10, 11, 12 OE/OESL:

Ingredients	Quantity
Water	600 litre
Size-tex 5	75 kg
Bevaloid	15 kg
Wax	4 kg

Temperature	85/90°C
Cooking time	60 min

For count 9, 10, 11, 12 R/RSL:

Ingredients	Quantity
Water	600 litre
Size-tex 5	80 kg
Bevaloid	20 kg
Wax	5 kg



Temperature	85/90°C
Cooking time	60 min

3.6.12 Working procedure in SDL & SRDL:

1. Setup program according to plan
2. Received beam from LCB according to program
3. Put the machine Power switch on in front of electrical Person
4. Make the Count wise parameter setting on the monitor.
5. Then clean the machine carefully
6. Creel loading by the beam
7. Do the knot with leader rope.
8. Complete the yarn passage from creel to head stock
9. Do the Proper tapping, leasing and reed denting
10. Load the weaver's beam on the head stock.
11. Put the Safety guard on place
12. Firstly switch on the control button.
13. Pass the sized yarn on the weaver's beam
14. Switch on the Beam control button
15. Run the machine in creep position
16. When the machine control the tension every zone, then machine run slow position
17. Switch on the beam presser button
18. Then machine runs fast.
19. When target beam length fills up, then beam doffing
20. Then this weaver's beam waits for loom section

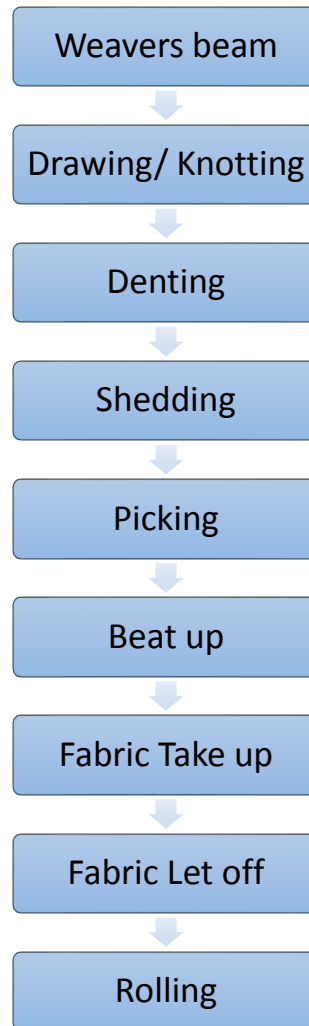


3.7 Weaving

3.7.1 Definition: The process of producing a fabric by interlacing warp and weft threads is known as weaving. The machine used for weaving is known as weaving machine or loom.

Weaving is an art that has been practiced for thousands of years. As of today, there is a wide range of looms being used, right from the simplest handloom to the most sophisticated loom.

3.7.2 Flow chart of weaving:



3.7.3 Loom: The Loom used in Sinha Denim Ltd & Sinha Rope Denim Ltd for weaving of Denim fabric is Air jet loom.

3.7.4 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 system utilizes a multiple nozzle systems and a profiled reed. Yarn is drawn from a filing supply package by the filing 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, which provide the initial acceleration.

3.7.5 Specification of Air Jet Loom:



Fig: Air Jet Loom



Brand	Picanol
Origin	Belgium
Model	OMP800-2-P
Speed	850 r.p.m
Production	Approximately 65000 meter
Reed	Profile reed
Shedding type	Tappet
Type of shed	Open shed
Type of picking	Modern
Type of Beating	Single
Air pressure required	6-7 bar
Total relay valve	12
Number of Healed shaft	4
Number of cutter	2 (Filling & wastage)
Number of nozzle	2
Number of Weft accumulator	2
Number of cams	Depend on construction
Feeding type	Negative
Type of cam	Negative
Reed count	27-52's

3.7.6 Machine components: The main parts of loom are as follows-

- i. Beam
- ii. Drop wire
- iii. Healed shaft
- iv. Healed eye
- v. Reed
- vi. Pre-winder
- vii. Healed Frame
- viii. Elsy



- ix. Leno
- x. Catch cord
- xi. Nozzle
- xii. Cutter

3.7.7 Yarn used for weft insertion: Various types of yarn used for weft insertion in Sinha Denim Ltd & Sinha Rope Denim Ltd for weaving. Such as-

- i. Cotton
- ii. Polyester
- iii. Lycra
- iv. Filament

3.7.8 Yarn count (weft):

Cotton: - 6-30 Ne

Polyester: - 150-600 denier

3.7.9 Fabric GSM: Depend on requirement of weight.

- Batcher is used to wound fabric and it wounds about 2000 meter.
- Take up and let off speed depend on construction
- Catch cord is used about 20 doubles (9-10's)
- Crimp % is about 10-12



3.7.10 Fabric Construction: Some fabric construction for weaving are as given bellow-

Sl No	Style name	Construction	Weft Ratio	Weave	Reed	T-Ends
1	1226-EI	(6.5Rsl+7Oe+10Oe)*(8Rsl+9Oe)/60*42	1:1	3/1 RHT	590/4	4250
2	777-A7	(7.5Rsl+8R+11R)*(8Rsl+9Oe)/65*45	1:2	3/1 RHT	634/4	4530
3	1182-BM	(8.3Oesl+7Oe+10Oe)*(7Oesl+8Oe)/68*39	1:1	3/1 RHT	892/3	4692
4	1246-Q521	7Rsl*7Oe/62*40	Full	3/1 RHT	610/4	4284
5	5NM-18	(7Rsl+7R)*9Oe/60*38	Full	3/1 LHT	590/4	4224
6	779-2	(6.5Rsl+7Oe+10Oe)*(8Rsl+8Oe)/60*46	1:1	3/1 RHT	590/4	4250
7	1182-BMF	(8.3Oesl+7Oe+10Oe)*(7Oesl+7Oe)/60*42	1:1	3/1 RHT	590/4	4692
8	4040	(10Oesl+12Oe)*18L40D/66*43	Full	2/1 RHT	869/3	4524
9	4031-Q6	7.2Rsl*7Oe/65*41	Full	3/1 RHT	634/4	4380
10	4157	(8.3Oesl+7Oe+10Oe)*7Oe/68*39	Full	3/1 RHT	892/3	4692
11	42518	7Rsl*10L40D/54*44	Full	3/1 RHT	530/4	3840
12	1233-A	(6.5Rsl+6.5R)*8Oe/60*39	Full	3/1 LHT	590/4	4224
13	42318	(7.5Rsl+8R+11R)*(8Rsl+9Oe)/65*45	1:2	3/1 LHT	634/4	4530
14	4294	(8Oe+12Oe)*(16Rsl+16R)/68*46	1:2	2/1 RHT	892/3	4716
15	4287-C	26R*20Oe/84*52	Full	3/1 RHT	1102/3	5600
16	4171-E	7Rsl*600D white/54*44	Full	3/1 RHT	530/4	3912
17	41308	(8Rsl+10Oe)*16L40D/62*52	Full	3/1 RHT	610/4	4224
18	4051	12Oe+12Oe/72*46	Full	2/1 RHT	945/3	4848
19	4149	(7Oe+9Oe+10Oe)*300L40D/65*50	Full	3/1 RHT	634/4	4068
20	4090	(12Oesl+12Oe)*12Oe/72*55	Full	3/1 RHT	945/3	4872
21	1089	20Rsl*20Rsl/68*48	Full	1/1 Cham	892/3	4560
22	4263	7Rsl*7Oe/62*43	Full	3/1 RHT	610/4	4284
23	41458	8Rsl*9Oe/65*46	Full	3/1 RHT	634/4	4608
24	4258	(7Rsl+7R)*6.25Oe/62*44	Full	3/1 RHT	610/4	4356
25	4198	(10Oesl+12Oe)*150L40D Black/67*50	Full	2/1 RHT	869/3	4524
26	4140	(20Rsl+20R)*20R/91*47	Full	2/1 RHT	892/4	5920
27	4178	(7+12)*16L40D/66*45	Full	2/1 RHT	869/3	4464
28	4175	(7+12)*16L40D/66*45	Full	2/1 RHT	869/3	4464
29	4010	26R*26R/84*60	Full	2/1 RHT	1102/3	5600
30	4123	(20Rsl+20R)*16L40D/91*54	Full	2/1 RHT	892/4	5922
31	4129	(9Oesl+9Rsl+9Oe)*7Oe/62*41	Full	3/1 RHT	610/4	4164
32	4174	16Oe*20Oe/66*42	Full	2/1 RHT	869/3	4500
33	1005-D	(10Rsl+10Oe)*10Oe/68*38	Full	2/1 RHT	892/3	4416
34	4170	10Rsl*(8Rsl+8Oe)/62*45	1:3	3/1 RHT	610/4	4512
35	1007-B	(8Rsl+8Oe)*10Oe/65*37	1:2	2/1 LHT	892/3	4224
36	1064	(20Rsl+20R)*(20Rsl+20R)/91*47	1:1	2/1 RHT	892/4	5922
37	4065	12Oe*16Oe/72*44	Full	3/1 RHT	945/3	5040
38	4088	(7.5Rsl+8R+11R)*(9Oesl+9Oe)/65*46	1:1	3/1 BT	634/4	4530
39	4161-B	(6.5Rsl+7Oe+10Oe)*(8Rsl+600D)/60*46	1:1	3/1 RHT	590/4	4250
40	4140-A	(12Rsl+12Oe)*(9Oesl+600D Balck)/72*51	1:3	3/1 BT	945/3	4824
41	40358	(12Rsl+12R)*16L40D/72*53	Full	3/1 RHT	945/3	5184
42	1157	(7Oesl+9Oe)*12L70D/60*42	Full	3/1 RHT	590/4	3972
43	5D-15	(8Rsl+8Oe)*(10Rsl+9Oe)/62*48	1:1	3/1 RHT	610/4	4116
44	1002-D	14Rsl*16Oe/72*45	Full	2/1 RHT	945/3	4764
45	43078	(8.3Oesl+7Oe+10Oe)*(7Oesl+8Oe)/68*39	1:1	3/1 LHT	869/3	4692
46	41848	(9Oesl+9Oe)*150L40D white/68*58	Full	3/1 RHT	892/3	4524



3.7.11 Weave designs: The following weave designs are used:

- i. 1/1 Chambray
- ii. 2/1 RHT
- iii. 2/1 LHT
- iv. 3/1 RHT
- v. 3/1 LHT
- vi. 3/1 BT

3.7.12 Plain Weave: Plain weave is the simplest of all weaves. It has one-over one-under interlacing for both warp and filling yarns, therefore the plain weave formula repeats on two warp and two filling yarns. Plain weave requires only two harnesses. In Denim manufacturing this weave is called Chambray.

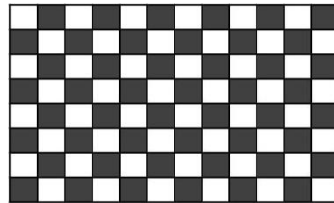


Fig: 1/1 plain weave

3.7.13 Twill Weave: Twill Weave is produced in a stepwise progression of the warp yarn interlacing pattern. The interlacing pattern of each warp yarn starts on a different filling yarn and follows the same formula. These results in the appearance of a diagonal line called twill line in the fabric, which is then characteristic of this design.

Depending on the direction of the twill line, the twill weaves are called right-hand or left-hand twills.

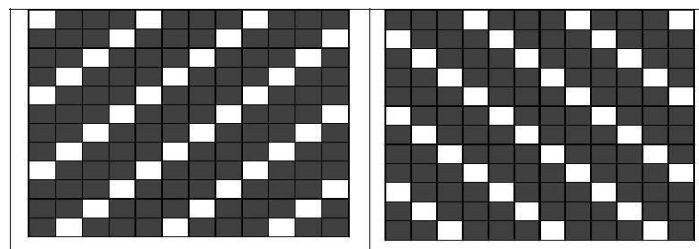


Fig: 3/1 RHT & 3/1 LHT



3.7.14 Working Procedure in SDL & SRDL:

1. At first according to the fabric structure and weave, we make ready the loom by changing the reed, cams and the healed frames.
2. We mount the sized beam on loom with the help of beam carrier (loading device) by the mechanical team.
3. Then every yarn of the draw frame and the mounted beam is individually knotted with the help of a knotting machine.
4. Then the knotted portion is passed through the healed eyes and reed dents.
5. According to the G.S.M and style of the fabric we input a numerical value of picks per inch on the machine monitor.
6. Finally, the machine is run with the necessary weft yarn by a shift officer.
7. Every operator is engaged for four looms to run.
8. According to the fabric construction, there is a loom card hanging on the loom.
9. To check the desired quality, we send first 100 meters of fabric to our enriched laboratory.
10. When the warp breaks the machine stops automatically. Then the operators knots the two broken ends and run the machine by pressing the start button.
11. Similarly, when the weft breaks the machine stops automatically. Then operator pick out the last inserted pick and run the machine by pressing the start button.
12. The woven fabric is wound on fabric roll by batching device. After winding minimum 400-500 meters fabric on batching roll then we cut it and send to finishing section.

3.7.15 Looming:

Looming covers the process involved in warp preparation after sizing up to setting them to loom.

The process can be shown as follows: Drawing-in _ Warp Tying _ Loom during slashing, the exact number of warp yarns required in fabric is wound on to the loom (or weaver's) beam. The warp ends are then passed through the drop wires of the warp stop motion, the heddles of the harness frames and the dents at the reed. This can be achieved by drawing - in or tying - in, the choice depending upon whether or not the new warp is different from the warp already on the loom.

Drawing-In:

The process of drawing every warp end through its drop wire, heddle eye and reed dent can be performed manually or by means of automatic machines. In both case, a length of



warp yarn, just enough to reach to the other side of the frame, is unwound. Leasing (i.e. selecting warp) of the warp at this stage simplifies the separation of the yarns. Then they are threaded through drop wires heddle eyes and reed dents. The automatic drawing machine can handle the leasing-in and drawing -in process in one single operation.

Tying-In:

When fabric of a particular type is being mass-produced, the new warp beams will be identical with the exhausted beams on the looms. Therefore, if every end on the new beam is tied to its corresponding end on the old beam, the drawing-in process can be omitted. Tying-in may be done by means of a small portable machine on the loom or as a separate operation away from the loom.

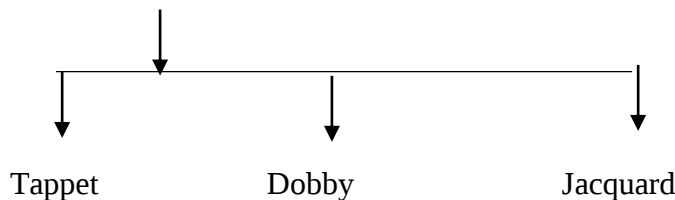
3.7.16 Motions in weaving: There are three motions in weaving. These are-

- i. Primary motion
- ii. Secondary motion
- iii. Tertiary or Auxiliary motion

1. **Primary motion:** These are fundamental or essential motion. Without these motions, it is practically impossible to produce a fabric. It is for this reason that these mechanisms are called primary motion.

Primary motions are-

- i. Shedding



- ii. Picking
- iii. Beat-up

3.7.17 Shedding Mechanism:

The shedding mechanism separates the warp threads into two layers or divisions to form a



tunnel known as 'shed'. The shed provides room for passage of the shuttle. A shed may be formed by means of tappets, dobby and jacquard.

3.7.18 Shedding Components: There are two main shedding components:

- i. Healed frame
- ii. Cam

- i. **The Healed or Heddle:** Alternate vertical movements according to the evolution of the warp yarn and the passage of the picks drive the heddles. Healed frame or heddles consists of a wooden frame, which consist of healed wires. To provide straight path for the passing of the warp. These are twisted and metallic wires, which slides on flat bars within the frame.
- ii. **Cam / Tappet:** The purpose of the cam is to control the motion of harness frames, the lift of reed and the weave pattern. Possible weave patterns of fabric are 1/1, 2/1, 3/1 and 4/1. There are approximately 4 cams used in the air jet loom. The cam acquires special curved shape.

3.7.19 Healed Shaft: A healed shaft consists of a wooden or metal frame carrying healed wires.

3.7.20 Picking Mechanism:

The picking mechanism passes weft thread from one selvage of the fabric to the other through the shed by means of a shuttle, a projectile, a rapier, a needle, an air-jet or a water-jet. The inserted weft thread is known as "pick".

3.7.21 Components of Picking Mechanism:

- i. Cone stand
- ii. Cone
- iii. Holder disc
- iv. Tensioner
- v. **Cone Break Detector:** Cone break detector detects filling yarn breaks that occur between the cone and pre winder. The cone break detector stops the weaving



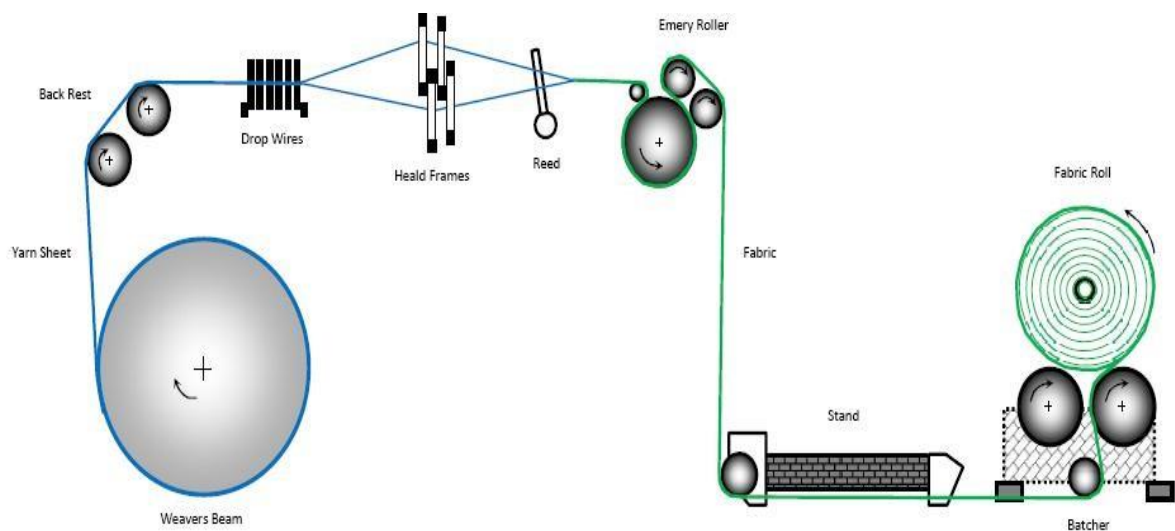
machine before the pre winder is empty. Cone break detector between the cone and the pre winder prevents starts up marks.

- vi. **The Filling Tensioner:** Filling tensioner are necessary to ensure a most uniform yarn tension between the cones and pre winder drum, therefore ensuring an absolute uniform tension under filling yarn winding without any loop formation.
- vii. **Weft Accumulator or Pre winder:** The pre winder draw filling yarn from a cone, winding it on the winder drum which in turn, makes for gentle pick insertion. The weft yarn is drawn off the package and wound on to measuring bands and fingers by the rotating motion of thread guiding tube. The diameter of the measuring band can be adjusted according to the width of the loom. Adjusting the measuring bands and the number of coils sets the pick length. The electro magnetically controlled stopper pin releases the weft yarn at the machine angle set.
- viii. **Storage Control:** As it takes time to rise the motor rpm to the standard rpm at starting required weft yarn for next insertion is wound in advance to secure smooth weft insertion. While the loom is running, corresponding length weft yarn to one insertion is supplied to the pre winder, and storage is controlled in the pre winder.
- ix. **Measuring Control:** One pick length of weft yarn is measured by releasing or hooking solenoid FDP pin electrically. There are two timings; one is for the first pick at starting and the other is preceding pick at normal operation. These timings secure accurate measuring, storage, measuring and weft insertion are controlled by output of signal command.
- x. **Balloon Breaker:** The balloon breaker reduces the balloon dimensions when drawing yarn from the pre winder. The closer the pre winder to the balloon breaker, the smaller the yarn balloons. When weaving heavy filling yarns, there is the potential to increase the rate of insertion when using a balloon breaker.
- xi. **Main Nozzle:** Nozzle is a duct of smooth varying cross section in which air is used to accelerate weft yarn through the shed across the width of fabric. On air jet weaving machines in each channel there are two main nozzles, one is fixed and other is movable.
- xii. **Relay Nozzles:** Relay nozzle mounted in sley are connected in groups to

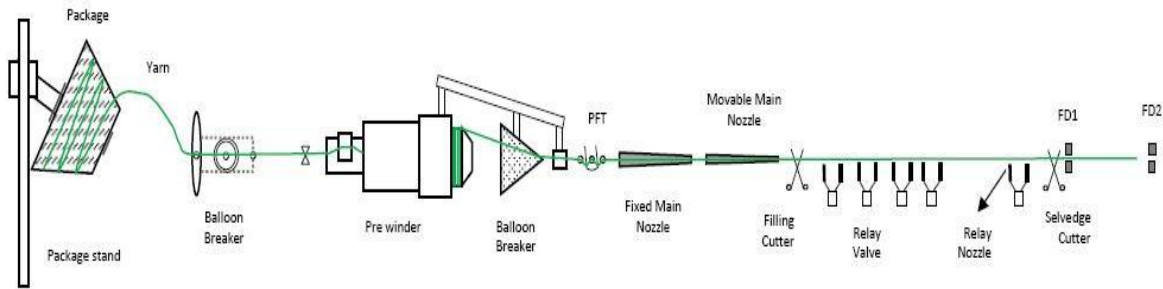
electromagnetic valves. The electromagnetic relay nozzle valve starts the air jet. The length of time the valve is opened depends on the reed width and relay valve spacing as well as on the yarn. The compressed air is distributed from the compressed air tank via the valves to the nozzles. Relay nozzles are arranged over the entire length of the reed, the relay nozzles assists the movable main nozzle.

- xiii. **Filling Cutter:** The function of cutter cuts the filling at the left hand and right hand side of an insertion. The cutter is driven by the motor and is completely independent of the machine drive. The position, the movement of cutting and the condition of the filling cutter are very important for the insertion. Cutter is mounted on both ends of the fabric. On yarn supply side, yarn is securely cut every time reed is beaten. On driving side preceding yarn is cut between the temple and the space roll. The motion of the cutter cam attached to the main shaft is transmitted through cutter cam lever and cutter rod to cutter edge.
- xiv. **Filling Detectors:** The filling detectors or sometimes called feelers mounted at the reed holder on the loom and the end of the driving side photo electrically monitors whether there is weft yarn arrive or not.

3.7.22 Warp Yarn Path Diagram (Air jet):



3.7.23 Weft Yarn Path Diagram (Air jet):



3.7.24 Beat Up Mechanism:

The beat-up mechanism beats or pushes the newly inserted length of weft thread (pick) into the already woven fabric at a point known as “fell of the cloth”. These three mechanisms namely shedding, picking and then beat-up are done in sequence.

3.7.25 Beating Components:

Sley: The sley is a metal frame. In case of air jet contains profile reed, relay nozzles, filling detector, stretch nozzle and side detector. At its forward motion the last pick is beaten up to the fell of the cloth, and at its forward motion the weft is allowed to insert through relay nozzles through the open shed. The heavy reciprocating sley with the help of a reed firmly beats up the last pick to the fell with the sufficient velocity.

Reed: The reed is an arrangement of vertical steel wires spaced at a given distance apart and securely fastened at the top and bottom by the bindings. The space between two wires is known as “dent”. Reeds are made with any desired number of dents per inch, according to the requirements of the cloth that is to be woven. A reed contains a definite number of dents on a given length; this is termed as the count, the pitch, or the number of reed. The reeds are named differently. Reeds are named from the number of dents contained in one inch. The shape and thickness of the metal wires used in the reed is important. Reed selection depends on several considerations including fabric appearance, fabric weight (ends per unit width), beat up force, air space requirements and weave design.



2. Secondary Mechanisms:

These mechanisms are next in importance to the primary mechanisms. If weaving is to be continuous, these mechanisms are essential. So they are called the “secondary Mechanisms”. They are:

- i. Take-up
- ii. Let-off

- i. **Take-up motion:** The take-up motion withdraws the cloth from the weaving area at a constant rate so as to give the required pick-spacing (in picks/inch or picks/cm) and then winds it on to a cloth roller. The main part of the mechanism is the take up rollers, which draws the cloth at the regular rate, and the number of picks per inch decides this rate. The take up roller is covered with emery cloth or hard rubber depending upon the type of cloth woven. The drive to the take up roller is by a train of gear wheels put into motion directly from the main shaft.
- ii. **Let-off motion:** The let-off motion delivers the warp to the weaving area at the required rate and at constant tension by unwinding it from the weaver’s beam. The secondary motions are carried out simultaneously. The speed of the servo motor is transmitted to warp beam gear via reduction gear, thus driving beam.

3. Tertiary Mechanisms:

To get high productivity and good quality of fabric, additional mechanisms, called auxiliary mechanisms, are added to a loom. The auxiliary mechanisms are useful but not absolutely essential. This is why they are called the “auxiliary mechanisms”. These are listed below-

- i. Warp stop motion
- ii. Weft stop motion
- iii. Warp protector
- iv. Weft replenishment
- v. Cutter
- vi. Temples
- vii. Brake
- viii. Selvedge



3.8 Finishing

3.8.1 Definition:

Finishing is a series of processing operations applied to a textile material to improve its appearance, handle and functional properties.

3.8.2 Objects of Finishing:

- To enhance the suitability of the fabric for end use.
- To improve appearance and sale appeal for comfort and utility.

To give desirable qualities to the fabric like-

1. Softness
2. Luster
3. Drape
4. Dimensional stability
5. Crease recovery
6. Soil repellence

More specifically, objects of finishing can be-

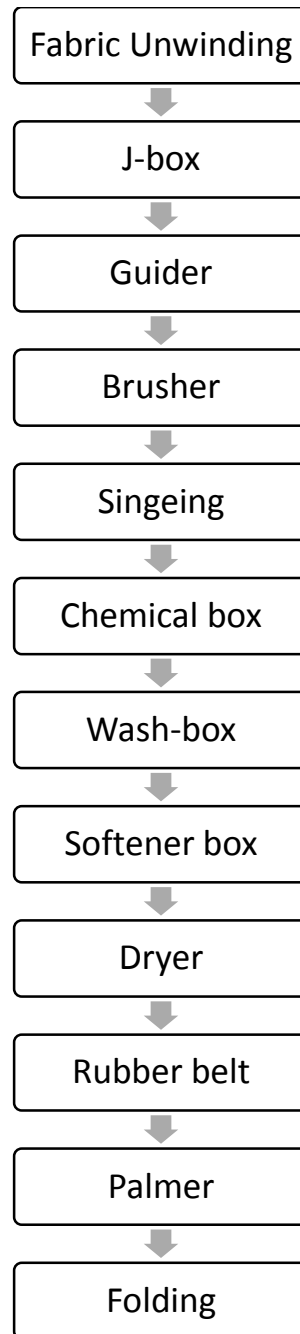
- To improve the appearance of the fabric.
- To improve the feel of the fabric.
- To cover faults in the original fabric.
- To improve wearing qualities of fabric by making it shrink or crease resistant.
- To set garment shape. E.g. Durable press.
- To impart special properties to the fabric for special end uses such as waterproofing, flame-proofing etc.
- To strengthen the fabric by coating or laminating.
- To produce novelty effects e.g. organdie fabrics by parchment sing.

3.8.3 Types of finishing:

1. Physical/Mechanical Finishing:
2. Chemical Finishing:



3.8.4 Flow chart (with mercerization):



3.8.5 Flow chart (without mercerization):

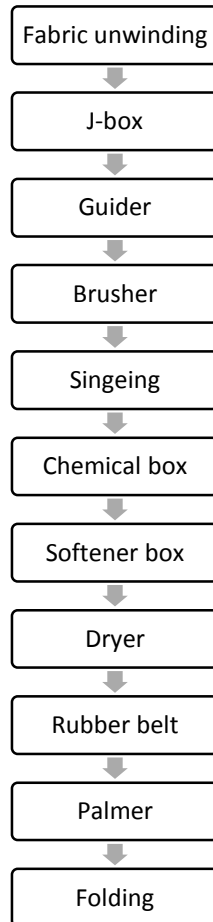


Fig: Finishing Machine

3.8.6 Machine description:

Name	Finishing Machine
Brand	Morrison
Origin	U.S.A
Total Machine	2
Machine speed	Max 80 & Min 25-35 r. p. m
Production	50000-60000 yds/day
Shrinkage value	11-13.5%
Moisture	9-10
Rubber belt temp.	130-140°C
Palmer temp.	110-115°C

3.8.7 J-Box: Store the fabric for some while during the process. This unit is important when change of batcher. Stored fabric supports the continuous operation.

3.8.8 Brushing: In the brushing stage, 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.

3.8.9 Singeing: The fabric is then singed in both or only faces side which burn off the protruding fibers from the fabric surface. Normally denim fabric is singed twice in a single passage of a singeing machine. The denim finished fabric must have soft and pleasant handle.

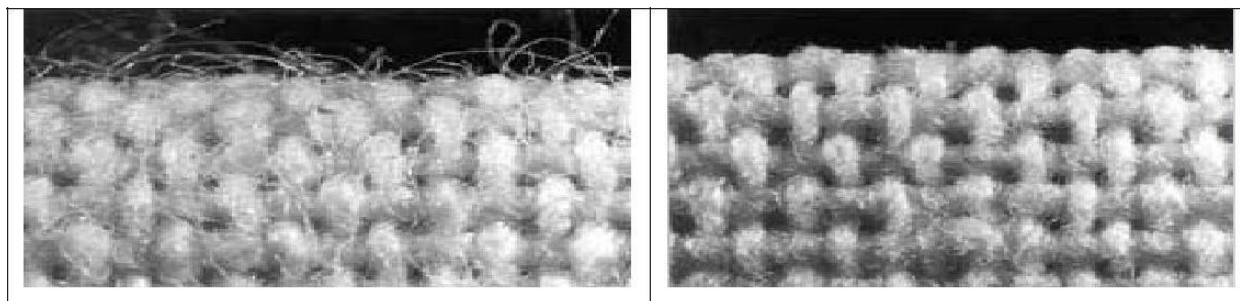


Fig: Before singeing (left side) and after singeing (right side)

3.8.10 Types of singeing:

1. Direct
2. Indirect



3.8.11 Direct Singeing: The action of burning away the protruding ends of the fibers is brought about by the direct action of the flame ensuing from the gas burners. In an alternative improved system, the fully combusted hot flue acts directly on the protruding fiber ends. The rate of fuel gas and air are carefully adjusted so that sufficient hair is removed without damaging the core.

3.8.12 Indirect Singeing System: In this system, the heat, in the forms of diffused infra-red radiations, produces a more even singeing effect. Owing to the indirect character of the singeing effect, this system is quite suitable for fabrics having wavy selvages, such as those occurring in the case of fabrics coming out from shuttle-less types of looms.

3.8.13 Softening: After the singeing range, 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.

3.8.14 Skewness Control:

The skewness in denim fabric, particularly in twill weave creates a serious problem in subsequent garment manufacturing and its washing. Leg twist is a major problem in denim manufacturing. Due to this problem the leg is rotated in the opposite direction of the twill of the fabric after laundering. Leg twist is assumed to be happening due to the directional yarn stresses. These are inherent in regular twill weave fabrics and developed during weaving. During washing the yarn stresses is relaxed which change the regular position of interlacement between warp and filling yarns. Due to this reason the legs are twisted. Normally leg twist not shown on garment stage. It only observed after laundering of the garment. Although leg twist appears after first laundering and it increases progressively with repeated launderings.



Figure: Fabric with skew

Figure: Fabric without skew



3.8.15 Working procedure in SDL & SRDL:

1. Unwind the grey fabric and put it into the J-box, which is the starting end of the machine.
2. Start brusher section
3. Start burner (singeing) section
4. Load softener into the chemical box then put the machine on auto dozing
5. Set pressure for peddler, Roller and dancing roller to set width of the fabric in process
6. Set the skew of the fabric in process
7. Set temperature into dryer for moisture control of the fabric in process
8. Set pressure and temperature for rubber belt, for shrinkage control of the fabric in process
9. Set temperature for palmer unit to dry the fabric in process
- 10 Folder attachment on the machine itself, lays down the finally finished fabric in folded form into trolley.



3.9 Inspection

The following standards for fabric quality and roll put up specifications are to be used and adhered to as closely as possible when grading all fabrics consigned to Levi Strauss & Co. Europe and Dockers.

3.9.1 Visual Fabric Quality: Fabric is graded using the “4-point Demerit System”. All defects, which are clearly noticeable from one meter and not considered a part of the character of a particular fabric by LSE and suppliers, shall be scored as defects and demerit points assigned according to severity.

1. Demerit points are assigned as follows:

- | | | | |
|-------------|---|---------------------------------|---------|
| A. 1-points | - | defects 7.5cm or less | = minor |
| B. 2-points | - | defects between 7.5cm and 15cm | = minor |
| C. 3-points | - | defects between 15cm and 22.5cm | = minor |
| D. 4-points | - | defects exceeding 22.5cm | = major |

2. No matter shall be penalized more than 4-points.

3. Point count by fabric type

	Roll		Shipment	
	DP/100m ²	Major/100m	DP/100m ²	Major/100m
Denim R/OE	18	4	12	2
Denim R/R	18	4	12	2.5
Twill/Poplin, 100% CO or CO blends	22	4	16	2.5
Linen or Worsted	26	4	20	3

4. The recommended inspection speed is 20m/min

5. All fabrics consigned to LSE and Dockers must be 100% inspected at and by the supplier according to LSE procedures and versus the agreed specifications. Details of DP & Majors per roll should be on packing list and sent to the manufacturing location.

6. LSE Inspection audit: The production outcome can always be audited by the LSE quality specialist at a random basis.

7. Rolls shall be rejected found defective for:



- a. out of shade range
 - b. Shading end to end
 - c. Skew out of tolerance
 - d. Hand too stiff or soft to standard
8. It is up to the fabric supplier to discuss and agree with the contactor the acceptance of rolls found defective for:
- a. side to side or side to center shading
 - b. Dry streak or unevenness
 - c. Narrow width
 - d. Bow, bias in excess of tolerance
 - e. Loose, wavy or tight selvages
- if considered necessary, LSE should be involved
9. Flagging & marking requirements or minor and major defects:
- a. Minor defects must be marked with chalk, unless otherwise agreed between supplier & quality specialist
 - b. Major defects shall be identified with a silver metallic adhesive flag wrapped around the selvedge visible from the face and back of the fabric
 - c. Indelible or UV pen marking for minor defects is not accepted
 - d. A defect of one meter or more in length, warp direction, should be flagged at the start and finish of the defect.
10. No 3 or 4 point defects shall be left in the first or last 3 meters of a roll or splice there in
11. No running or repeating defect through more than 3 continuous meters should be left in the roll-any defect found to repeat and or run in a continuous manner is constituted a running defect.
12. All holes regardless of size shall be penalized 4-points. There must be two or more yarns broken at the same place to consider a defect a hole.
13. All splices shall be flagged, but NOT counted as a defect



3.9.2 Rolls length and width:

a. Roll-Length Table:

	Roll		Shipment
	Min	Max	Avg.
Denim	90	450	250
Non-Denim	40	250	100

b. Individual rolls shall not deviate more than 2% from the length of the ticketed yardage

c. Fabric shipments shall not deviate more than 0.5% from the ticketed yardage

d. No rolls shall be accepted as first quality where the useable width is less than the minimum useable width mentioned in the RMM. It is up to the fabric mill to inform and agree with the contractor in case of rolls with a reduced useable width.

3.9.3 Splicing:

a. DENIM: Rolls can be composed of several spliced together parts provided that no splice is less than 18 meters, and that the average length of all parts does not fall below 90 m.

b. NON-DENIM: 1 splice allowed per roll

c. All parts must have shade continuity allowing for mixing at garment components from any part piece with those taken from another part piece comprising that roll. All splices/parts in a roll must be from the same wrap.

3.9.4 Skew, bias & bow (rigid fabric):

a. All 3/1 and some 2/1 twill fabrics for bottoms require skewing. Since the optimum skew varies depending on the fabric (anywhere from 5% to 9%), this must first be determined by the supplier and agreed upon before bulk fabric orders are placed. Target for individual rolls = +/- 3%

b. Patterned fabrics (prints or woven) exhibiting more than 1.5 % bow, bias of the weft will not be accepted as first quality.

3.9.5 Machine description:

Name	Inspection m/c
Brand	STT Machinery
Model	Amoeba
M/C dimension	2580 mm x 2920 mm x 2310 mm (L×W×H)
Speed	0 - 80yds/min

Size of inspection board	860mm (height)
Motor power	3 HP
Roller width	72 inch
Fabric roll diameter	450mm



3.9.6 Fabric Defects are divided into two types:

- Removable defects
- Non removable defects

3.9.7 Major Fabric Faults:

1. Starting mark:

Causes: Main cause is loom stoppage.

Remedy: This cannot be avoided but can be controlled by starting mark setting.

2. Reed mark:

Causes: If any fault occur at reed Faulty denting in the reed.

Remedy: Right selection of the reed and right denting.

3. Snarl:

Causes: Excess main nozzle pressure,

Low filling tension

Remedy: Main nozzle air pressure control,

Correct setting of the PFT finger value

4. Double pick:

Causes: Cutting problem of the cutter. Faulty setting of the air pressure.

Remedy: Cutter position is to be set correctly. Air pressure should be reset.

5. Miss pick/ broken pick:

Causes: Excess air pressure of main nozzle

Remedy: Main nozzle air pressure should be reduce



6. Warp breakage:

Causes: Bad sizing

Low strength of the yarn

Crossing of the warp yarn

Remedy: Re knotting Proper sizing

7. Loose or Tight (sizing Fault):

Causes: knotting is given, when breaks yarn, the yarn tension does not match with other yarn as a result Loose or tight occurs.

8. Filling Stop:

Causes: If weft is failed to reach FD1 If weft is too long & reach FD2

Remedy: Correct setting of the weft length

Correct setting of main nozzle

Correct setting of relay nozzle

Proper setting of air pressure

Proper setting of pre-winder

Proper setting of creel position

9. Oil Mark or Crease, Hole:

When fabric gets spots of oil lubrication from any part.

10. Contamination:

It is a yarn fault, Plastic Others are mixed with yarn.

11. Patti:

It is the dark color or thick weft lines in the fabric.

12. Crease Mark:

Creases occur due to improper finishing.



3.9.8 Working procedure in SDL & SRDL:

1. Load the finish fabric onto the Inspection machine.
2. The fabric Inspection process is 4 (four) point inspection International system
3. Marking the fault for every roll
4. Grading the fabric according to the 4 point systems (A- Elite. B- Shady, C- Cut piece)
5. The fault wise grading system is attached with the (SOP) /Measurement the roll length and width and then making every roll with paper tube
6. Indicate the buyer name, production date, program no, style, roll no, length, Width on a sticker and paste it onto the body of the roll
7. Every roll is pack with polythene and then weight is also been done
6. Plating of the fabric rolls is done according to styles.
9. Finally it is delivered to store from finishing floor



CHAPTER-04

Utilities



4.1 Definition: The definition of utilities can be expressed in many ways. A Company 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.

4.2 Utility department of SDL & SRDL is related to the following things:

1. Electricity: Gas Generator, Rural Electrification Board (REB)
2. Water: Deep Tube well
3. Gas: TITAS
4. Steam: Boiler
5. Compressed air: Air compressor
6. Chiller
7. Humidification plant
8. Workshop
9. Effluent Treatment Plant (ETP)
10. Water Treatment Plant (WTP)

4.3 Water Supply:

Water is supplied by deep tube well. 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 dryer, boiler, generator, compressor etc.

Total water consumption: 700m³/day.

4.4 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.

4.4.1 Features:

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

4.5 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.



Fig: Boiler

4.5.1 Supplied sections for steam:

1. Sizing
2. Finishing
3. Dyeing unit
4. Washing unit
5. Chiller

4.5.2 Machine description:

Brand	MechMar
Origin	Malaysia + England
Model	AS 2400/150 (24000 PPH)
Fuel used	Natural Gas
Power consumed	25 kWh
Maximum steam output	10.8 ton/hour

Water content	15.45 m ³
Fire tube	130
Maximum heat capacity	6.5 MW
Maximum working pressure	10 bar
Gas pressure	1.3 bar
Total tube	130
Air: Fuel	4:1
Sparking input power	240 V (AC)
Sparking output power	1000 V (DC)

4.6 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



Fig: Generator

4.6.1 Features:

1. 12 cylinders turbocharged and intercooled
2. Fully integrated engine diagnostic and control system including:
 - i. Spark timing control
 - ii. Turbocharger control
 - iii. Speed governing
 - iv. Individual cylinder knock detection
 - v. Air/Fuel ratio control
3. Fuel tolerance
4. High altitude capability
5. Low Btu option

4.6.2 Machine description:

Brand	Waukesha
Total machine	04
Origin	USA
Fuel	Natural Gas
No. of inline cylinder	6
Capacity	900 kWh
Volt	50 H.Z & 400 Volts
Speed	1000 rpm

4.7 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 SDL & SRDL rotary screw compressor is used.

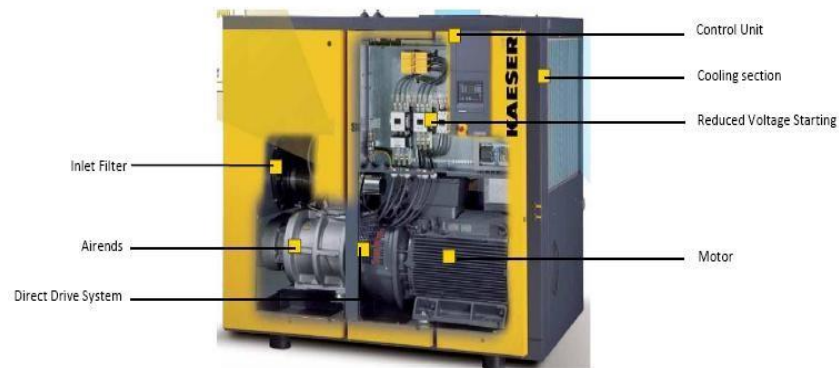


Fig: Compressor

4.7.1 Machine description:

Brand	Kaeser
Origin	USA
Total machine	08
Compressor Output	20.5 m ³ /min/mc
Dryer Output	52.5 m ³ /min/mc
Output Pressure	9-9.5 bar
Power Consumption	132 kWh/mc

4.7.2 Features:

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

4.8 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.



Fig: Chiller

4.8.1 Machine description:

Brand	Spacco
Model	SPC 600 RT
Capacity	2060 m3/h
Water in	37OC
Water out	32OC
Fan motor power	20 HP
Air Capacity	132400 m3/min



4.9 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.

Area	Total Machine	Consumption per machine (kWh)	Total Consumptions (kWh)
Warping machine	3	25	50
Dyeing machine	2	100	200
Loom	180	----	600
Finishing (Cibitex)	1	150	300
Finishing (Mercerizing)	1	150	150
Finishing (Coating)	1	150	150
Finishing (Desizing)	1	150	150
Inspection	4	---	50
Lighting	---	---	80
Compressor	8	132	1050
Chiller	2	75	150
Humidifier	2	150	300
Boiler	2	25	50
E.T.P	---	---	25
W.T.P	---	---	25
Power produced by Generator	4	900	3600
Total Power consumption			3330



CHAPTER-05

Effluent Treatment Plant



5.1 Introduction: In this industrialized age, environmental pollution is a matter of great concern. Surface water pollution is one of the elements of environmental pollution. Chemical processing industries especially textile processing industries are claimed to produce huge effluent to discharge in our rivers. A complex mixture of hazardous chemicals both organic and inorganic is discharged into the water bodies from all these industries, usually without treatment. It is well known that textile mills consume large volume of water for various processes such as sizing, de-sizing, scouring, bleaching, mercerizing, dyeing, printing, finishing and washing. Due to the nature of various chemical processing of textiles, large volumes of wastewater with numerous pollutants are discharged every day.

In Bangladesh most of the industrial units are located along the banks of the rivers and they do not use Effluent Treatment Plant (ETP) for wastewater. As a consequence, industrial units drain effluent directly into the rivers without consideration of the environment. Setup an effluent treatment plant is mandatory for a factory today. Authority gives no permission of electricity and gas connection to a new factory without ETP.

5.2 Inlet Effluent Parameters (General):

Flow Rate	30 m ³ /hr
pH	8-14
BOD	400-600 PPM
COD	1000-1200 PPM
TSS	200-500 PPM
TDS	3000-6000 PPM
Oil & Grease	30-60 PPM
Colour	Dark Mixed
Temperature	60°C

5.3 Outlet Effluent Parameters (Bangladesh Standard):

Flow Rate	30 m ³ /hr
pH	7-8
BOD	< 50 PPM
COD	<250 PPM
TSS	<100 PPM
TDS	<2000 PPM
Oil & Grease	<10 PPM

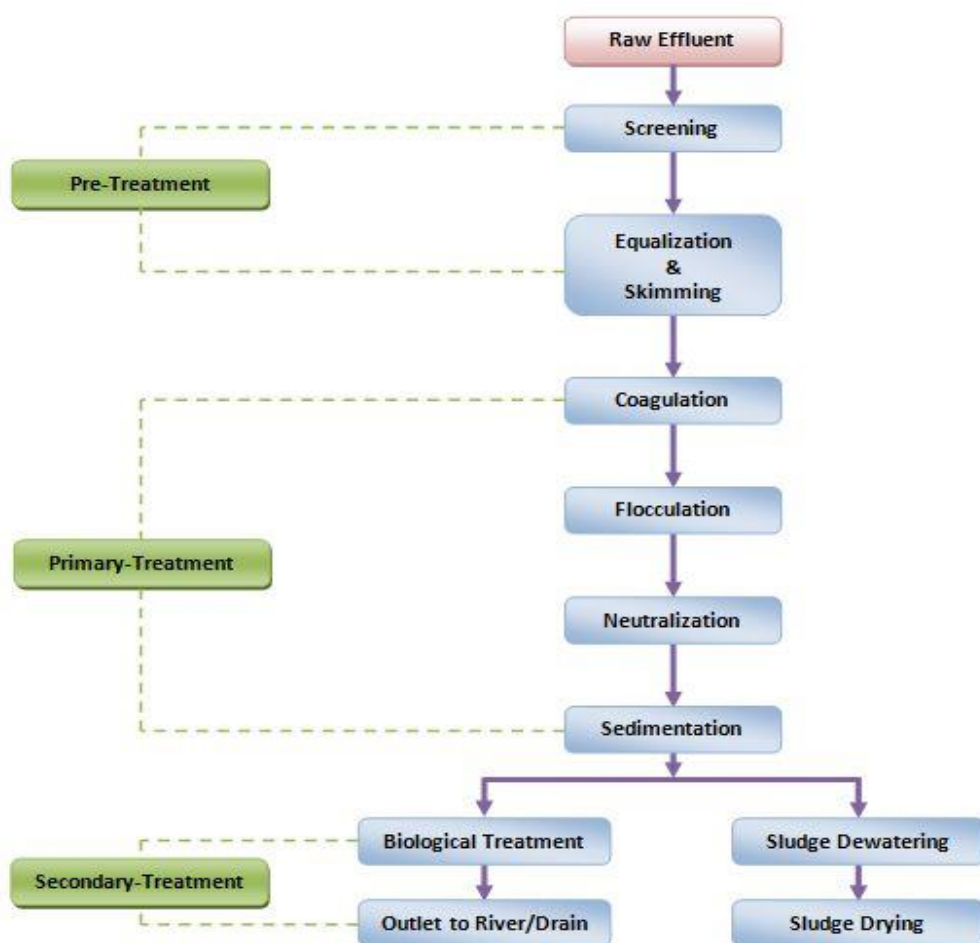


Colour	Clean
Temperature	<30°C

5.4 Capacity of the effluent treatment plant: The effluent treatment plant has been designed on the basis of the following:

1. Denim fabrics manufacturing plant.
2. Contaminated effluent is 100%
3. Less contaminated is nil
4. Operated continuously for 24 hours a day
5. Flow rate of treatment envisaged is 30m³/hr.

5.5 Process Flow Chart:





5.6 Pre-treatment:

Screening:

The raw waste water (Raw Effluent) from the process of the plant would be first screened through a manual bar screen strainer channel, where all particles with dia. > 5mm as well as small pieces of the fiber and floating suspended matters like polythene paper, polythene bags, rags and others materials removed by bar screen net. The bar screen consists of parallel rods or bars and is also called a bar rack. These devices are used to protect downstream equipment such as pumps, lines, valves etc. from damage and clogging by rags and other large objects. The bar screen is cleaned manually by means of rakes. The screening is disposed of suitably after they are de-watering. The screened clean effluent flows by gravity to an equalization tank.

Equalization and Skimming:

The raw waste water from the screen chamber is collected in the equalization tank, where it is equalized with respect to its characteristics and homogenous flow and an uniform pollution load as well as to make bacteria acclimatized the waste water is stored in a tank. High speed bottom fixed aerating device which blows air through the waste at a rate about 0.1 CUF of air per gallon of effluent. The rising air tends to coagulate the grease and oils and cause them to rise to the surface where they can be removed by a scraper mechanism. Besides, in order to accomplish a proper equalization of both varying loading and flocculating pH values. The equalization tank is designed for hydraulic retention time of around 6 hours. A substantial part of the COD will also be removed by the dissolved air flotation process.

5.7 Primary Treatment:

Coagulation & Flocculation:

The homogenized effluent is than pumped to a flash mixing tank followed by a flocculation tank. Where added coagulants like lime (Calcium Hydroxide) and Ferrous Sulfate (FeSO_4) for coagulation of the total dye particles. The basic idea of adding coagulant is to bring together all the suspended and dye particles so that they can precipitate out in a flash mixing and coagulation mechanism. Adequate quantity of poly electrolyte polymer solution are dosed to enhance the process of color removal by the flocculation process.



Precipitation and Sedimentations Tube Settler-1:

The flocculated effluent is taken by natural gravity in to the tube settler-1 from flocculation tank for precipitation of dyes and suspended particles. The flocs formed are removed in the downstream tube settler-1 by the help of tube settler media. The effluent will further flow by overflow system to a pH correction tank where requisite quantity of acid will be dosed and pH will be adjusted as per the requirement.

pH Correction:

The overflow effluent from tube settler-1 tank is than taken by gravity in to the pH correction channel for neutralization. 33% HCl acid is dosed for neutralizing the pH from around 10 to 7. The pH correction channel is designed for hydraulic retention time of around 10 minutes and is provided with slow speed agitator for thoroughly mixing of waste with acid. A pH indicator is installed in the tank for measuring the pH (optional).

5.8 Secondary treatment:

Biological Reactor 1 & 2:

The neutralized effluent is taken by gravity in to the biological treatment aeration tank for treatment of organic matter to reduce BOD/COD aerobically. The biological reactor is designed on extended aeration principle. The aeration is provided with fixed type surface aerator for providing the required oxygen for the biological degradation of BOD and COD. The air is supplied by means of the bubble diffusion.

Tube Sattler- 2:

After aerobically treatment effluent flows by gravity to the tube settler – 2, the biological solids generated are removed from the tube settler – 2 by the help of tube settler media.

Filter Feed Pump:

The effluent from tube settler – 2 overflow in to the pressure sand filter and activated carbon filter feed pump. From here the disinfected effluent is pumped by means of the pressure sand filter feed pump to the pressure sand filter. The pump is normally operated in automatically with interlock to the level switch in the filter pump.



Pressure Sand Filter:

The effluent is pumped to the pressure sand filter. The filtration takes place in the downward mode. The filter is filled with a layer of graded sand media supported by a layer of graded gravel. The suspended matter in the effluent is filtered out in this unit, the effluent is then flown into the activated carbon filter.

Activated Carbon Filter:

The filtered effluent from the pressure sand filter flows into the activated carbon filter. In this unit the feed flow is downward through a layer of granular activated carbon filter in which dissolved organics in the effluent are absorbed.

Treated Effluent Tank:

The effluent emanating from the activated carbon filter is collected in the treated tank. From this sump the final treated effluent is disposed off. As indicated before, this effluent is utilized for backwashing the pressure sand filter and activated carbon filter units.

Sludge Treatment:

The sludge generated in tube settler-1, tube settler-2 and biological reactor is taken to a sludge sump and pumped to a sludge thickener where sludge is concentrated. The thickened sludge from the thickener shall be pumped to sludge drying bed for de-watering. The de-watered sludge is formed into cake by natural dry or a centrifuge. The dried cake will be disposed in a tank. The overflow from the sludge thickener will be flow back to equalization tank for further treatment.



CHAPTER-06

Maintenance



6.1 Definition: Maintenance is the action taken to prevent a device or component from failing or to repair normal equipment degradation experienced with the operation of the device to keep it in proper working order.

6.2 Objects:

1. To keep the factory plants, equipment, machine tool etc. in optimum working condition.
2. To ensures accuracy of product & time schedule to delivery customers.
3. To minimize downtime of machine.
4. To prolong the useful life of factory plant & machine.
5. To modify or improve productivity of existing machine to meet the need for production & thus avoid sinking of additional capital.
6. To improve the factory environment.

6.3 Types: Maintenance can be classified as following way:

- ❖ Reactive/Break-down Maintenance
- ❖ Preventive/Schedule Maintenance
- ❖ Predictive/Planned Maintenance
- ❖ Capital Replacement

6.4 Maintenance Department of SDL & SRDL:

There is very active maintenance team in SDL & SRDL. Every group having a leader and two assistant fitters. They all are very efficient and hard working. They can fix any type of mechanical problem of machines. No necessity happens to hire others from outside to fix machine maintenance. There are electro-mechanical groups to work for electrical problem of machineries. They work for overall factory.

6.5 Maintenance Procedure:

1. If there is any mechanical fault of machine which is responsible for production hamper, operator informs mechanical fitters in duty. Mechanical fitters come and observe the problem firstly, and then they begin to fix it.
2. If mechanical fitters unable to fix it, then they inform technical in-charge, then he comes in spot and fix it.
3. For there is any electrical problem of machine or serious founding mechanical problem, mechanical and electrical department are informed, they come and fix the problem. They commence at work after informing of production manager.
4. For restore active maintenance, senior production officer orders mechanical fitters to fit required machine.



6.6 Cleaning:

Section	Cleaning
Warping	Every day (by air)
Dyeing	Every shade change (by air & water)
Sizing	Every day (by air)
Weaving	Every day (by air)
Finishing	In a week/month (by water)

6.7 Functions/Elements of Maintenance Department: Following are some important functions of maintenance department:

Inspection or check-ups:

1. Crews kept for inspection should be well trained.
2. External inspection means to detect from abnormal sound, vibration, heat, smoke etc.
3. Internal inspection means to check internal parts of the machine.

Lubrication:

1. Systematic lubrication means the application of right type of lubricant at right time at right place & in right quantity.
2. It is done to minimize friction & reduce decay of machine parts.

Planning & analysis:

1. Every preventive maintenance work should be pre-planned.
2. The program is specified in detail by mentioning daily, weekly & yearly attention.

Records & analysis:

Following records are generally maintained:

1. Operational manual
2. Maintenance instruction manual
3. History cards & history register
4. Inspection register
5. Log books
6. Defects register etc.

Training of maintenance personnel:

The technicians & supervisors of maintenance department should be well trained in a systematic way.

Storage of spare parts:

It is essential to store some essential spare parts which are needed every now & to keep the machine running & reduce stoppage time for machine defects.



Requirements for Good Maintenance:

1. Good supervision & administration of maintenance department.
2. Operators should be well trained.
3. Proper maintenance record should be maintained.
4. Adequate stock of spare parts should always be kept.
5. Manufacture of the machine tools should be consulted as & when required.
6. Maintenance department should remain in contact with planning & purchasing department deciding the type of machine tools to be purchased

Store and Inventory Control:

Inventory control of raw materials, semi-finished goods, finished goods and other miscellaneous goods lead smooth production. As SDL & SRDL follow the correct way of inventory control system, it can have a good and huge production as it demands.

There are two (one is small & other huge) room for storing and inventory control.

Scope of inventory control:

1. Raw materials
2. Yarns
3. Dyes store
4. Others chemicals store
5. Finished fabric
6. Spare parts
7. General store
8. Capital equipment
9. Accessories
10. Stationary

6.8 Inventory System for Raw Material:

The main raw material of denim fabric is yarn, which is stored in two stages such as-

1. Long time storage
2. Storage before production

Inventory System of Spare Parts: The spare parts of different section such as preparatory & dyeing, weaving section, finishing section are stored. If a machine is innovated its slightly effected parts will be stored as spare after repairing needed. In addition, these parts are used in conjunction with new parts.

Inventory Control of Finished Goods: After the completion of finishing, the finished fabric is stored from where the finished fabric is delivered to the buyer.



CHAPTER-07

Quality Assurance



7.1 Quality Assurance in Denim

Denim has gained much popularity that if you look around, you will surely notice somebody wearing denim in your nearby. Now, more than just complementing a rugged style, the denim has become suitable for any occasion. Denim is being worn irrespective of demographic differences. The material denim is synonymous with familiar blue jeans and is denoted by a rugged twill textile that produces the familiar diagonal ribbing. Today, there are around twenty Denim manufacturers in Bangladesh alone catering to the domestic and export markets. The manufacturing facilities are fast catching up at India, Pakistan and Vietnam. Denim today is now available in various shades of blue, black and brown within each there are different effects generated by washing.

Quality Assurance in Denim mill can thus significantly help in achieving the above objectives. Academically, Quality Assurance may be defined as "the planned and systematic activities implemented in a system for fulfilling the quality requirements of a product or service." The current paper highlights in brief various check points employed in Denim mill for arresting the non-conformities so as to reduce the production losses and quality down gradations.

7.2 Handling of Raw materials in Go-down:

Basic raw material for denim fabric is yarn. The same is either produced internally or is procured from outside. Following care should be taken for avoiding the damage of packages in go down:

1. In case of yarns purchased from outside, yarn should be unloaded from truck gently and location of go-down should be as near to warping. This will ensure minimum yarn damage due to impact and significantly improve the warping performance due to reduction in cut ends.
2. In case of In-house yarn, plastic packages are used generally. Care needs to be taken to use undamaged plastic packages only so as to minimize breaks at warping due to worn out packages.

7.3 Approval of raw material:

The raw material for composite Denim mill is fibre, while for non-composite mill it is yarn only. The raw material should be approved first before consuming for production. Following raw material parameters affect the yarn properties and running performance. For any new supplier/yarn sample it is always better to test the same by running the yarn as weft in the running looms for assessing its performance. Slub yarn approval should be given only after assessing the appearance either on yarn appearance board or by producing the fabric by running the same on the loom along with standard Slub yarn.

7.4 Warping:

Warping serves as the acid test for the assessing the yarn quality. Warping performance is considered to be satisfactory if breaks/million metre at 1200 mpm is as under:

Following points should be taken care while warping for getting the lower end breakage rate:

1. Damaged package found while mounting should not be creeled.
2. Tension in the yarn should be adjusted so that yarn sheet is neither slack nor very tight (Norm is 10% of the yarn breaking strength).



3. High speed provides necessary tension to the yarn sheet. In case of higher breaks speeds can be reduced to some extent. Drum pressure should be selected based on the hardness required of the warpers beam.
4. The warpers beam rims (flanges) should be checked periodically for damage and eccentricity.
5. The breakages should be recorded along with the reason like cut ends, breakage from Slub, opening of splice portion so as to take corrective action for next supply.

7.5 Dyeing & Sizing:

It has been found that yarn performing very good at warping sometimes create problem at dyeing range due to greater liveliness leading to grouping of yarn. Sometimes yarn performing poorly at warping leads to good running at dyeing. This may be due to elimination of all weak points at warping itself. In addition to performance concerns, shade consistency and centre side variation is also one of the challenges for mills having sheet dyeing ranges. These challenges make dyeing and sizing as very important operations in the Denim manufacturing. Following points should be taken care while dyeing & sizing:

1. Alignment of warpers beam in creel should be perfect.
2. In Bangladesh most of the mills are using indigo in powder form only. Thus purity, moisture content and tone (reddish/greenish) of indigo powder must be checked before taking in bulk production.
3. The parameters like pH & mV of the dye liquor needs to be checked every 30 to 45 minutes. Generally it is kept around 11.5 to 12.0 and 750 ± 30 respectively. In many advanced machines, online checking & display of these parameters is also available.
4. For shade consistency, yarn should be drawn from every beam for shade evaluation manually as well as by spectrophotometer.
5. Mills facing Center Side Variation should draw yarns from both the sides and centre from front of the dyeing machine and check for any variation Size add on is generally kept around 8 to 12% depending on yarn count.

7.6 Weaving:

Weaving is an operation where first image of denim fabric is realized. On getting perfect beams, the weaving efficiencies generally reaches Y6 to 98% per shift. In general the performance is considered satisfactory till Warp and Weft break level is less than 1.5 breaks/ cmpx. Following points should be taken care while weaving so as to supply defect free material to the next operation.

1. Weft yarn should be kept covered with plastics / cardboards so that no fly gets deposited on the packages.
2. Care should be taken while beam knotting so as to avoid any crossed ends.
3. High speed air jet looms are commonly used for weaving denim fabrics. Air pressure should be adjusted perfectly depending on the weft so that weft passes smoothly through the shed without creating defect like furkey.



7.7 Singeing:

Singeing is an important operation as it burns the protruding fibres from the fabric surface.

Following care needs to be taken while singeing:

1. Flame quality should be perfect (singeing should be done in blue flame only).
2. Flame height should be uniform (4 to 5 inches) and should not vary throughout the width else it will lead to bands in the fabric.
3. Speed should be optimum (around 70 to 80 mpm) so that effective singeing action is performed.

7.8 Finishing:

In denims two types of finishing machines (Foam finish/Wet finish) are found. Both have its own advantages and disadvantages. Irrespective of the type of finishing machines, following points should be taken care while finishing operation:

1. The greige fabric must be tested for knowing the shrinkage & skew potential.
2. Based on the shrinkage & skew potential, shrinkage & skew is applied so that residual shrinkage in fabric is less than 3.0% and skew movement less than 2.0%.
3. The fabric entering Sanforiser should be moist (around 12 to 15%) in order to get good body. In absence of moist fabric, the fabric feel is very limpy. Nowadays online moisture meter are also installed in the region for monitoring of same.
4. The draft between sanforiser and palmer cylinder should be less than 1.0% so that shrinkage applied is not lost due to stretching.

7.9 Inspection & Packing:

Inspection provides the true picture of the fabric quality by informing the main defects for down gradation. Action can be taken in particular department for reducing the value losses. Following steps to be taken in inspection and packing department for getting the right quality product:

1. Inspection to be done for 100% fabric by any accepted inspection system. In general 4 point inspection system is commonly followed.
2. Full width fabric sample of 10" length from every roll is collected for pick checking and shade grouping.
3. Full width sample after every 4000m should be sent to laboratory for parameter testing like weight, shrinkage, skew, stiffness, tensile and tear strength.
4. Paper tube length & quality should be perfect so that fabric doesn't hang from the edges and paper tube doesn't get collapsed during storage or transit.
5. Each fabric roll is weighed and packed using HOPE woven cloth, shrink wrapping or stretch wrapping Fabric weight (OSY) should be checked from length and weight of the roll before dispatching so as to segregate lower weight rolls if any.

7.10 Washing and shade grouping:

Washing and shade grouping is very important activity in Denim mill. Export buyers or very reputed domestic buyers ask for the taper/sequencing report along with the dispatches.

Generally buyers ask for the washed swatches along with taper/sequencing reports. The important point is as under:



1. The collected 10" sample from every roll is cut into five equal pieces. One piece from all the rolls of the particular order are stitched as blanket along with standard swatch and washed as per the customer recipe or own developed recipe. After washing the swatches are measured on spectrophotometer for shade values and off shade rolls are removed from the dispatches. In case of major shade off, recipe of washing can be changed (if acceptable to customer) and same should be communicated to customer for getting the desired shade as required.
2. 10 Storing of Rolls Storing in go-down is all together a specialized activity. If not done properly all the good work done so far will be no use. In general, care should be taken for following points;
 - i. Rolls should be stacked horizontally and not vertically. Vertical stacking lead to waviness problem on opening.
 - ii. Rolls should be stacked in such a way that it is easy to locate any roll at the time of dispatch

7.11 Dispatch:

Dispatch is last activity but certainly but very important. Following care needs to be taken during dispatch operation:

1. Care should be taken the approved roll list given by QA is only loaded Loading should be gentle enough so that there are no damage to the packing.



CHAPTER-08

*Suggestions &
Limitations*



8.1 Some Suggestion: The warping floor is dirty most of the time though it is cleaning every day. Fly dust removed from yarn surface create this problem. Necessary steps should be taken for keep better cleaning condition all the time. Better cleaning environment will increase better satisfaction to buyers.

1. The upper shed of the factory floor is a little bit broken/leakage in some places which causes water fall when raining.
2. The temperature of the slasher dyeing & sizing shed is higher than others because there is no ventilation system. I think there should be ventilation system to pass hot air and keep the floor cooler.
3. There is no overhauling maintenance for few machines. I think overhauling maintenance should carry on by maintenance department for continuous production of machines.

8.2 Limitations of the report:

1. I had a very limited time. In spite of my willing to study more details it was not possible to do so.
2. Some of the points in different chapter are not described as these were not available.
3. The whole process is not possible to bind in such a small frame as this report, hence my effort spent on summarizing them.



CHAPTER-09

Conclusion



9.1 Conclusion:

I have completed my internship successfully by the grace of Allah. By doing my internship I have learned a lot of practical life.

Though this Denim industry was established only a few years ago, it has earned “very good reputations” for its best performance over many other export oriented textile mills.

I am enough fortunate that I have got an opportunity of having a training in this mill. During the training period I have received co-operation and association from the authority full & found all man, machines & materials on appreciable working condition.

All stuffs & officers were very sincere & devoted their duties to achieve their goal. Finally I would like to wish SDL & SRDL to have a blast & thanks to administration of SDL & SRDL for their cordial attitude to me.



References:

1. <http://www.slideshare.net/saleem1991/denim-process-internship-report>
2. <http://textilefashionstudy.com/what-is-warping-objects-and-importance-of-warping/>
3. <http://textilefashionstudy.com/functions-of-different-parts-of-a-warping-machine/>
4. <https://en.wikipedia.org/wiki/Dyeing>
5. <http://www.slideshare.net/yousufali612/production-of-denim-fabrics-using-rope-dyeing-and-slasher-dyeing-methods-a-comparative-study>
6. <http://textilefashionstudy.com/what-is-vat-dyes-properties-of-vat-dyes/>
7. <http://www.fibre2fashion.com/industry-article/30/2942/technology-of-denim-production-part-iii1.asp>
8. <http://textilefashionstudy.com/what-is-sizing-purpose-of-textile-sizing-properties-of-sized-yarn/>
9. <http://textilelearner.blogspot.com/2012/05/textile-finishing-treatment-object-of.html#ixzz3fAa9MA6j>
10. <http://www.textilesindepth.com/singeing/>
11. <http://www.denimsandjeans.com/>
12. Lecture of Head sir