UGC & Govt. Approved
Sonargaon University (SU)
সোনারগাঁও ইউনিভার্সিটি (এসইউ)

Faculty of Engineering

Department of Textile Engineering

REPORT ON

Industrial Attachment At

Tivoli Apparels Limited (Impressive Group).

Plot No : A 102, BASIC Industrial Estate, Tongi, Gazipur, Po-1710 Bangladesh

Course Title: Industrial Attachment
Course Code: Tex-442.
15B, Mahananda. Fall'2021
Submitted By:

S/L No	Submitted By:	ID Number	Batch	Group(AM)
1	Md. Abdul Halim	TEX1803015048	15B	D
2	Md. Reaz Uddin	TEX1803015003	15B	D
3	Sarmin Akter	TEX1803015024	15B	D
4	Sahariar Jahan	TEX1803015056	15B	D
5	Md. Anisur Rahman	TEX1803015097	15B	D

Academic Supervised

Kamrul Hassan Bhuiyan
Coordinator & (Lecturer)
Department of Textile Engineering
Sonargaon University (SU).
146 Mohakhali, Wireless Gate. Dhaka.

This report we have presented in partial fulfillment of the requirement
For the
Degree of Bachelor of Science in Textile Engineering.

Advance in Apparel Manufacturing Technology
Duration: From 05 October 2021 to 28 December 2021.

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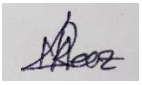
সোনারগাঁও ইউনিভার্সিটি (এসইউ)

Declaration

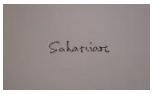
We hereby declare that, this Industrial Attachment on **Tivoli Apparels Limited,** of Bangladesh is done by us under the supervision of **Kamrul Hassan Bhuiyan , Lecturer,** Department of Textile Engineering, **Sonargoan University (SU),** Dhaka. We also declare that, this Industrial Attachment report has not been submitted anywhere for award, degree or diploma. We ensure that, any part of this attachment has been presented anywhere.

Md. Abdul Halim
TEX1803015048

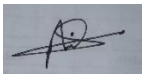


Md. Reaz Uddin
TEX18030150003

Sarmin Akter
TEX18030150024



Sahariar Jahan
TEX1803015056



Md. Anisur Rahman
TEX1803015097

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সোনারগাঁও ইউনিভার্সিটি (এসইউ)

PERMISSION OF INDUSTRIAL TRAINING

LETTER OF APPROVAL

This is to certify that **Md.Abdul Halim-TEX1803015048**, **Md.Reaz Uddin-TEX1803015003, Sarmin Akter-TEX1803015024, Sahariar Jahan-TEX1803015056, Md.Anisur Rahman-TEX1803015097,** B.Sc Engineering Textile program, 15B Batch have successfully completed their Industrial Internship on Apparel Manufacturing Technology under my supervision. I do hereby approve their report. I also recommend accepting their report for partial fulfillment of Bachelor of Science in Textile Engineering (B.Sc) Degree.

.....

Kamrul Hassan Bhuiyan

Coordinator & Lecturer

Department of Textile Engineering

Sonargaon University (SU), Dhaka

UGC & Govt. Approved
Sonargaon University (SU)
সোনারগাঁও ইউনিভার্সিটি (এসইউ)

Department of Textile Engineering

SU/Textile/Int. Letter/2021/Fall/12
Date: 03/10/2021
To
Sr,Manager HR & Compliance Department
Tivoli Apparels Ltd (Impressive Group)
Plot No:A102,BSCIC Industrail Estate,Tongi,Gazipur,PO-1710,Bangladesh.
Subject: Request for Permission to undertake industrial training in your industry.

Dear Sir,
It is for your kind information that, Sonargaon University(SU) is a private University approved by the Ministry of Education(MOE),& UGC of Bangladesh.
The Student named below with the identification Number is very close to complete 4 years B.Sc in Textile Engineering of Sonargaon University (SU).
As industrial training is one of the important core courses of 4years B.Sc in Textile Engineering Program, therefore the university seeks your kind help and cooperation in order to impart practical knowledge to our students. Duration of this program would be 12 weeks and it is advised to accommodate the students at your production unit from 05 October, 2021.

SL No.	Student Name	Specialized	Student ID	Contact No.
01	Md. Abdul Halim	Apparel Manufacturing	TEX 1803015048	01758588926
02	Md. Reaz Uddin	Apparel Manufacturing	TEX1803015003	01648461004
03	Sarmin Akter	Apparel Manufacturing	TEX 1803015024	01950455432
04	Sahariar Jahan	Apparel Manufacturing	TEX 1803015056	01760423232
05	Md. Anisur Rahman	Apparel Manufacturing	TEX 1803015097	01737699371

Therefore, I am requesting you to provide him with opportunity to conduct the industrial training in your well reputed industry. It will also be highly appreciated if you kindly consider them for training in your Industry.

Your Co-operation will be highly appreciated
Thanking you

Kamrul Hassan Bhuiyan
Coordinator
Department of Textile Engineering. Sonargaon University (SU)
Cell Phone: 01955-529892

Copy to: For necessary information:
1. Dean, Faculty of Engineering, Sonargaon University(SU).
2. Office Copy

ABSTRACT

The project is on industrial training in garments. Traditionally operated garments industries are facing problems like how productivity, longer production lead time, high re-work and rejection, poor line balancing, low flexibility of style changeover etc. These problems were address in this study by the implementation of lean tools like cellular manufacturing, single piece flow, work standardization, just in time production etc. After implementation of lean tools results observed were highly encouraging. Some of the production time decreased by 8%, number of the operations required to produced equal amount of garments decreased by 14%, re-work label reduced by80%, work in process inventory stays at maximum of 100 pieces from around 500 to 1500 piece. Apart from these tangible benefits operator multi skilling as well as flexibility of style changeover has been improved. This study is connected in the stitching section of shirt manufacturing company. This study includes time study, the conversation of traditional batch production into single piece flow and long assembly line into small work cells.

Acknowledgement

First of all, our gratefulness goes to Almighty who gave us strength and ability to complete this industrial training and prepare this report, may your name be exalted, Honored and glorified now we wish to take this excellent opportunity to thank a lot of people who have assisted and inspired us in the completion of our training period. **"Engr. Kamrul Hassan Bhuiyan "** our supervisor, to whom we are extremely indebted for his tremendous support and guidance throughout our training period.

Being working with him we have not only earned valuable knowledge but was also inspired by his innovativeness which helped to enrich our experience to a greater extent. His ideas and way of working was truly remarkable.

We also express our "**Mohammad Hosain Reza**" Department head of **Sonargaon University** ,for his support and continuous guidance through our long journey in "**Sonargaon University**" and the industrial internship.

We would like to thanks the management of the "**Tivoli Apparels Ltd (Impressive Group)**" for giving us the opportunity to do the industrial training successfully and also their valuable suggestion. Our deepest appreciation goes to "**Md. Khairul Islam**", General Manager (Garments) and **Md. Zinnah Manager** (finishing) in "**Tivoli Apparels Ltd (Impressive Group)"** for his permission to conduct our industrial training without which it would be uncompleted.

We are also thankful to **Md. Imran Sarkar Haque** Senior Manager (knitting), **Md. Azad**, Manager (Q.A.), **Md. Ruhul Amin**, Manager (washing), **Siddikur Rahman,Manager** (Lab) and **Md. Mazharul Islam**, Manager Merchandiser their generous support is greatly appreciated. Also like to thank executives, senior executives and other officials of "**Tivoli Apparels Ltd (Impressive Group)**" for helping us to complete industrial training successfully.

Our gratitude also go to the employees of "**Tivoli Apparels Ltd (Impressive Group)**" for their sincere co-operation, support and valuable advices. Last but not least, thanks goes to our precious family for their never ending love and inspire at every stages of our life. Without their continuous we realize that we would not be a person we are right now.

CONTENTS

EXECUTIVE SUMMARY

Tivoli Apparels Ltd (Impressive Group) is one of the leading Company in Bangladesh and is going from strength to strength since its inception. By observing the factory existing condition and employees behavior to one other, their fasted and quality production and organization structure, we was led to believe that the company is very centralized.

The factory is consisted with some well-equipped departments and these are, Dyeing finishing, Washing and Garments Departments. The factory faces good competition from their competitors which motivates them to work harder to achieve their objectives and goals. The organization uses the multiple departmental bases and according to the management this base is the most appropriate.

While surveying the organization we found that the factory provides comfortable working conditions, friendly co-workers, efficient management and status and from the factory management part, they have made ensure the world class accommodation, amenities, services, facilities without any doubt.

CHAPTER- 01
COMPANY PROFILE

(Concern of Tivoli Apparels Ltd (Impressive Group)
(Impressive Group)
(In Plot No : A 102, BASIC Industrial Estate, Tongi, Gazipur, Po-1710)

COMPANY INFORMATION:

1.1 Units name & location in this premises:

1, Tivoli Apparels Ltd. (Ground,1st, 2nd,3rd,5th, 6th& top floor of ten storied building#

2, Ground floor of four storied building# 4and Shade # 7,11 &14)

3, Tivoli Apparels Ltd.(Knitwear Division) (Six storied building#1,Seven storied building#5 and Shade# 1,3,6, 8,10 &17)

4, Tivoli Apparels Ltd.(Unit-2) (Ground, 1st& 2nd) floor of five storied building#2 and 4th,6th&7thfloor of ten storied building# 3 and 1st, 2nd, 3rd& 4thfloor of five storied building#4 and shade #15)

5, Tivoli Apparels Ltd.(Textile Division) (3rd & 4th floor of five storied building#2 and shade#2,4,12,13 &18)

6, Tivoli Apparels Ltd. (Weaving Unit) (Tin Shade # 5)

7, Tivoli Carton & Accessories Solution Ltd. (Tin Shade# 9)

Total Buildings are 5 and Shades are 18 in these premises:

Building #1 Six storied building under Tivoli Apparels Ltd. (Knitwear Division),(Garments)

Building #2 Five storied building under Tivoli Apparels Ltd. (Unit-2 &Textile Division), (Garments)

Building #3 Ten storied building under Tivoli Apparels Ltd. and Impressive GroupLtd.

Building #4 Five storied building (Main Store) Accessories store of Impressive Group., Accessories Store Tivoli Apparels Ltd. (Unit-2) and Common Doctor's & Daycare Centre.

Building #5 Seven storied building under Impressive GroupLtd.(Knitwear Division).(Printing &Embroidery section)

Shade #1 Knit Dyeing old under Impressive GroupLtd.(Knitwear Division),

Shade #2 Woven wash-1 under Tivoli Apparels Ltd. (Textile Division),

Shade #3 Yarn dyeing section under Tivoli Apparels Ltd. (Knitwear Division),

Shade #4 Woven dyeing under Tivoli Apparels Ltd. (Textile Division),

Shade #5 Tivoli Apparels Ltd. (Weaving Unit),

Shade #6 Yarn re-coning under Tivoli Apparels Ltd.(Knitwear Division),,

Shade #7 Knit Dyeing underImpressive GroupLtd. & Woven wash-2 under Tivoli Apparels Ltd.(Unit-2),

Shade #8 Old Knitting

Shade #9 Tivoli Carton & Accessories Solution Ltd., (Accessories factory)

Shade #10 Grey Fabrics Store under Tivoli Apparels Ltd. (Knitwear Division)

Shade #11 Yarn Store under Tivoli Apparels Ltd.

Shade #12 Generator & Boiler (Common facility)under Tivoli Apparels Ltd. (Textile Division) under Tivoli Apparels Ltd. (Knitwear Division)

Shade #13 Chemical store (Woven dyeing) under Tivoli Apparels Ltd.(Textile Division)

Shade #14 ETP (Common Facility) under Tivoli Apparels Ltd. (Textile Division), Tivoli Apparels Ltd. (Knitwear Division) &Impressive Group.

Shade # 15 Finished goods/Acc Store under Tivoli Apparels Ltd. (Unit-2)

Shade #16 Finished goods/Acc Store under Tivoli Apparels Ltd. (Unit-2)

Shade #17 Hanger/Carton Store under Tivoli Apparels Ltd. (Knitwear Division)

Shade #18 Chemical/Acc Store under Tivoli Apparels Ltd.(Textile Division)

Section wise location of Tivoli Apparels Ltdof Ten storied building# 3 :

Ground floor : Knitting Section

1st floor : Sewing section, Finishing section, Finish carton area & Time section. (One Side Admin office & Lab)

2nd floor : Finishing section, Needle free zone, spot remove room & Inspection room, GM office

3rd. floor : Sewing section, Accessories sub-store, Inspection room, GM office & Mechanic room.

5th floor : Cutting section, Sample section, Pattern- CAD and Merchandising & MD/Director's office.

8th floor : Cutting section, Sewing section, Accessories sub-store & Mechanic room & Time Section.

Top floor : Dining hall & Canteen.

Section wise location of Tivoli Apparels Ltd of Four storied building # 4:

Ground floor : Accessories Main store (One side)

Ground floor : Medical Center & Child Care Center (One side), Common facility.

Section wise location of Tivoli Apparels Ltd:

Shade # 7 : Knit Dyeing

Shade # 11 : Yarn Store

Shade # 14 : ETP (Common facility)

1.2 Tivoli Apparels Ltd

Tivoli Apparels Ltd was established in 2005 for export of knit apparels. Tivoli Apparels Ltd. was formed exclusively for knitted garments within house knitting, dyeing, accessories, laboratory and effluent treatment plant covering premises area 46000 sq. meter floor area on 10 acres land.

Head Office : J.R. Casero Tower (5^{th}, 7^{th} to 9^{th} Floor)46 Mohakhali C/A, Dhaka-1212

Bangladesh.

Tel : 01817046765

Fax : 880-02-8816093

Contact Person : Md. Khairul Islam
General Manager
Mobile : 01700808472
Fax : 880-02-8816093

E-mail : khairul.tvl@gmail.com

Owner : Eng. Md. Swopon Chowdhory-30%, Md. Abul Kalam-17.50%, Md. Mamun 17.50%, Md. Dhali-17.50%, Md. Tareq -17.50%.

Factory Address : Tongi , Gazipur .
Mobile : +8801817048765
Fax: 880-02-8816093

Contact Person : Md Abul Kalam / Md. Mamun/ Md. Dhali/ Md. Tareq.
Owner / Executive Director / Manager (Compliance & HRD)
Mobile: +880711529182
E-mail : kalam@impressivegrp.com

Year of establish : 2005

1.3 Floor area of Tivoli Apparels Ltd. (including Knitting &Dyeing):

Description	Garments	Knitting	Dyeing	Y/Store & ETP	Total
Total floor area	158,264 Sq. Feet	28,000 Sq. Feet	55,000 Sq. Feet	17,346 Sq. Feet	2,58,610 Sq. Feet
Total production area	140,044 Sq. Feet	25000 Sq. Feet	50,000 Sq. Feet		2,15,044 Sq. Feet
Total finishing area	36,000 Sq. Feet				
Total fabrics store area			2210 Sq. Feet		

Customer	Customer	Busi ness Type	Product Group	% in total Cap acity

Total accessories store area	2117 Sq. Feet				
Total canteen area	3,500 Sq. Feet				
Grey fabrics store		3,934 Sq. Feet			
Yarn store		10,450 Sq. Feet			

1.4 PRODUCT ITEM: POLO SHIRTS, JACKETS, CARDIGAN, T-SHIRTS, TANK TOP, NIGHT DRESS.

1.5 EXPORT COUNTRIES: EUROPEAN COUNTRIES, JAPAN, BRAZIL, INDIA, CHINA.

1.6 Buyers: 1. Walmart, 2. Pepco, 3. Takko, 4. Tom Tailor, 5. Canda.

Mothercare, Laradoute, Debenhams, Verbadoute, Puma, Volcom, Otto, Auchan, Nishimatsuiya, O BS, Group Casino &Asmara etc.

Mothercare	UK	FOB	Kids	30%
Laradoute	France	FOB	Mans, Ladies	28%
Ve rbadoute	France	FOB	Ladies & Kids	10%

Volcom	USA	FOB	Men's T-shirt	1 %
Debenhams	Germany	FOB	Ladies & Kid s	5 %
Otto	Germany	FOB	Mans	6 %
Auchan	France	FOB	Mans & Ladies	5%
Nishimatsuiya	Japan	FOB	Kids	5%
OBS	Italy	FOB	Kids	5%
Group Casino	UK	FOB	Kids	2%
Asmara	Indonesia		Mans T/Polo shirt	2%

1.8 Employee (male &female) Including Knitting & Dyeing Unit :

Male			Female			Total	
Garments	**Knitting**	**Dyeing**	**Garments**	**Knitting**	**Dyeing**	**Male**	**Female**
1191	190	218	974	5	4	1599	983

Percentage of Male & Female : 62%& 38%:

1.9 Section wise present manpower (Garments Unit) :

1.10 Drinking water closet/Filter:

Garments							Knitting	Dyeing	G.Total
1st Fl.	2nd Fl.	3rd Fl.	4th Fl.	5th Fl.	9th Fl.	S.Total	Gr . Fl.	Gr. Fl.	
2	2	3	1	3	1	12	1	2	15
Requirecloset/filter									9

1.11 First Aider/First aid box / Doctor/Nurse (Including Knitting &Dyeing Unit):

First Aider				First Aid Box			
Garments	**Knitting**	**Dyeing**	**Total**	**Garments**	**Knitting**	**Dyeing**	**Total**
65	6	6	77	22	2	2	26
Require first aider(2% of total			47	Require first aid box			16

1.11.1 Internal Trained Fire Fighter (Including Knitting & Dyeing):

Fire Figher			
Garments	**Knitting**	**Dyeing**	**total**
756	61	71	88
Requirefire fighter (25% of total employee)			646
Trainedby Fire Service & Civil Defence			320

CHAPTER- 02

KNITTING

2.1 Knitting is defined as the construction of fabric by interlocking loops of a single yarn with the help of hooked needles. Knitting is the method of creating fabric by transforming continuous strands of yarn into a series of interlocking loops, each raw of such loops hanging from the one immediately preceding it.

2.2 Types of Knitting:

There are two types
a. Warp Knitting.
b. Weft Knitting.

a. Warp Knitting: *In warp knitting, one or two yarn produce vertical column of loops and fabric is produced at length way such as – Net, Mesh fabric etc*

b. Weft or Circular Knitting: *In weft knitting, one yarn produces a horizontal row of loops and fabric is produced at width way such as– single jersey, rib, interlock etc*

In **Tivoli Apparels Ltd** two types of machines are used for producing knitted fabrics. These are:-

(1) Circular knitting machine (Single& Double Jersey Machine
(2) Flat knitting Machine (Cuff & Collar).

(1) <u>Circular Knitting Machine:</u>

This section contains 36 circular knitting machines.Circular knitting machines are of different types, made by different manufacturer and also have different specifications. In this section
body fabric for knitted garments are produced. The different specifications of different machines are given one after another.

2.3 Knitting Machine layout at Tivoli Apparels Ltd.

2.4 Process requirements:

	Machine Dia	Machine Gauge	Brand	Countryof	Quantity
S/J With Spandex Attachment	2 1 "	24/48	Pailung	**Origi- n**	1 Set
	2 2 "			-	1 Set
	2 8 "			-	1 Set
	3 0 "			-	1 Set
	3 2 "			-	1 Set
	3 4 "			-	1 Set
	3 6 "			-	1 Set
	3 8 "			-	1 Set
	4 0 "			-	1 Set
3-Thread Fleece With Lycra Attachment	3 0 "	20/24	Pailung	-	1 Set
Rib & Interlock With Lycra Attachment	3 2 "	18/20/24	Pailung	-	1 Set
	3 4 "			-	1 Set
	3 8 "			-	1 Set
	4 0 "			-	1 Set
Rib With Lycra Attachment	4 2 "	18/20/24	Pailung	-	1 Set
					15 Sets

Single Jersey Machine:

Products Type	Machine Dia	Machine Gauge	Brand	Country of Origin	Feeder	Quantity
S/J, LYCRA S/J, SINGLE LACOSTE, DOUBLE LACOSTE, WAFFLE, PIQUE, TWO THREAD FLEECE, THREE THREAD F L E ECE .	26",28"	24	Fukuhara	Japan	84	4 Sets
	30	24	Fukuhara	Japan	96	2 Sets
	30	28	Mayer&Cie	Germany	96	3 Sets
	32	24	Fukuhara	Japan	104	4 Sets
	34	24	Fukuhara	Japan	108	5 Sets

	34	28	Mayer & Cie	Germany	108	1 Sets

	36	24	Fukuhara	Japan	116	3 Sets
	38	24	Fukuhara	Japan	120	3 Sets
	42	24	Fukuhara	Japan	126	1 Set
					Total	26 Sets

Auto Stripe Machine:

Products Type	Machine Dia	Machine Gauge	Brand	Country of Origin	Feeder	Quantity
Stripe S/J, PIQUE , Terry fleece etc with Lycr a	30"	24	Fukuhara	Japan	72	2 Set 6-Colour
	34"	24	Fukuhara	Japan	7 2	2 Set 6-Colour

Rib& Interlock Machine:

Products Type	Machine Dia	Machine G a u g e	Brand	Country of Origin	Feeder	Quantity
RIB & INTERLOCK, LYC RARIB	3 0 "	18/24	Fukuhara	J a p a n	72	1 Set
	3 4 "	16/18/24	Fukuhara	J a p a n	62	1 Set
	3 6 "	16/18/24	Fukuhara	J a p a n	64	2 Sets
	3 8 "	16/18/24	Fukuhara	J a p a n	68	1 Set
	4 0 "	1 8	Fukuhara	J a p a n	72	1 Set

Fig: FUKAHARA Knitting Machine

(2) Flat knitting Machine:

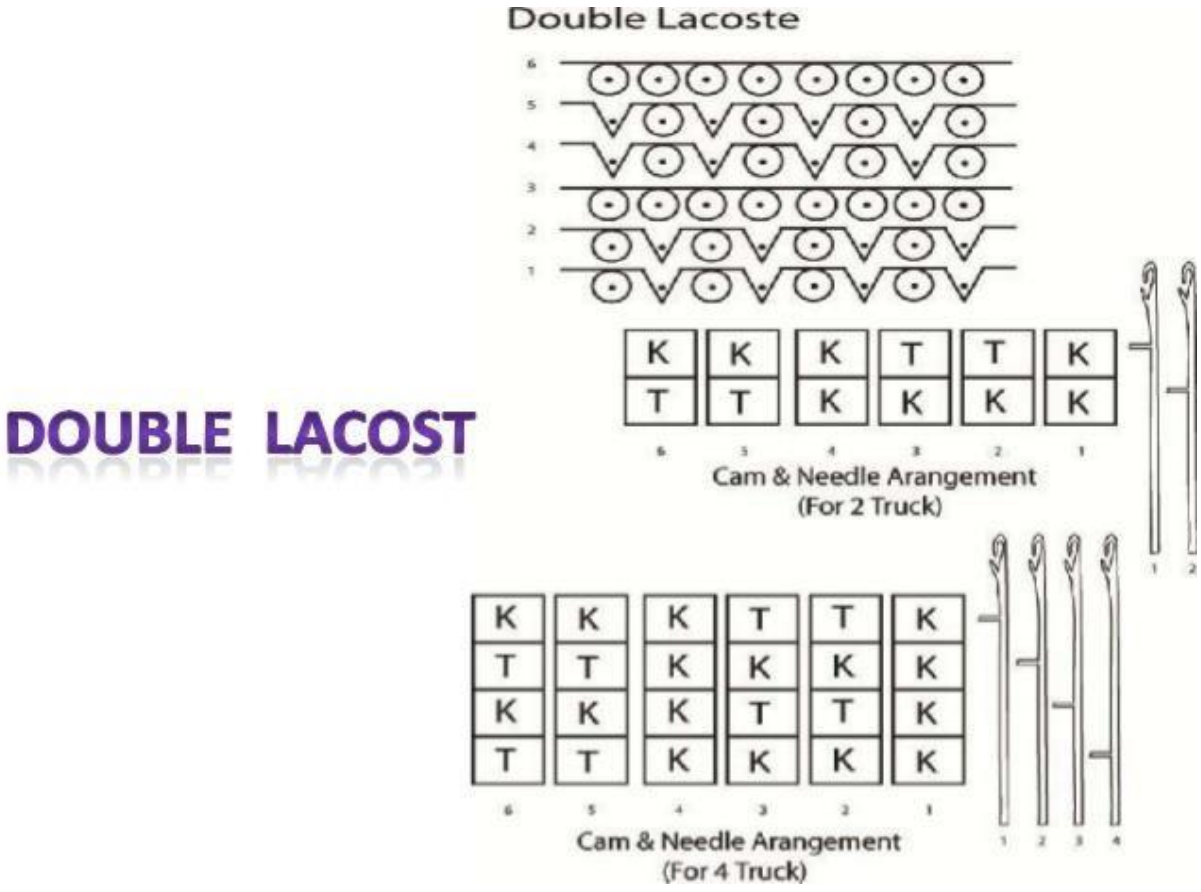
Generally collar, cuff of knitted garments is produced in this section. In thissectiontherearе6flat knitting machines, all of the mare same type and also have same specification. The specification of all machines is given below.

Type: Automatic Flat knitting machine

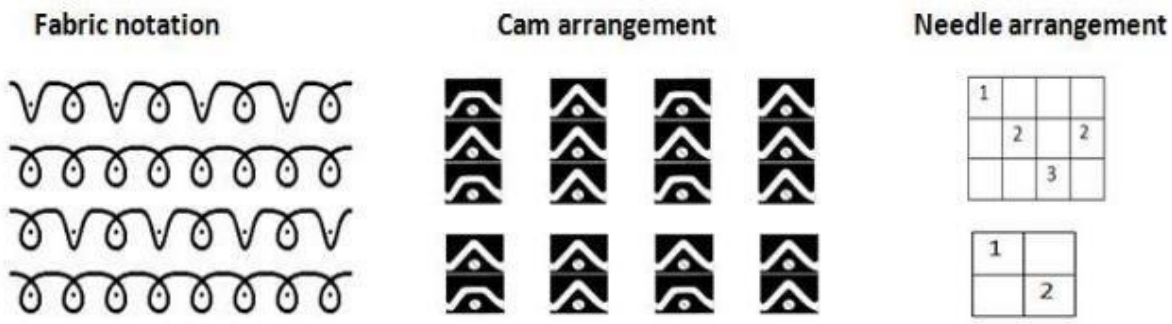
Manufacturer Name: SHIMA SEIKI	
Gauge	G14
Production	4500 sets
Needle	840X2
Country	Japan

Fig: Flat Knitting Machine

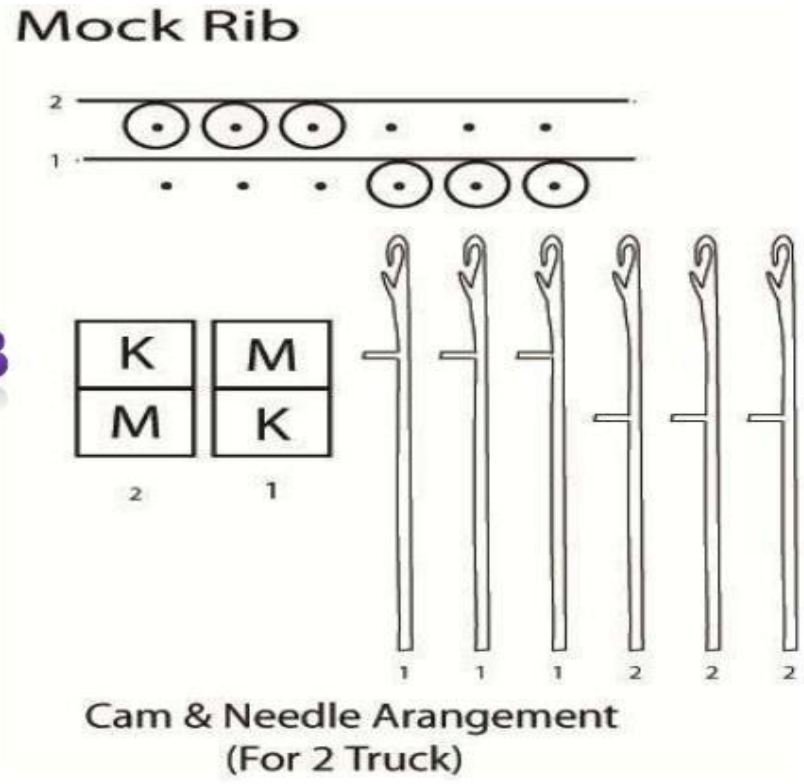
2.5 Knitting Cam Arrangement:



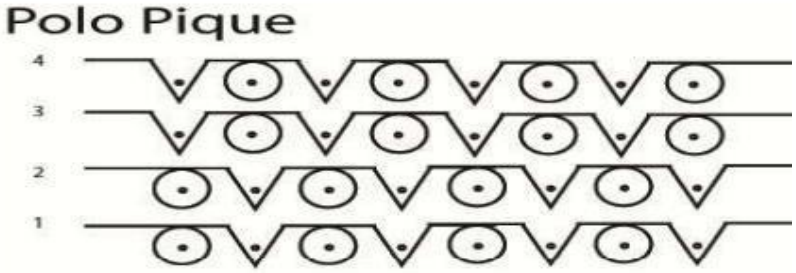
SINGLE LACOST

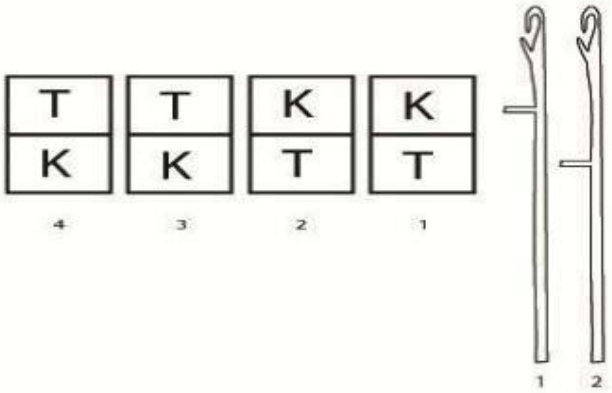


MOCK RIB



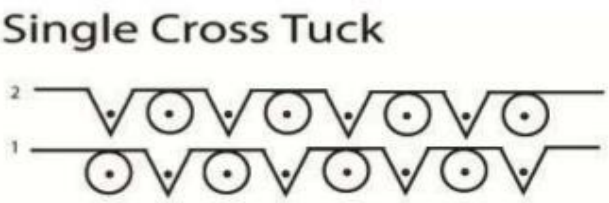
POLO PIQUE

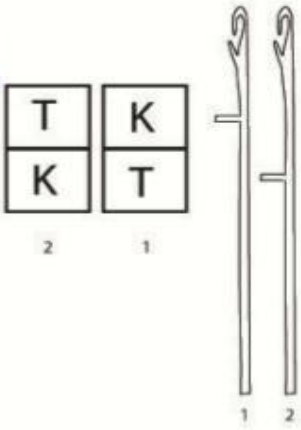




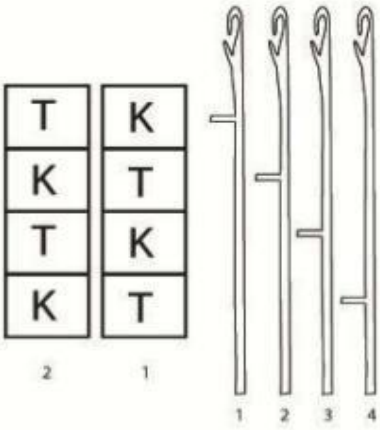
Cam & Needle Arangement
(For 2 Truck)

SINGLE CROSS TUCK



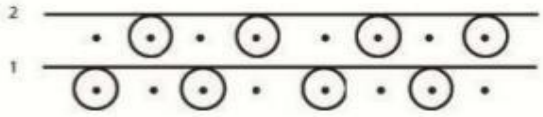


Cam & Needle Arangement
(For 2 Truck)

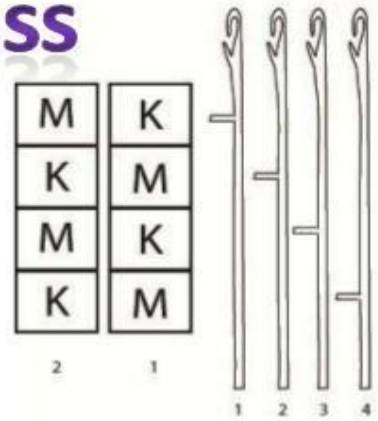


Cam & Needle Arangement
(For 4 Truck)

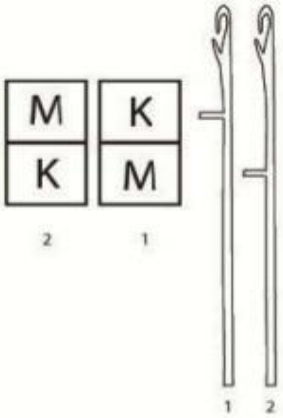
Cross Miss



CROSS MISS



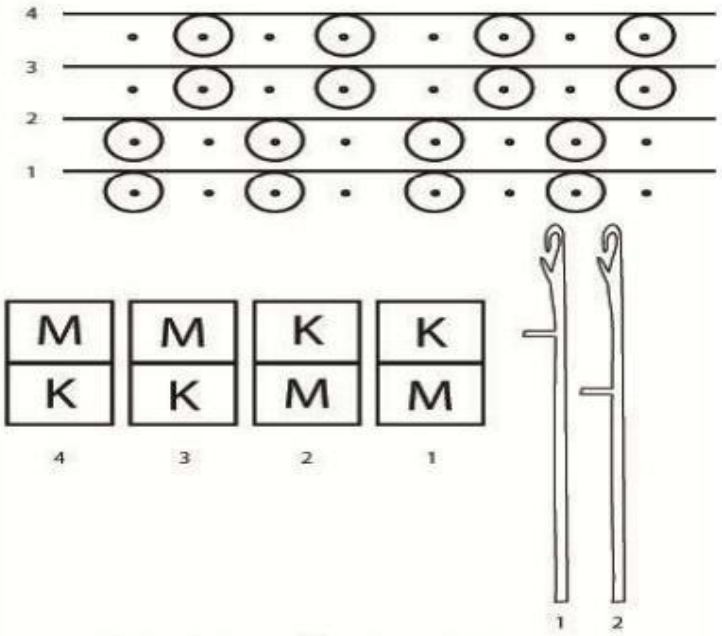
Cam & Needle Arangement
(For 4 Truck)



Cam & Needle Arangement
(For 2 Truck)

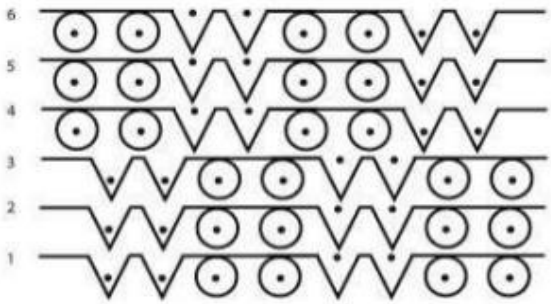
Birds Eye

BIRDS EYE

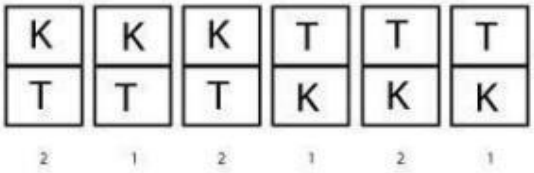


Cam & Needle Arangement
(For 2 Truck)

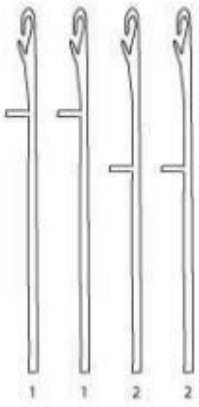
Popcorn Design



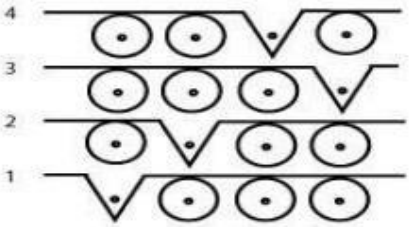
POPCORN DESIGN



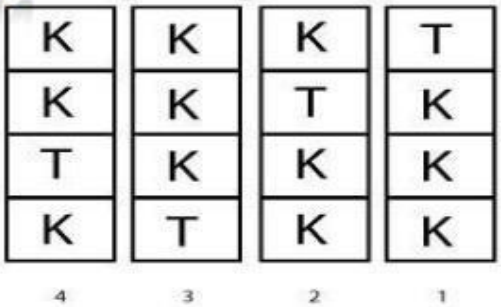
Cam & Needle Arangement
(For 2 Truck)

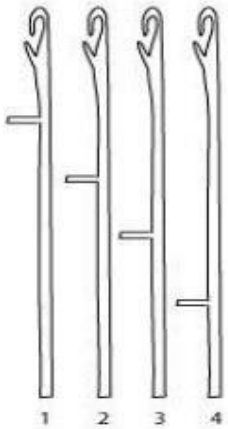


Crepe Design



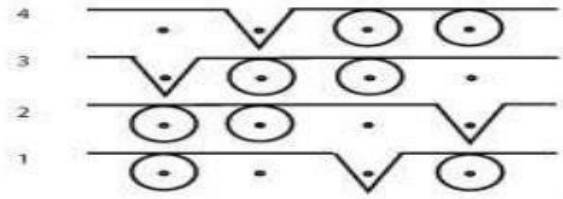
CREPE DESIGN





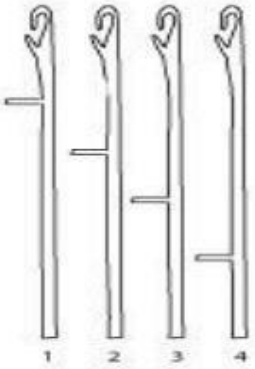
Cam & Needle Arangement
(For 4 Truck)

Twill Effect



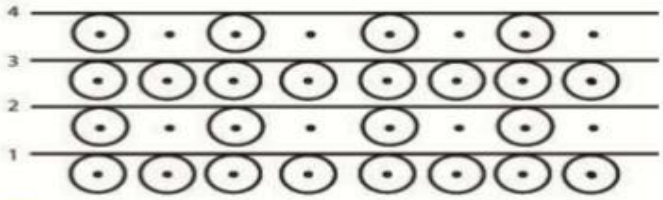
TWILL EFFECT

M	T	K	K
T	K	K	M
K	K	M	T
K	M	T	K
4	3	2	1



Cam & Needle Arangement
(For 4 Truck)

Weft Locknit



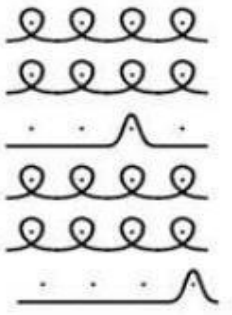
WEFT LOCKNIT

K	K	M	K
M	K	K	K
4	3	2	1

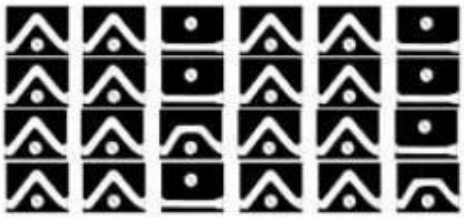
Cam & Needle Arangement
(For 2 Truck)

FLEECE

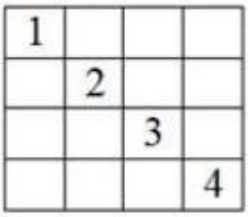
FABRIC NOTATION



CAM ARRANGEMENT



NEEDLE ARRANGEMENT



2.6 Knitting Production:

DESCRIPTION OF PRODUCTION PROCESS:

In every mill, there maintains a sequences in production processing.

It is also followed in this mill where I was in industrial attachment. The process sequences are in list below:

Firstly, knitting manager gets a production sheet from merchandisers as accordance as consumer requirements. Then he informs or orders senior production officer about it. 2) Senior production officer informs technical in charge and knows about m/c in which the production will be running.

3) Technical in charge calls for leader of mechanical fitter troops, they two take decision about m/c for production considering m/c condition, production capacity, maintenance complexity etc.

4) Production officer with experienced mechanical fitter adjusts required stitch length and grey GSM (gram per square meter) for required final GSM.

5) Supervisor check daily production regularity and make operators conscious about finishing in due time.

6) Operators operate machine in highly attention as if there were no faults in the fabrics. If he thinks or sure about any fabric fault, then he call for mechanical fitter in duty, Mechanical fitter then fixes it if he can or he informs technical in-charge. He then comes in spot. 7) After required production and final inspection in 4-point system, they are sent in store section.

8) From store section, fabric sent batch section

2.7 PRODUCTION CALCULATION:

A. Production/shift in kg:

$$\frac{RPM \times 3.14 \times No.of\ Feeder \times Gage.no \times SL(mm) \times Efficency \times shift \times 60}{10 \times 2.54 \times 36 \times Yarn\ count \times 840 \times 2.2046}$$

B. Production/shift in meter:

$$= \frac{Course/\min .}{Course/cm}$$

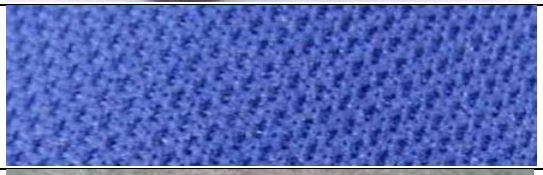
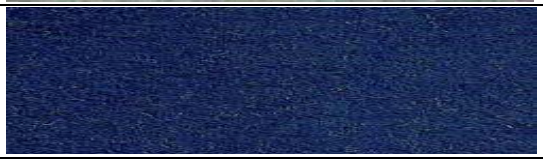
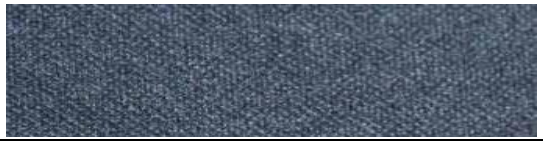
$$= \frac{RPM \times No.\ of\ Feeder \times 60 \times 12 \times Efficiency}{Course/cm \times 100}$$

C. Fabric width in meter:

$$= \frac{Total\ no.of\ wales}{Wales/cm \times 100}$$

$$= \frac{Total\ no.of\ Needles\ used\ in\ knitting}{Wales/cm \times 100}$$

2.8 Some Sample of fabrics are as follows:

Name of fabric	Sample of fabric
S/J	
Lycra S/J	
Rib 1/1	
Rib 2/2	
Lacoste / Pique	
Grey Melange	
Fleece	
LycraLacoste	
Slub S/J	

CHAPTER- 03

YARN DYEING

3.1 YARN DYEING: Yarn dyeing is slightly difference from fabric dyeing. Dyed yarn are used for making stripe knit or woven fabrics or solid dyed yarn fabric or in a sweater manufacturing.

3.2 PROCESS SEQUENCE OF 100% COTTON YARN:

Pretreatment

Batch loaded
↓
Demineralization (50˚C, 20 min; PH=4.5)
↓
Scouring & bleaching (100˚C×40 min.)
↓
Drain
↓
Rinse
↓
Drain
↓
Neutralization with acid (50°C ×20 min)
↓
Hot Wash with peroxide killer (60˚C,20 min.)
↓
Drain
↓
Dyeing
↓
Levelling agent & Salt (60° × 20 min; PH=6)
↓
Color dosing (60°C×20 min.)
↓
Run time = 10 min. (60°C)
↓
Color migration (80°C × 20 min.)
↓
Cooling (60°C)
↓
Level Check
↓
Soda dosing (60°C×30 min.)

↓

Dyeing run (Dark-60°C×60 min; Medium-60°C×40 min;Light-60°C×30 min)

↓

Dyeing sample check

↓

(If Ok)

↓

Drain

After-treatment

Rinse (with cold Water)

↓

Neutralization after dyeing (50°C×20 min.)

↓

Drain

↓

Soaping (Hot wash)

↓

Drain

↓

Rinse

↓

Add finishing chemical(60°C×20 min)

↓

Drain

↓

Unload

CHAPTER- 04

KNIT DYEING

4.1 Dyeing:

Dyes are colored unsaturated organic chemical compounds capable of giving of giving color to substrate i.e. coloring or dyeing it.

4.2 Batch Preparation:

Batch preparation can be defined as a process where the visually Inspected greige fabric are divided into different batches. It is a part of dyeing process & it is done to feed the dyeing machines for fabric dyeing. It is very important to make a batch with maintaining a correct length of each nozzle.

4.3 Objective of Batching:

To receive the grey fabric roll from knitting section or other source.
Turn the grey fabric if require.
To prepare the batch of fabric for dyeing according to the following criteria Order sheet (Received from buyer).
Dyeing shade (color or white, light or dark).
Machine capacity.
Machine available.
Type of fabrics (100% cotton, PE, PC, CVC).

4.4 Dyeing Machine layout at Tivoli Apparels :

4.5 Dyeing Machines:

The **Tivoli Apparels Ltd**there are 17 dyeing machines. Among them 10 machines are stfloor. Among second floor, 2 SLAVOCH in the 2nd floor and 7 machines are in the 1 sample dyeing machines, 8 stdyeing floor 4 THIES, 2 Dilmenler and 1 AYTC
DILMENLER and among them 1
production is dyeing machines. We worked on the first floor. The description and specifications of the machine are given below-

Machine Type: 01

Name of the machine : Sample Dyeing Machine
Brand Name : Fong's
Manufacturer : Fong's National Engineering (SHENZHENE) Co.

LTD. Capacity : 25 Kg

Year of manufacturing: 2002

Hydraulics Test Pressure: 650

Winch motor – 1

Pump motor– 1

Stirring motor – None

Machine Type: 02

Name of the machine: Winch Dyeing

Machine

Brand Name : Thies (No. of machines:

4) Manufacturer : Germany.

Capacity : 150,200,400,400, Kg

Year of manufacturing: 2000

Maximum operating temp: 140^0C Maximum operating pressure: 3.5bar

Machine Type: 03

Name of the machine: H.T. Dyeing Machine

No. of machine : 10

Brand Name : DILMENLER

Manufacturer : Turkey

Capacity : 150, 150 ,150, 350, 350, 700, 1050, 1050, 1500, 1500k

Maximum operating temp : 145^0c

Machine Type: 04

Name of the machine: ATYC Dyeing Machine
No. of machine : 01
Brand Name :

ATYC

Manufacturer :

TERRASSA

Capacity : 900

Kg

Year of manufacturing: 2002
Maximum operating temp :135^0C
Maximum operating pressure : 3.5 bar (6 bar max.)

4.6 LIST OF THE MACHINERY:

M / C NO	M/C TYPE	BRAND NAME	ORIGIN OF MACHINE	NUFACT URINAR Y	CAPACITY Kg	No. Of Nozzle	Max . Temp
0 1	WINCH	THIES	GERMANY	2000	150	01	120^0C
0 2	WINCH	THIES	GERMANY	2000	200	02	140^0C

0 3	WINCH	THIES	GERMANY	2000	720	04	140^0C
0 4	WINCH	THIES	GERMANY	2000	720	04	140^0C
0 5	H.T.D.M	ATYC	TERRASSA	2002	900	04	135^0C
0 6	H.T.D.M	DILMENLER	T U R K Y	2003	150	01	135^0C
0 7	H.T.D.M	DILMENLER	T U R K Y	2003	550	0	135^0C
0 8	H.T.D.M	DILMENLER	T U R K Y	2004	150	0	135^0C
0 9	H.T.D.M	DILMENLER	T U R K Y	2004	150	01	135^0C
1 0	H.T.D.M	DILMENLER	T U R K Y	2004	350	03	135^0C
1 1	H.T.D.M	DILMENLER	T U R K Y	2004	350	03	135^0C
1 2	H.T.D.M	DILMENLER	T U R K Y	2004	1050	06	135^0C
1 3	H.T.D.M	DILMENLER	T U R K Y	2004	1050	06	135^0C
1 4	H.T.D.M	DILMENLER	T U R K Y	2004	1500	01	135^0C
1 5	H.T.D.M	DILMENLER	T U R K Y	2003	1500	01	135^0C
1 6	SAMPLE	F O N G	SHENZHEN	2002	25	01	140^0C
1 7	SAMPLE	F O N G	SHENZHEN	2002	25	01	140^0C

4.7 Recipe No :01

S.Machine No : 02	F.Type : Fleece-300	Quality : 60kg
Batch : 70661	Liquor ratio : 1:8	Date: 18-09-17
Color : Brown	Water : 600L	High temperature

Programs	Brand name	g/l	Chemical name	Time &Tem.	pH	Drawing
Scouring	Ablutex:1050	1%	Detergent	98^0 x 60’ Cooling : 80^0 x 10’	Sample cutting	
	Jintex ACN	1%	Anti-creasing			
	AZ-500	0.5%	Sequestering			
	MAT OSR	0.5%	Oil spot remover			
	Stab	0.25%	Stabilizer			
	Caustic	0.5%				
	H_2O_2	2.5%	Hydrogen peroxide			
					10.5-11	
N.Hot				60^0 x 10’		
Peroxide killing	A.Acid	1%	Acetic Acid	55^0 x 45’		
	CAT:1000	0.4%	Peroxide killer			
Anzyme	JQ 444	0.2%	Anzyme			
Dye Acid	Dye acid	0.5%			P^h:4.5	

Leveling	Ablutex RTM	1%	Leveling	70^0 x10’	
	Jintex: ACN	1%	Anti-creasing		
					6-6.5
Colour dosing	Tai-G.Yellow SPRST	0.25% /kg	Dyes	70^0 x 25’ colour (1.5^0/min) 135^0 x50’ Then 80^0 cooling	
	Tai-RED KXFT	0.084 %/kg	Dyes		
	Tai-Blue 2RHWT	0.217 8%/kg	Dyes		
Reduction	Caustic	1%			
	Hydrose	1%			

Recipe No : 02

W.Machine No : 05	F.Type : S/J (175)	Quality : 416kg
Batch : 67976	Liquor ratio : 1:8	Date: 18-08-17
Color : Navy	Water : 3328	High temperature

Programs	Brand name	g/l	Chemical name	Time & Tem.	PH	Drawing
Scouring	Ablutex:1050	0.5%	Detergent	98^0 x 40’ Cooling : 80^0 x 10’	Sample cutting	
	Jintex ACN	1%	Anti-creasing			
	AZ-500	0.5%	Sequestering			
	MAT OSR	0.5%	Oil spot remover			
	Stab	0.25%	Stabilizer			
	Caustic	2%				
	H_2O_2	1.5%	Hydrogen peroxide			
					10.5-11	
N.Hot				60^0 x 10’		
Peroxide killing	A.Acid	1%	Acetic Acid	55^0 x 45’		
	CAT:1000	0.4%	Peroxide killer			
Anzyme	JQ 444	0.2%	Anzyme		4.5-4.75	
Leveling	Ablutex:SEQ-7	1%	Leveling			
	Jintex: ACN	1%	Anti-creasing			
	AZ-500	0.5%	Sequestering		6-6.5	
Colour dosing	K/V-G.Yellow merl(5510)	1.296%/kg	Dyes			

	P/fix-RED 3BS (1604038)	1.6%/kg	Dyes			
	P/fix-black B (1605002)	3.52%/kg	Dyes			
G.salt inject	Glober salt	70%				
Soda dosing	Soda	18%	Soda-ASH		11.5-12	
Neutralization	A.Acid	0.7%	Acetic Acid		5.5-6.5	
Soaping	BCSR	1%	Soaping Agent			
Softness	RHNB	1%	Softner			

Recipe No :03

S.Machine No : 08	F.Type : Slub/J-140	Quality : 470kg
Batch : 70237	Liquor ratio : 1:8	Date: 04-08-17
Color : Khaki	Water : 4000	High temperature

Programs	Brand name	g/l	Chemical name	Time & Tem.	pH	Drawing
Scouring	Ablutex:1050	1%	Detergent	98^0 x 60’ Cooling : 80^0 x 10’	Sample cutting	
	Jintex ACN	1%	Anti-creasing			
	AZ-500	0.5%	+Sequestering			
	MAT OSR	0.5%	Oil spot remover			
	Stab	0.25%	Stabilizer			
	Caustic	2%				
	H_2O_2	2.5%	Hydrogen peroxide			
					10.5-11	
N.Hot				60^0 x 10’		
Peroxide killing	A.Acid	1%	Acetic Acid	55^0 x 45’		
	CAT:1000	0.4%	Peroxide killer			
Anzyme	JQ-444	0.2%	Anzyme		4.5-4.75	
Leveling	Ablutex:SEQ-7	1%	Leveling			
	Jintex: ACN	1%	Anti-creasing			
	AZ-500	0.5%	Sequestering		6-6.5	

Colour dosing	Rema-yellow RR(51000)	0.466%/kg	Dyes		
	Rema-Red RR (10741)	0.088%/kg	Dyes		
	Rema blue RR(52714)	0.264%/kg	Dyes		
G.salt inject	Glober salt	30%			
Soda dosing	Soda	8%	Soda-ASH		11.5-12
Neutralization	A.Acid	0.7%	Acetic Acid		5.5-6.5
Soaping	BCSR	1%	Soaping Agent		
Softness	RHNB	1%	Softner		

4.8 Description of the main parts:

a. Main tank:

Main tank is the largest part of the dyeing machine. It is the main dye bath which contains the dye liquor and the fabric. The size of the tank depends on the capacity of the machine. Liquor & fabric circulates in the main tank during dyeing process. There may have one or multiple numbers of nozzles connected to the main tank according to the machine capacity.

b. Reserve tank:

This tank is mainly used for storage of hot water that is used in different stages of processing. The temperature of water in this tank is maximum 80C. Actually this tank saves the production time due to storage of hot water.

c. Additional /Mixing tank:

Additional tank is used for- Color dosing

- Soda dosing
- Salt dosing
- Chemical dosing
- Auxiliaries injection

Fig: Dosing Tank

d. Circulatip:

It is one of the most essential parts of the dyeing machine. It is used for circulation of dye bath liquor causing a flow from main tank to heat exchanger through filter net. **e. Nozzle:**

Nozzle is the cylindrical pipeline inside the machine located at top position, through which the fabric is moved continuously by reel. It contains the spraying portion of the circulated liquor. The diameter of the nozzle may vary depending on the GSM of fabric.

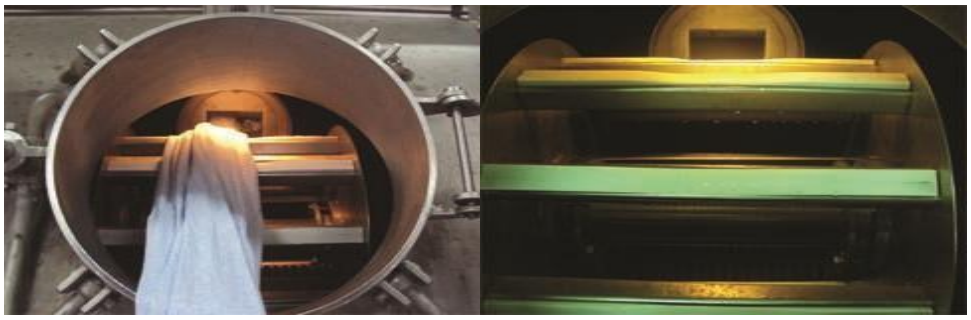


Fig:Nozzle and Reel

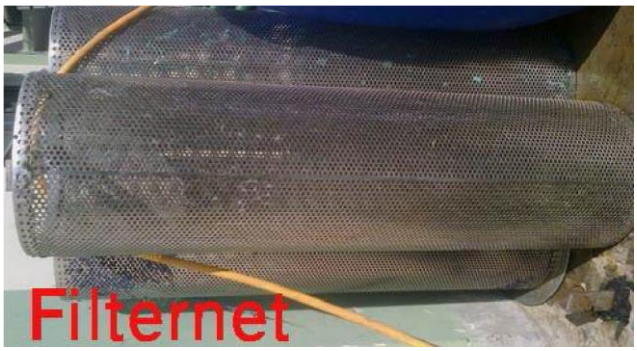
f. Valve:

Valve is a small part of the dyeing machine. The closing or opening of the valve indicates the bath fill, bath drain, and steam in, steam out, dosing and inject operation during the process.

g. Filter net:

During the treatment of fabric in the machine bath, lots of loose fibers are produced from the fabric. To eliminate these loose fibers, filter net is used prior to main/circulation pump. If these loose fibers are not eliminated, then

liquor pumping may hamper and entanglement of fabric can be occurred as well.



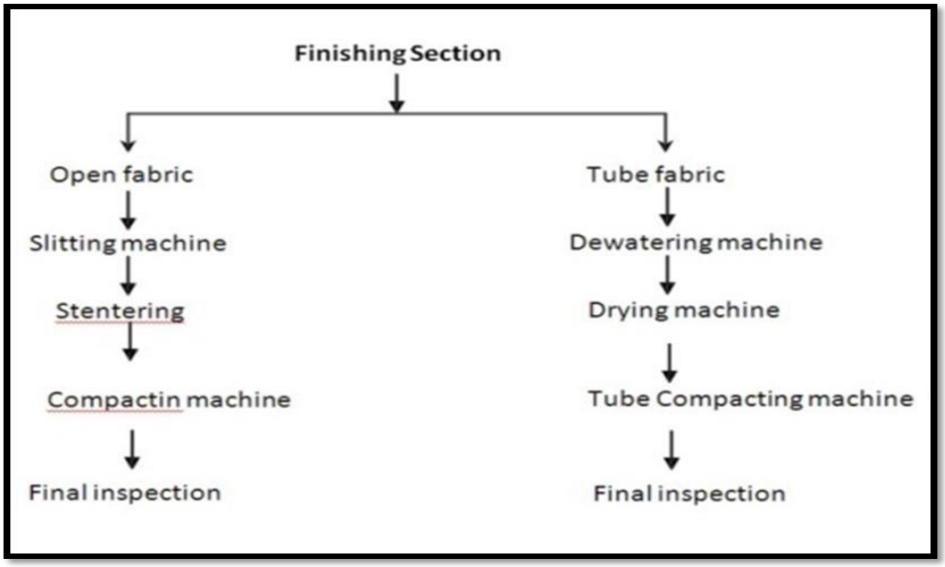
4.9 Operation Procedure:

- Check production plan to set the priority Select 7-8 batches/shift to prepare
- Consult with previous shift stuff to get the required information about the batches
- Check batch card & job card specification(e.g.-Yarn type,quality,weight etc) for fabric & collars/cuffs respectively
- Calculate number of batches, nozzles & rolls to be prepared for each order & specify on the batch & job card. One should be very careful while calculating & entering such data on these cards.
- Feed the fabric into the turning m/cs
- Start batching operation & check the following
  - information- Machine no.
  - Number of nozzle to be prepared.
  - Order no.
  - Customer number.
  - GSM.
  - Width.
  - Lot no.
- Prepare the body fabric of specified weight. This weight must be accurate & each nozzle of same batch must weight equal to ensure even dyeing.
- Calculate the number of collar/cuffs & attach the collars& cuffs with the body fabric.
- Write down the weight of each roll on the back of batch card.
- Check hole mark in each roll for identification.
- Turn the roll (if required).
- Calculate the total weight very carefully & write it down in the specific area of the batch card.
- After completing of one batch, write “OK” as comments at the notes section of batch card & send the batch along with the card to the dyeing section

4.10 Finishing: The making of a marketable and consumer usable textile is not completed after fabric production dyeing or printing operation. Fabrics usually still need to under go an

additional processing known as finishing, which is the final processing before the fabric is cut into apparel or made into any articles of textiles. Finishing is what improves attractiveness and makes fabrics suitable for their intended end use.

4.11 Flowchart of Finishing Section:



Finishing Machine

4.11.1 Finishing Machine Setup:

S L No.	MACHINE **NAME**	BRAND	TYPE	COUNTRY **OF ORIGIN**	UNIT	R E M A R K S

1	Stenter	Dilmenler	7 chamber with Seltex 848 plccontrol, Bianco Digitex 6 weft Straighter .	Turkey with German, Italian&US Parts	1	**7 chamber with the Capacity of 7000 kg Finished fabric& 3000 kg heat set.**
2	Bianco Tension Lesssli ting	Bianco	Head,Detwister,Basket, Conveye Belt & Double Padder	Italy	1	**With the capacity of 90 meter / Min that is more or less**
3	DMS Slitting	Dilmenler	Head,Detwister,Basket from Bianco,Padder from Rolling	T u r k e y	1	**With the Capacity of 90 Meter/min tha t is more or less .**
4	Stitching Machine	Tuana Makina	Edege Sewing from Cutter,Italy With D-Threading	Turkey with Italian Parts	1	42 Meter / Min
5	Dryer	Dilmenler	2 Chamber 2 pass Relaxed Dryer for open Width fabric	Turkey	1	400lt/hr evaporation capacity that is 8000kg/Day
6	Open width Compactor	Ferraro	Open width Compactor Ferraro Revolution 3000,with 9.6 Meter Pin Frame,Low Rise Positive Feeding, Device.	Italy	1	10000kg

CHAPTER -05
Dyeing Finishing

Dyeing finishing:

Intextile manufacturing,**finishing** refers to the processes that convert thewovenorknittedcloth into a usable material and more specifically to any process performed after dyeing theyarnorfabricto improve the look, performance, or "hand" (feel) of the finish textile orclothing. The precise meaning depends on context.

Some finishing techniques such asbleachinganddyeingare applied to yarn before it is woven while others are applied to the grey cloth directly after it is woven or knitted. Some finishing techniques, such asfulling, have been in use with hand-weaving for centuries; others, such asmercerisation, are byproducts of theIndustrial Revolution.

Slitting machine:

Slitting is also a shearing **process**, but rather than making cuts at the end of a workpiece like shearing,**slitting** us used to cut a wide coil of metal into a number of narrower coils as the main coil is moved through the**slitter**.

Slitter machine is used for tubular knit fabric to make it in open form. In open form fabric finishing line; slitter machine is used after**hydro-extractor**, de-watering and**dryingmachine**.

Slitting is a process that is applied for cutting the**tubularfabric**through the intended break Wales line on lengthwise direction prior to stenter processing. During slitting, it is required to be aware about the cutting line otherwise,**fabricfaults**can be occurred there

Slitter machine

Objectives of Slitting:

Following objectives are achieved by the slitting machine.

1. To open tube fabric according to specific needle mark.
2. To prepare the fabric for next stentering process.

Function of the Slitting Machine:

1. Used to remove excess water after pretreatment and dyeing.
2. To slit the tube fabric by the knife for opening of the fabric and ready for stentering.
3. Delivered fabric in crease free state.
4. Before squeezing balloon is formed with the help of compressed air passing by a nozzle or air sprayer.
5. It can control the diameter of fabric and**GSM**and**shrinkage**by over feeding mechanism.

Main Parts of Slitter Machine and their Functions:

Following are the main machine parts and their functions.

1. **Rotary Blade:** Rotary blade is used for cutting the fabric through break Wales line.
2. **Ring:** Ring is use to help the cutting process.
3. **Guide Roller:** After slitting, plaiting of the fabric is done. Guide roller guides the fabric to plaiting.
4. **Plaiting:** Open fabric is make plait by plaiting.
5. **Sensor:** Sensor is used for identify the specific Wales line. It makes sense for cutting through break Wales's line.

Checking Parameters Slitter:

Following parameters are checked after slitting.

1. **Cutting Line Check:** Fabric cutting line is checked by the operator of the slitting machine. Operator checks that the rotary blade cut fabric through break Wales's line or not.
2. **Bow and Slant check:** Bow and slant is checked in the delivery side of the machine by the operator.
3. **Fabric Faults:** Various fabric faults also checked in slitting process.

Working Principle of Slitter Machine:

The slitting m/c has 4 units - initial squeezer, de-twisting, slitter and padder. After dyeing completed and falling of water from fabric the fabric is fed in slitting m/c. So it is necessary to

remove some water initially for the case of further processing in this m/c. The initial squeezer does this work. The de-twisting unit removes twists that may present in tubular rope form fabric. This unit has 3 de-twisting rollers, one rotation drum and 2 feeler rollers with sensors. By these rollers it detects twist in fabric and removes by rotating rope fabric in opposite direction. Before slitting there is a blower which blows air to open the tubular fabric & makes it easy to pass over cigger. The cigger can be extended in circumference and opens the tubular fabric in full circumference. Slitting is done by using open mark detecting golden eye by around knife. Then the fabric passes through the padder where washing or chemical treatment is done. Squeezer is used to remove 60-70% of water. After removing water width is controlled by stretcher and fabric is delivered by folding device.

Operational Parameter:

1. Set the padder pressure as required (3-7bar) 2. Set the speed as much as possible (30-80m/min).

Stenter Machine:

A machine or apparatus for stretching or stentering fabrics. The purpose of the stenter machine is to bringing the length and width to pre determine dimensions and also for heat **setting** and it is used for applying finishing chemicals and also shade variation is adjusted.
The main function of the stenter is to stretch the fabric widthwise and to recover the uniform width.

Stentering machine

Function of Stenter Machines:

1. **Heatsetting**is done by the stenter for**lycrafabric**, synthetic and blended fabric.
2. Width of the fabric is controlled by the stenter.
3. Finishing chemical apply on fabric by the stenter.
4. Loop of the knit fabric is controlled.

5. Moisture of the fabric is controlled by the stenter.
6. Spirility controlled by the stenter.
7. **GSMofthefabric**is controlled by stenter.
8. Fabric is dried by the**stenteringprocess**.
9. **Shrinkage**property of the fabric is controlled.
10. Curing treatment for resin, water repellent fabric is done by the stenter.

Components of Stenter Machine:

- Paders
- Weft straightner (Mahlo)
- Burners 10
- Heat recovery
- Attraction rollers
- Circulating fans 10,8
- Exhaust fans 2
- Winder 2
- Clips
- Pins
- I.R
- Cooling drums 2

Working Procedure of Stenter Machine:

The fabric is collected from the batcher to the scray and then it is passed through the padders where the finishes are applied and some times shade variation is corrected.The fabric is entered into the mahlo (weft straigtner) the function of the mahlo is to set the bow and also weave of the fabric is griped by the clips and pins are also provided but the pins has a disadvantage that they pins make holes at the selvedge but the stretchning of the pins are greater than the clips.these clips and pins are joined to endless chain.there are 8 to 10 chambers provided on the machine each chamber contains a burner and filters are provided to separate dust from air.the circulating fans blow air from the base to the upper side and exhaust fans sucks all the hot air within the chambers. Attraction rollers ar provided to stretch the warp yarn.

After stentering we can increase the width of the fabric up to 1.5-2 inch.The speed of the machine is about 7-150 m/min.3 meters fabric can run in each chamber.temperature is adjusted that according to the fabric as for,

1. PC 210 c

2. Cotton 110-130 c

After dyeing 160-170c and after print 130-140c.

Comparison Between Stenter 10 F, Stenter 8 F and KnitStenter:

Stenter 10F:

The word 10 F stands for 10 flames.in stenter 10 F clips are used to stretch the fabric and this is a disadvantage that holes appears on the selvedge of the fabric and also uneven dyeing is achieved.

Stenter8F :

Stenter 8 F has 8 flames and the main purpose of 8F stenter same as 10F stenter. The basic advantage of the machine is dyeing can also done on 8F machine and has I.R system. Finishing, dyeing can also done even we can dye pigment , heat setting and also we can control skew and bow problems and another advantage is using light shades no clip marks appears.

Knit Stenter:

The basic difference of the knit stenter machine is that it is used for knit fabric weft straightening, heat setting, dyeing, light shades and also for print and knit fiishing chemicals applicaions. Pins are also provided with the clips.flat rollers are present and a brush to hold the pin,the L-guide is also used for knit fabric and a selvedge cutter with suction privided.

Specification of a Stenter Machine:

Brand Name	Bruckner
Serial no	72276-0463
Origin	Germany
Year of manufacture	1995
Speed range	15-30 m/min
Temperature range	50-250C
Used utilities	Electricity, Gas, Compress air, Steam
Production capacities	8 ton /day

No. of chamber	3
Maximum fabric width	102”
Minimum fabric witdth	30”
Steam pressure	2 bar
Air pressure	10 bar
Applied for	Open tube fabric
No. of ratamatic burner	6
Extra Attachment	Mahlo weft straightener
M/C parts	Burner,Nozzle, Exhaust air fan, Over feed roller, Suction fan, Chain arrangement

Compactor Machine:

Compactor is a textile **finishing machine** which is designed specially for compacting 100% cotton knitted fabric like jersey, pique, interlock, plush, rib and sinker etc. as well as cotton blended fabric in rope form, changing the loft and dimensional stability of the fabric and presenting it to plaited form. Fitted with two felt compacting units which makes it to obtain top quality fabric, with minimized shrinking nature and a soft fluffy hand.

Compactor machine

Function of Compactor Machine:

Compactor is important machine in**knitfabricfinishingprocess**. There are a lot of technical work which are done by compactor machine. The works are done by compactor machine are pointed out below:

1. **GSM**control of the knitted fabric. For high GSM, overfeed is increased and fabric width is decreased. For low GSM, overfeed is decreased and fabric width is increased.

2. Control shrinkage
3. Twisting control
4. Increase smoothness of fabric 5.**Heatsetting**is done of fabric etc.

Checking Parameters of Compactor Machine:

Following parameters check in compactor machine.

1. **Shade Check:** Shade of the compacting fabric is checked in the delivery side of the machine. The operator collects the fabric and compare the shade of the fabric with the buyer's approved swatch.
2. **Width Check:** Operator measures the width of the fabric with the measuring tape and compares it with the buyer's requirement.
3. **Weight Check:** Weight of the fabric is determined by GSM check. Operator checks the GSM of the fabric by GSM cutter and electric balance.
4. **Edge Line Checking:** Two edges of the fabric is check in delivery side. If any fix line is identified, which normally occurs from the expander it should be connected.
5. **Design and Slanting:** Operator checks design and slanting of the fabric in the delivery side of the machine.
6. **Fabric Faults:** Various types of fabric quality are measured in the delivery side of the fabric.

Types of Compactor Machine:

Compactor machines are two types. They are-

1. Tubular compactor
2. Open compactor

Tubular Compactor:

Tubular compactor is used after hydro-extractor, de-watering and dryer. By the compactor machine, compacting is done for control the shrinkage of the fabric. Here, different types of off line quality of the fabric are measured.

Functions of Tubular Compactor:

Following objectives are achieved by the tubular compactor. They are-

1. Shrinkage of the fabric is controlled by the compactor.
2. Fabric width is controlled by the compactor.
3. GSM of the fabric is adjusted by the compacting.

4. Fabric smoothness is achieved by the compactor.
5. Heat setting of fabric for Lycra is done by tubular compactor.

Working Procedure of Tubular Compactor:

The treatment of knit fabrics in tubular form on the Tubular compactor meets the exacting standards set by customers so that garment stitched from the fabric finished on this machine will yield the lowest residual shrinkage values.

1. Width control through a stepless adjustable special tubular fabric spreader driven by variable speed motor for distortion-free fabric guidance.
2. Steamping with a condensate-free steam box which is easily operated and completely made from stainless stell.
3. Compacting through two Nomex felt belts.
4. Calendaring while passing between the felt belt and the heated shrinking rollers.
5. Precision plaiting with automatic platform level adjustment controlled by folded fabric height. Alternatively, a fabric rolling system can be provided.

The fabric is fed through the guiding system and stretcher which then takes the fabric through the steam box onto the felt of the twin compacting units.

At the fabric delivery, the machine is equipped with a precision plaiting device with its platform. The height of the platform is controlled automatically and is adjustable according to the plaited fabric height.

An optical fabric density measuring sensor can provide the means to automatically control the compaction of a tubular compactor to achieve the desired course count. An automatic compaction control system based on density measurement and control will:

- Eliminate over- and under-weight fabric.
- Reduce or eliminate punch-weight measurements.
- Provide consistent results from all operators.
- Result in uniform fabric, seam-to-seam.
- Yield predictable residual shrinkage.

Specification of Tubular Compactor Machine:

Brand name	Ferraro
Model no.	Comptex/Fv200
Manufacturing country	Italy
Speed range	13-22 m/min
Temperature	110-140C
Used utilities	Electricity,Compress air,Steam
Production capacity	4 ton/day

Maximum width	86”
Minimum width	36”
Applied for	Open width

Open Width Compactor:

Open compactor is used for compacting the open form fabric. Here, slitting machine is used for open the fabric from the tubular form.

Feature of Open Width Compactor:

Perfect sanforising finishing of knit fabrics.

1. Ideally suitable for in-line with**stentermachines**.
2. Effective shrinkage control
3. A.C. Inverter drives, PLC with touch screen used.
4. Equipped with modem connectivity and online troubleshooting system.
5. Metal detector.

Working Procedure of Open Width Compactor:

Open Width Compactor is suitable for open width knit fabrics to achieve exact dimensional stability and a soft feel. The machine generally consists of a feeding frame with centering device and driven scroll rollers, an equalizing stenter frame with overfeed roller and brush pinning arrangement.

The entry section of Pin Frame is provided with edge spreaders IR In-Feed device, an S.S. fabricated steaming unit for uniform moistening of the fabric. The Steaming Device has stainless steel sliding shutters that allow steam to flow only as per the width of the fabric.

A low contact Glueing and Drying unit is provided with a stainless steel trough. Four selvedge drying units with infra-Red emitters are placed on either side of the machine. The delivery side section consists of edge dryer, Selvedge trimmer and a suction device, Exit roller, Width Adjustment device and the drive to the chain are housed in a exit box.

The compacting unit consists of 2 felt compacting units, each of them consisting of a Nomex felt approx. 20 mm thick, a steam heated chrome-plated center roller of dia. 400 mm, a rubber covered roller driven by variable frequency drive, a compacting pressure roller, a felt tensioning roller and a felt centering roller. Each unit is provided with a special anti-fiction sheet type shoe controlled by an electrical actuator to control the compressive shrinkage. A fabric cooling roller

is provided after second felt to cool the fabric by means of chilled water circulation. Fabric Tension through the machine is controlled with the help of sensitive load cells and variable frequency drive with PLC and touch screen.

Specification of Open Width Compactor Machine:

Brand name	Ferraro
Model no.	Comptex/Fv200
Manufacturing country	Italy
Speed range	13-22 m/min
Temperature	110-140C
Used utilities	Electricity,Compress air,Steam
Production capacity	4 ton/day
Maximum width	86”
Minimum width	36”
Applied for	Open width

Brushing Machines

Brushing machines create a uniform workpiece surface finish after undergoing turning, punching, milling, or machining processes. Workpieces include wires, metal discs, pipes, tubes, and sheet metal blanks. Removal of dust or impurities is a secondary application of brushing machines.

Traditionally, gear deburring required heavy duty products like wire brushes. However, new developments in deburring technology led to increasing use of

nylon abrasive filament (NAF) brushes. Computer numerical controlled (CNC) machines employ NAF brushes to remove sizable burrs and refine the material surface finish with superior precision, eliminating the need for re-fixturing or secondary deburring.

Brushing machines are employed in polishing, edge radiusing, deburring, and honing applications. They are also used for processing agricultural products. They are effective in cleaning and polishing seeds or grains and removing skins from nuts.

Operation

Compared to bonded or coated abrasive products, the filamentary nature of NAF brushes minimizes surface damage. The nylon abrasive filament brushes are less aggressive and are relevant for finishing and deburring applications as well as edge radiusing.

When an NAF brush contacts the surface during deburring, it generates a high cutting force due to the limited contact area. This force diminishes as the filing action of the brush removes the burr and increases the contact area. This also limits the aggressive force to the edges, allowing the machines to perform their function without changing dimensions of the parts. The nylon abrasive filament brushes achieve deburring and finishing of flat parts such as engine blocks or cylinder heads. The brush filament generates a low cutting pressure as it moves away from the edge and towards a more flat surface. This effect facilitates the process of refining the surface finish necessary for polishing parts with complex geometries.

NAF brushes are also efficient in producing precise edge radii. Creation of a specific edge radius in addition to deburring or polishing is essential in particular industries. The abrasive brushes form a true radius by blending corners into the sides.

NAF brushes require direct perpendicular access to the area subjected to deburring or finishing.
A successful outcome is impaired if access to the burred edge is restricted or if the filaments are deflected away from the targeted area.

When integrated with in-line systems, NAF brushes minimize time to completion and eliminate the need to acquire separate deburring units. These single-point systems perform machining and deburring of the parts simultaneously using the same equipment. Robotic systems integrated into production lines present an alternative approach. A complete cycle performed by a robot covers handling, deburring, and returning the part back to the conveyor.

An additional method for employing deburring is allocating dedicated equipment to handle individual parts or sets of parts. Devoted machines allow for a reduced cycle time and increased throughput levels, making them ideal for high-production environments.

Features

Brushing machines contain a multitude of features supporting a vast range of applications. These features include:

- Adjustable brush abrasion
- Wet operation
- Solid metal body
- Varying brush grit combinations
- Adjustable conveyor speed
- Horizontal axis rotation
- Modular construction
- Hardened billy rolls
- High-speed brushing
- Integrated brushing unit pull-off mechanism
- Dynamic wheel balancing (eliminates vibration)
- Adjustable stroke oscillation
- Double-sided operation
- Turbo blower
- Heat-resistant brushes
- Individual brushing unit pull-off mechanism

Applications

Use of brushing machines extends to a broad range of applications for cleaning, honing, polishing, or removing impurities from a workpiece or surface. These applications include:

- Impurity removal
- Brushing
- Burr removal (deburring)
- Radiusing
- Polishing
- Fin removal
- Smoothing □ Rounding
- Cleaning
- Descaling
- Derusting
- Surface processing of tubes, pipes, metal discs, and plates

CHAPTER-06
LABORATORY

Laboratory:

In an organization, especially in a textile industry Lab is the main key point, with a higher precision lab can aid easily to achieve the goal of the organization. Before the bulk production a sample for the approval from industry is prepared and sent to the buyer, as per the requirements that the buyer mentioned. The lab dip is prepared in a lab considering the economical aspects.

List of Laboratory Instruments:

- Lab dip machine
- Electric balance
- Crock meter
- Spectrophotometer
- Light box
- Stirrer
- Dryer
- pH meter
- Electronic pipette

Laboratory Equipment's:

- Dryer
- Iron
- Computer
- Balance
- Scissors
- Light box
- Calculator
- Stirrer
- conical flax
- Beaker
- Manual pipette
- cylindrical flax

Chemicals and Auxiliaries are used in Laboratory:

- Hydrogen peroxide (H_2O_2)
- Acetic acid (CH_3COOH)
- Sulphuric Acid (H_2SO_4)
- Caustic soda ($NaOH$)
- Detergent (Sand clean/Imerol PCLF)
- Soda Ash (Na_2CO_3)
- Hydrous ($Na_2S_2O_4$)
- Gluber salt ($Na_2SO_4.10H_2O$)
- Dispersing agent (Jinlev –RLF)
- Leveling Agent (Ionactive PP 105)

Specification of Lab Dip Machineries:

Table5.1: Specification of lab dip machine

Sl. No.	Name of Machine	Brand	Manufacturer	Supplier	Origin
1	LAB DIP1,3,4,5 Capacity-24 pots (250ml)	F&P	Heshan Project Dyeing Equipment Ltd.	Manufacturer	China
2	LAB DIP-2 Capacity-24 pots(250ml)	Labortex	Centrary Faith Industrial Ltd.	Manufacturer	Taiwan
3	ELECTRIC BALANCE	Adventurer Balance	Ahaus corporation	SMH Engg. &Trading Co.	USA
4	CROCK METER	Crock Meter-67	James H heal & Co.	TH Corporation	UK
5	SPECTROPHO TOMER	Specta flash sf-600x	Data Color	Data Color	USA
6	LIGHT BOX	VERIVIDE	Roaches International Ltd.	PENDORA	UK
7	DRYER	Labtech	Daiham Labtech Co.	TH Corporation	Korea
8	pH METER	Microproces sor Bench pH meter	HANNA Instruments	TH Corporation	Italy

Selection of Stock Solution for Lab Recipe:

Selection of stock solution for lab recipe

Shade %	Stock solution %
Above 5 %	2%
0.10%--5%	1%
Below 0.10%	0.10%
Glauber salt%	25%
Soda ash%	10%

Ratio between Salt and Soda According to Shade Percentage:

M: L =1:10; Salt solution = 25%; Soda ash = 10%

Table 5.3: Ratio between salt and soda according to shade percentage

Shade%	Salt (g/l)	Soda (g/l)
0.00-0.09	10	2
0.10-0.20	15	3
0.20-0.40	20	4
0.40-0.80	25	5
0.80-1.20	30	6
1.20-1.60	40	10
1.60-2.50	50	12
2.50-3.50	60	15

3.50-4.50	70	17
4.50-5.50	78	18
5.50-10	80	20

Order Flow Chart of Lab Dip:

Buyer
↓
Merchandiser (Buying house)
↓
Merchandiser (Factory)
↓
Lab dip receiving (Lab)
↓
Input samples code no.
↓
Entry in lab register

Lab Dip Making Procedure:

Collect standard swatch/pantone number from buyer.
↓
Select appropriate combination of dyes and making recipe with required fabric from available
reference or data color
↓
Making stock solution as per respective dyes & chemicals
↓
Pipetting by manually or digitally from stock soln. according to dye percentage
& liquor ratio (M: L)
↓
Taking a fabric of 5gm weight
↓

Dyeing in m/c by keeping exact parameter as per percentage & dyestuff (migration & fixation) Cooling, washing, & drying sample matching with swatch.

Flow Chart of Lab Dip Submission:

Lab preparation
↓
Checking light box or Spectrophotometer
↓
Lab dip submission
↓
Keep submission in register
↓
Re-submit if not pass
↓
Shade receive from buyer
↓

↓ Transfer to dyeing floor with recipe

CHAPTER- 07

QUALITY ASSURANCE

The types of fabric defect:

1. Oil spot.
2. Missing yarn.
3. Hole.
4. Thick yarn.
5. Slub
6. Fly yarn

4-Point inspection system:

Defects Penalty Point	
1.0-3 inch	1
2.3-6 inch	2
3.6-9 inch	3
4.9 inch and above	4
5.Any hole and miss pick	4

4 point system fabric inspection:

4 Point system for fabric inspection is widely used in apparel industry for fabric quality inspection. To use this system below things should be in concern.

- Fabric inspection method or preparation
- Criteria of giving penalty points based on defects and defect length.
- Calculation method of total penalty points for total defects found in a fabric roll.
- A check sheet or format for recording data
- Knowledge of different types of defects (how a defect looks and its appearance)

Fig: Fabric inspection machine

Shrinkage & GSM Test:
Shrinkage is the process in which a fabric becomes smaller than its original size, usually through the process of laundry. Cotton fabric suffers from two main disadvantages of shrinking and creasing during subsequent washing. There are two types of shrinkage occurs during washing 1) Length wise
2) Width wise

GSM Test:
GSM (Gram per square meter) or weight test is done with the GSM cutter. At first the fabric is taken in and GSM cutter is put upon the fabric. Then the fabric is cut and the weighed. The weighed value is multiplied by 100 to find the GSM of the fabric.

Shade Segragation (Blanket 100%):
Shade segragation is a process of combining all the shades of a lot together. For doing this samples of 6 X 6 inch is collected from each roll of fabric and then stitched together. This is known as Blanket. Samples are collected from 100% roll of a lot.

6.4 Quality of trimmings:
Trimmings may be of textile materials or non-textile materials. They should be selected carefully to get desired performance. The quality of trimmings are described below-

1. **Lifetime:**
The life time of garments and that of the trimming should be equal .Otherwise the trimming will be faded or spoiled by washing, pressing, ironing, rubbing.

2. **Shrinkage:**
The appearance of the garment may be hampered if the accessories shrink due to ironing, washing or pressing. For example seam pucker will be result in if the sewing thread shrinks. So the shrink ability of the dress material and the trimming should be checked earlier.

3. **Color fastness:**
The fastness properties of accessories should be good. The color of trimming should not be faded due to washing or exposure to sunlight.

4. **Rust:**
Where items are made from metal, the main construction is the problem of rusting. The button, clamp, rivets etc may be made up the metals like iron, brass, steel etc .If rusting occurs they will create spot on garment. So to avoid this problem the metal trimmings should be electroplated or they should be made up of non-rusting materials.

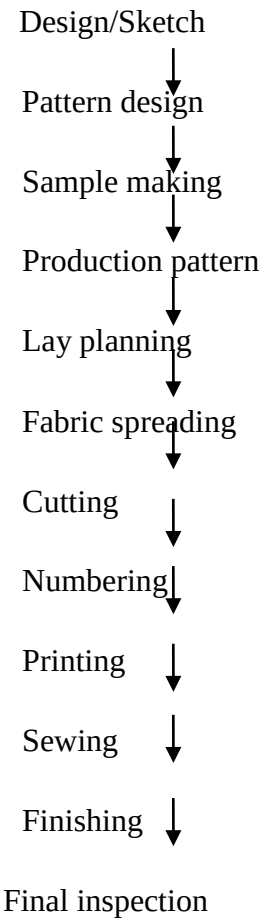
5. **Comfortability:**
Trimming should not create any uncomfortable felling to the wearer .They should be hygienic also as to cause no skin diseases.

CHAPTER- 08
GARMENTS PRODUCTION

A garment is a piece of clothing. The area of New York City where clothes are manufactured is known as the Garment District.

Derived from the French word for "equipment,"garment is a somewhat generic term you can use when the specific kind of clothing you're describing is not the point. A dress, for example, is a dress, and pants are pants. They are not the same thing, unless you refer to them both as garments, in which case they are the same thing.

Production sequence of garments production:



Pattern & Sample section:

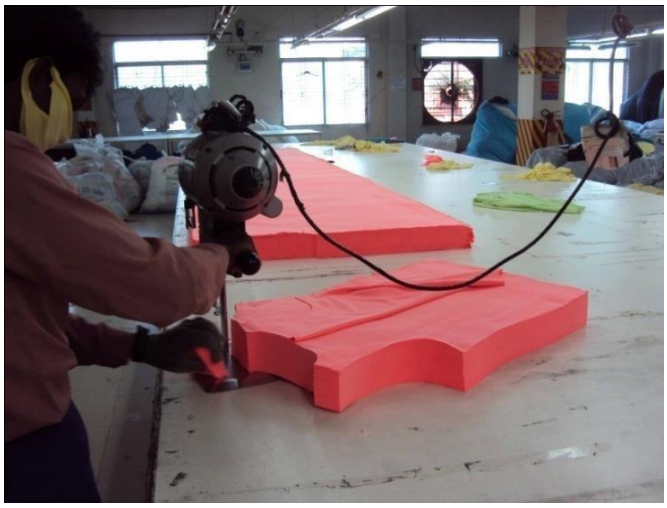
PATTERN: At first pattern make with the help of buyer given order sheet. In this factory CAD (Computer Aided Design) software used for making pattern.

SAMPLE: Different types of samples are: Fit/style sample, PP sample (Pre-production sample), Photo sample, Final sample, Side set sample, etc.

Cutting Section:

The main role of a cutting department is to cut garment components from fabric rolls or fabric than as per style specifications and send cut components to sewing department in bundles. A cutting department of a garment manufacturing unit includes following subprocesses

- Fabric relaxation
- Fabric spreading / layering on cutting table Marker making
- Cutting - manual cutting (using scissors), machine cutting, automatic cutting.
- Numbering of garment plies (parts)
- Shorting and Bundling
- Inspection of cut components
- Shorting of printed and embroidery panels
- Re-cutting of panels



Layout of cutting section:

Process sequence of cutting room:

Fabric Marking
↓
Fabric Spreading
↓
Fabric Cutting
↓
Cut components inspection
↓
Numbering
↓
100% checking & Parts replacing if needed.
↓
Shorting & Bundling
↓
Sewing/Assembling

Fabric spreading:

Before fabric laying a thin paper as like as marker that is marker size and thin paper size is same, then thin paper attach with spreading table by gum tape then spread the fabric according to marker size.

Fabric cutting:

Fabric lay is cutting by straight knife cutting machine then separated cutting part.

Numbering:

In this stage sticker is attached with all part of cutting part for shade matching. The sticker number maintains cutting number, size number, serial number.

M/c used in cutting section:

Fabric cutting m/c

Brand: Mack
Model: KS-AU V
Origin: Japan Volts: 220v, 50/60 Hz

another 10")

Number of m/c = 2 (One 8” &

Numbering m/c:
Brand: BLITZ & Model:2253

Sewing Section:

Sewing department is the heart of a manufacturing unit. Cut components are assembled in

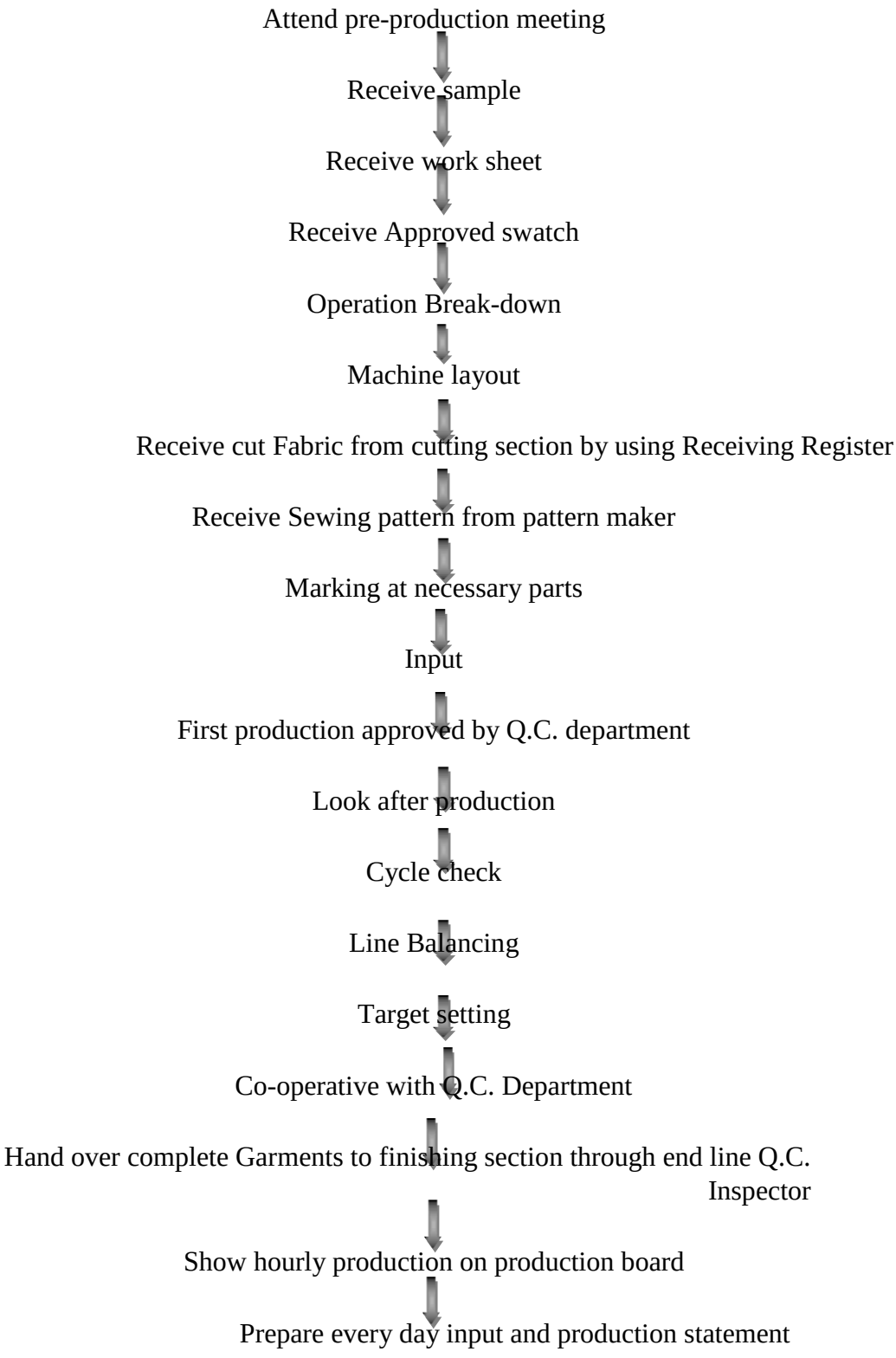
sewing department in assembly line. List of sub-processes those are done in sewing department

includes.

- Making garment parts
- Sewing full garment
- Making garment accessories like tabs, cords etc.
- Checking of stitched garments
- Alteration work of defective garments

7.10 Lay out of sewing section at Tivoli Apparels :

Process Flow Chart:



Machineries:

- Over lock
- Single needle
- Flat lock
- Button stitch
- Button holing
- Piping cutter
- Bar tack
- Kansai
- Snap button

Fig:Plain machine

Fig: Over lock machine

Fig: Bar tack machine

Sewing Quality Checking Points:

- Skip/ Drop / Broken Stitch

- Raw Edge
- Size Mistake
- Uneven Cuff
- Uneven Neck
- Uneven Shoulder
- Uneven Placket
- Uneven Pocket
- Twisting
- Without Care Label
- Open Task
- Sleeve Up-Down
- Stripe Up-Down
- Open Seam
- Four Point Up-Down
- Spot

Some defects of sewing operation:

- Skip/ Drop stitch
- Uneven stitch
- Over stitch
- Joint stitch
- Raw edge
- Tension loose
- Broken stitch
- Puckering
- Open stitch
- Shading
- Incorrect stitch per inch
- Pleat
- Needle cut
- Wrong Thread
- Wrong size/ care label
- Slanted
- Wrong button placement
- Run off stitch

Sewing Problems “Factory”:

- Input problem
- Shortage of skilled operator
- Poor m/c maintenance
- Sometimes bulk production will start without layout as a result there is on production target.
- To achieved the overtime, they worked slowly

Major operations carried out by the section:

- Collect counter sample
- Take cut panel measurement
- Front / back matching
- Start sewing
- Use mockup for critical operation
- Process wise thread trimming & cutting sticker remove
- Process quality check
- End table quality check

Product evaluations carried

out by the process Calculate

the production capacity.

- To establish proper layout of the sewing floor.
- To provide accurate guideline for the floor supervisor ,floor quality ,line chief and other person of the floor.
- To solve any problem of the floor, it may production problem, worker problem etc.
- To provide production report and other information in the floor of the higher authority.
- To look after the floor.
- To maintain the line chief line quality ,line supervisor and other persons of the floor.
- To solve any problem of any line in the sewing floor.
- To maintain line input and output materials.
- To find out per line production capacity of the sewing floor.

Finishing section:

The term garments finishing mainly applies to pressing, folding and packing of garments. After completing pressing, the garments have to be folded. After completing pressing, the garments are folded with a predetermined area. Garments are folded according to the direction of Buyers requirements or in a standard area. Finishing is the final stage of garment manufacturing. Quality is the major issue in finishing. Final quality inspection is applied here which determines and ensure the total quality of the product.

The term finishing covers all textile dry/wet process, the general aim of finishing is to improve attractiveness and/or serviceability of fabric. Finishing can:

-Improve the dimensional stability of the fabric
-Modify the handle of fabric
-Improve the appearance of fabric
-Improve the durability of the fabric
-Modify the serviceability of the fabric

Process flowchart:

Carton
↓
Needle check
↓
Packing
↓
Folding
↓
Hanging tag
↓
Needle check
↓
Getup check
↓
Quality check
↓
Pressing
↓
Body reversing
↓
Receiving

Receiving:
In finishing section receiving is the first procedure to start the activities of this section. Receiving is mainly done by a supervisor who preserves all data about the bodies coming in this section. The bodies completed all procedure of sewing section come to sewing section received in receiving area.

Reversing:
After receiving the bodies are taken to a table to open the face side. Mainly in sewing section bodies are in a state of backside opening form which is not

suitable for pressing process so some people are in a job of reversing these bodies.

Pressing:

This is a finishing process done by subjecting a cloth to heat & pressure with or without steam to remove unintended creases and to impart a flat appearance to the cloth or garment. Also, pressing is done to introduce creases in the garments. In garments industries, pressing is called Ironing.

Object of pressing:

The main aim of pressing is to increase the adornment of the garments. Also the followings are the objects of pressing.

1. Removal of unwanted creases and crinkles
2. To apply creases where necessary
3. Shaping
4. Increase the beauty of garments and to impart a flat appearance to the cloth or garments.

Pressing equipments and methods:

The garments may be different in types especially different in design and garments materials. As a result it needs different types of pressing for different types of garments. To do this it needs different types of pressing machines. Because of it cannot be done all types of pressing by using the same machine. There are different types of pressing machines or equipments used in garments industries for ensuring required quality of garments are mentioned below:

1. Iron
2. Steam press
3. Steam air finish
4. Steam tunnel

Chemical Used to Remove Spot:

Dyeing Spot: Lifter
Cutting Spot: Thinner
Printing Spot: Thinner
Oil Spot: Thinner or Power
Sewing Spot: Lifter

Thinner:

Thinner is used to remove the soil spot, color spot, dust and dirty spot, etc

Lifter:

Lifter is used to remove the oil spot, soil spot, sewing spot etc.

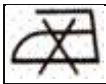
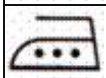
Water:

Water is used to remove the dirty spot, ink color, etc.

Folding:

After completing pressing, the garments have to be folded. After completing pressing, the garments are folded with a predetermined area. Garments are folded according to the direction of buyers requirements or in a standard area. Classification of folding depends on the fabric type. There are mainly 4 types of folding available.

Stand up: Collar is folded with body and situated at 90^0 angles.
Semi stand up: Collar is folded with body and situated at 45^0 angles.
Flat pack: Collar is spread as a whole on the body of shirt.
Hanger pack: Shirt is packed and transported by hanging on the hanger.
Basic Ironing symbols:

	Do not iron
	Cool iron (110°)
	Medium iron (150°)
	Hot iron (200°)

Metal Detection:

Ok garments are inspection and passed through the metal detection machine. The machine determines whether the garments contain any ferrous components or not. If a garment contents any ferrous item or broken needle, the garment will fail to pass the machine and it will come back. Fail garments are kept in reject box kept beside the metal detector machine. The passed garments are kept to the quarantine area.

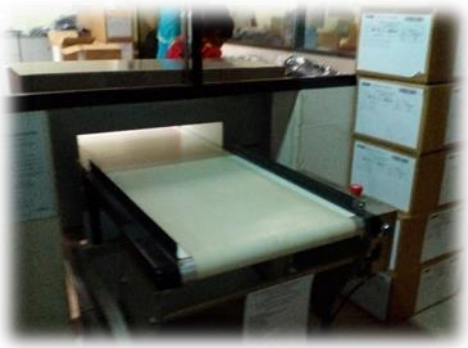


Fig: Metal Detector M/c.

Type of packing:

-Solid size packing (One size garment)
-Ratio packing (Similar color, different size)
-Assort packing (Different color, different size)

CHAPTER- 09
GARMENTS WASHING

Washing: Garmentswashingis the vast place for thetextile engineersor chemical engineers to prove their capability in today's readymade garmentbusiness. New comers of this sector have to learn so many in the earlier stage of their job to sustain here.

The technology which is used to modify the appearance, outlook comfort ability and fashion of the **garments** is called **garment washing**. Depending on **garments** construction different types of **washing** process can be done. Objects of **Garment Washing**: **Garment washing** is the best touch of a **garment.**

Objective of washing:

- To remove size material (starch) from the garments.
- To remove any dirt, dust, spot, impurities, germ which is present duringmanufacturing.
- To prevent further shrinkage of wash garments.
- To produce similar or different outlook in the garments.
- To develop softness in fabric by removing hardness of fabric.

Types of Garment Washing:

The different types/methods of washing are mentioned below:

Primarily garment washing are two types

1. Wet process/Chemical process
2. Dry process/Mechanical process

1. Wet process/Chemical process

- Normal wash/ garment wash/rinse wash
- Pigment wash
- Caustic wash
- Enzyme wash
- Stone wash
- Stone enzyme wash
- Tinting (Tie) & Over Dyeing(Dip Dyeing)
- Super white wash
- Bleach wash
- Acid wash
- Silicon wash
- Soft wash

2. Dry process/Mechanical process

- Sand blasting
- Hands scraping
- Over all wrinkles
- Permanent wrinkle
- Broken and tagging
- Grinding and destroy
- PP Spray, Resin Spray
- Heat pressing
- Crimping

Flow Chart of Wet Process in Garments Washing:

De-size

↓

Enzyme

↓

Cleaning

↓

Bleaching

↓
Neutralize
↓
Extracting
↓
Drying
↓
P.P Neutralize
↓
Tinting
↓
Softening
↓
Extracting
↓
Drying

All the above processes are discussed in the following table:

SL No.	Process	Procedure
01	De-size	It is the first process of wet process section in garments washing. Here, de-sizing process is done by using de-size chemical to remove size material from the garments.
02	Enzyme	To match with the desired shade, here enzyme process is done by using Acid or Neutral enzyme. Enzyme process can be medium enzyme, light enzyme, heavy enzyme or stone enzyme.
03	Cleaning	After completing enzyme process, garments are cleaned here by rinsing 2-3times.
04	Bleaching	Here, color can be removed uniformly from the garments and removal of color is done according to the buyer approved shade. Bleaching can be done by using K.C.I bleach or Japanese Bleach.
05	Neutralize	Bleaching chemical must be neutralize here by using Sodium meta-bisulphite or sodium hypo.
06	Extracting	After completing all the above processes, garments are unloaded from the machine and extracted by using hydro extractor machine.
07	Drying	Garments are dried here by using gas dryer or steam dryer. Types of dryer selection depends on the desired shade. Here, it should be noted that, gas dryer is perfect for reddish shade and steam drys is for bluish shade. After drying, all the garments should be sent to the dry process section for P.P spray.

08	P.P Neutralize	Here, P.P sprayed garments are neutralized by using sodium meta bisulphite.
09	Tinting	Tinting is normally used for increasing the attractiveness of garments. Sometimes tinting is needed for matching with the desired shade.
10	Softening	This process is done for increasing softness effect of garments. Softening can be done by using cationic or non ionic softener.

Procedure of Garment Washing:

1. Garments can be inverted to minimize unwanted abrasion streaks (especially useful when preset creases are present).
2. Load machine with garments.
3. DE size with alpha amylase enzyme and detergent.
4. Drain.
5. Rinse.
6. Fill machine with water and heat to 60◦C. The liquor ratio can range from 10:1 to 20:1. A number of synthetic detergents can be used. Also, alkaline products such as soda ash or caustic soda can be added in amounts ranging from 0.5 to 2.0 grams/liter.
7. Wash/tumble action for 20-60 minutes, depending upon desired effect.
8. Drain and rinse.
9. Apply softener.
10. Tumble dry.
11. Invert garments, if previously turned.
12. Press, if required.

Machines of washing section:

1. Dip Dye M/C : No of m/c =2
2. Green Mac M/C: No of m/c =6 ; Sample m/c (2) + production m/c (4) ; Made in Singapore; Capacity =10kg
3. Ngai sling, New Horizon Com Ltd:

No of m/c =3 ; Sample m/c (1) + production m/c (1) ; Belly (1); Made in China; Capacity =80kg

4. Tonello M C : No of m/c =1; Sample m/c (1) + production m/c (2); Made in Italy; Capacity =100kg
5. Hydro extractor M/C: No of m/c =1 ;Made in china
6. Triventa Grand Impianti: No of m/c =1; Capacity =100kg ;Made in Italy
7. Ngai shin M /C(Dryer) : No of m/c =3 ; Made in china

Types of Garment Wash:

1. Normal wash/ garment wash/rinse wash
2. Pigment wash
3. Caustic wash
4. Enzyme wash
5. Stone wash
6. Stone enzyme wash
7. Tinting (Tie) & Over Dyeing(Dip Dyeing)
8. Super white wash
9. Bleach wash
10. Acid wash
11. Silicon wash

Advantages of Garment Washing

1. Starch materials is present in the new fabrics of he new garment are removed, hence feels soft during use.
2. Softness feeling of garments could be further increased. Washed garment could be wear directly after purchase from store.
3. Fading affect is produced in the garment in regular or irregular pattern.
4. Fading affect could be produced in the specific area of the garment as per specific design.
5. Different outlook of garment could be produced in the garment by different washing techniques.
6. Similar outlook can be produced in the garments by different washing techniques.
7. Initial investment cost to set up a garment washing plant is comparatively lower.
8. Dirts and spots if present in the garment are removed.

9. Shrinkage occurs in the garment washing, hence no possibility of further shrinkage.

Different Types of Washing Defects:

There are different types of washing defects. After and wash and dry process these faults or defects are shown in the garments. Such washing faults are as follows:

1. Over blasting / low Blasting.
2. Over grinding / low grinding.
3. Bad smell due to poor neutralization.
4. Poor hand feel.
5. To high hairiness.
6. Poor brightness.
7. After wash hole.
8. Very dark & very light.
9. Bleach Spot.
10. Bottom hem & course edge destroy.
11. Running shading.
12. High or low affect / abrasion on garments.
13. Spot on garments.
14. Out of range / level of pH value of garments.
15. Colour shade variation.
16. Crease Marks.
17. Lycra damage

Fig: Washing defects in garment

Washing Machine Problems:

1. Washing m/c does not spin
2. Washing m/c does not drain properly
3. Washing m/c does not rotate
4. Washing m/c is noisy
5. Washing m/c bounces or vibrates excising
6. Washing m/c spots during a cycle
7. Washing m/c door cannot be opened
8. It bad smells
9. It is leaking
10. It does no start

Pigment Dye:

Process:

Hot Wash Detergent (Biotex Nila, PCLF,KRCP)

↓ Anticreasing agent (X-Jet)

↓ Sequestering agent (70*10`)

↓ Soda ash (it increases water absorbency)

Normal Wash (1`)

Cationization Catanizing (Acramin) 70*20`

PH 8.5 (also using for levelling of color Dyeing)

↓

Dyeing Dyes X% (pigment)

75*30`

Normal Wash

Binder For fixing cold *10`

0.5-1.0 gm/l

Normal Wash

Softner or Silicon(0.5gm/l or 0.2 gm/l) cold*5`

Unload

Direct Dye

Process:

Hot Wash Detergent (Biotex Nila, PCLF,KRCP)

Anticreasing agent (X-Jet)

Sequestering agent (70*10`)

Soda ash (it increases water absorbency)

Normal Wash (1`)

Cationization Cat of direct dyes (modern NAM)60*25`

PH 8.5- 11.0

Normal wash

Dyeing Dyes X%

85* 30-40 Check

Normal Wash

Acid (Depends on direct dyes group)

Fixing (Depends on direct dyes group) Super fixing

Softner .05gm/l cold*5`

Unload

Reactive Dye

Process:

Hot Wash Detergent (Biotex Nila,Imerol blue ,PCLF,KRCP)

Anticreasing agent (X-Jet) Dosing time -10`

Sequestering agent Run time- (98*1h)

Soda ash (it increases water absorbency)

Bleaching H_2O_2 *60` , Run time – 10`

Dekol 1097 , Jet , ADM (Color levelling agent)

Enzyme Dosing gm/l =0.25 , PH – 6

↓

Time – 1h ,Temp. -55^0 c

Dyeing Salt dosing- 10`, Soda dosing – 40

↓

Run time- 10` ,color dosing -30`

Run time + Sample -20` , PH =5

Color striming -2.25h

Acid PH =5.5-6 (removes the effect of soda)

↓

Soaoing agent PH =5.5

Fixing PH= 6 gm/l (super fix 800)

↓

Time -10` ,Temp- 45` Softner (TES)

↓

Unload

Flow chart of garment dyeing for medium / dark shade with reactive dyes.

M : L – 1 : 8

Garments Load - 2 kg
↓
Level in water 16 liter
↓
Wetting agent 0.5g/l NOF (70° c × 5')
↓
Normal Wash
↓
Leveling agent LDR (60° c× 5')
↓
Color dosing (60° c× 10')
RG Yellow RGB - (0.44%)
RG Red RGB - (0.254%)
RG Blue RR - (0.898%)
Run 10'
↓
Salt dosing {(50g/l) 60° c × (10' + 10'}
↓
Soda dosing {(16g/l) (60° c × 10')}
↓
Run Time 35' (sample check)
↓
A – Acid (1 g/l × 5')
↓
Fixing agent (E.C) (1g/l) – (40° c × 5 min)
↓
Raise temp. 50° c
↓
Run time 5
↓
Drain
↓
Level in
↓
Cold wash (27° c × 2min)

[5]

Flow chart of garment dyeing for light shade with reactive dyes.

Level in Raise temp. (70° c × 5min)
□
Wetting + Detergent (NOF)
↓
Leveling agent (LDR) 60° c × 5min)
↓
Color dosing {60° c × (10 +10)}
{CIBA Yellow FNR - 0.048%
CIBA Red FNR – 0.048%
CIBA Blue FNR – 0.048%}
↓
Salt dosing (24g/l){60° c × (10+10)}
↓
Soda dosing {(8g/l) (60° c × 10')}
↓
Run time 35 min (sample check)
↓
Normal Wash
↓
Acetic Acid (1 g/l)
↓
Cold wash
↓
Fixing agent (E.C) (1 g/l) – (40° c × 5 min)
↓
Raise temp. 50° c
↓
Run time 5 min
↓
Drain
↓
Level in
↓
Cold wash (27° c × 2 min)

Technique used for Garment dyeing

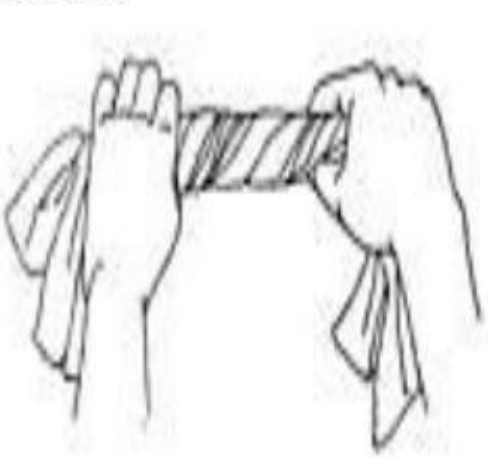
There are various technique used for garment dyeing; recently some latest technology has developed for garment dyeing in our industry.

1. Tie dyeing
2. Dip dyeing
3. Spray dyeing
4. Over dyeing
5. Cold dyeing
6. High white dyeing
7. Washable dyeing
8. Reverse dyeing
9. Top dyeing

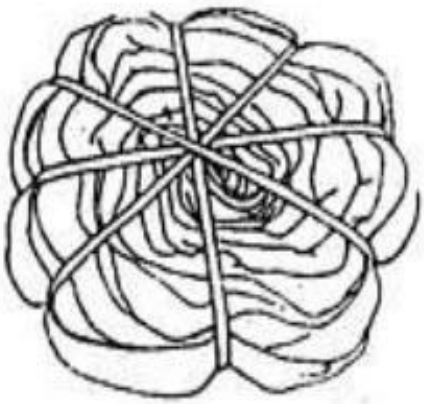
Tie Dyeing:

Tying technique

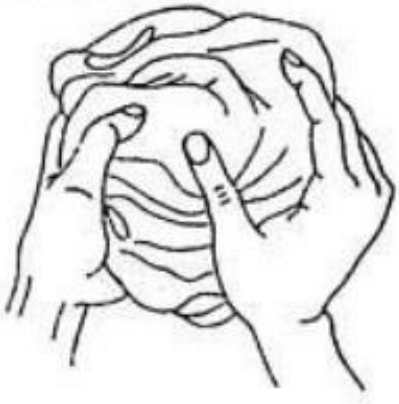
Knot Tying

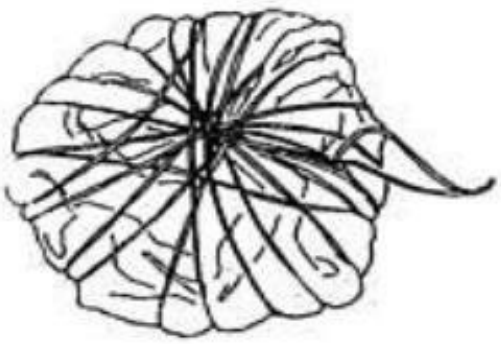


Spirals



Electric Bunching





Dyeing recipe

Pigment dyes-% (depends on shade)
Binder-1-1.5gm/l

Flow chart of Tie dyeing

Shorting garment
↓
Scouring (detergent-1-1.5% at 70°c for 10 min)
↓
Hydro extractor (remove excess water)

Dryer (for drying the garments)
↓
Tie the garments (as per requirement)
↓
Dyeing (garment load onto the dye bath for 15-20 mins)
↓
Bath drain
↓
Rinse (2 times)
↓
Hydroextractor(remove excess water)
↓
Tie open
↓
Dryer (for drying the garments)
↓
Color fixing (1-2gm/l)

***In tie dyeing process there is no way to re process or rematch**

Tie effect on twill garment

We may get tie effect by enzyme wash on a dyed garment. Dyeing may be done by direct or reactive or lava (low reactive dyeing).

Process sequence of tie dyeing wash

Take white garment

Desizing
Soda ash-1-1.5 gm/l
Detergent-1 gm/l
Time-10 min
Temperature-80°c

Neutralization
Acetic acid-.3 gm/l
Time-5 min
Temperature-45°c

Dyeing

Direct dyes
Scarlet BL-.5%
Dark blue GL-.8%
Yellow 2RL-.02%
Salt-20 gm/l
Time-10 min (sample check)

Fixing
Fixing agent-1 gm/l
Time-5 min
Temperature-45°c

Reactive dyes
Red FNR-.05%
Blue FNR-.07%
Yellow FN2R-.8%
Salt-20 gm/l
Soda ash-10 gm/l
Time-10- 15min (sample check)
Temperature-60-70°c

Soaping
Soaping agent (europen R) - 1gm/l
Time-5 min
Temperature-70°c

Lava dyes (low reactive dyes)
Lava yellow-GLF-.6%
Lava ponix GLF-.3%
Lava blue GLF-.02%
Caustic soda-.5 gm/l
Salt-20 gm/l
Soda ash- 10 gm/l
Time-15-20 min
Temperature-50-55°c

Neutralizing
Acetic acid-.5 gm/l
Time-5 min
Temperature-45°c

Soaping
Detergent - 1gm/l
Time-5 min
Temperature-50°c

Hydro extractor (3-5 min)

Dryer for drying
Time-45 min
Temperature-60°c

Tying
Packed by a knit bag

Tie wash effect on pant after garment dyeing

Dip dyeing

If somebody wants to dip dye of a garments need a dip dyeing machine. Tie dyeing makes every garment unique, so garment specialist gives the steps to make any piece of clothing special with the proper way of dip dyeing.

Dip dyeing technique

Materials

- Sheer jersey long-sleeve T-shirt, in White,
- Large plastic storage bin or galvanized-steel bin
- Stir stick
- All-purpose liquid dye
- Sample fabric or paper towel
- Sewing pins
- Synthrapol detergent (optional)

Steps of dip dyeing

Step 1

Wash and dry the fabric or garment to remove any finishes that resist dye. Fill plastic bin with hot water to a depth of at least 6 inches. Stir in dye, starting with a small amount and adding more as desired. Dip a sample strip of fabric or paper towel to test the color. If too dark, add water; if too light, add dye. Let solution settle, so there are no bubbles at the surface.

Step 2

Determine where you want the top of the dyed band to be; use pins to mark that line on fabric. Holding your fabric as straight as possible, dip into dye solution to just below the pin line (make sure you don't dip the pins; the fabric will wick the dye higher). Keep fabric in dye until it turns the desired color (it will dry slightly lighter).

Step 3

Rinse fabric in cold water to remove excess dye until the water runs clear. Hang to dry. If desired, wash item with synthrapol detergent.

Dip dyeing hoody shirt/jacket

Flow chart of Dip dyeing

Shorting garment
↓
Scouring (detergent-1-1.5% at 70°c for 10 min)
↓
Hydroextractor(remove excess water)
↓
Dryer (for drying the garments)
↓
Garment may be wet/ dry state
↓
Apply binder 1-1.5gm/l (Catanizer 2-2.5 gm/l if any)
↓
Dip a sample into the dye bath (as per shade)
↓
Keep garment in dyebath and shake until it turns the desired color
↓
Shaking 15-20 times for 10-15 min
↓
Hanging the garment on the dye bath (5-6 hours)
↓
Curing (80-90°c for 30-40 mins)

* When the garment dry slightly it will lighter. The top of the dyed band is gradually lighter than the bottom part. In dip dyeing face and back side of garment dyed but in spray dyeing only one side is dyed.

Dip dyeing machine

Application

There are two types of dip dyeing machine garment and rope dyeing machine. This type rope form dip dyeing machine is applicable for loose type rope form dip dyeing the acrylic and knitted cotton fabric, such as scouring, dyeing, bleaching, washing, soaping process.

Technical parameter and main specification

1, Dyeing tank working volume:2800L.

2, Capacity of dyeing cotton and knitted fabric:105L

3, Cloth guiding folder block:10 blocks; cloth guiding folder distance:180mm

4, Working width:1800mm.

5, Dyeing tank :2100mm.

6, Machine shape size:L*W*H 3390*3060*2510mm

7, Motor power:1.5KW.

Specifications

Normal temperature dyeing.
Suitable for hank yarn and garment of cotton, silk, acrylic fabric, artificial wool etc.

Purpose:

Under normal temperature, it is suitable for hand dyeing of fabric and hank yarn and garment of cotton, silk, acrylic fabric, artificial wool etc.

Specification of dip dyeing machine:

Model	Output(piece/lbs)	weight(kg)	Head Power Engine(kw)	Power Engine Dyeing Pump(kw)	Speed-reducing(1:60)	Dimension(mm)
DR-50	50/60	250	0	0.55	70type	1220*980*2800
DR-100	100/120	310	1.5	0.55	80type	1220*1860*3000
DR-200	200/250	560	2.2	0.75	100type	2030*2050*3010
DR-300	300/370	800	4	1.1	120type	2840*2300*3010
DR-400	400/500	1000	4	1.1	120type	4320*2300*3010

Spray dyeing

This is one kind of dyeing which give white effect on a specific area of garments. All type of textile & garments are suitable for spray dyeing. It is also called pigment spray. Color pigment paste is used for this type of dyeing. This spray can be water based colours. These are designed and developed

> Bring a new look to home décor, clothing and accessories with Simply Spray fabric paints — the only non-toxic, non-flammable, virtually odorless aerosol paint for fabrics.

In spray dyeing first need select the garment. Mainly ready for dyeing (RFD) is used. In spray dyeing only one side is dyed it may face or back depend on what I want. We may get same effect by dip dyeing but not for all design. We may spray back side of the garment.

Dyeing recipe :(for a standard shade for 15 pieces body)

Black-PABN-20gm
Oxal(fixing agent)-25gm
Pin well (wax/silicone)-15 gm
Nk binder (for pigment)-50gm
Water----------890ml
Total -1000gm(for 15 pieces)

Flow chart of Spray dyeing

Shorting garment (RFD)
↓
Enzyme the garment (.5gm/l at 55°c for 50 mins)
↓
Dryer (for drying the garments at 70-80°c)
↓
Garment wear on dummy
↓
Spray the solution onto the garment
↓
Curing for knit (120°c for 30-40 mins)
↓
Curing for woven (130°-150°c for 30-35 mins)
↓
Binder for color fixing
↓
Softener/Silicone

*In spray dyeing the color effect is visible only the face side of a garment. In side of the garment is not colored. Pigment dyes are suitable for spray dyeing.

Spray dyeing for getting old looking

We may get old looking by spray dyeing. Especially pigment black, yellow, red and so many colors used on a dyeing by spray gun.

Recipe:
White paste-1-2%
Pigment black- 2%
Prinoil(oil to make soft the spray area)- 1-2gm/l
Oxal(fixing agent)-.5-1 gm/l

Flow chart of Spray dyeing
↓
Desizing 1gm/l (10 min at 70°c)
↓
Enzyme .5-1gm/l (20 min at 45°c)
↓
Spray the solution as per recipe onto the garment
↓
Curing for knit (130°c for 35-40 mins)

Binder (3gm/l, 50°c for 5-10 mins) for color fixing

↓

Softener-1-2gm/l and silicone-1-2gm/l

↓

Hydro extractor (remove excess water)

↓

Dryer (for drying the garments)

Spray dyeing T-shirt for getting old

Over Dyeing:

- *Two times garments dyeing are called over dyeing.*
- *First garment is dyed by pigment dyes then direct dyes this is also called over dyeing.*
- *Tinting by any kind of toner is also called over dyeing.*
- *Ready for dyeing (RFD) is dyed by any color is called over dyeing.*
- *Fabric is dyed in any color then make garment without accessories finally after making garment again dyed by same dyes is also called over dyeing*
- *Ready for dyeing(RFD) is printed by suitable technique then dyed by reactive or direct or pigment dyes is called over dyeing*

Over dyeing of a garment with reactive dyes

Dyeing recipe: (for a standard shade)

Reactive black dyes = 0.8 %
Reactive red dyes = 1.0 %
Reactive yellow dyes = 0.05 %
Salt = 30 g/l
Soda = 10 g/l

Flow chart of over dyeing with reactive dyes on undyed garment

Process sequence

Load Garment
↓
Scouring (Detergent-.1-1.5% at 80°c for 10 min)
↓
Anticreasing-.5%+A.Acid-.6%+Leveling-1.5%
↓
Load garment into the dye bath (60°c)
↓
Run for 5 min
↓
Salt = 30 g/l
↓
Run for 5 min
↓
Soda = 10 g/l
↓
Run for 35 min
↓
Shade Check
↓
Bath Drain (BD)
↓
Rinse-1
↓
Rinse-2
↓
Fixing -1gm/l (45°c for 30 mins)
↓
Softener-1-2gm/l and silicone-1-2gm/l
↓
Hydroextractor(remove excess water)
↓
Dryer (for drying the garments)

Flow chart of over dyeing with pigment dyes

Process sequence

Load Garment

↓

Scouring (Detergent-.1-1.5% at 80°c for 10 mins)

↓

Catanizer(2-2.5 gm/l at 60°c for 30 mins)

↓

Rinse (for 5 mins)

↓

Load garment into the dye bath (60°c for 30 mins)

↓

Bath Drain (BD)

↓

Rinse (2 times)

↓

Apply cross binder (to remove unfixed dyes)

↓

Rinse (2 times)

↓

Shade Check

↓

Rinse-1

↓

Softener-1-2gm/l and silicone-1-2gm/l(40°c for 5-10 mins)

↓

Hydroextractor(remove excess water)

↓

Dryer (for drying the garments)

*Pigment dyes is not suitable for deep shade because dyeing cost is not meet, so when deep shade is required garment is tint by direct dyes.

Over dyeing garment

Acid WASHING:

Acid wash is a process in which a garments treated with a bleach solution containing chlorine-soaked stones so that the color becomes faded and the material is softer. In case of acid wash, pumic stones are used. By the action of pumice stones, irregular fading affect is developed on the heavy garments like denims, thick canvas/twill, and sweater. The pumice

stones act a brushing action on the garment fabric surface. Fading affect may be developed on the garment by acid wash technique. Flowchart of acid wash is given below.

Acid washed shirt

FLOW CHART OF ACID WASH

Garments loading in machine

↓

De-size

↓

Extracting the garments

↓

Drying

↓

Soaking of pumice stone

↓

Damp pumice stone

↓

Neutralization the garments

↓

Softening

↓

Extracting the garments

↓

Drying

All the above processes are discussed in the following:

1. **Garments loading in machine:**
   Required amount of garments are loaded in the machine here for de-sizing the garments.

2. **De-size:**
   Required amount of de-sizing agent should be applied here by following M: L ratio. Here, sometimes needed 50-60° C temperature depends on the shade. De-size should be done at least 15-20minutes.

3. **Extracting the garments:**
   After completing de-sizing process, the garments are squeezed here by using hydro-extractor machine and send to the drying section.

4. **Drying:**
   Here the extracted garments are dried by using gas dryer or steam dryer depending on the sahde. It should be noted here that, gas dryer is used for reddish shade and steam dryer is used for bluish shade.

5. **Soaking of pumice stone:**
   The fresh pumice stones are soaked here at room temperature for 10minutes by shuffling using Potassium permanganate ($KMnO_4$) and Phosphoric acid (H_3PO_4) containing the liquor ratio 1:2. Pumice stones are naturally perforated and should pick up the solution very quickly.

6. **Damp pumice stone:**
   Then de-sized garments are treated in the machine with damp pumice stones at room temperature for 15 minutes (depending on the shade).

7. **Neutralization the garments:**
   After completing damp pumice stone process, the garments must be neutralized here by using Sodium meta-bisulphite ($Na_2S_2O_3$) containing the liquor ratio (M: L) for 5minutes (depending on the shade).

8. **Softening:**Here the garments are producing too soft effect by using softening chemical containing liquor ratio (M: L). After completing this process, garments are unloaded from the machine.
9. **Extracting the garments:**
   Here the acid washed garments are extracted and send to the drying section.

10. **Drying:**
    Finally the garments are drying here by using gas dryer or steam dryer depending on the shade.

CHAPTER- 10
IE DEPARTMENT

Work Study:

Work study is the systematic examination of the methods of carrying on activities so as to improve the effective use of resources and to set up standards of performance for the activities being carried out.

Method Study :

Method study is the systematic recording and critical examination of ways of doing things in order to make improvements.

Work Measurement:

Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out a task at a defined rate of working.

Time Study:

Time study is a work measurement technique for recording the times of performing a certain specific job or its elements carried out under specified conditions, and for analyzing the data so as to obtain the time necessary for an operator to carry it out at a defined rate of performance.

Time Study Tools:

To do time study you need to arrange following tools

1. A stop watch
2. Time study format
3. One pen or pencil
4. Time Study board

Work Cycle:
A work cycle is a sequence of elements which are required to perform a job or yield a unit of production. The sequence may sometimes include occasional elements.

Rating:

Rating is the assessment of the worker's rate of working relative to the observer's concept of the rate corresponding to standard pace.

Standard Performance:

Standard performance is the rate of output which qualified workers will naturally achieve without over-exertion as an average over the working day or shift, provided that they know

and adhere to the specified method and provided that they are motivated to apply themselves to their work.
This performance is denoted as 100 on the standard rating and performance scales.

SMV:

SMV is an abbreviation word; it means "Standard Minute Value". In the efficiency report SMV means the total time required for produce garments in sewing section. In sewing section SMV calculating time start from input transfer from input rack to sewing operator all the sewing process up to the final sewing process check.
For a specific process SMV calculation process include:
1. Pickup time: It means the operator when touch the parts up to starting sewing.
2. Stitching time: Is means the time when the garments passing under the needle.
3. Dispose time: Is means the time after finish the stitch the garments take off from the machine thread cutting and pass it to another process.

SMV factor:

- SMV factor is a numerical standard value, which is constant for a specific quantity.
- SMV always calculates on standard qualified worker.
- SMV with factor means SMV multiply by factor.
- So the capacity= $\frac{\text{Total working minutes}}{\text{SMV}}$ X Number of worker in the line

Efficiency:
Efficiency means the capacity of a person or machine or a specific process. It is the combination of different activities are- -Standard time limit -Consumed time.
- Number of employee
- Total input
- Total output
- Denoted variable (Percentage).

To calculate Efficiency there is a specific formula.
Efficiency for a single line= $\frac{\text{SMV} * \text{total output}}{\text{Total worker} * \text{Total working Hour} * 60} \text{x} 100\ \%$

Example: Say,

SMV (Standard Minute Value) = 21.70 Minutes
Specific line total output =1300pcs
Total worker in the line = 85 person
Total working hours =10 hours
1 hour = 60 minute

Efficiency for a single line = $\frac{21.70 * 1300}{85 * 10 * 60}$ x100
=55.314%

Basic Time:

Basic time is the time for carrying out an element of work at standard rating, i.e. (Observed time x observed rating)/ Standard rating

Selected Time:

The selected time is the time chosen as being representative of a group of times for an element or group of elements. These times may be either observed or basic and should be denoted asselected observed or selected basic time.

Relaxation Allowance:

Relaxation allowance is an addition to the basic time intended to provide the worker with the opportunity to recover from the physiological and psychological effects of carrying out specified work under specified conditions and to allow attention to personal needs. The amount of allowance will depend on the nature of the job.

Standard Time:

Standard time is the total time in which a job should be completed at standard performance.

Predetermined Time:

A predetermined time standard is a work measurement technique whereby times established for basic human motions (classified according to the nature of the motion and the conditions under which it is made) are used to build up the time for a job at a defined level of performance.

Work Specifications:

A work specification is a document setting out the details of an operation or job, how it is to be performed, the layout of the workplace, particulars of machines, tools and appliances to be

used, and the duties and responsibilities of the worker. The standard time or allowed time assigned to the job is normally included.

9.1 Flow chart of Working Process

Prepare a machine lay out.
↓
Monitoring the line situation.
↓
Time study and balancing.
↓
Individual operation follows up.
↓
Line wise efficiency, daily report.
↓
Daily lost time analysis

9.2 Benefit of Work Study:

1. It increases productivity at cheap cost.
2. It is a systematic and comprehensive method of analyzing a problem. So low factor is overlook in evaluating the problem and finding out the solution.
3. It can be easily and quickly implemented.
4. It provokes benefit as soon as it is applied and continuous till it is in use.
5. It can reduce hazard by developing made of work.
6. It is the most accurate method of setting time of performance upon which effective planning and production control relies upon.
7. Production quota can be determined for daily or hourly workers.

9.3 Work Study Officer & IE Responsibilities:

- List & Inventories the entire available operator, helper & machine.
- Balance each line hourly production target.
- Prepare daily basis absent report & make a plan to balance. ➢Ensure operation training scheme monthly.

CHAPTER - 11

MERCHANDISING SECTION

What is merchandising?

Merchandising is the promotion of the sale of goods that can employ pricing, special offers, display and other techniques designed to influence consumers' buying decisions. The concept of merchandising is based on presenting products at the right time, at the right place, in the right quantity and at the right price to maximize sales.

Types of merchandising

1. Market merchandising
2. Product merchandising

Market merchandising:

1. Product development
2. Costing

Ordering marketing merchandising is to bring orders costly products development and direct contact with buyer.

Product merchandising:

It is done in the unit. This includes all the responsibilities all from scouring to finishing. i.e: 1st sample onward, the product merchandishing work starts to end till shipment.

Merchandising strategies

When it comes to merchandising strategies, a "one size fits all" approach won't suffice. Depending on the overarching objective for the retailer, brand, and category, the merchandising strategies should vary by category or even by segment to target a specific goal, such as developing customer loyalty, increasing sales, raising awareness of your brand, and so on.

In a retail setting, some of the most popular methods to compel shoppers to buy include:

1. Interactive displays that use scent, sound, and motion technology
2. In-store and window displays in unique shapes
3. Shelf signage
4. Creating themes to bundle products together (e.g. school lunch, barbecue season, Christmas, etc.)
5. Free tasting sessions and in-store demonstrations
6. Giveaways and samples
7. Well planned, eye-level product placement
8. Well-stocked shelves and displays

Duties and responsibilities of a merchandiser

Merchandiser always tries to give his best efforts to the exporting garments. Here, I like to list the principle duties and responsibilities of a merchandiser. They are-

1. The main duties of a merchandiser are to fulfill the demand of a garment buyer.
2. At first, take an export order from the buyer.
3. To make a time schedule for export those garments as per exporting date.
4. To make sample for the export order from a factory.
5. If the sample approved then order for bulk production.
6. All the materials should be arranged which is required for manufacturing garments.
7. To inspects quality of the products as a buyer.
8. A merchandiser calculates the consumption of fabric and YPD.
9. The merchandiser also calculates thread, button, interlining, label, poly bag, cartoon and other accessories required for a full garment export.
10. Merchandiser sometime sourcing the fabrics.
11. He also sourcing the accessories.
12. The merchandiser follows up the full production process.
13. Another main duty of the merchandise is to calculate the costing of garments.
14. Merchandise analyses and planning the garment production.
15. Merchandiser should concern about the shipment date of the fabric.
16. Merchandiser arranges the pre shipment inspection schedule.
17. Merchandiser makes the shipment documents.
18. To collect the payment is also a big dealing of a merchandiser.
19. It is also important to calculate the profit by exporting the products.
20. All the activities of the merchandise are to deliver quality products to the buyer. So, there are lots of duties of a merchandiser. One should consider the above steps to be a good merchandiser.

Process flow chart of apparel or garments merchandising

Order received from the buyer with details

↓

Sample development

↓

Price negotiation with the buyer

↓

Confirmation of order and receive the order sheet

↓
Make buyer requirement sample (Fit, Proto etc) for approval
↓
Make requisition for bulk fabric
↓
Make requisition for accessories
↓
Swatch board making and approval
↓
Raw material collection and also receive it in factory
↓
Check and also listing
↓
Make P.P (pre production sample) with all actual
↓
Pre-production meeting
↓
Start bulk production
↓
Collect daily production and quality report
↓
Make online inspection by strong quality team
↓
Sample sent to third party testing centre
↓
Make final inspection for bulk production
↓
Shipment
↓
Send all documents to the buyer
↓
Receive payment from bank

Benefits of merchandising

Since merchandising is all about selling, the ultimate benefit of effective merchandising is higher sales and better profit. Stores that manage to create a seamless shopping experience and effectively guide consumers to purchase completion, enjoy an array of benefits including:

1. Higher profits
2. More satisfied shoppers
3. More engaged buyers (longer on-site time)
4. Faster inventory turnover
5. Increased brand loyalty
6. Increased brand recognition

CHAPTER- 12
INVENTORY MANAGEMENT

Inventory: Inventory is the stock of any item or resources used in an organization.
Fabric storage: Supplied grey fabrics are first subjected to the 4 point inspection system. Only those goods are stored here which are passed from the quality control department. Defected fabrics are store in rejected area and then back to the supplier.

Types:
Here exists 3 types of store.

1. General store.
2. Fabric store.
3. Accessories store.

Fabric inventory:
Various types of fabric and accessories such as sewing thread, button, interlining, zippers, label etc are stored in a room. Here also machine parts and stationary are stored in store room.
Accessories: The materials which are not attached with the body of garments by sewing, only used for garments finishing and packing (decorative purposes) are termed as accessories. The main difference between trimmings and accessories is, trimmings are used as functional.

Accessories inventory items:

LABEL : Labels are the most important trimmings by which customer easily know about the product. Here two types of label are available.
1. Main label: It contains the name of the buyer and country.
2. Sub label:
a) Size label: It contains the size of the garment.
b) Care label: It contains care construction. Different types of care label are given below.
1) Washing Code
2) Bleaching Code
3) Ironing Code 4) Dry cleaning Code etc
c) Composition: It contains fiber composition of the fabric. Ex: 65% cotton, 30% polyester, 5% lycra.

Sewing Thread: Different types of sewing threads are available in store room. Such as, a) 20/2
b) 20/3
c) 20/9 (Used in eyelet and bar tack m/c)
d) 40/2 (Most thinnest thread).
Button: Buttons are hardware items used in junction with buttonholes for the fastening of garments.

Purpose:

The purposes of using buttons are:
A) Functional purpose:
This referee to buttons which are used to open and close garments with security.

B) Decorative purpose:
These are buttons which are used purely for decorative purpose .for example, Sleeve vents.Types of buttons:

Zipper:
This is one kind of trimming which is use open and close of special parts of garments.
Purpose:
Functional:
Functional purpose of zipper is as a part of a garment here zipper is used to open and close the openings.

Decorative purpose:
Where zipper is used as a decorative purpose, it increases the beauty of garments.
Uses:
In making trousers and jackets , chain or zipper is in essential component which is used to open.
Types of zipper:
According to manufacturing material there are 3 types of zipper.
1. Metal zipper:
Metal zipper is used in trousers and shorts.
2. Nylon zipper: Polyester or nylon zipper are used in jackets .It is made from a continuous filament paced onto narrow fabric tape.
Slider:
It is move up and down. Function of slider is to engage or disengage the teeth of opposite sides of chain.
Slider mainly three types they are:- 1.
Non –locking.
2. Semi-looking.
3. Full or auto locking. or close of special parts of garment.

10.5 Interlining:
Interlining are used to support reinforce and control the shape of some areas of garments such as collar, cuffs, waist bands ,facings and in front of corts .They may be sewn into the garments or they may be attached by the fusing .Nowadays sewn interlining are hardly used and usable interlinings are widely used.
Interlining is available in a wide variety of weights and constructions to mach the fabric of garment. They can be woven non -woven product .Woven interlining are most commonly of plain weave construction, whereas non-woven interlining are made directly from textile fibers.

CHAPTER- 13

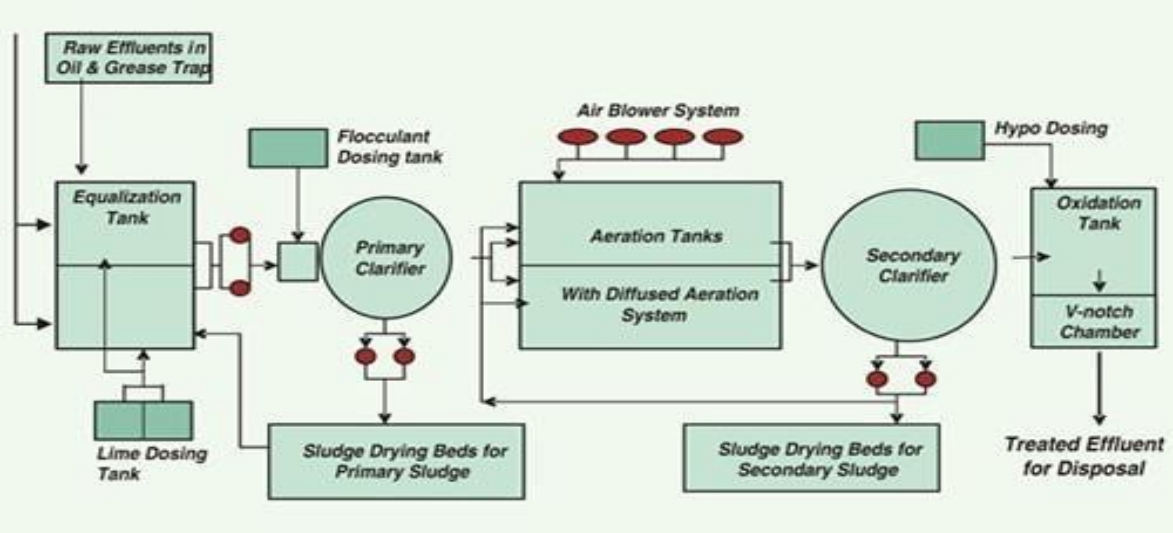
EFFLUENT TREATMENT PLANT (ETP)

ETP plant is very important for our environment. By reusing water we can save our environment. The effluent is treated here by lime & acid. Sometimes poly aluminum chloride is used instead of lime. The PH of outlet water is 7.01 & the PH of entering water of boiler.

Effluent in the artificial sense is generally considered to be water pollution, such as the outflow from a sewage treatment facility or the wastewater discharge from industrial facilities. In textile and wet processing industry use different types of dyes and chemicals in the operation of weaving, dyeing, printing, finishing and garment washing plant. This wastewater is treated in effluent treatment plant (ETP).

Textile wastewater is the main source of organic contamination regarding pollution within the textile industry. Several cleaning processes may be used to remove organic pollutants from textile waste water. In general, we distinguish between physical methods (adsorption, filtration methods, coagulation and flocculation processes), chemical methods (oxidation, advanced oxidation, Fenton's reagent) and more recently, more attractive biological treatment (anaerobic, aerobic) as an effective option for relatively inexpensive effluent de-coloration. Non-destructive physical techniques just transfer the pollutants to other mediums (sludge, concentrate in filtration techniques) and cause secondary pollution.

Process sequence of effluent treatment plant (ETP) in wet processing:



Primary filtration

↓

Cooling & Mixing

↓

Neutralization by acid/alkali dosing

↓

Chemical coagulation

↓

Setting & separation of sludge

↓

Bio-degradation

↓

Again setting & separation of sludge

↓

Sludge pit

↓

Filtration

↓

Discharge to drain

Primary filtration:

Waste liquor after pretreatment, dyeing, printing and finishing is subjected to primary filtration in which removal of gross solids, such as waste threads, fabric pieces, lint's etc. takes place.

Cooling & Mixing:

After primary filtration, the liquor passes to cooling and mixing tank in which uniform mixing of effluents from various process takes place. A paddle mixer is provided for mixing. Cooling of the effluent may be done with the help of cooling tower.

Neutralization:

The effluent is pumped to a tank in which it is neutralized by acid or alkali dozing. The tank has an automatic dosing controller which at automatically control the dose of acid or alkali to maintain the required pH.

Coagulation:

Then the effluent is pumped to the coagulation tank. Chemical coagulation very effective for removal of color and suspended materials, aluminum, ferrous sulphates, ferric chloride, chlorinated copper etc. to increase the efficiency of coagulation, coagulation gain may be added for example polyacrylate.

Setting & separation of sludge:

Some of the soluble organic matter and light suspended solids will form a blanket of flocculent matter with the coagulants. The blanket is skimmed off to another tank and the remaining solution is moved to pressure filter.

Pressure filter:

For pressure filtration vacuum pumps may be used to force through the filter and suspended flocks are collected in the pressure fine filter.
After filtration the purified water sent to drain which eventually reach to the river or

Discharging to drain:

anywhere else.

CHAPTER- 14
UTILITY SERVICE

UTILITY SERVICES

Power & Utilities Section

Description of m/c	No of m/c	Cpacity
Generated Power		
Prime power generated , Cruascar Gas Generated Model: FGLD 480 Origin : Spain	1 Unit	636KW
Stand by : Diesel Generator, Puma Origin : England	1 Unit	140KW
Sub station		1000kAV
Total connected load		1776kw
Air Compressor		
Kaiser Screw Compressor, Model: AS44,30 KW,4M3/MIN. each	2 Units	8M3 /MIN
Omgersp: Rand Reciprocating Compressor Model: SSR ML 5057.5kW CAPACITY of air discharge	1 Unit	8M3 /MIN
Ingersol Rand Reciprocating Compressor Model : 3000.22 kW	2 Units	4.40 M3/MIN
SWAN Reciprocating Compressor, Model: C4080,10 kW		1 M 3/MIN
Total air discharge capacity		251.4M3/MIN

Description OF Water Pump	**No. of m/c**	**Capacity**
Centrifugal pump for water supply to dyeing & others Section	1	100 m^3/h
20HP pedrollo pump each pump, 1000L/min flow rate	4 Unit	4000L/min
20HP pedrollo pump each pump,600L/min min flow rate	1 Unit	600 L/min
5.5HP pedrollo pump each pump,350L/min min flow rate	1 Unit	350 L/min
Spare Pump motor Pedtollo 20HP	1 Unit	1 L/min 000
Boiler		
Ciever Brooks Boiler 10 tons/hr	1 Set	

Prime power Generator:

- Brand name: GUASCOR

- ORIGIN: Spain
- Model: FGLD
- Stand by voltage; 380 kw,795 KVA
- Prime voltage: 636KW,1208 KVA

Diesel Generator:

- Brand name; KOMATSU
- Origin: Singapore
- Model: EGS630-3
- Stand by voltage; 440 kw,550 KVA
- Prime voltage: 440KW,550 KVA
- Phase: 3
- Weight5: 3 □3800kg

Boiler:

- Brand name: Cleaver Brooks
- ORIGIN: U.S.A
- Model: CB700-650
- SL No: L94002
- Max. pressure:200 psi

CHAPTER -15
MAINTENANCE

MAINTENANCE
Objective of maintenance

1. To keep the factory plants, equipment ,machine, tools, in the optimum condition.
2. To ensure specified accuracy to product and the schedule of delivary to customer.
3. To keep the downtime of machines miniumthes to have control over the production program.
4. To keep the production cycle within the stipulated range to modify the machine tools to meet the need for production.

Maintenance Tools, Equipments& their function:

Name of Tools Functions

Hammaer	To give shape
Slide Wrench	Tightening & opening bolt
Spanner	Tightening & opening bolt
Pliar Cutting Holding, Joining Wire Hacksaw	Cutting
Pipe Wrence Tightening, opening, gripping pipe Chisel	Shaping, cutting
File	Shaping
Clamp	Griping

Name of Equipments Functions:

Grinding m/c	Grinding
Cutting m/c	Cutting
Drill m/c	Drilling
Lathe m/c	To make something
Shaping m/c	Shipping

Shaping Bending **MAINTENANCE PROCEDURE:**

Normally preventive maintenance is used. During Maintenance period following points should be checked

CHEKCK LIST OF DIFFERENT PARTS

Maintenance :
Mechanical
Machine ;
Dueing

SL.Items need to be checked & serviced

1. Grease the m/c bearing.
2. Complete cleaning of m/c
3. Cleaning of drain valves, replace seals if required.
4. Check air supply filters, regulators auto drain seals.
5. Clean filters element & blow out.
6. Greasing of unloading roller bearing.
7. Checking of oil level and bolts unloading roller gearbox.
8. Checking of unloading roller coupling and packing.
9. Checking and cleaning(if required) of main vessel level indicator
10. Check the oil level of pump bearing and refill if required.
11. Check the function of heat and cool modulating valvas.Check all door seals.

MAINTENANCE: ELECTRICAL
MACHINE: DYEING MACHING
SL. ITEMES NEED TO BE CHECKED & SERVICED

1. Check& clean fluff & dirt at drit at all motor fan covers.
2. Check all motors terminals.
3. Check main panels (by using compressed air).
4. Check penel cooling fun and clean its filter.
5. Clean main pump invertor and its cooling fun.
6. Check all circuit breaker, magnetic conductors and relays.
7. Check current setting of all circuit preacher and motor over load.
8. Visual checking of all power and control cables.
9. Check all pressure switches.
10. Check calibration of main vessel and all addition tank.
11. Check all pneumatic solenoids.
12. Check calibration of heating or cooling modulating valve.
13. Check setting of tangle sector.
14. Check setting and operation of lid safely switches.
15. Check all emergency switches.
16. Check all on/off switches.
17. Check all indicating lamps.
18. Check all signal isolators.

CHAPTER-16
COMPLIANCE

Compliance means conformity of certain standard PPC maintain a moderate working condition for their employees. Though it is well established project , there is some lacking of proper compliance issues. Here is list of compliance in which some points are maintained fully and some are partially

- Compensation for holiday
- Sexual harassment plicy
- Child labor abolition policy
- Anti-discrimination
- Zero abusement
- Working hour
- Hiring/recruitment
- Environment
- Security
- Buyers code of conduct
- Health care and safety committee
- Canteen
- Equal remuneration
- National holiday
- Overtime register
- Labor welfare
- Weekly holiday fund
- Time care
- Accident register
- Workman register
- Leave with wag
- Children Day Care

Health:

- Drinking water at least 4.5 L/day/employee
- Cup availability
- Drinking water supply
- Water cooler, heater available in canteen
- Drinking water signs in Bangla and English locate min 20 feet away from work place
- Drinking water vassal clean at once in a week
- Water center in chage person with cleanliness
- Suggestion box register

- **Toilet:**
- Separate toilet for woman and men
- A seat with proper privacy and lock facility
- Effective water sewage system
- Soap toilet

- Water tap
- Dust bins
- Toilet white washed one in every four month

- Daily cleaning log sheet
- No-smoking signs
- Ladies/gents toilet signs both in bangle and English
- Deposal of wastes and effluent

Fire:

- Sufficient fire extinguisher and active
- Access area without hindrance
- Fire signs in both languages
- Fire certified personal photo
- Emergency exit

- **Safety Guard:**
- Metal glows on good conditions
- Rubber mats and ironers First aid box one
- Ironers wearing sleepers
- First trained employees
- Motor/needle guard
- Eye guard
- Doctor
- Medicine
- Welfare officer

- **Others:**
- Room temperature
- Lighting facilities

FIRST AID BOX

DOCTOR

FIRE TRAINING

CHAPTER- 17
PRINTING

Textile Printing:

Textile printing involves the production of a predetermined coloured pattern on a fabric, usually with a definite repeat. It can be described as a localised form of dyeing, applying colorant to selected areas of the fabric to build up the design. Textile Printing, like**Textiledyeing**, is a process for applying color to a substrate. However, instead of coloring the whole substrate (cloth, carpet or yarn) as in dyeing, print color is applied only to defined areas to obtain the desired pattern. This involves different techniques and different machinery with respect to dyeing, but the physical and chemical processes that take place between the dye and the fiber are analogous to dyeing.

Fig: Textile printing

A Typical Printing Process Involves the Following Steps:

Color paste preparation:

When printing textiles, the dye or pigment is not in an aqueous liquor, instead, it is usually finely dispersed in a printing paste, in high concentration

Textile Printing:

The dye or pigment paste is applied to the substrate using different techniques, which are discussed below:

Fixation:
Immediately after printing, the fabric is dried and then the prints are fixed mainly with steam or hot air (for pigments). Note that intermediate drying is not carried out when printing carpets (too much energy would be needed for removing the highly viscous liquor)

After-Treatment:
This final operation consists in washing and drying the fabric (it is not necessary when printing with pigments or with other particular techniques such as transfer printing).

Pigment Printing:
Pigment printing has gained much importance today and for some fibers (e.g. cellulose fibers) is by far the most commonly applied technique. Pigments can be used on almost all types of textile substrates and, thanks to increased performance of modern auxiliaries, it is now possible to obtain high-quality printing using this technique.

Pigment printing pastes contain a thickening agent, a binder and, if necessary, other auxiliaries such as fixing agents, plasticizers, defoamers, etc.

White spirit-based emulsions, used in the past as thickening systems, are used only occasionally today (mainly half-emulsion thickeners).

After applying the printing paste, the fabric is dried and then the pigment is normally fixed with hot air (depending on the type of binder in the formulation, fixation can also be achieved by storage at 20°C for a few days). The advantage of pigment printings that the process can be done without subsequent washing (which, in turn, is needed for most of the other printing techniques).

Printing Paste Preparation

Dye Printing process traditionally starts with the preparation of the paste. Compared to pigment printing, the composition of the pastes is more complex and variable, being determined not by the dye used, but by theprintingt echnique, the substrate, the application and the fixation methods applied.

Apart from the dye, printing pastes contain a thickening agent and various other auxiliaries, which can be classified according to their function as follows:

- Oxidizing agents (e.g. m-nitrobenzenesulphonate, sodium chlorate, hydrogen peroxide)
- Reducingagents (e.g.sodium dithionite, formaldehyde sulphoxylates, thiourea dioxide, tin(II) chloride)
- Discharging agents for discharge printing (e.g. anthraquinone)

- Substances with a hydrotropic effect, like urea
- Dye solubilisers, which are polar organic solvents like glycerine, ethylen glycol, butyl glycol, thiodiglycol, etc.
- Resists for reactive**resistprinting**(e.g. sulphonated alkanes)
- Defoamers, (e.g. silicon compounds, organic and inorganic esters, aliphatic esters, etc.).All the necessary ingredients are metered (dosed) and mixed together in a mixing station. Since between 5 and 10 different printing pastes are usually necessary to print a single pattern (in some cases up to 20 different pastes are applied), in order to

- reduce losses, due to incorrect measurement, the preparation of the pastes is done in automatic stations. In modern plants, with the help of special devices, the exact amount of printing paste required is determined and prepared in continuous mode for each printing position, thus reducing leftovers at the end of the run.

It is common practice in many printing houses to filter the printing pastes before application, using for example a filter cloth. This operation is especially important for thickeners to prevent free particles from blocking the openings of the screens.

Printing (Paste Application)

After preparation, the paste is applied to specific areas of the textile using one of the following techniques:

- Direct printing (which also includes digital and**transferprinting**)▪**Dischargeprinting**▪**Resistprinting.**

In the case of direct printing the dye is applied to specific areas of a pretreated textile substrate, which can be white or pre-dyed (in light colours).

Printing Processes:

There are five main**methodsofprinting**a fabric, these being the block, roller, screen, heat transfer and**ink-jetmethods**. The heat transfer method differs from the others in that it involves the transfer of color from the design printed on paper through the vapour phase into the fibres of the fabric. With the other methods the dye or pigment is applied to the fabric surface through a print paste medium. The ink jet printing process however is a comparatively recent innovation and is referred to as a 'non-impact' method, because the print paste is fired on to the textile from a jet which is not actually in contact with the fabric.

All Over Printing Another name of possibilities for the country's growing textile industry is 'All Over Printing' (AOP). Demands are increasing day by day in this sector as per expectation. Although rotary, flat bed, screen printing were used before, nowadays the digital inject 'All Over Printing' has been added with them. With the change of era, people's attitude, choice & demand also changes. All over printed clothing are getting priority to the fashion conscious young people day by day. It has acceptance for all in every season. Shirts, tall Gowns, tank tops, punjabi, denim shirts and jeans, woven pants, home textiles etc. are being made largely with all over print.

Figure 1: Bangladesh is successfully delivering AOP products for many global fashion brands.
AOP demand trend

The current shoppers are quite fashionable. So the garments manufactures are also making garments keeping fashion in the mind. New technologies are developing through which it is easy to work. When a printing machine print full width fabric with its impression it is call

AOP. Usually in case of AOP fabric is cut after printing. All over printing is one type of printed clothing

that is attracted by buyers of all ages. Due to having its colorful design, it's used almost in every program.

Figure 2: Demand for AOP fashion is to remain strong in coming days.

There are various types of printing processes in the industry. Screen print, rotary screen, flat bed, digital ink jet all over, sublimation (transfer) ink jet print etc. All of these could be used in AOP. Most of the AOP companies in Bangladesh are using rotary screen printing machinery. There is digital machinery as well. The cost of digital AOP machinery is usually ten times higher than rotary or flat beds. But the production cost in digital ink jet printing machinery could be cost effective is sustainability and environmental issues are considered. However biggest benefit of digital machine is flexibility, robustness, fast batch/design changing capacity. Though the digital printing cost is more, color combination can be done as desired. There is no problem to create screen.

Synthetic fabric is printed by the sublimation process. Transfer printing technology is also used in AOPs. The number of screens which are used in the rotary or flat beds is limited.

"The tendency of the young generation of the country or the western country is now towards fusion fashion. Fashion lovers want to get out of the traditional style and wear new things. In

this case, currently they are giving more importance to the all over printed designed garments", said Rifat Jaman, an AOP marketer.

The demand of All over print (AOP) is increasing around the world. New York Fashion Week recently featured a runway show parading pieces of clothing made of digitally printed textiles. The show had also been done in the United Arab Emirates. It has been presented with various diversified and attractive designer clothing of All Over Print. The fashion houses of our country (Aarong, Kay Craft, Cats eye, BishwoRang etc.) have emphasized on all over print. The different show is being organized in the capital.

AOP garment could easily be washed after sewing and so another stage of value addition is possible. Older looked faded all AOP garments are hot in fashion market. The demand is to remain strong in coming days.

Digital AOP:

Conventional print creates huge bunch of effluents which are hazardous for the ecosystem and even for the human being. The technology makes possible to have faster production cycles, to reduce the water consumption. That's why, digital inject All Over Printing is becoming very popular day by day due to the less environmental impact.

Nowadays, consumers want to change frequently and give them a much greater individual touch. There is scarcely any other technology that combines brilliant colors, wonderful designs and production on demand with low resource utilization. Currently, 60 percent of digitally printed textiles are produced in Bangladesh, India, Indonesia, Pakistan and Vietnam. Due to the increase in demand, many of the factories in Bangladesh are opening digital 'All Over Printing' section along with conventional. New jobs are also being created in the different houses with attractive salary.

Figure 3: Projected Digital AOP Clothing Market Size in Value (USD in Billion)

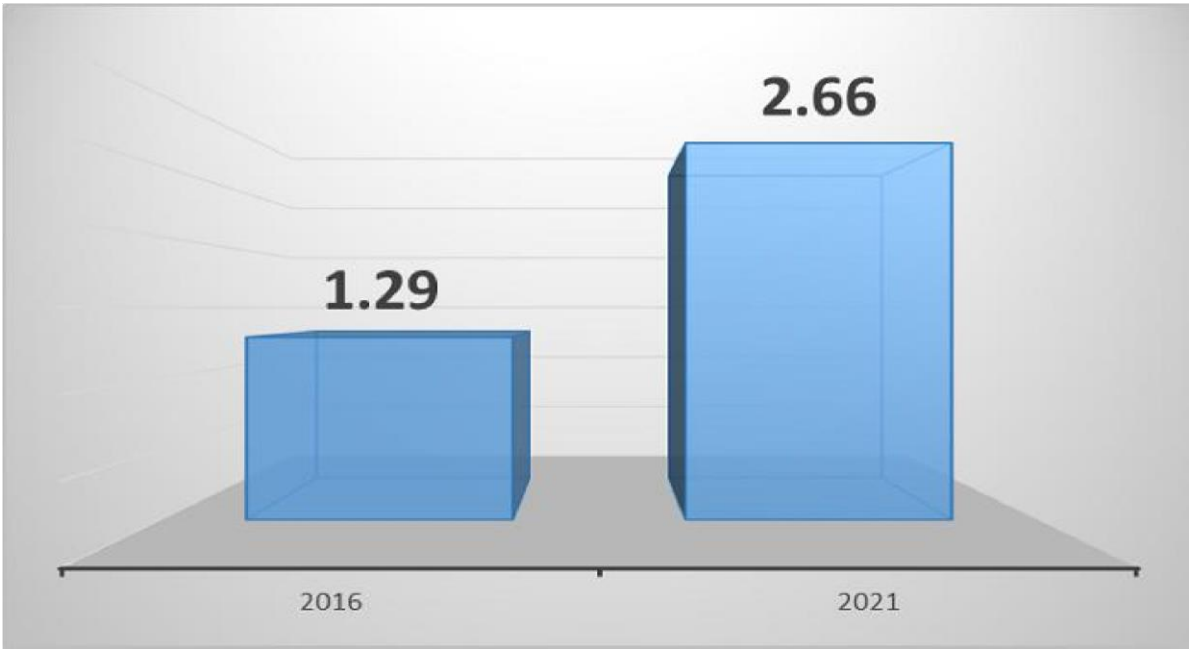
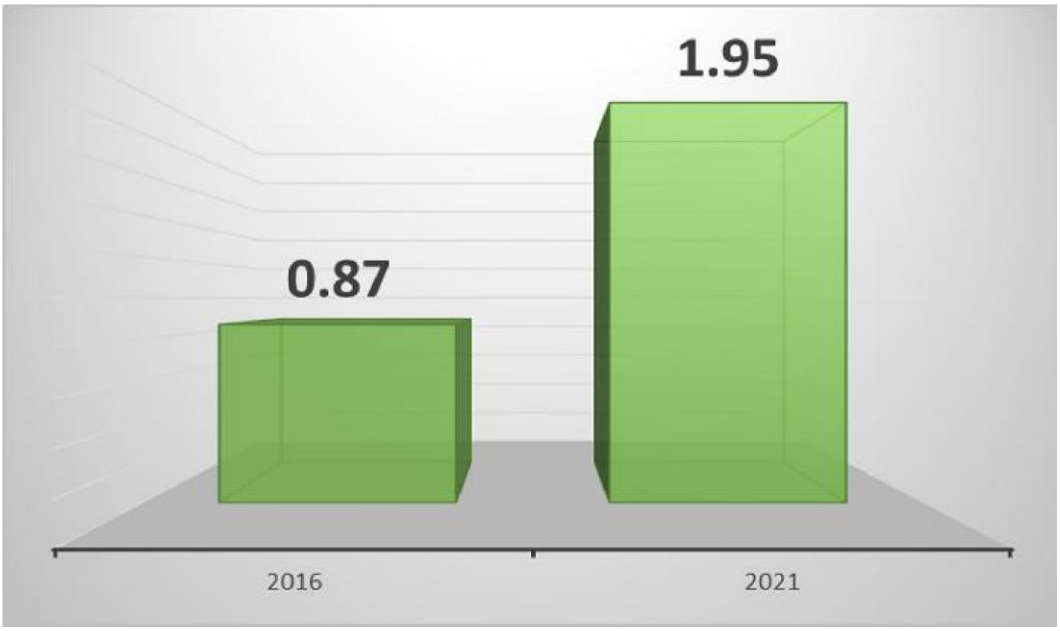


Figure 4: Projected Digital AOP Clothing Market Size in Volume (Billion square meters of fabric)



According to the UK-based market research firm Smithers Pira report on "TheFuture of Digital Textile Printing to 2021", the future of digital textile printing to 2021 confirms that

this industry segment will continue to see double digit strong growth across the 2016-2021 period. Its exclusive data shows that a total of 870 million square meters of fabric were

printed on digital equipment in 2016 and was worth US $1.29 billion. This volume is expected to increase a rate of 17.5% CAGR across the next five years to 2021, consuming nearly 1.95 billion square meters in that year and a market value of US $2.66 billion. This rapid and lucrative market expansion is being fuelled by a series of factors – including technical innovations and evolving end-user demands – all of which are examined and quantified in full in this report.

AOP as a career:

There was a time when the newly graduate students wanted to work in dyeing, knitting, spinning or garments section. They thought that without joining those sectors, career growth is not possible. But now choices have been changed because of the changing era. Graduate students are choosing the printing sector as profession. It's too much a challenging sector like medical or journalism. But if anyone is persistent towards the goal, he/she will be successful in this sector soon.

Barriers

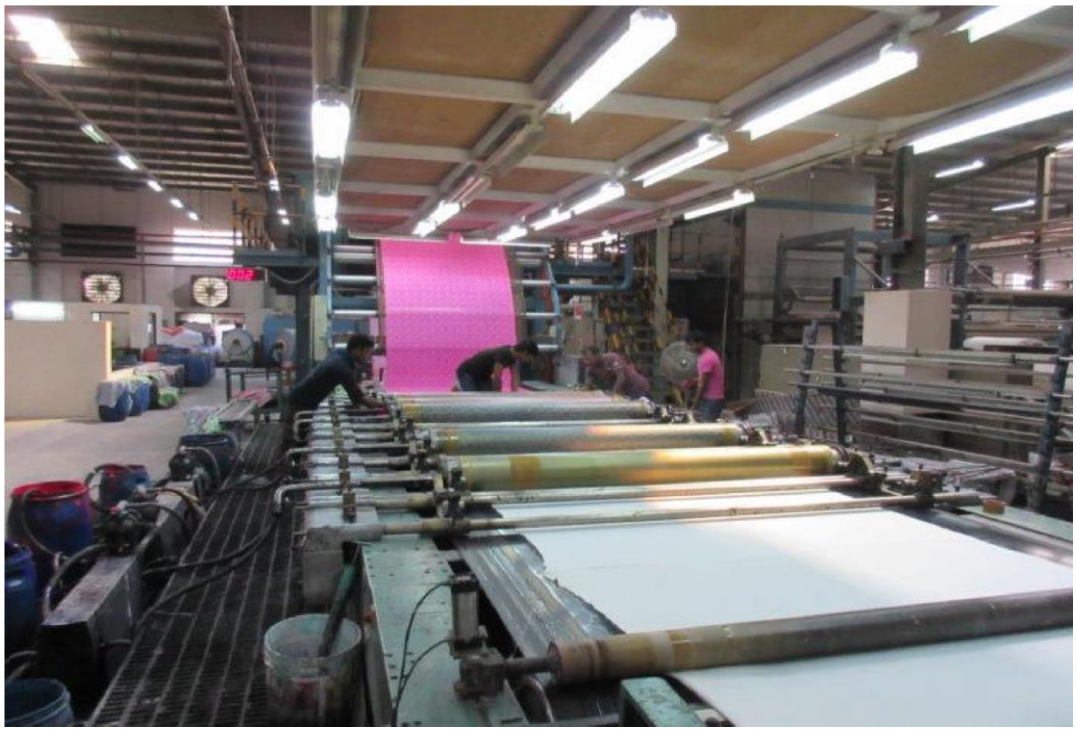
Being one of the major exporters of garments with the huge growth and success in this sector, Bangladesh needs to solve the problems of printing industry to generate more revenue. The textile printing raw materials are directly imported from abroad. There are no manufacturing companies & solution providers in this country who can make printing solutions.

Besides, there is a lack of adequate technology and skilled manpower in the country's textile printing industry according to the needs. For this reason, a lot of orders are refused every year in Bangladesh. Many foreign experts are directly or indirectly involved in this sector. Another disadvantages are the inadequate opportunities for research and development, insufficient gas, electricity, improved infrastructure etc. Even there is no world-class textile printing studio, development company or training center in the country to support manufacturers to get hands on experience on printing products.

Recently a reputed printing solutions manufacturers and distributors DCC India opened a branch office in Dhaka. DCC is one stop printing equipment providing company. Many of our country's leading industrial establishments – Square Group, Liz Group, Masco Group, Knit Concern, Metro Group, Padma Textiles, Fortis Group, Mondol Group etc. are among the big-name producers and exporters involved in large scale digital printing.

Refat Jahan, Senior Executive of a reputed textile company named Hams Group (printing marketing) said, "Now the demand & popularity of all over print is increasing like washing. But the number of technical personnel in this sector is not very much. A few textile engineers are working here which is very less than requirements. It is very important to learn the total working procedure of this sector including the chemical functions in details. Abright future is waiting for all if the goal remains fixed in this sector."

Figure 5: Inside of a Bangladeshi ‘All Over Printing’ factory.



For Bangladesh, All Over Printing (AOP) is a growing sector in Bangladesh. A considerable number of experts have been developed here. Bangladesh can meet any quality demand in this. However, Bangladesh is behind in terms of digital printing in compared to India or China. If the sector can get proper patronization, investment and focus, Bangladesh will govern in the printing sector like denim or jeans across the world. In this case, the entrepreneurs, industry owners as well as the government have to work together keeping hand on hand. Have to take real and effective initiatives too. Only then Bangladesh will go ahead further to fulfill the dream of exporting 50 billion dollars by 2021.

IFFERENT TYPES OF PRINTING METHOD

BlockPrinting:

The blocks are usually made of wood and the design is hand carved, so that it stands out in relief against the background surface. The print paste is applied to the design surface on the

block and the block then pressed against the fabric. The process is repeated with different designs and colours until the pattern is complete.

Block Printing

Block printingis a slow, laborious process and is not suitable for high volume commercial use. It is a method still practised in the oriental countries where markets exist for the types of printed fabrics produced.

Roller Printing:

Roller printinghas traditionally been preferred for long production runs because of the very high speeds possible. It is also a versatile technique since up to a dozen different colours can be printed simultaneously. The basic roller printing equipment, shown in below figure, consists of a number of copper faced rollers in which the design is etched. There is a separate printing roller for each colour being printed. Each of the rollers rotates over the fabric under pressure against an iron pressure roller. A blanket and backing cloth rotate over the pressure roller under the fabric and provide a flexible support for the fabric being printed. A colour doctor blade removes paste or fibres adhering to the roller after contact with the fabric. After the impression stage the fabric passes to the drying and steaming stages.

Roller Printing

Screen Printing:

This type of printing has increased enormously in its use in recent years because of its versatility and the development of rotary screen printing machines which are capable of very high rates of production. An additional significant advantage is that heavy depths of shade can be produced by screen printing, a feature which has always been a limitation of roller printing because of the restriction to the amount of print paste which can be held in the shallow depth of the engraving on the print roller. Worldwide, some 61% of all printed textile fabric is produced by the rotary screen method and 23% by flat screen printing.

There are two basic types of screen printing process, the **flat screen printing** and the **rotary screen printing** methods.

Heat TransferPrinting:

Transfer printing techniques involve the transfer of a design from one medium to another. The most common form used is heat transfer printing in which the design is printed initially on to a special paper, using conventional printing machinery. The paper is then placed in close contact with the fabric and heated, when the dyes sublime and transfer to the fabric through the vapor phase.

Ink-Jet Printing:

There has been considerable interest in the technology surrounding non-impact printing, mainly for the graphic market, but the potential benefits of reductions in the time scale from original design to final production has led to much activity in developing this technology for textile and carpet printing processes. The types of machines developed fall into two classes, drop-on-demand (DOD) and continuous stream (CS).

Carpet Printing :

The printing of carpets only really achieved importance after the introduction of tufted carpets in the late 1950s. Until then the market was dominated by the woven Wilton carpets and Axminster designs were well established, but by the 1980s tufted carpet production accounted for some 80% (by area) of UK production. Much of this carpet production was printed

because the range of patterns possible to produce using tufting machines was limited and there was a desire to produce a greater flexibility of design for these types of carpet.

Warp Printing:
The printing of a design on the sheet of warp yarns before weaving. The filling is either white or a neutral color, and a grayed effect is produced in the areas of the design.

Resist Printing:
A printing method in which the design can be produced: (1) by applying a resist agent in the desired design, then dyeing the fabric, in which case, the design remains white although the rest of the fabric is dyed; or (2) by including a resist agent and a dye in the paste which is applied for the design, in which case, the color of the design is not affected by subsequent dyeing of the fabric background.

Photographic Printing:
A method of printing from photoengraved rollers. The resultant design looks like a photograph. The designs may also be photographed on a silk screen which is used in screen printing.

Pigment Printing:
Printing by the use of pigments instead of dyes. The pigments do not penetrate the fiber but are affixed to the surface of the fabric by means of synthetic resins which are cured after application to make them insoluble. The pigments are insoluble, and application is in the form of water-in-oil or oil-in-water emulsions of pigment pastes and resins. The colors produced are bright and generally fat except to crocking.

Blotch Printing:
A process wherein the background color of a design is printed rather than dyed.

Burn-OutPrinting:
A method of printing to obtain a raised design on a sheer ground. The design is applied with a special chemical onto a fabric woven of pairs of threads of different fibers. One of the fibers is then destroyed locally by chemical action. Burn-out printing is often used on velvet. The product of this operation is known as a **burnt-outprint.**

Direct Printing:
A process wherein the colors for the desired designs are applied directly to the white or dyed cloth, as distinguished from discharge printing and resist printing.

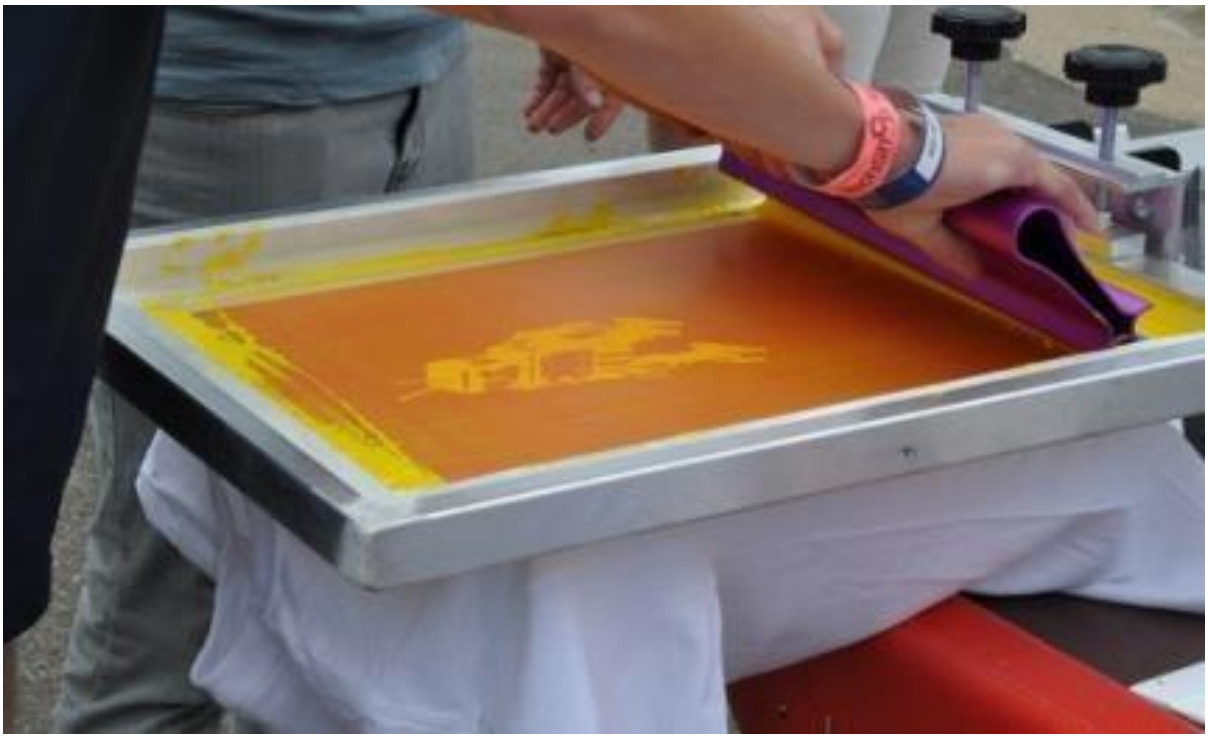
Discharge Printing:
In “white” discharge printing, the fabric is piece dyed, then printed with a paste containing a chemical that reduces the dye and hence removes the color where the white designs are

desired. In “colored” discharge printing, a color is added to the discharge paste in order to replace the discharged color with another shade.

Duplex Printing:
A method of printing a pattern on the face and the back of a fabric with equal clarity.

Printing Style

A process for producing a pattern on yarns, warp, fabric, or carpet by any of a large number of **printing methods.** The color or other treating material, usually in the form of a paste, is deposited onto the fabric which is then usually treated with steam, heat, or chemicals for fixation.



Printing Style

There are three different **printing 'styles'** used to produce patterned effects on textiles, these being termed as:

1. Direct Printing Style
2. Discharge Printing Style
3. Resist Printing Style

Each of these will be described in turn.

Direct Printing Style

This method involves the direct application of the colour design to the fabric and is the most common method of textile printing. The dyes used for direct printing are those which would normally be used for a conventional dyeing of the fabric type concerned.

Discharge Printing Style

In this method the fabric is pre-dyed to a solid shade by a traditional dyeing process and the colour is then destroyed locally, by chemicals incorporated in the print paste especially for that purpose. The result is a white patterned discharge on a coloured ground. In “white” discharge printing, the fabric is piece dyed, then printed with a paste containing a chemical that reduces the dye and hence removes the color where the white designs are desired. In “colored” discharge printing, a color is added to the discharge paste in order to replace the discharged color with another shade.

Resist Printing Style

In this method of printing the fabric is first printed with a substance called a 'resist' which will prevent the dye from being taken up in a subsequent dyeing process. The resist functions by either mechanically preventing the dye from reaching local areas of the fabric or by chemically reacting with the dye or the fibre, to prevent adsorption.

A printing method in which the design can be produced: (1) by applying a resistagent in the desired design, then dyeing the fabric, in which case, the design remains white although the rest of the fabric is dyed; or (2) by including a resist agent and a dye in the paste which is applied for the design, in which case, the color of the design is not affected by subsequent dyeing of the fabric background.

Thickener:

Thickener is a thick mass which imparts stickiness and plasticity to the print paste so that it may be applied on the fabric surface without bleeding or spreading and be capable of maintaining the design out lines.

Thickener or Print pastes are traditionally made by weighing out and, if necessary, dissolving the colorants and auxiliary chemicals and then stirring them into the required weight of pre-prepared thickener. A thickener is a colourless, viscous paste made with one or more thickening agents. The use of terms such as thickener, and thin, long or short, to describe print pastes is of course descriptive rather than scientific, but is long established and a useful city reminder that the materials being handled possess complex properties, not easily

defined.The thickener must be stable and compatible with the dyes and dyeing auxiliaries to be used.

Fig: Printing thickener

Function or Object or Purpose of Thickener:

1. To give the required viscosity to the printing paste.
2. To prevent premature reactions between the chemicals contained in the print paste.
3. To hold the ingredients of the print paste on the fabrics

Factors to be considered to select/choice of a thickener:

1. Type and quality of material to be printed.
2. Compatibility with dyes and chemicals.
3. Printing paste stability.
4. Styles and methods of printing.

5. Properties of the dried thickener film.
6. Effect on color yield, such as diffusion, fixation.
7. Preparation and removal of the thickener.
8. Cost.
9. Biological oxygen demand.

Essential quality of printing thickener:

1. Stability to keeping should be good.
2. It should have certain physical and chemical properties such as viscosity, flow property, ability to wet and adhere to the internal surface of etchings of the engraved roller.
3. It must be compatible with the other ingredients of the printing paste.

   The thickener film should dry properly on the fabric to prevent spreading of the color by capillary action.
4. The thickener should not have affinity for the dye and should not keep the dye from the fabric.
5. Proper extraction of water from steam during steaming should be ensured to provide free space for the dye molecules to move towards the fabric.
6. The thickener molecule should have a control over the free water pick-up and not carry the dye beyond the boundaries of the impression.
7. The thickener should be cheap and available in abundance.
8. After perform printing, the useable media i.e. block, roller, screen should be easily cleanable.
9. Once the dye is transferred from the thickener film the removal of the exhausted thickener film without fetching water soluble dye should be easy.

Four significantly different approaches may be used to produce thickeners, using:

1. A low concentration of a polymer of high relative molecular mass (r.m.m.)
2. A high concentration of a material of lower r.m.m. or of highly branched chain structure
3. An emulsion of two immiscible liquids, similar to the emulsions used as cosmetic creams, or a foam of air in a liquid
4. A dispersion of a finely divided solid, such as bentonite.

The first approach is the most important but all four have been used, sometimes in combination. Practical printers long ago discovered natural polymers with suitable properties and, by trial and error, acquired the art of using them. Because the natural products are variable materials and the requirements are complex and ill-defined, experience and subjective judgements were essential. Now that the chemistry and physics of polymers are better understood, it is possible to select and use them more scientifically. We also have

available a wider range of thickening agents, including completely synthetic polymers, and this has increased our knowledge. It must not be assumed, however, that our understanding of these complex materials and their behavior is adequate.

In the selection of thickening agents, it is necessary to take into account requirements other than viscosity, which can usefully be classified in five categories: print paste stability, good adhesion of the dried thickener film, minimum effect on colour yield, ease of removal and acceptable cost.

CHAPTER- 18

CONCLUSIONS

Conclusion:

We have completed our industrial attachment successfully by the grace of Allah. The industrial training gives me the opportunity to work in mills.. This training gives me actual picture about man, machine, material, methods and market. I have earned the direct knowledge about the raw materials, actual running condition of the m/c, works technologist and administration.

This mill is a well planned with enough expansion facilities. There exist wonderful employer and worker relation. Working environment for the labors is also good. During my training I visited knitting, weaving, lab, Dyeing and garments section. Everywhere I got cordial behavior from all employees.

On this training for 12 weeks in the **TIVOLI APPARELS LTD (IMPRESSIVE GROUP)**. has give me a new experience for practical life. **SONARGAON UNIVERSITY** has given me the field to perform the industrial attachment with **TIVOLI APPARELS LTD (IMPRESSIVE GROUP)**. This attachment seems to me as a bridge to minimize the gap between theoretical and practical knowledge. Undoubtedly, this attachment paved me the way to learn more aboutTextile Technology, industrial practices, industrial management and production process.

Limitation of this Report

i. Because of secrecy act, the data on costing and marketing activities has not been Supplied & hence this report excludes these chapters.

ii. We had a very limited time. In spite of our willing to study more details it was not Possible to do so.

iii. Some of the points in different chapter are not described as these were not available.

Lastly

What special in this report is that the information, data & description very much subjective & Practical. So, one can easily have an idea about the whole dyeing unit of Tivoli Apparels Ltd at single look on it.

The newcomer can use this report for further detailed study or can know Tivoli Apparels Limited without much work. But one thing should be remembered that, some process steps of chemical may be modified within the period this paper goes to the readers.

I believe with all these, the experience of the industrial attachment will help my future life as a Textile Technologist.