Faculty of Engineering
Department of Textile Engineering

Study on Quality Assurance in Denim Fabric

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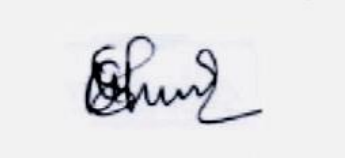
A thesis submitted in partial fulfillment of the requirements for the degree of
Bachelor of Science in Textile Engineering

Advance in Apparel Manufacturing
Technology Spring-2025

LETTER OF APPROVAL

This thesis report on **'Study on Quality Assurance in Denim Fabric''** is prepared by Md.Robiul Hasan Bhuiyan ID: 182-23-5386 , Md.Arman Amin ID: 143-23-4053.This report is submitted in Partial Fulfillment of the Requirement for the Degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING. The whole report of thesis has completed under my supervision. During the research period I have found them sincere, hardworking, punctual and enthusiastic.



Md.Mahsud Raihan

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Md.Mashud Raihan**, Assistant Professor,Department of Textile Engineering,Daffodil International University.We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any B.Sc in Textile Engineering degree or diploma.

Md. Robiul Hasan Bhuiyan

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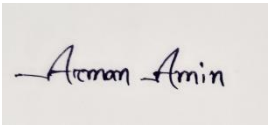

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ACKNOWLEDGEMENT

The completion of this project is not possible without numerous blessings by Almighty Allah and we want to express our sincere thankfulness to Almighty Allah

Here we would also like to express our heartfelt gratitude towards all our course mates at Daffodil International University as we had discussions and inputs of our course mates to our course work.

We would like to take this opportunity to express our heartfelt appreciation to all staff of NZ Denim Ltd. to take their valuable time to support us in our internship program since it provides necessary information to take our project to its successful end.

At long last, we should recognize with due regard the consistent help and patients of our parents.

DEDICATION

We would like to dedicate this thesis to our parents and teachers-we hope they will live long and well.

ABSTRACT

This project is on the study of Quality Assurance in Denim Fabric. The factor of quality has come to be a very important issue in all aspects in the recent times. Consumers are getting more aware about the quality of the product and they are also ready to spend extra premium to get a product of their entrepreneurship. It therefore means that producers need to emphasize quality in order to compete.

Considering our country is extensively known as one of the largest sources of ready-made woven clothes, the producers have to respect the high quality of products during the process of their production. The denim sector is an integrated one and it demands thorough quality check even at the initiatory stage i.e., yarn stage to the final product. In this project, efforts will be made to point out and discuss the important quality parameters in the denim industry.

The study aims at determining the quality assurance in denim fabric. Quality has in the recent past become an important issue in all aspects. Customers are becoming aware of quality of products and will pay extra money on products that satisfy them. This means that the producers have to insist on quality to be able to compete.

Since the competition in the market is rising gradually, any slight and preventable mistake of quality control can indeed serve as justified cause of the deceased of a product. Thus it is more important to uphold all the standards of quality required by the customers..

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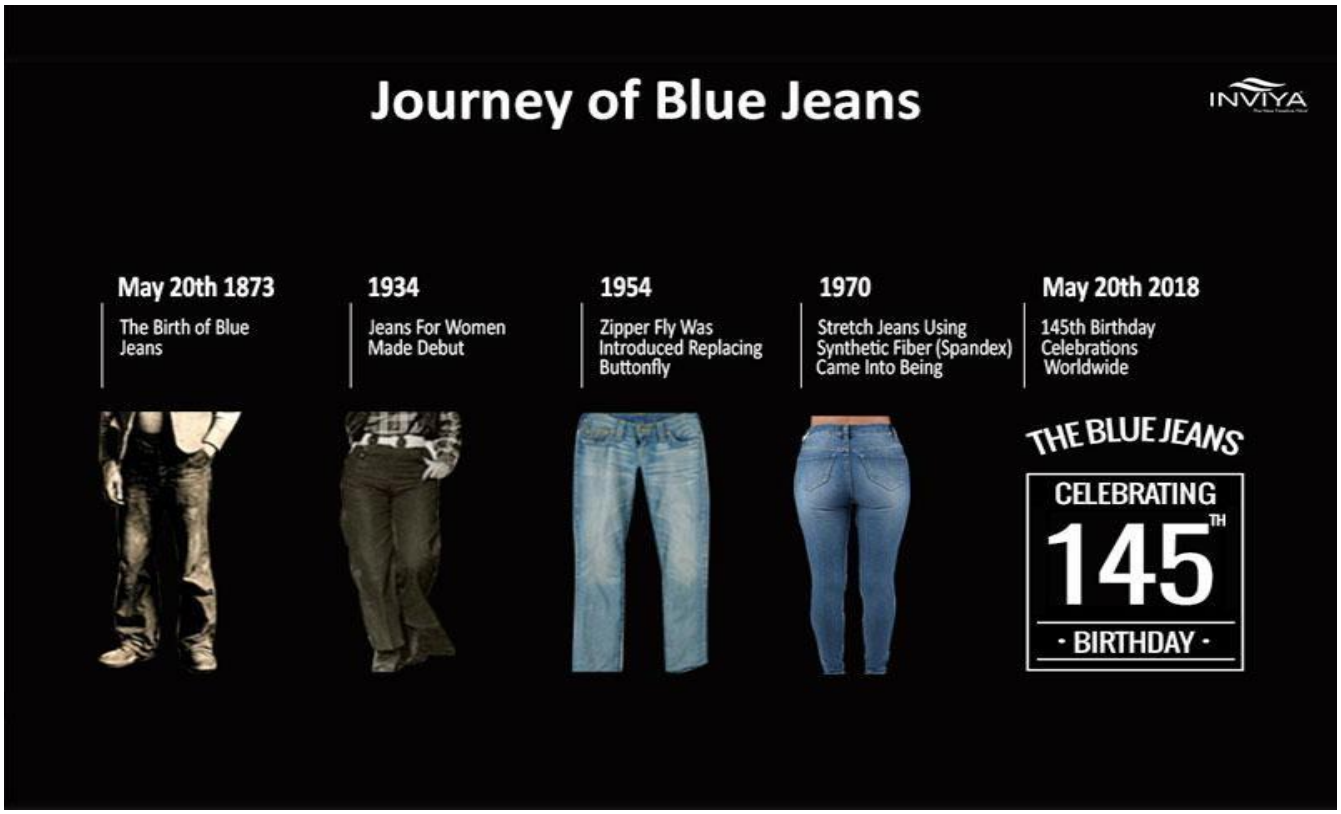
1.1 History of Denim :



Denim started as a simple, hard-wearing material and turned to an all-time consumer planet icon- Initially, among the working class, next, among rebels and later on, among the fashion shopspers. It interacts modernity with balance, balance of craftsmanship, style, and responsibility, which involves cultural and environmental priorities changing.

1.2 Quality Assurance:

Quality assurance (QA) in denim fabric refers to a set of procedures and checks that make sure rightful product at the end of the production process may reach set standards and customer satisfaction. Denim is a fabric that is both sturdy and stylish sensitive to quality and as such it needs to have quality supervision starting at fiber to finished material.

Products are subjective to quality and the trends and preferences of the customers toward it. To give an example, fading on denim is considered as trendy to younger customers, but older customers can look at this aspect as a defect. Critically such wearing out may be regarded as a flaw, which makes clear that there is no uniformity in the level of quality seen regarding age groups and the surroundings in the business of denim.

1.3 Denim fabric production sections:

Yarn Store

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Warping

↓

Dyeing (Rope/Slasher)

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Sizing

↓

Weaving

↓

Inspection

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Finishing

↓

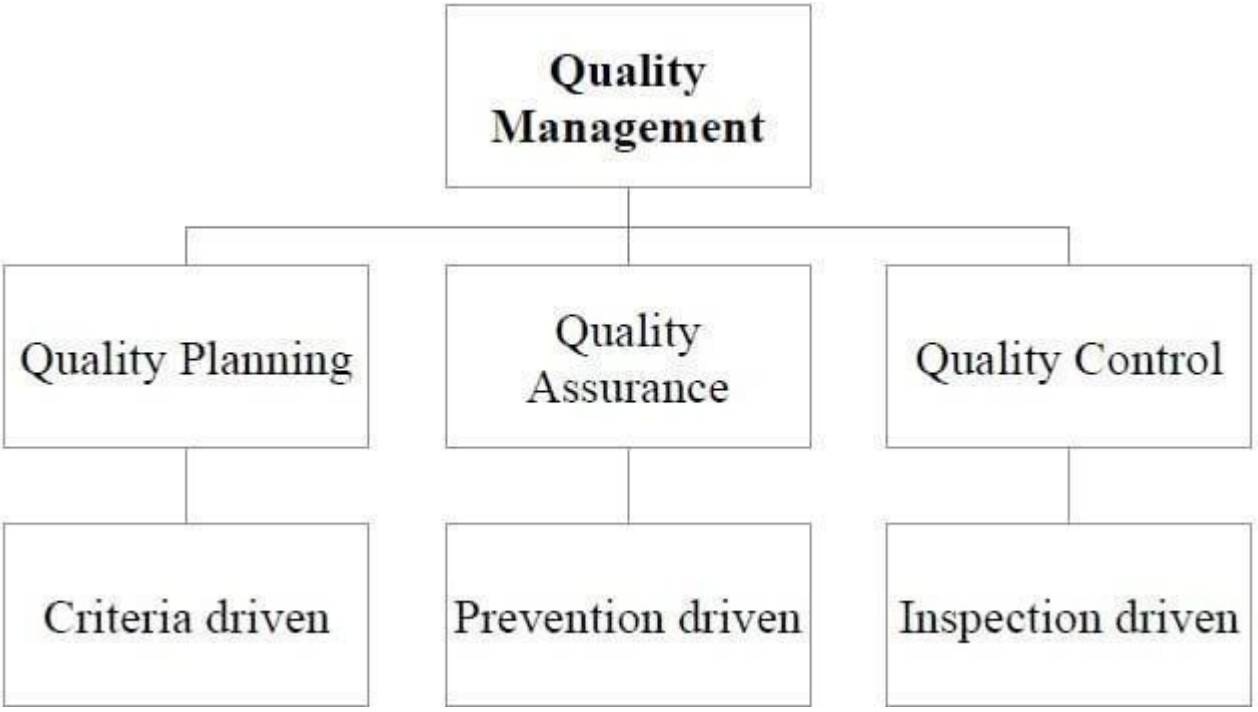
Final Inspection

↓

Packing

CHAPTER-2: LITERATURE REVIEW

2.1 Quality management



2.2 Quality Control:

The vital consideration in any business is quality. Quality Control (QC) is a methodical devise adopted by the manufacturer so as to make sure that the quality of products manufactured is as it should be-or, hopefully, as zero as possible-in short, zero defects. To be more exact, QC is programming and planning of organizational activity within the organization with the aim to maintain necessary standards of quality.

QC belongs to larger quality manager system where along with it there is Quality Assurance (QA) and Total Quality Management (TQM). Whereas QA deals with the proactive process whereby the occurrences of defects are avoided through design of a robust process, QC is the actual aspect of the product which involves testing its outputs to identify and eliminate existing defects.

2.3 What is denim?

Denim is considered heavyweight twill woven cloth that is composed of cotton or a mixture of cotton and Polyester. It is generally yarn-dyed having colour warp yarn and white weft yarns."

2.3.1 Various types of denim fabric used in the manufacture of apparel

Dry/Raw denim

Stretch denim

Colored/Reverse denim

Vintage / Marble / Crushed jeans

Bull denim

2.4 Various types of denim fabric defects:

1. **Yarn defect (Both warp & weft)**
2. **Weaving defects and**
3. **Dyeing & finishing defects.**

Warp/Weft slubs/thick yarns:

Disproportionate texture is made in irregularities such as coarse picks or nodular thick spots.

Weaving defects:

The weaving defects are the knots, weaving fly,loom stop,stack end, snarl,breaking pick,miss pick, tangle,broken warp,and hole and the weaving defects include sizing defect,oil spots, drawing defect and broken warp yarns.

Dyeing & finishing defects:

The physical damages are simpler damages compared to the dyeing and finishing defects. The common problems include inadequate fastness, inconsistent and inadequate washdown, scrub or abrasion marks on prewashed denim weaves, unequal shrinkage, hard hand following dyeing,dye streaks, loom-induced side to center shading, poor stabilisation and corrugation during sanforization.

There are numerous reasons that cause the bias of the shade on the indigo denim fabrics that are easily misconstrued. It can be generated during the yarn preparation like poor and unequal boil off etc.clumping of the yarn during dyeing, inconsistency in squeezing during dyeing and inconsistency in wash off.
It may be also due to poor-size, poor-weave, loom set-up or tension disparity.

2.5 yarn for denim

The historical denim yarn, a cotton material, is the basis of the denim fabric which is durable and has a twill fabric. It is normally spun by ring-spinning or open-end (OE) spinning, normally ring-spun as warp and OE-spun as weft. The diagonal ribbing feature of denim fabric is achieved by using warp and weft yarn which are interlaced in a twill weave.

2.5.1 Yarn quality requirements

In the case of the most simple stitching we would like to choose the most simple yarn or good yarn to draw by weaving accountable free texture or quality full texture. so we would like cautious about the characteristics of yarn or good yarn.The by accident yarn properties should possess to yarn yarn as a perfect yarn, that is, aforementioned material yarn.

1. **Circular cross-section & equal diameter**

   Yarn must be round and maintain consistent thickness along its length.

2. **Layers of concentric fibers**

   The fibers lie in onion ring type successive layers around the central axis.

3. **Standard Helical Fiber Traces**

   Every fiber takes a regular course, spiral with a definite distance to the center-with an exception of fibers in the center, which run straight.

4. **central fiber alignment**

   Fibers at the centre line up with the yarn axis and they do not exhibit any twist.

5. **Allied Cylindrical Axes**

   These layers create the central cylinders that have the same axis with the yarn itself.

6. **Unified Packing Density**

   Due to constant number of fibers passing through unit of cross-sectional area, it will be of even thickness.

7. **Uniform Twist Along Fibres**

   Each of the fibers is equally twisted per unit length (e.g. turns per inch), which guarantees the equal strength and behavior.

8. **High Number of Fibers**

   Is made of numerous fibers in order to reduce the irregularities and be smooth.

2.5.2 Parameters relating to yarn quality Essential

1. Evenness
2. Count (Linear density)
3. Tennessee / Tenacity
4. Break Age
5. Twist
6. Moisture Content
7. Winding Yarn & Clearer Faults
8. Yarn Lubrication
9. Hairiness

2.5.3 Yarn count

The yarn count is a quantitative notation (expressed in pounds or grams per inch) stating the thickness or the fineness of a yarn based on weight and length.

2.6 Warping

Warping comes first in the making of denim fabric.

A process of warping is undertaken in order to make a weaver beam.

A weaver beam consists of some number of yarns of the same or different number of yarns;

they are of the same or different number of yarns, organized in parallel.

2.6.1 Purpose of warping :

To reel a given length of yarn on to a warp beam.

With the aim of enhancing weaveability of the yarn.

To be used to improve the quality of the yarns and to enable recapture of small packages of yarns.

To facilitate the weaving ability of the twisted yarn in the formation of texture.

In order to prepare a uniform yarn sheet fit to undergo the next sizing process.

To make the production more efficient in general and guarantee an easier flow during the following stages.

2.6.2 Quality Improvement Steps for Warping Section

All the yarn ends should have the same tension and should be as close as possible during the severance of the supply packages.

The physical/mechanical properties of yarn should be controlled and not skewed in the warping process.

The warping should have a high rate of production so that it is effective.

The warping package must have a serve able cylindrical surface.

The result of the warp length should be well measured and retained.

The warp bundle is preferably held together into an outer shape that is horizontal; barrel shaped to give stability and consistent unwinding.

2.6.3 Defect of warping process

Incorrect mixing of counts and

knotting Slowing (yarn shedding)

Overutilization in the use of yarns

Hair cutting or tearing of yarns

Accidental intermixing of lots Mixing of different lots unintentionally.

2.7 Dyeing

Dyeing is the term used when a textile material undergoes physical or chemical treatment in the quest to achieve a solid equivalent of the material in the fabric. The success of dyeing is much as a result of other factors that comprise of nature of fabric, structure of fabric as well as the nature of the dye.

Purpose of dyeing

- The textile items are evenly colored in one colour.
- To improve the beauty of the textile materials.
- In order to make the fabric compatible to other uses and decoration.

Dyes use for denim:

1) Vat dyes
2) Sulfur dyes

2.8 Sizing:

Sizing In this case, the yarn is given a protective coating of sizing material. This treatment makes the warp yarn stronger by providing a protective surface to the yarn and this allows the yarn to have reduced breakage when being woven.

2.8.1 Purpose of sizing:

- So as to prevent the abrasion of the yarn
- In order to enhance the yarn breaking strength
- In order to make the yarn flows smoother
- In order to add stretchiness to the yarns
- To improve on yarn hairiness
- To reduce the creation of the electric charges

2.8.2 Variation of Sizing:

- Pure Sizing: The size pick up is 3 to 10 percent.
- Light Sizing: Pick-up of size is 11 to 16 percent.
- Medium Sizing: Pick-up of size is between 17-40 percent.
- High Sizing: Size pick-up is more than 40 per cent.

2.9 Weaving

The way a fabric is produced through interlace of warp and weft is called weaving. It has five simple functions namely shedding, picking, beating-up, let-off and take-up. Weaving takes place over a loom when the warp and weft fibers are combined- they are normally white warp and coloured weft. The machine employed in this process is termed as a loom or weaving machine.
The weaving industry is made up of assorted fabrics that are manufactured through diverse mechanisms of looms and related machines. Loom is the main machine in the production of fabrics, through which, the warp threads are organized as a sheet to be woven.

Kinds of Looms-

1. Hand /Manual Looms:

Vertical Loom
Pit Loom
Frame Loom

2. Power / Modern Looms:

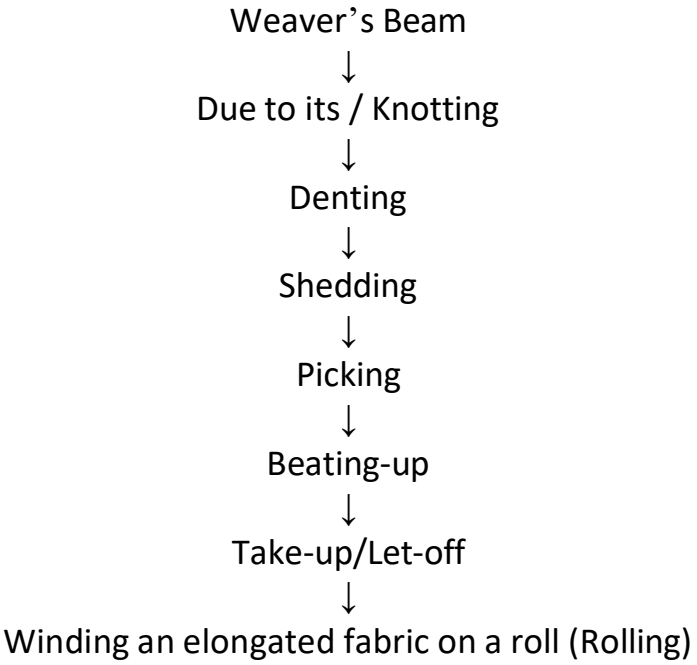
Air Jet Loom
Rapier Loom
Projectile Loom
Watyer Jet Loom
Water Jet & So On

Rapier loom

Air Jet Loom

Fig: Air Jet Loom & Rapier Loom

2.9.1 Weaving Process Flow Chart:



2.10 Finishing

Once woven, the finished woven fabric is reeled on material rolls at regular intervals and checked with the help of fabric review machine. The step assists in detection and rectification of weaving defects. When the weaving process has been concluded, the fabric goes through a process of finishing operations. These are normally loading, brushing, singeing, skewing, washing, drying, management of moisture, calendaring, ironing, cooling and folding.

These finishing processes are meant to enhance the look and performance of the fabric through elimination of impurities comprising of nep dust, loose fibers, and hairiness of the fabric. Also, such quality parameters as moisture content, fabric skew and bowing could be manipulated. The process of washing and drying is done in order to clean the fabric and then ironing and folding is done ready to be run into making garments. After all these processes have all been carried through with, the cloth can then be taken to the clothing manufacturing unit.

CHAPTER-3: METHODOLOGY

3.1 Quality assurance of raw materials :

Raw material QA is systematic approach to verify that material entering a supply chain meet defined standards.it focuses on preventing defects all the source rather than identifying then downstream aligned with “Fit for purpose” and first time principles.

3.2 Yarn Count Test (Linear Density):

- Determines the thickness or fineness of yarn
- **Direct System**: ISO 2060 or ASTM D1059 (Tex, Denier).
- **Indirect System**: British Standards (Ne, Nm).

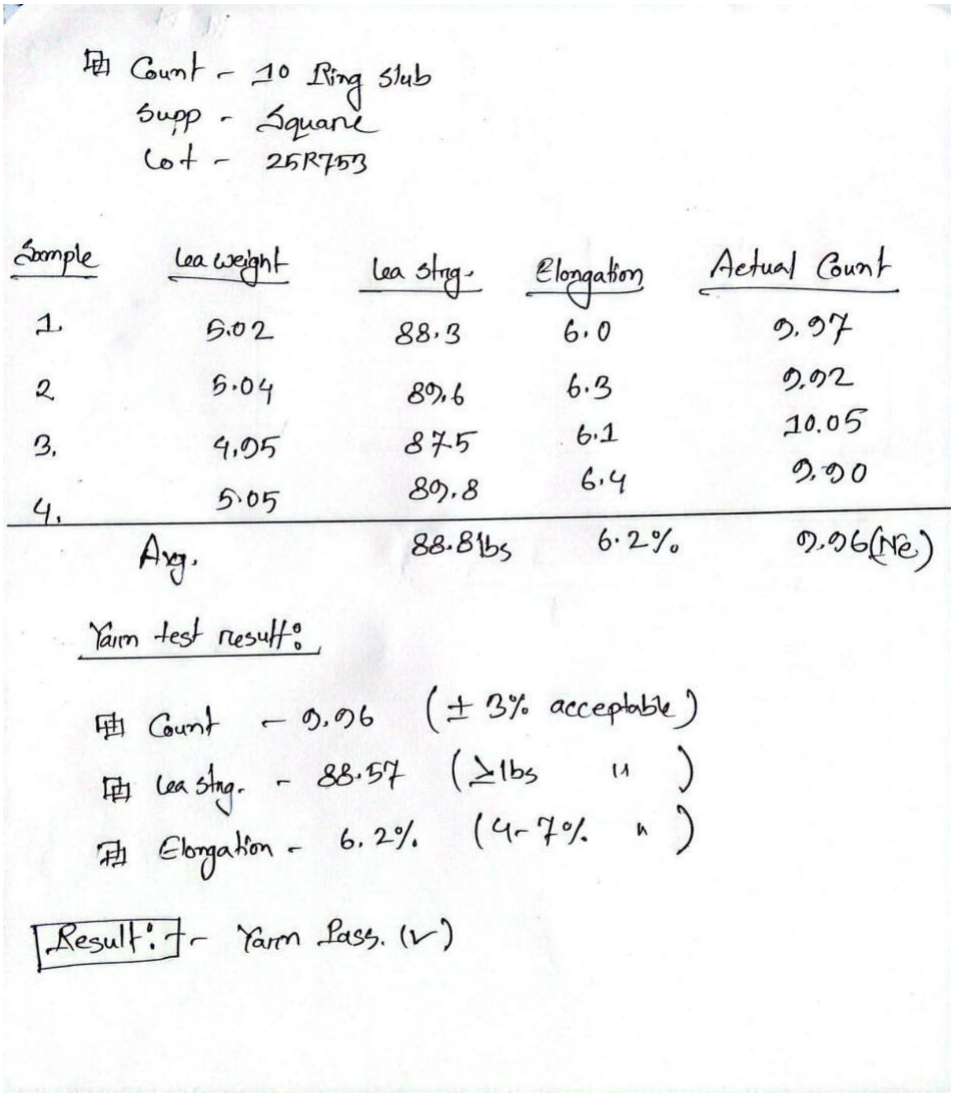
EleStretch XT Electronic Lea Strength Tester

Fig: Wrap Reel Machine

Yarn count Testing forlula:

English Cotton Count (Ne) – Indirect System

Count (Ne)= Length(Yards)/Weight (pounds)×840Length (yards)



Count - 10 Ring slub
Supp - Square
Lot - 25R753

Sample	Lea weight	Lea strg.	Elongation	Actual Count
1.	5.02	88.3	6.0	9.97
2.	5.04	89.6	6.3	9.92
3.	4.95	87.5	6.1	10.05
4.	5.05	89.8	6.4	9.90
	Avg.	88.8lbs	6.2%	9.96(Ne)

Yarn test resuff:

Count - 9.96 (± 3% acceptable)
Lea strg. - 88.57 (≥ lbs ")
Elongation - 6.2% (4-7% ")

Result:- Yarn Pass. (✓)

Yarn count test result-

Buyer requirement warp count = 10

Ne Test actual warp count = 9.96 Ne

3.3 Slub Yarn Testing

NZ TEX GROUP	NZ DENIM LTD			
	Balaikha ,Vulta,Rupganj, Narayanganj			
	Yarn Specification			
Count :	10 RSL	Part No :	Date:	1/6/2025
Supplier:	NZ TEXTILE LTD		Receive Date:	14/04/2025
			Receive Quantity :	1834.20
Lot No:	S-379		Slub code :	NZ-2010
SL No	Slub length		SL No	Pause length
1	9.0		1	35.0
2	7.5		2	25.3
3	7.2		3	27.7
4	8.5		4	19.6
5	6.2		5	19.8
6	6.5		6	19.6
7	9.0		7	21.5
8	8.7		8	19.6
9	7.3		9	22.8
10	7.5		10	30.4
11	6.0		11	19.0
12	6.2		12	19.7
13	6.5		13	24.5
14	7.5		14	28.8
15	7.8		15	28.8
16	6.5		16	31.0
17	7.2		17	22.0
18	7.2		18	20.5
19	8.6		19	23.3
20	6.5		20	20.6
21	6.1		21	20.3
22	6.2		22	20.1
23	6.8		23	36.1
24	6.4		24	37.5
25	6.7		25	35.4
Avg :	7.184		Avg :	25.156
Slub Wt (gm) :	0.1411		Pause Wt(gm) :	0.3236
Actual Count(Ne) :	7.51		Actual Count:	11.47
Slub Length Min (cm) :	6		Pause Length Min (cm) :	19
Slub Length Max(cm) :	9		Pause Length Max(cm) :	37.5
Slub per meter :	2.80	A.Count (Ne) = 10.01	CSP = 2838	Elongation% = 7.01
Slub Dia (times) :	1.53			
Requirement	Slub length (cm)	Pause length (cm)	Slub Dia (times)	Slub/Meter (cm)
	6.0~9.0	19.0~38.0	1.55~1.60	2.78
Final Achive	6.0~9.0	19.0~37.5	1.53	2.80
Prepaired By		AGM (QA&PC)		HOD(QA&PC)

Slub Yarn test result

Buyer requirement; Slub length (cm)	Pause length (cm)
6.0 - 9.0	19.0 - 38.0

Slub yarn test result; Slub length (cm)	Pause length (cm)
6.0 - 9.0	19.0 - 37.5

3.4 Yarn Twist testing (Twist per Inch or TPI)

Method : Measures the number of twists in the yarn. (ISO 17202 or ASTM D1422)

Fig; Yarn twisting measurement machine

Yarn twist Testing formula:

TPI (Twist Per Inch) = Length of Yarn Sample (in inches)/Total Number of Turns (T)

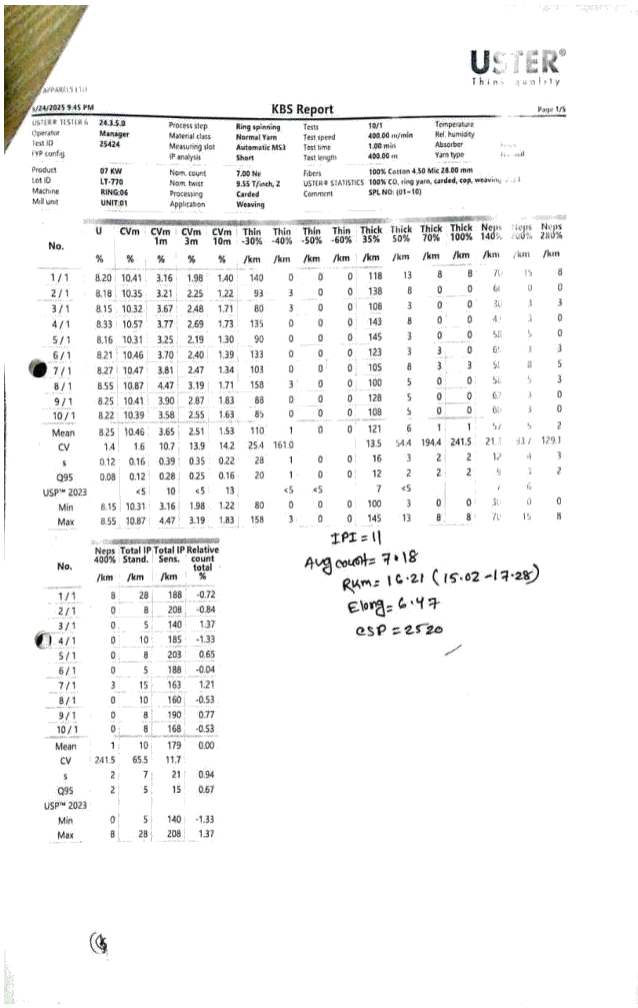
TPM (Twist Per Meter) = Total Number of Turns (T)Length in meters\text{TPM (Twist Per Meter)

Yarn twisting result-

Buyer requirement	= TPI(twist per Inch)	TPM(twist per meter)
	14.0 – 15.0	551 - 590
Actual twisting Result	= TPI(twist per Inch)	TPM(twist per meter)
	14.5 -15.5	570 - 610

Yarn neps,hairness,thick,thin Testing

Uster tester report



USTER®
Thins quality

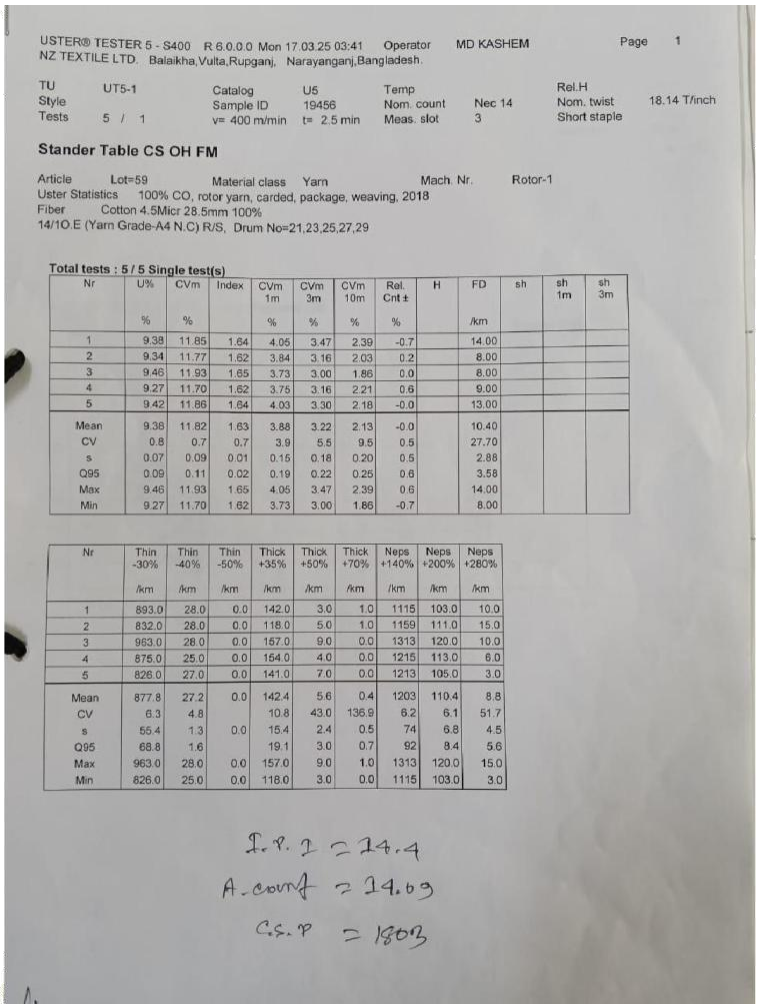
KBS Report

USTER® TESTER 6	24.3.5.0	Process step	Ring spinning	Tests	10/1	Temperature	
Operator	Manager	Material class	Normal Yarn	Test speed	400.00 m/min	Rel. humidity	
Test ID	25424	Measuring slot	Automatic MS3	Test time	1.00 min	Absorber	
IVP config.		IP analysis	Short	Test length	400.00 m	Yarn type	
Product	07 KW	Nom. count	7.00 Ne	Fibers	100% Cotton 4.50 Mic 28.00 mm		
Lot ID	LT-770	Nom. twist	8.55 T/inch, Z	USTER® STATISTICS	100% CO, ring yarn, carded, cop, weaving,		
Machine	RING:06	Processing	Carded	Comment	SPL NO: (01-10)		
Mill unit	UNIT:01	Application	Weaving				

No.	U	CVm	CVm 1m	CVm 3m	CVm 10m	Thin -30%	Thin -40%	Thin -50%	Thin -60%	Thick 35%	Thick 50%	Thick 70%	Thick 100%	Neps 140%	Neps 200%	Neps 280%
	%	%	%	%	%	/km	/km	/km	/km	/km	/km	/km	/km	/km	/km	/km
1 / 1	8.20	10.41	3.16	1.98	1.40	140	0	0	0	118	13	8	8	70	15	8
2 / 1	8.18	10.35	3.21	2.25	1.22	93	3	0	0	138	8	0	0	68	0	0
3 / 1	8.15	10.32	3.67	2.48	1.71	80	3	0	0	108	3	0	0	30	3	3
4 / 1	8.33	10.57	3.77	2.69	1.73	135	0	0	0	143	8	0	0	43	3	0
5 / 1	8.16	10.31	3.25	2.19	1.30	90	0	0	0	145	3	0	0	58	5	0
6 / 1	8.21	10.46	3.70	2.40	1.39	133	0	0	0	123	3	3	0	63	3	3
7 / 1	8.27	10.47	3.81	2.47	1.34	103	0	0	0	105	8	3	3	58	8	5
8 / 1	8.55	10.87	4.47	3.19	1.71	158	3	0	0	100	5	0	0	58	5	3
9 / 1	8.25	10.41	3.90	2.87	1.83	88	0	0	0	128	5	0	0	63	3	0
10 / 1	8.22	10.39	3.58	2.55	1.63	85	0	0	0	108	5	0	0	60	3	0
Mean	8.25	10.46	3.65	2.51	1.53	110	1	0	0	121	6	1	1	57	5	2
CV	1.4	1.6	10.7	13.9	14.2	25.4	161.0			13.5	54.4	194.4	241.5	21.1	93.7	129.1
s	0.12	0.16	0.39	0.35	0.22	28	1	0	0	16	3	2	2	12	4	3
Q95	0.08	0.12	0.28	0.25	0.16	20	1	0	0	12	2	2	2	9	3	2
USP™ 2023		<5	10	<5	13		<5	<5		7	<5			7	6	
Min	8.15	10.31	3.16	1.98	1.22	80	0	0	0	100	3	0	0	30	0	0
Max	8.55	10.87	4.47	3.19	1.83	158	3	0	0	145	13	8	8	70	15	8

No.	Neps 400%	Total IP Stand.	Total IP Sens.	Relative count total
	/km	/km	/km	%
1 / 1	8	28	188	-0.72
2 / 1	0	8	208	-0.84
3 / 1	0	5	140	1.37
4 / 1	0	10	185	-1.33
5 / 1	0	8	203	0.65
6 / 1	0	5	188	-0.04
7 / 1	3	15	163	1.21
8 / 1	0	10	160	-0.53
9 / 1	0	8	190	0.77
10 / 1	0	8	168	-0.53
Mean	1	10	179	0.00
CV	241.5	65.5	11.7	
s	2	7	21	0.94
Q95	2	5	15	0.67
USP™ 2023				
Min	0	5	140	-1.33
Max	8	28	208	1.37

IPI = 11
Avg count = 7.18
Rkm = 16.21 (15.02 - 17.28)
Elong = 6.47
CSP = 2520



USTER® TESTER 5 - S400 R 6.0.0.0 Mon 17.03.25 03:41 Operator MD KASHEM Page 1
NZ TEXTILE LTD. Balaikha,Vulta,Rupganj, Narayanganj,Bangladesh.

TU	UT5-1	Catalog	U5	Temp		Rel.H	
Style		Sample ID	19456	Nom. count	Nec 14	Nom. twist	18.14 T/inch
Tests	5 / 1	v= 400 m/min	t= 2.5 min	Meas. slot	3	Short staple	

Stander Table CS OH FM

Article Lot=59 Material class Yarn Mach. Nr. Rotor-1
Uster Statistics 100% CO, rotor yarn, carded, package, weaving, 2018
Fiber Cotton 4.5Micr 28.5mm 100%
14/1O.E (Yarn Grade-A4 N.C) R/S, Drum No=21,23,25,27,29

Total tests : 5 / 5 Single test(s)

Nr	U%	CVm	Index	CVm 1m	CVm 3m	CVm 10m	Rel. Cnt±	H	FD	sh	sh 1m	sh 3m
	%	%		%	%	%	%		/km			
1	9.38	11.85	1.64	4.05	3.47	2.39	-0.7		14.00			
2	9.34	11.77	1.62	3.84	3.16	2.03	0.2		8.00			
3	9.46	11.93	1.65	3.73	3.00	1.86	0.0		8.00			
4	9.27	11.70	1.62	3.75	3.16	2.21	0.6		9.00			
5	9.42	11.86	1.64	4.03	3.30	2.18	-0.0		13.00			
Mean	9.38	11.82	1.63	3.88	3.22	2.13	-0.0		10.40			
CV	0.8	0.7	0.7	3.9	5.5	9.5	0.5		27.70			
s	0.07	0.09	0.01	0.15	0.18	0.20	0.5		2.88			
Q95	0.09	0.11	0.02	0.19	0.22	0.25	0.6		3.58			
Max	9.46	11.93	1.65	4.05	3.47	2.39	0.6		14.00			
Min	9.27	11.70	1.62	3.73	3.00	1.86	-0.7		8.00			

Nr	Thin -30%	Thin -40%	Thin -50%	Thick +35%	Thick +50%	Thick +70%	Neps +140%	Neps +200%	Neps +280%
	/km	/km	/km	/km	/km	/km	/km	/km	/km
1	893.0	28.0	0.0	142.0	3.0	1.0	1115	103.0	10.0
2	832.0	28.0	0.0	118.0	5.0	1.0	1159	111.0	15.0
3	963.0	28.0	0.0	157.0	9.0	0.0	1313	120.0	10.0
4	875.0	25.0	0.0	154.0	4.0	0.0	1215	113.0	6.0
5	826.0	27.0	0.0	141.0	7.0	0.0	1213	105.0	3.0
Mean	877.8	27.2	0.0	142.4	5.6	0.4	1203	110.4	8.8
CV	6.3	4.8		10.8	43.0	136.9	6.2	6.1	51.7
s	55.4	1.3	0.0	15.4	2.4	0.5	74	6.8	4.5
Q95	68.8	1.6		19.1	3.0	0.7	92	8.4	5.6
Max	963.0	28.0	0.0	157.0	9.0	1.0	1313	120.0	15.0
Min	826.0	25.0	0.0	118.0	3.0	0.0	1115	103.0	3.0

I.P.I = 14.4
A.count = 14.03
C.S.P = 1803

Yarn Appearance result-

Buyer requirement =	**IPI**	**CSP**
	7-8	**3500**
Actual Result =	**IPI**	**CSP**
	11	**2800**

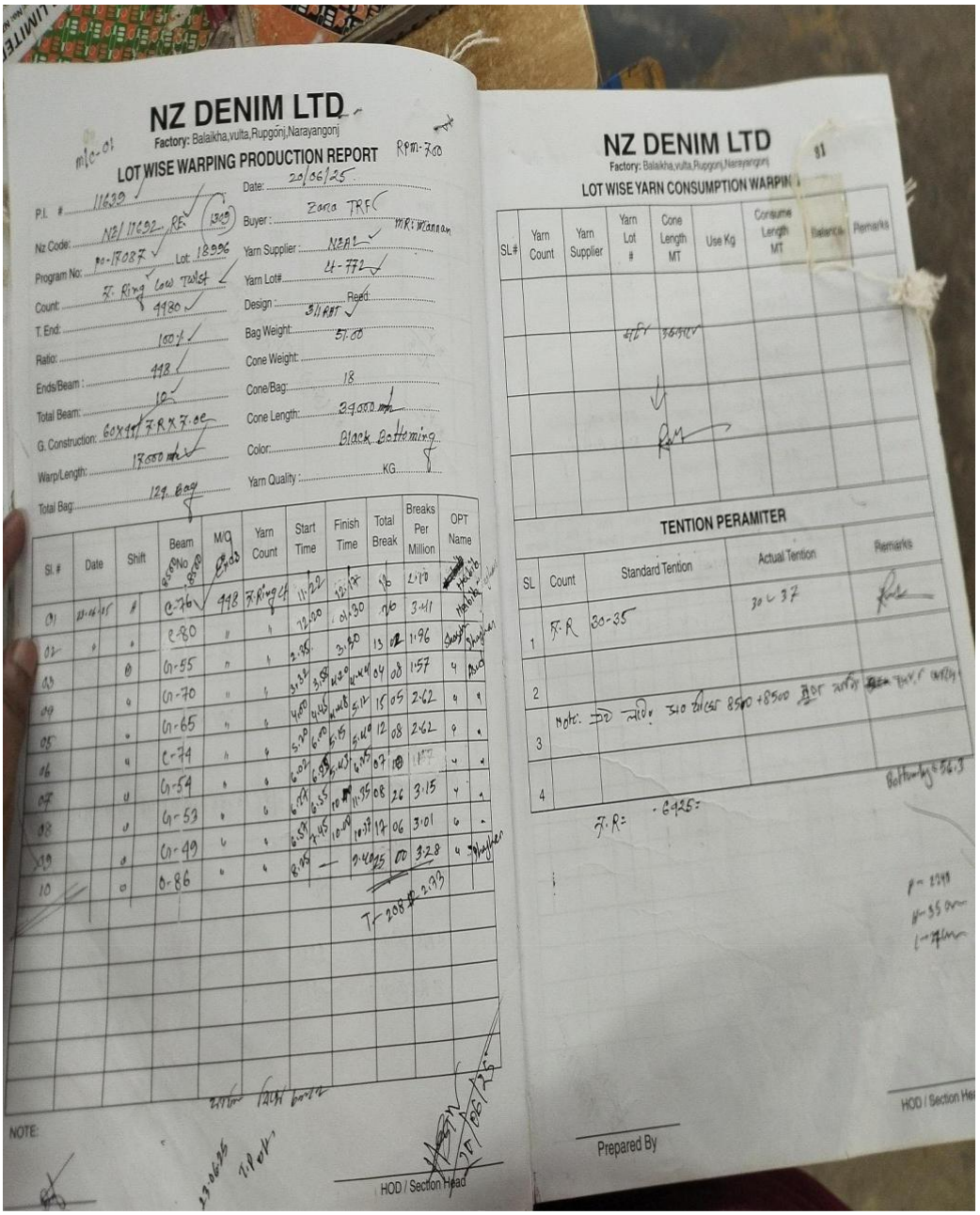
3.5 Quality Assurance in Warping section

3.6 Moisture and temperature test:

Moisture and temperature check result-

Buyer requirement	**=**	**Moisture**	**Temperature**
		65-70 RH	**20C -25C**
Actual Result	**=**	**Moisture**	**Temperature**
		60-65 RH	**25C -32C**

3.7 Tension check According to count



Yarn tension check result-

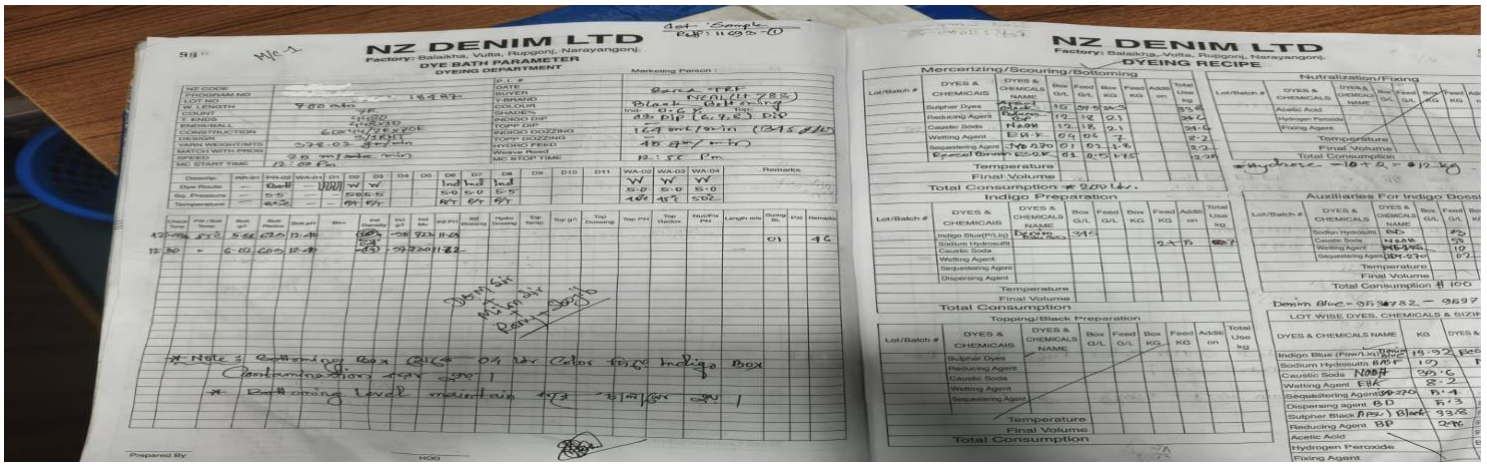
Buyer requirement =	**Count**	**Tension**
	10 Ne	**25-30**
Actual tension Result =	**Count**	**Tension**
	10 Ne	**27-32**

3.8 Quality Assurance in preparatory section:

Shade:

Comparatively Running shade lighter to master copy

3.8.1 Dyeing Recipe



3.8.2 Viscosity & RF%

Fig Viscosity measuring cup **Refractometer**

Viscosity and RF check result-

		Viscosity	RF
Buyer requirement	=	**16-22 sec**	**5-6%**
Actual Result	=	**Viscosity**	**RF**
		18-25 sec	**4-5%**

Running Shade Cheaking

Running shade are uniform and align with master copy

3.9 Weaving section

Weavers beam

↓

Drawing/ knotting

↓

Denting

↓

Shedding

↓

Picking

↓

Beat up

↓

Take up and take off

↓

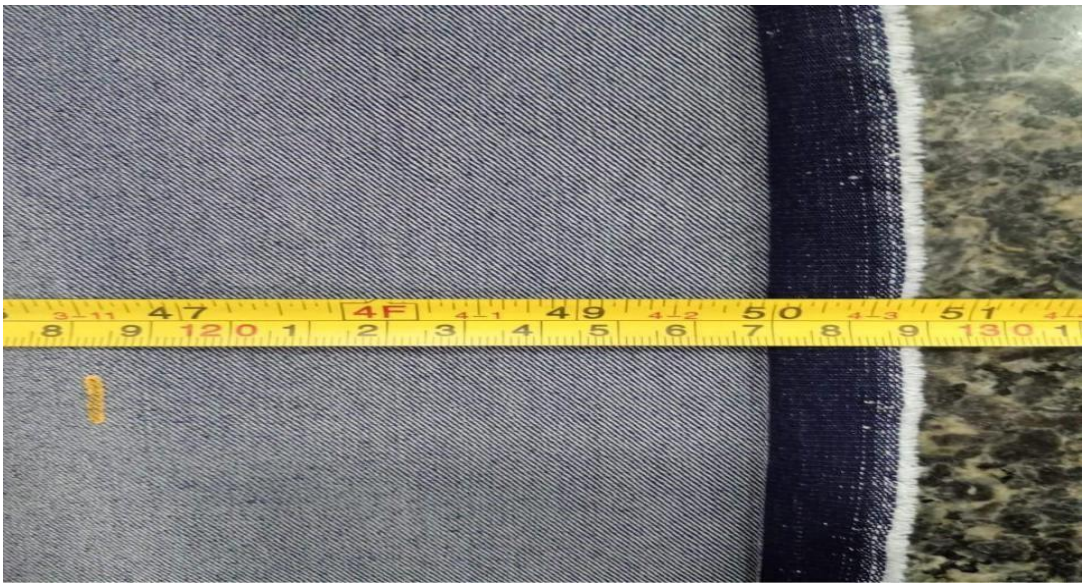
Rolling

Quality assurance in weaving section

Gram per square Meter (GSM) Test:

GSM check result- Buyer requirement	=	**GSM**	**OZ**
		376	**11.10oz**
Actual Result	=	**GSM**	**OZ**
		373	**11.00oz**

Fabric width



Fabric width check result-

Buyer requirement = width
50 inch

Actual Result = width
50 inch

EPI x PPI

Fabric EPI x PPI test

Buyer requirement = **EPI x PPI**

94 x 60

Actual Result = **EPI x PPI**

94 x 61

3.10 Finishing section

Loading & J Box

↓

Singeing

↓

Skewing

↓

Weft stretching.

↓

Calendaring.

↓

Moisture guider .

↓

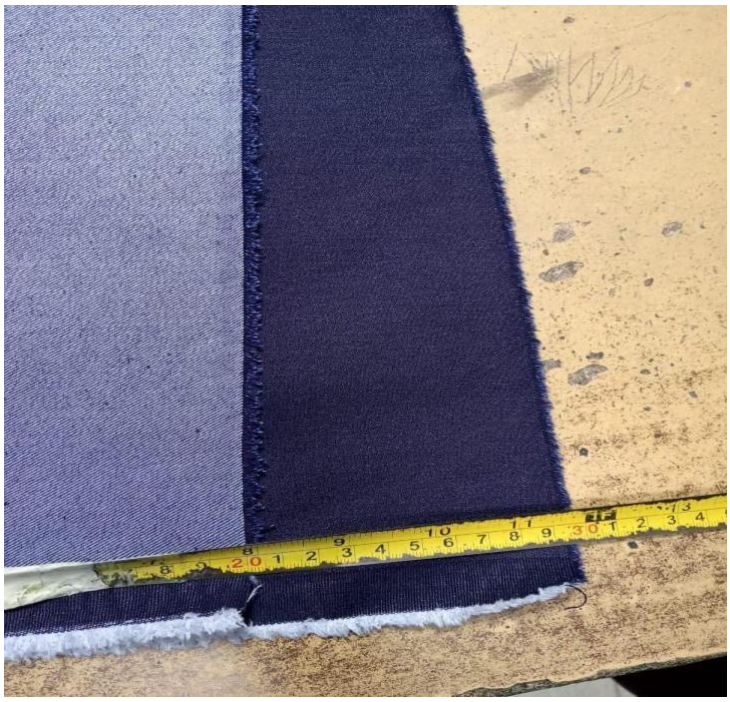
Mercerization

↓

Inspection and folding

Quality assurance in weaving section

Skew:



Fabric skew checking result

Buyer requirement	=	**skew 12**
Actual Result	=	**skew 11.5**

Bowing:

Fabric bowing checking result

Buyer requirement	**=**	**Bowing**
		0.5-1.0
Actual Result	**=**	**Bowing**
		0.6

3.11 Quality Assurance Sample VS Bulk Production

3.11.1 Sample test report:

"FABRIC TEST REPORT"

CUSTOMER	C&A	DATE OF REPORT	13.06.2022
CONSTRUCTION	10 NE X 150L70D/95 X 59	FABRIC CODE	SIS16-POS1261 DF
LAST PROCESS	DESIZE FINISH	WEAVING CODE	22214 POS DF
COLOR	INDIGO	SET CODE	10-2515
ARTICLE		LAB REFERENCE	13479/22
WEAVE	3/1 RHT	ORDER	
FINISH WIDTH (INCHES)	52"(C/W)	WASH TYPE	LAB WASH (60°C)

TEST SPECIFICATION:	AS PER BUYER REQUIREMENTS			
TEST PERFORMED	REQUIREMENTS	ACHIEVED RESULTS		REMARKS
(A) COLOR FASTNESS TO RUBBING (ISO 105-X12)		AFTER 1HL		
DRY	3-4	3-4		
WET	1-2	1-2		
(B) COLOR FASTNESS TO WASHING [ISO 105 C06 (C2S)]		BEFORE WASH		
CHANGE IN SHADE	3-4	3-4		
STAINING	2-3	WOOL 4-5	ACRYLIC 4-5	POLYESTER 4-5 NYLON 3-4 COTTON 3-4 DIACETATE 4-5
(C) COLOR FASTNESS TO PERSPIRATION ACIDIC (ISO 105 E04)		BEFORE WASH		
CHANGE IN SHADE	3-4	4		
STAINING	2-3	WOOL 4-5	ACRYLIC 4-5	POLYESTER 4-5 NYLON 4-5 COTTON 4 DIACETATE 4-5
(D) COLOR FASTNESS TO PERSPIRATION ALKALI (ISO 105 E04)		BEFORE WASH		
CHANGE IN SHADE	3-4	4		
STAINING	2-3	WOOL 4-5	ACRYLIC 4-5	POLYESTER 4-5 NYLON 4-5 COTTON 4 DIACETATE 4-5
(E) COLOR FASTNESS TO SALIVA (GB/T 18886)		BEFORE WASH		
CHANGE IN SHADE		4		
STAINING		WOOL 4-5	ACRYLIC 4-5	POLYESTER 4-5 NYLON 4-5 COTTON 4 DIACETATE 4-5
(F) COLOR FASTNESS TO WATER (ISO 105 E01)		BEFORE WASH		
CHANGE IN SHADE	3-4	4		
STAINING	2-3	WOOL 4-5	ACRYLIC 4-5	POLYESTER 4-5 NYLON 4 COTTON 4-5 DIACETATE 4-5
(G) DIMENSIONAL STABILITY TO WASHING (ISO 3759, ISO 5770, ISO 6330)		AFTER 3HL		
WARP (%)	-3% to +2% = Non stretch	-4.00%		
WEFT (%)	0 to -14% = Stretch	-16.25%		
(H) TENSILE STRENGTH (ISO 13934-2)		AFTER 3HL		
WARP (N)	As per weight	580 N		
WEFT (N)		470 N		
(I) TEAR STRENGTH (ISO 13937-1)		AFTER 3HL		
WARP (N)	As per weight	66 N		
WEFT (N)		48 N		
(J) SEAM SLIPPAGE (ISO 13936-1/ISO 13936-2)		AFTER 3HL		
WARP (N)	As per weight	5 MM		
WEFT (N)		3 MM		
(K) ELASTIC BEHAVIOUR (EN ISO 20932-1)		AFTER 3HL		
ELONGATION %		47.00%		
RECOVERY %	Recovery ≥95%	95.00%		
(L) FABRIC WEIGHT (EN 12127)	±5%	BEFORE WASH 339 gsm/ 10.0 oz.		AFTER WASH 390 gsm/ 11.50 oz.
(M) pH VALUE (ISO 3071)	4.5 to 7.5	6.89		
(N) FORMALDEHYDE (ISO 14184-1): 1999		NOT PERFORMED		
(O) THREAD COUNT (DIN EN1049-2)				
ENDS PER INCH	±3%	EPI 95		TOTAL 154
PICKS PER INCH		PPI 59		
(P) YARN COUNT (ISO 7211-5)				
WARP COUNT	±3%	WARP 10 NE		
WEFT COUNT		WEFT 150L70D		
(Q) FABRIC COMPOSITION (BS 4407)	±3%	COTTON: 81%	POLY: 17 %	SPANDEX: 2.0 %
(R) LIGHT FASTNESS (ISO 105 B02)		NOT PERFORMED		
CHANGE IN SHADE				
(S) PILLING RESISTANCE (ISO 12945-2@2000 CYCLES)	3-4	3-4		

Md. Moinul Islam Bijoy
Shift Engineer
SDCL Testing Lab
Sister Denim Composite Ltd.
REPORTED BY

Md. Habibur Rahman
Sr. Lab Officer
SDCL Testing Lab
Sister Denim Composite Ltd.
CHECKED BY

Md. Mahabubur Rahman Khan
Deputy Manager
SDCL Testing Lab & Chemical Mgt.
Sister Denim Composite Ltd.
APPROVED BY

3.11.2 STRES ABILITY GROWTH RECOVERY TEST

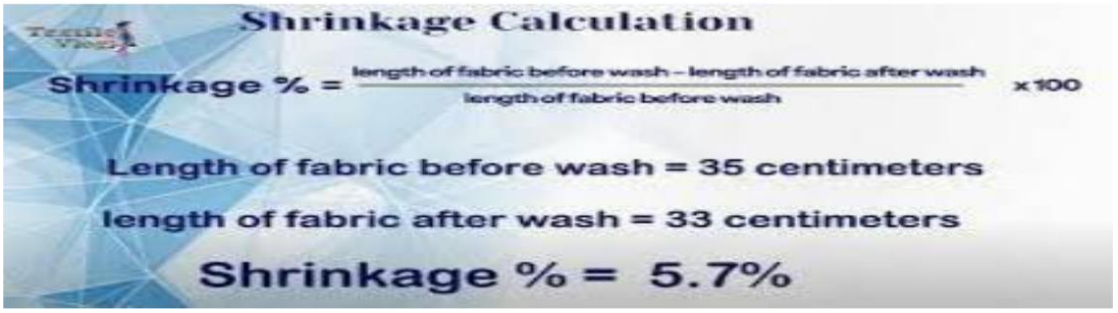
1	SIS16POS126IDF									
2	SL	ROLL NO:	F.WIDTH	F. EPI XPPI	DARK SHADE AFTER MATCH					
4	19	908107	50.8	98X61	109x64+	-15%	50.99%	4%	97%	11.3
5	1	911748	51.6	96X60+	116x64+	-18%				11.7
6	2	911749	52	96X60+	114x64+	-18%	52.15%	3%	97%	11.65
7	4	912029	52	92X60+	114x64	-17.50%	50.30%	3%	97%	11.45
8	11	911547	52	96X61	114x63+	-17.50%				11.5
9	6	912035	52.5	96X61	113x63	-17%	52.35%	4%	96%	11.4
10	7	911444	52.5	94X60+	13x64+	-17.50%	51.52%	3%	97%	11.5
11	8	911441	52.5	94X60+						
12	10	911443	52.5	96X60+	113x64	-17.50%	51.47%	3%	97%	11.45
13	13	911546	52.5	96X61	114x63+	-17.50%				11.5
14	16	911445	52.5	96X60+	110x64+	-15.50%	47.63%	3%	97%	11.3
15	12	911758	52.6	96X60+						
16	14	911757	52.6	96X61	108x64+	-15%				11.15
17	17	911760	52.6	94X60+	114x63+	-17.50%				11.4
18	5	914446	52.7	94X60+	114x64	-17%				11.35
19	3	911448	53	94X61	115x63+	-17.50%				11.45
20	9	911756	53	94X60+	114x64	-17.50%	51.35%	3%	97%	11.55
21	15	911550	53	94X60+	114x64	-16.50%				11.3
22	18	911548	53	96X61	115x63+	-17%	52.63%	4%	96%	11.45
23	Avarage						51.15%	3%	97%	
24	18.08.22 trial			96X60+	115x64	-18.50%	53.76%	3%	97%	11.65
25	privous trial			98x60+	118x63+	-17.50%	54%	3%	97%	11.7
26	sample				110x64	-16.50%	51.06%	4%	96%	11.45
27	FTD						47%		95%	11.5
28										

3.11.3 Checking all quality parameter Sample Vs Bulk

	Quality Assurance Department			
	Second Beam Analysis depend on Sample			
			Date: 23.12.24	
	Fabric Ref# SIS16POS1261DF RCP			
	Set No: 10-5170-2			
	Set Length: 7365		GRL No: 245727	Loom no: E-6
	General Information			
	Weave	3/1 RHT		
		Indigo		
	Buyer Name/Vendor	C&A	Pacific Blue Jeans	
	Order Qnty(Yds)	147000		
	PI No.			
	Marketing Person	Mr. Mahi/Arefin		
	Construction (Finish)	10RCX150L70D-144F/95X60		
	Buyer Approval Status			
	Weave	3/1 RHT		
	Color	Indigo		
	EPIXPPI (Wash)	110x61		
	Physical Test Report			
		FTD Declaration	Sample	Production
	Warp Yarn Source	TTML	TTML	ARGON
	Warp Yarn Lot	04/21	3201/24	CJ-01-KW
	Weft Yarn Source	Shaoxing	HANGZHOU FUYANG	HANGZHOU FUYANG
	Weft Yarn Lot	ETO-42	MX1735	MX-1746-26
	Total Ends	5160	5160	5160
	Warp Ratio	Full	Full	Full
	Greige EPIXPPI	71X50	Not found	80X55+
	Greige Width	68.5	Not found	65.8
	Greige GSM	246	Not found	264
	Reed Space	72.57	Not found	72.3
	Finish EPIXPPI	95X60	94X61	92X60+
	Wash EPIXPPI	109X62	108X62	108X62
	Cuttable width (52)	52.4	52.8	53.5
	PI Cuttable width (52)			
	Wash Width	46.8		45.7
	Weight 10	9.79	9.75	9.85
	PI Weight 10			
	Wash weight	11.53	11.25	11.3
	Shrinkage (L,0-3) (W:13-17)	Length Shrinkage:-3.50	Length Shrinkage:-2.50	Length Shrinkage:-3.0
		Width shrinkage:-13.50	Width shrinkage:-15.0	Width shrinkage:-14.50
	Finish Skew	Not Found	N/A	11
	Finish Skew %	Not Found	N/A	8.09%
	Wash Skew	Not Found	N/A	10
	Wash Skew %	Not Found	N/A	8.61%
	Movement	Not Found	N/A	-0.52%
	Lab Test Report			
		FTD Declaration	Sample	Production
	Stretch Ability%	47%	50.00%	50.00%
	Growth%	N/A	3.00%	4.00%
	Recovery%	95%	97.00%	96.00%
	Warp Tear	66 N	88 N	80 N
	Weft Tear	48 N	75 N	70 N
	PH	N/A	N/A	
	Inspection Report		Inspected Length=100 YDS	conta:32p,snarl:4p,coarser warp:4p,Loose:4p,starting mark:4p
			Total points=48P	
			P.P.H.S.Y=32.29%	
	Quality Comments			
	Appearance	ok		
	Shade	1 step light than sample		
	CSV	normal		
	Hand Feel	OK		
	Physical Test Report	Finish width high.		
	Neps, Haireness	Not Found		
	Lab Test Report:			
	Finishing Lot number	FL:2241159		
	Finishing Process Type	Destze Finish		
	Remarks			

Quality test According to Bayer manual:

Dimensional stability shrinkage test



Fabric shrinkage check result-

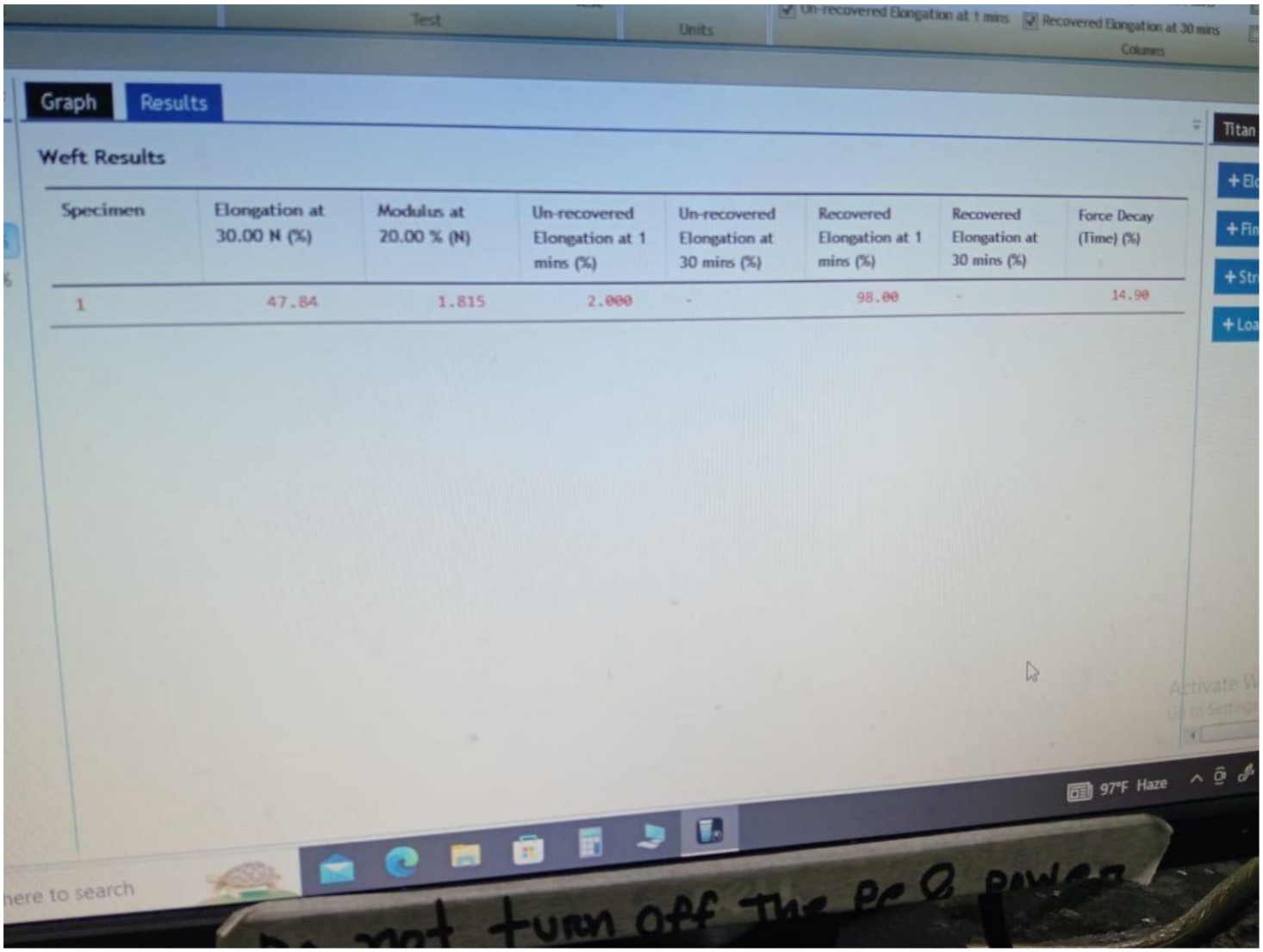
		warp	weft
Buyer requirement	=	-(0-3)%	-(13-17) %
Actual Result	=	warp -(0-2.5)%	weft -(13-15) %

3.11.4 PH TEST

Fabric PH check result-

Buyer requirement	=	**PH**
		6.0 - 7.5
Actual Result	=	**PH**
		7.2

3.11.5 Tear & Tensile Test



TEAR & TENSILE TEST REPORT

SIS45POS1267DF

Tear requirements :Warp tear :30N,Weft tear :24 N

Tensile requirements : Warp tensile 480N, Weft tensile :320N (As per fabric weight)

EPIXPPI (BULK)		Un-wash				FTD DEC (After 3HL)				Buyer Manual Wash(After 3HL)				Matching Wash			
		Tear		Tensile		Tear		Tensile		Tear		Tensile		Tear		Tensile	
UNWASH	WASH	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
94X60	109X62	88 N	53 N	959 N	736 N	64 N	47N	570 N	380 N	88 N	50 N	958 N	632 N	62 N	26 N	766 N	294 N
94X60	112X62	79 N	58 N	780 N	606 N					85 N	51 N	938 N	639 N	66 N	25 N	810 N	288 N
94X60	110X62+	86 N	62 N	826 N	778 N					87 N	52 N	912 N	640 N	69 N	27 N	756 N	251 N
94X58+	109X62	88 N	53 N	940 N	696 N					84 N	52 N	931 N	618 N	60 N	23 N	800 N	240 N
		85.25 N	56.5 N	876.25 N	704 N					86 N	51 N	934 N	632 N	64.25 N	25.25 N	783 N	268.25 N
94X58+	107X62	75 N	43 N	934 N	750 N	N/A								40 N	25 N	730 N	228 N

SIS16POS1261DF

Tear requirements :Warp tear :30N,Weft tear :24 N

Tensile requirements : Warp tensile 480N, Weft tensile :320N (As per fabric weight)

EPIXPPI (BULK)		Un-wash				FTD DEC (After 3HL)				Buyer Manual Wash(After 3HL)				Matching Wash			
		Tear		Tensile		Tear		Tensile		Tear		Tensile		Tear		Tensile	
UNWASH	WASH	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
93X61	115X63+	71 N	51 N	929 N	763 N	66 N	48 N	580 N	470 N	64 N	49 N	975 N	677 N	60 N	28 N	719 N	234 N
93X60+	113X62+	67 N	44 N	910 N	759 N					70 N	50 N	830 N	683 N	58 N	25 N	804 N	320 N
93X60+	114X62+	68 N	42 N	895 N	706 N					69 N	40 N	961 N	609 N	64 N	27 N	816 N	286 N
93X61	114X63	71 N	44 N	885 N	633 N					71 N	50 N	987 N	652 N	61 N	27 N	710 N	272 N
		69.25 N	45.25 N	904.75 N	715.25 N					68 N	47 N	938 N	655 N	60.75 N	26.75 N	762.25 N	278 N
93X60	111X63	75 N	46 N	970 N	769 N	N/A								59 N	28 N	772 N	290 N

3.11.6 Shade grading with buyer approval standard

Before wash **After wash**

Center to selvage shade variation (CSV) test:

Shade variation check Sample Vs bulk:

Shade Quality check for final shipment

3.12 Denim wash

Denim washing refers to the finishing process involving denim fabric and whose aim is to increase the aesthetic value of denim fabric as well as its texture and durability. It is very important in the process of giving the denim garments their own distinctive and stylish looks. In contrast to the wash denim that is subjected to numerous post-dyeing treatments, the dry denim (dry denim, too, is referred to as raw denim) goes untreated after dyeing.

Dry denim has its charms due to the fact that as it is used it takes on an individual wear pattern. The denim will fade as the wearer walks, bends and lives the life they live, depending on their shape and their living style. The resulting natural wear gives the garment a unique appearance that most people find more natural and attractive in comparison to the forced wear effects employed during the manufacture of pre-washed jeans. Denim washing therefore does not only add style, but also enables one to express his/her individuality in the sense of fashion.

There are basically two distinct categories of denim washing techniques:

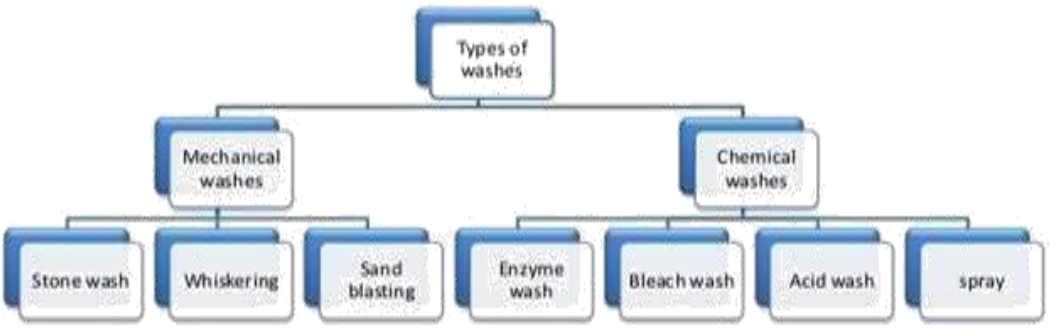
1. Techniques of Mechanical Washing

Such procedures can entail some physical treatment in order to transform the way the denim looks and feels:
Stone Wash-A process in which pumice stones are employed to give a rugged outlook to the denim thus, making it look worn out.
Micro Sanding This is a process which lightly scrubs the surface of the fabric to achieve a velvet feel and slightly faded.

2. Chemical techniques of washing.

These are performed with the help of the chemical agents to alter the colour, texture or finishing of the fabric:

Bleach wash- this involves use of bleach reagents to make the denim lighten.
Enzyme Wash- The surface dye is broken down using enzymes to give a faded and softer effect.
Acid Wash- Mix pumice stones with acid to make it dramatic and are used to provide the effect of contrast and mottled vintage appearanc



On the base of chemical use

On the bases of water use

Defect of Washing :

3.13 Fabric Inspection Manual:

Fabric inspection is conducted to determine quality and acceptability of the same. Such systems of fabric tests are employed, as

4-point system

10-point system

3.14 Four Point system

One of the methods which have been adopted most commonly in the apparel area is the Four Point System to check the quality of the fabric. In order to properly take advantage of this system one should grasp the following points. The process of inspection of the fabric or preparing the fabric.

The factors considered as the basis on the penalty points due to the kind and length of the defects. The formula that is used to obtain the total number of penalty points for the aggregate amounts of thus far found defects on a roll or a bolt. Some sort of a check sheet or the layout to use in order to record the data concerning inspection accurately. Familiarity with the different forms of mechanically related defects

3.15 Key imperfections/deficiencies/mistakes of yarn, dyeing tailoring and sizing weaving and completing:

- Weak yarn
- Neps
- Hairness
- Slub effect
- Twist
- Thick and thin
- Uneven yarn count
- Unlevel dyeing
- Listing
- Ball formation
- Wrong dyeing &padder tension
- Off shade
- Loose , tight , miss warp
- Double warp
- Line mark
- Tample mark
- Stop mark
- White and black mark
- Knot
- Wrong denting, reed, twill
- Hole
- Smach
- Loom bar
- Line mark
- Snarl
- Miss , broken, short pick
- Reed mark
- Cresh mark

- Wrinkle
- Shrinkage
- Skew
- Bowing
- Weavy
- Float
- Burning
- Water sport

CHAPTER-4: RESULT AND DISCUSSION

4.0 Result and Discussion:

4.1 Yarn count test result	
Buyer requirement count	10 Ne
Test actual count	9.96 Ne

4.2 Slub Yarn test result		
Buyer requirement;	Slub length (cm)	Pause length (cm)
	6.0 - 9.0	19.0 - 38.0
Slub yarn test result	Slub length (cm)	Pause length (cm)
	6.0 - 9.0	19.0 - 37.5

4.3 Yarn twisting result		
Buyer requirement;	TPI(twist per Inch)	TPM(twist per meter)
	14.0 – 15.0	551 - 590
Actual twisting Result	TPI(twist per Inch)	TPM(twist per meter)
	14.5 -15.5	570 - 610

4.4Yarn Appearance result		
Buyer requirement;	IPI	CSP
	7	3500
Actual Result	IPI	CSP
	11	2800

4.5 Yarn tension result		
Buyer requirement;	Count	Tension
	10 Ne	25-30
Actual tension Result	Count	Tension
	10 Ne	27-32

4.6 Moisture and temperature check result		
Buyer requirement;	Moisture	Temperatur e
	65-70 RH	20C - 25C
Actual Result	Moisture	Temperatur e
	60-65 RH	25C - 32C

4.7 Viscosity and RF check result-		
Buyer requirement;	Viscosity	RF
	16-22 sec	5-6%
Actual Result	Viscosity	RF
	18-25 sec	4-5%

4.8 GSM check result-		
Buyer requirement;	GSM	OZ
	376	11.10oz
Actual tension Result	GSM	OZ
	373	11.00oz

4.9 Fabric width check result-	
Buyer requirement;	width
	50 inch
Actual Result	width
	50 inch

4.10 Fabric EPIxPPI check result-	
Buyer requirement;	EPI x PPI
	94X60
Actual Result	EPIxPPI
	94X61

4.11 Fabric skew checking result	
Buyer requirement;	skew
	12
Actual Result	skew
	11 .5

4.12 Fabric bowing checking result	
Buyer requirement;	Bowing
	0.5- 1.0
Actual Result	Bowing
	0.6

4.13 Fabric PH check result	
Buyer requirement;	PH
	6.0-7.5
Actual Result	PH
	7.2

4.14 Fabric shrinkage check result		
Buyer requirement;	Warp	Weft
	0-3	-14
Actual tension Result	Warp	Weft
	-2.5	-12.5

4.15 Discussion:

Collectively, the findings indicate that incorporation of a layered QA approach, with focus on raw material testing, optimized wash routine, blended fiber selection, automated measurement and sustainable finishing, helps improve durability and decrease defects. Nonetheless, the issues of the balance between cost investment in prevention in comparison with reactive measures, trade-offs (e.g. strength vs comfort, sustainability vs abrasion resistance), continue to be the core issues. These, in turn, help to establish a data-oriented QA framework that aligns the mechanical performance with the environmental and economic objectives, thus laying the grounds of strong brand trust and efficient production.

CHAPTER-5: CONCULSION

5.1 Conclusion:

High quality denim fabric that is produced consistently is only possible by means of a multi-stage quality assurance process that starts by use of a stringent raw material inspection, continues with in-process assessment, and ends with accurate end test and finishing. Taking high quality raw materials as point of departure which is high-grade cotton and yarn after consideration of fiber length, tensile strength and spinning process that have direct relation to durability and appearance, manufacturers have laid a solid foundation of assuring good quality.During manufacturing process, visual inspection in the same trade is subjected to standard visual standards which could be American 4-point system of counting or Japanese 10-point system of counting followed by other objective measures such as GSM, density of weave, tension and uniformity of dye which all help in identification of defects and associated costs and allow prevention The finishing treatments like sanforizing, heat -setting, and singeing also improve dimensional stability, surface texture and hand feel.traceability systems, utilizing batch codes and digital logs, ensure entire supply chain transparency.When used in conjunction with compliance with ISO, ASTM, AATCC, and Oeko -Tex, this is a combined effort at QA that ensures limited defects, high consistency and support of sustainability and consumer confidence.

REFERENCES:

1) All information gathered from the manufacturing plant (NZ Denim Ltd.).

2) All enlightening data gather from the specialized individual.

3) Lecture sheet.

4) Web: http://www.otdtextile.com, http://textilelearner.blogspot.com

5) Some Magazine like: Textile Today, Textile Learner.