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Faculty of Engineering

Department of Textile Engineering

Study On Production Process Of Double Jersey Knitted Fabric

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Declaration

We hereby declare that, this project has been done by us under the supervision of **prof. Dr. Md. Mahbubul Haque , Head**, Department of Textile Engineering, Daffodil International University. We also declare that neither this project nor any part of this project have been submitted elsewhere for award of any degree.

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LETTER OF APPROVAL

This project report prepared by **Masum Billah** (ID:142-23-3927) and **MD. Tarif Rahman** (ID:142-23-3885), is approved in Partial Fulfillment of the Requirement for the Degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING. The said students have completed their project work under my supervision. During the research period I found them sincere, hardworking and enthusiastic.

Prof. Dr. Md. Mahbubul Haque

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FACULTY OF ENGINEERING

DAFFODIL INTERNATIONAL UNIVERSITY

ABSTRACT

On this study was complete by the production process of double jersey knitting machine . and this article are focused on interlock and rib structure and how this type of machine are work. We also focus about different type of problem those are face to done by the machine running . we get some problem. The major problem of this types of machine are wastage. We discus how can we reduce the wastage of fabric. Compare the different type of rib and interlock machine production process get different type of production data.

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Chapter – 01

1.1 Introduction

In the world of textile technologies there has been lots of attempt going on to find out effective replacements of different materials to meet the basic demands of clothing. Textile is the most growth able sector of the world . Bangladesh is the 2nd largest garments cloth producing country of the world. Bangladesh mainly produced 2 types of fabric- knit fabric, woven fabric. Now Bangladesh widely produced denim product. Denim is one kind of woven fabric. Bangladesh export 60% knit product and 40% woven product. Knit product are two types single jersey and double jersey.

Now at this time world market growth developed day by day. And every body of the world want to be quality full product. And those country product like this product. Customer are attract of them.

In knitting machine, the process of producing fabric by transferring continuous yarn into interlocking loops, each row of loop hanging from the one immediately preceding it. There are mainly one set of yarn are used in knitting. Bangladesh produce a huge number of knitting product. Mainly Two types of knitting product are produce in this country. They are single jersey and double jersey.

There are many problem of producing knitting product. The major problem of producing knitting product is wastage. A huge amount of knitting product are wastage in Bangladesh are every year . The main reason of wastage are unskilled labor , old machine, machine defect , machine efficiency , dust on machine and many other reason . if we overcome this type of problem then we must increase our productivity and we increase our profit . That's way we need to attention the development of our labor skill and strength. And also try to use proper machine .

1.2 Aim of this research :

- ❖ To know about The production process of double jersey circular knitting machine.

- ❖ To compare the physical properties of rib structure and the interlock structure.
- ❖ To compare the production process of interlock machine and rib machine.
- ❖ To know how many wastage of double jersey circular knitting machine and how can we reduce those types of wastage.
- ❖ To collect the machine gauge, Yarn count, yarn strength, fabric dia and also try to know which types of fabric are suitable for double jersey circular knitting machine.

1.3 Objectives :

Textile is the main earnable sector in our country. In this reason we must be try to know everything about In this sector. The objective of our study is find out the different types of knitting machine and to know how to those types of machine work.

To complete this topic we can know many thing about the double jersey circular knitting machine.

1.4 Research limitation:

- The main limitation of double jersey knitting machine is wastage.
- Fabric breakage is one of the major limitation of double jersey circular knitting machine.
- Needle breakage is causes for the low productivity of circular knitting machine. So it is one types of limitation.
- Less fabric strength is causes for less productivity.
- Unskilled labor can not control machine properly many wastage produce for there fault. This is major lack of double jersey circular knitting machine.

Chapter -02

Literature survey

2.1 Rib fabric : A double-knit fabric in which the rib wales or vertical rows of stitches intermesh alternatively on the face and the back of the fabric. Rib knit fabrics have good elasticity and shape retention, especially in the width .

Properties □ The appearance of face and back are identical.

□ Fabric length wise and width wise extensibility is approximately that of single jersey.

□ Fabric does not curl at edges.

□ Fabric thickness is approximately twice than single jersey.

□ There are two series of knitted loops arranged into two parallel in a course.

□ Combination of Wales of face loop and back loop are present on the both side of the fabric

2.1.1 Derivatives of Rib Structure

□ 1x1 rib

□ 2x2 rib

□ Half cardign

□ Full cardign

□ Swiss double pique

□ France double pique

□ 4x2 rib

03

2.1.2 Rib circular knitting machine

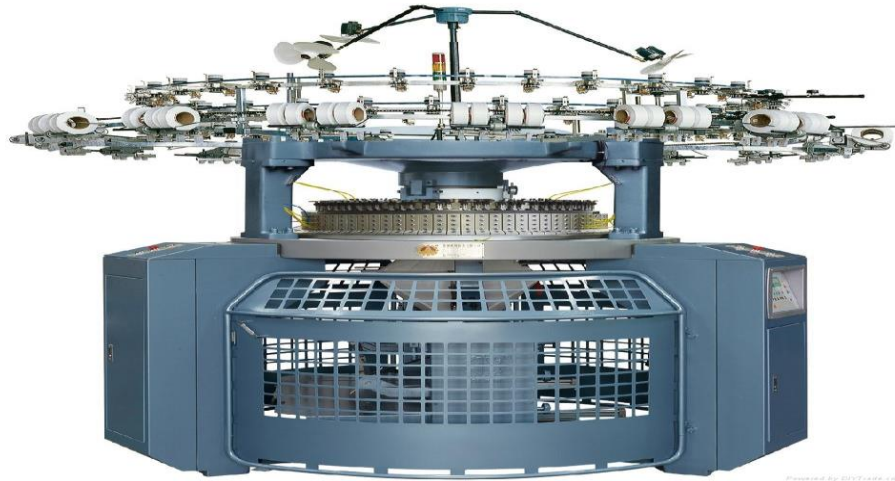


Figure-01 : Rib circular knitting machine

- There are two sets of needles present in this machine.
- The cylinders are midway between the dial needles.
- The needle gauge is mainly 80
- In vertical cylinder, one set of needles is used & in horizontal cylinder, the other set of needles is used.
- Two types of needles should have both cylinder and dial needle bed
 - a) Long needle
 - b) Short needle

2.1.3 Structure :

The normal rib fabric is 1*1 rib. The 1st rib form was discovered by Jedediah Strutt of Derby in 1755, which behavior a number of two sets of needles to choose and knit the sinker loops of the 1st set. Now it is usually knitted with two sets of latch needles. 1*1 rib is produced by two sets of needles being alternately set or gated. Among each other 1*1 rib is basically twice the depth and half the width of fabric. 1*1 rib is the double jersey fabric.

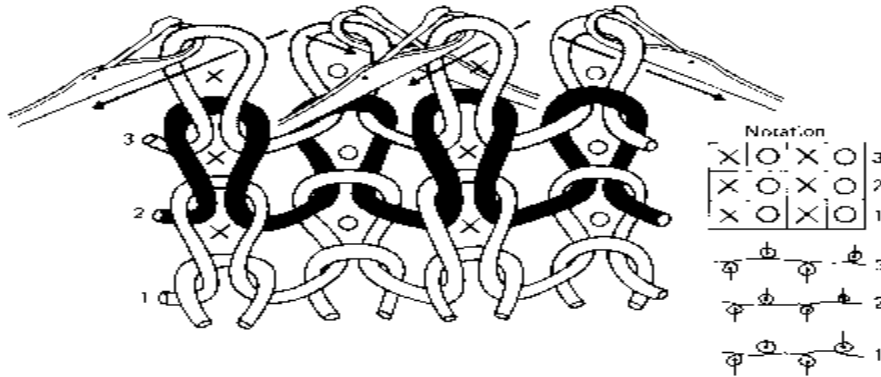


Figure –1.2 : Simple rib structure

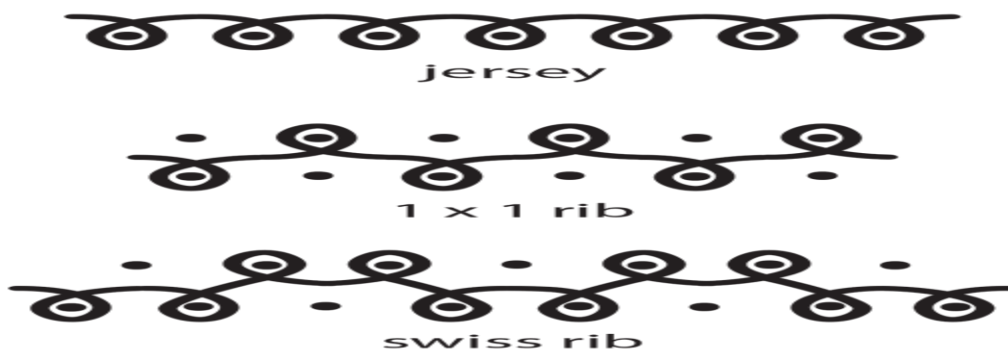


Figure -1.3 : 1*1 & swiss rib structure

2.2 Interlock fabric: In knitted fabric, loops are locked to each other and loops are identical. The stitch variation of the rib stitch, which resembles two separate 1x1 ribbed fabrics that are interknitted. Plain interlock stitch fabrics are thicker, heavier, and more stable than single knit construction .

Properties

- Interlock the technical face of plain on both side so the appearance of face and back are same.
- The Wales of each side re exactly opposite to each other and are locked together.
- Widthwise and length elongation are approximately same as single jersey.
- The fabric does not curl at the edges.
- The fabric can be unraveled from the knitted last.

- Two yarns must be removed to unravel a complete repeat of knitted course.
- Fabric thickness is approximately twice than that of single jersey.

2.2.1 Derivatives of Interlock Structure :

- 1x1 interlock
- Jersey card, etc

. **Stitch length** The length of yarn required to produce a complete knitted loop is known as stitch length or loop length. Stitch length is a length of yarn which includes the needle loop and half the sinker loop on either side of it. Loop exists in course in

course length and it is that which influence fabric dimension and other properties including weight. Take a fabric and mark with pen 100 wales for single jersey and 50 wales for rib and interlock fabric. Then open the course and measure the length in cm scale and divided this data by 10 and measure stitch length .

2.2.2 Interlock circular knitting machine :



- There are two needle bed present in this machine .
- In vertical there are one set of needle are mounted & in horizontal dial other set of needle is mounted.
- Dial needle are face to face between cylinder needle.
- The needle gauge mainly 20 .
- Two types of needle should have both cylinder and dial needle bed

1. Long needle
2. Short needle

2.2.3 structure

American scientist Scott and William show a pattern in 1908 for interlock was elaborate for 20 years. The model diameter of under garments manufacturing found the needle expensive especially on the larger 20 inch. In 1925 suitable hosiery twice cotton yarn are available the technical face of plain interlock fabric are both side

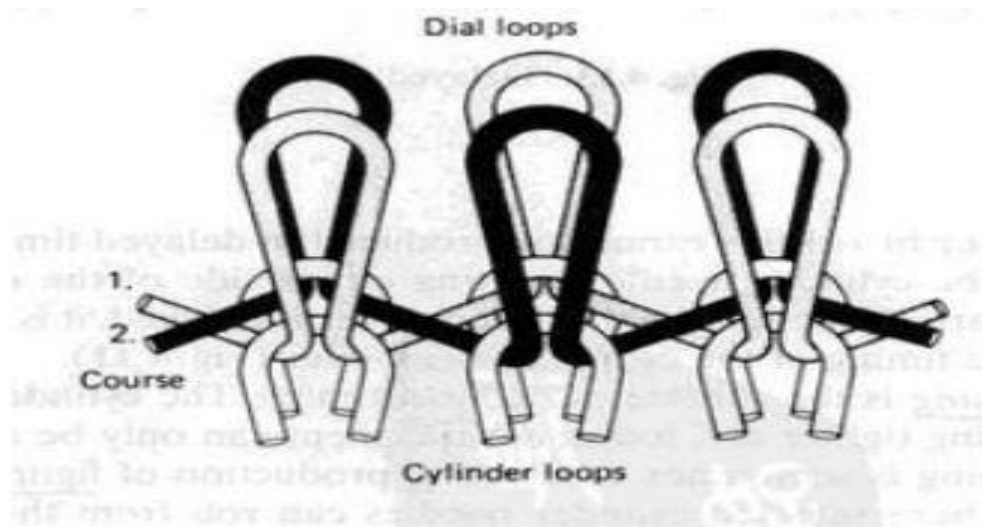
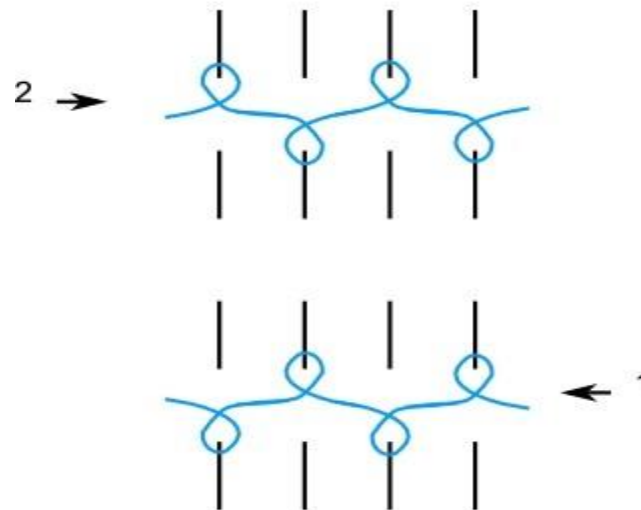


Figure -2.1 : Basic interlock structure

INTERLOCK KNIT FABRIC



Needles at full pitch (interlock gating)

Figure-2.2 : Interlock gating

2.3 Machine requirement for interlock knit fabric

- Interlock fabrics are mainly produced on specially designed circular double jersey machines called interlock machines.
- They are high speed, multi-feeders with closed cam track machines.
- The common gauges for interlock fabrics are 20-24 npi, using 1/30 Ne cotton or 1/48 Nm worsted yarns.
- Worsted interlock is for ladies' winter suiting fabrics. For those 28 gauge fabrics, the yarns used are mainly textures polyester of 75 denier.

2.4 The dial system:

- Raising cam for tuck position only
- Dial knock over cam
- Guard cam to compete the truck
- Auxiliary knock over cam to prevent the dial needle reentering the old loop
- Guide cams provides the tracks for idling needles
- Sewing type clearing cam which may occupy the knitting position.

2.5 Fabric GSM :The GSM is one kind of fabric specification which is very important for a textile engineer for understanding and production of fabric. GSM means gram per square meter that is the weight of fabric in gram per one square meter. By this specification compare the fabrics in unit area which is heavier and which is lighter.

For measuring GSM, fabric sample is cut by GSM cutter. Weight is taken by electric balance. By this way we get the weight in gram per one square meter fabric . Here GSM of the fabrics by the GSM cutter is obtained by the multiplying the sample weight with 100.

2.6 Count: Count is numerical expressions which express or indicate the fineness or coarseness of yarn used in textile. According to Textile intuition, count is a number indicating the mass per

unit length or the length per unit mass of yarn. Here, count has two systems indicate coarseness and fineness of yarn.

Count is mainly two types

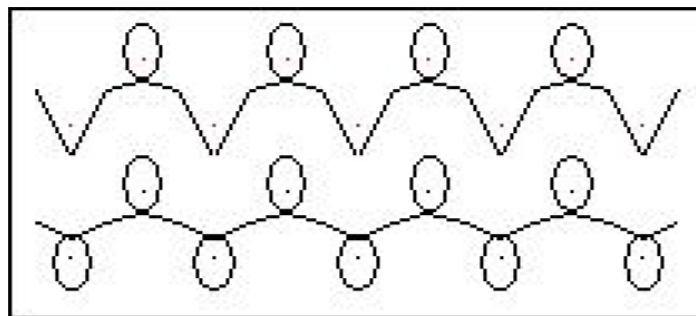
Indirect system

Direct system.

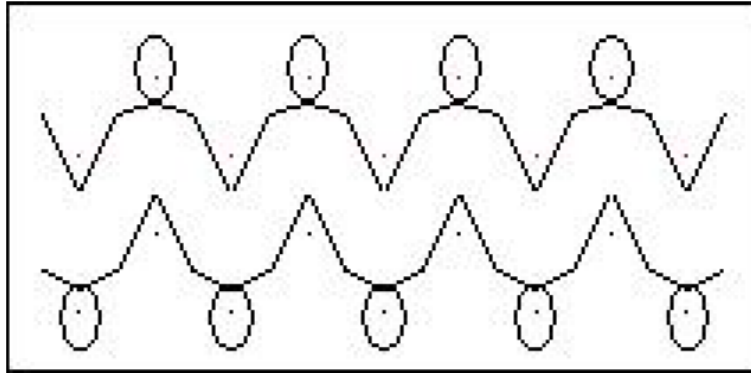
2.7 Design :

2.7.1 Rib derivatives

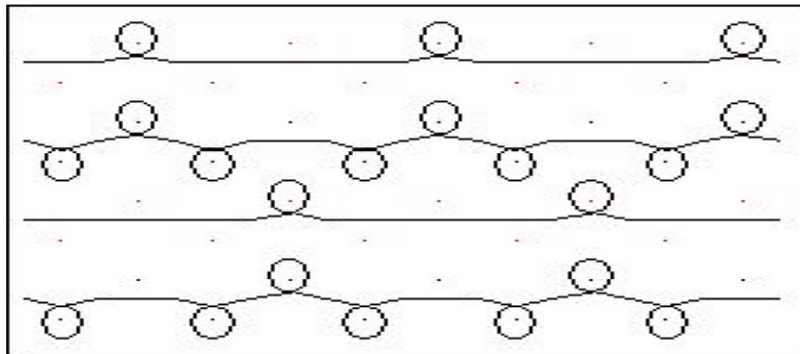
Half cardigan



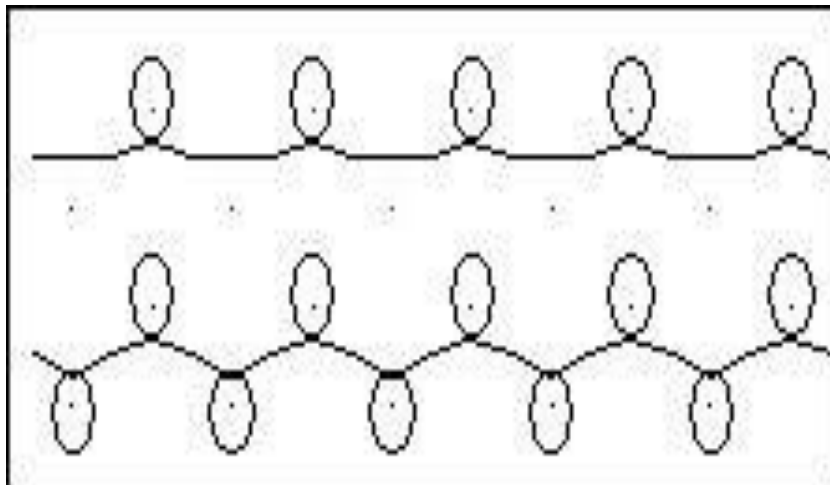
Full cardigan



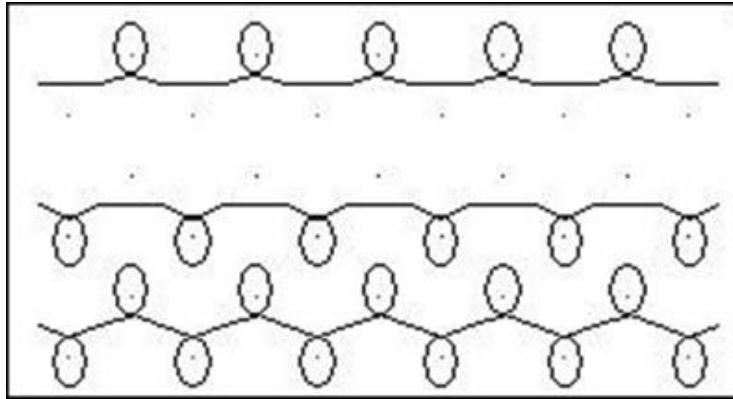
Swiss double pique



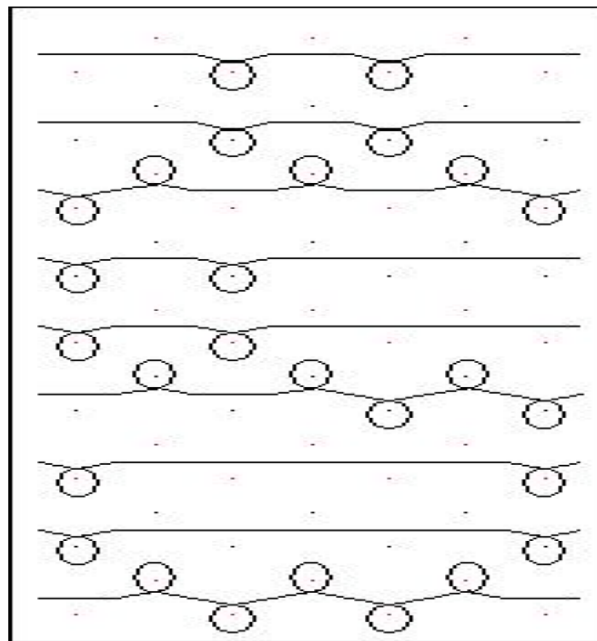
Half Milano rib



Milano rib

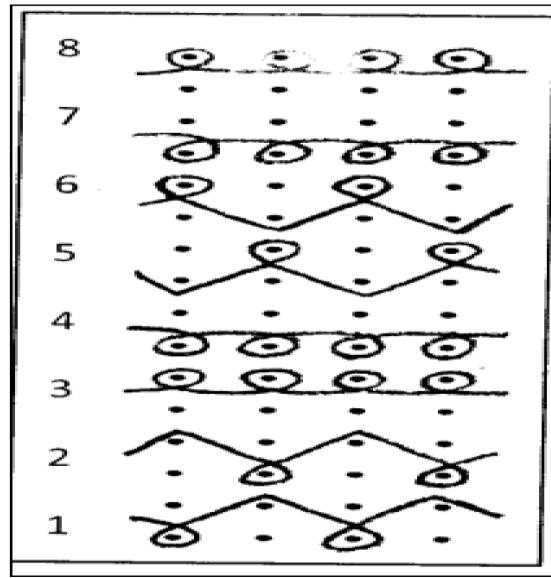


Milano rib : Gaberdine

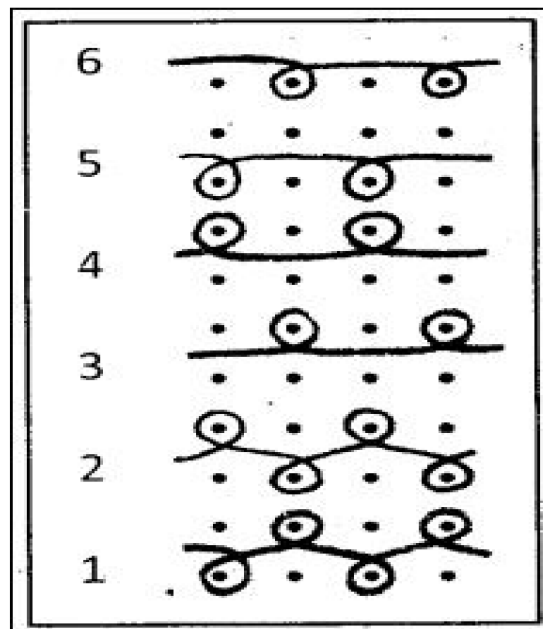


Interlock derivatives

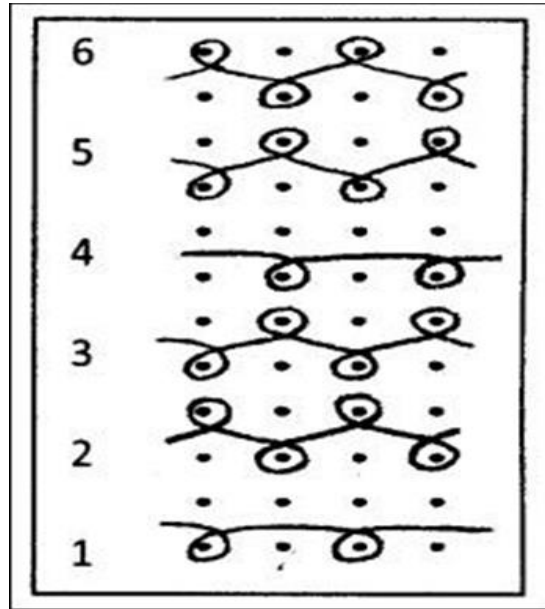
Bourrelet



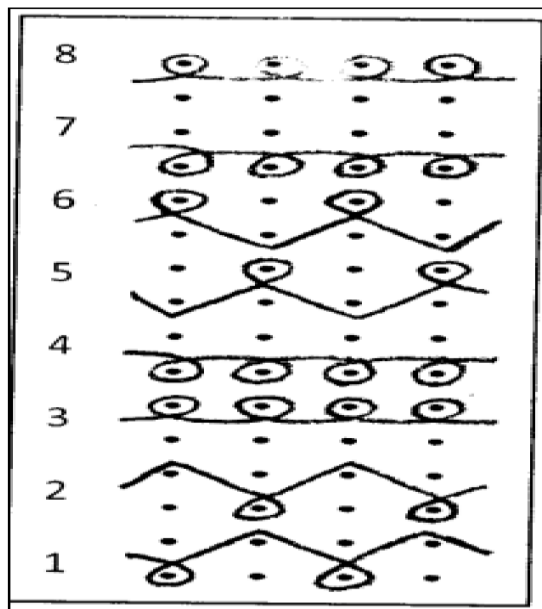
Cortina



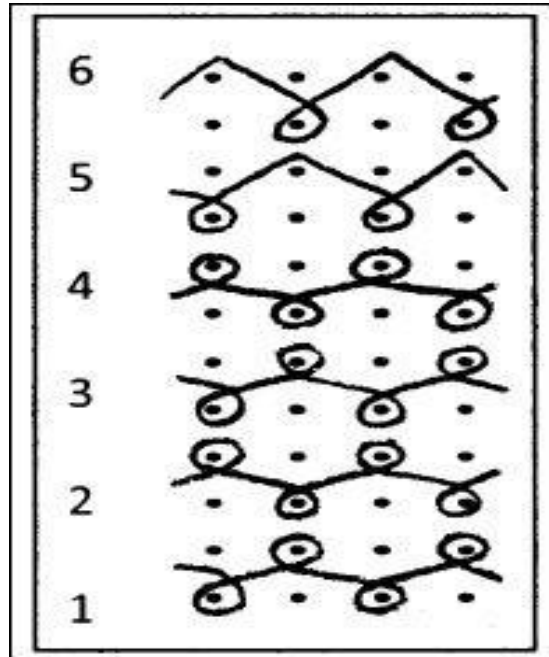
Cross miss structure



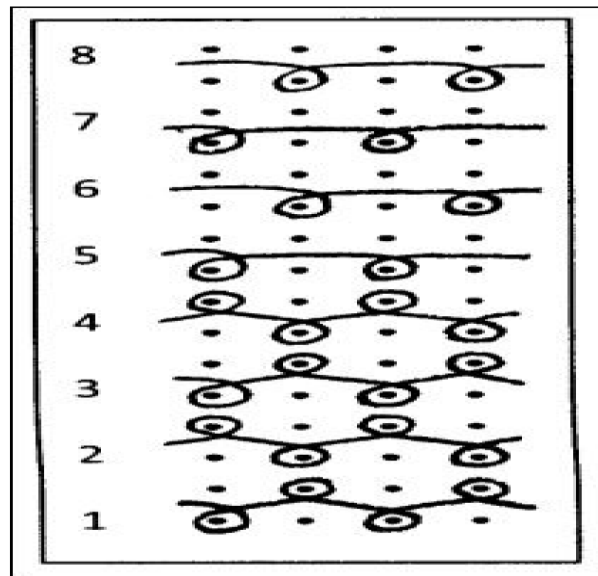
Evermonte



Jersey cord



Pin tuck



Chapter -03

Methodology

3.1 Definition

In double jersey machine are single jersey machine with a dial which an extra set of needle were positioned by horizontally adjacent to vertical cylinder needle. Excessive set of needle allows the production of fabrics that are twice as single jersey fabrics.



Figure – 03

3.1.1 Machine Parts:

1. Motor
2. Dial
3. Cylinder
4. Break stop motion
5. Yarn guides
6. Dial cams
7. Cylinder cams
8. Dial needles
9. Cylinder needles
10. Oiling and air following devices
11. Sensors
12. Take up rollers
13. Batch rollers
14. Yarn career

- 15. Belts
- 16. Clutches
- 17. Pulleys and gears

3.2 Machine Specification (Double jersey) :

3.2.1 Rib :

Model : JI-HYD

Origin : China

Total teeth :188

Inch : 28

Guage : 24

Feeder : 84

Length *Width*Hight :1.89*1.87*1.97

Raw material : Cotton, Chemical Fiber, Blended Yarn, Silk &Wool

3.2.2 Interlock

- Origin of the machine:- Japan
- Model no. :- V 8ME 43
- Dia of the machine:- 30”
- Gauge of the machine:- 22
- No of Feeder:- 85
- Serial no:- 1352761.
- Creel Capacity: 86.
- Feeding: Positive.

3.3 Fabric Specification

3.3.1 (Rib) :

Table no- 01

Fabric type	Finished fabric	Yarn count	M/C diameter	Feeder diameter	G/GSM/S.L
(1*1)ly.rib	280	26	40*18	38 (T)	2.95

3.3.2 (Interlock) :

Table no -1.2

Fabric type	Finished fabric	Yarn count	M/C diameter	Feeder diameter	G/GSM/S.L
Interlock	290	28	30	40	2.2

3.4 Fabric (sample) analysis :

Table no -02

Fabric type	WPI	CPI	Stich length	Count	GSM
Rib	47	54	2.765	29	217.33
Interlock	66	80	1.67	36	225.54

3.5 Relationship between machine gauge & yarn count :

Table-03

Interlock		1*1 RIB	
M/C gauge	Yarn count	M/C gauge	Yarn count
24	46	16	30
24	46	18	28
24	40	18	24
24	40	18	26
24	34	16	30
24	36	16	28
24	36	18	30

18

3.5.1 Relationship between machine diameter and fabric diameter :

Machine diameter are varies with the fabric finished diameter. The variation of fabric GSM are at different range with the separation machine diameter but similar construction chase particular path of variation.

Table-4

1*1 RIB					
Machine		Finished diameter of fabric (inch)			
M/c dia Inch	M/c gauge	Count 20/1 Ne &fin GSM - 270-280	Count 24/1 Ne &fin GSM - 230-240	Count 26/1 Ne &fin GSM - 215-225	Count 20/1 Ne &fin GSM - 155-165
30	18	34	32	31	26
36	18	40	39	37	32
40	18	44	43	42	36
42	18	46	45	44	38

Table- 4.1

Interlock				
Machine		Finished diameter of fabric (inch)		
M/c dia Inch	M/c gauge	Count 30/1 Ne & fin GSM - 250- 260	Count 34/1 Ne & fin GSM - 225- 240	Count 40/1 Ne & fin GSM - 205- 215
28	22	24	24.5	28
34	22	29	33	34
36	22	31	35	36

3.6 Operating parameter of double jersey

Table no -05

Fabric type	GSM	Diameter	Temperature	Over feed	Padder pressure	RPM	Blomer rpm
1*1 rib	160-220	2'' +	130-160	45%	2 bar	24-28	1300-1400
2*2 rib	190-220	2'' +	140-160	45%	2 bar	20-25	1200-1400
Interlock	190-220	3'' +	130-160	50%	2 bar	20-25	1200-1400

3.7 Rib to interlock and interlock to rib.

In rib machine 100% needle are work and interlock machine 50% needle are work. we can convert rib machine to interlock machine and interlock machine to rib machine to change the needle. When 100% needle are work we told them rib machine and when 50% needle are work then we told them interlock machine.

The dia of rib machine are 20 and the dia of interlock machine are 30. we can convert rib machine to interlock machine and interlock machine to rib machine change the dia\

To change the sinker we can convert rib machine to interlock machine and interlock machine to rib machine.

Basically rib machine, number of 40 feeder are used and interlock machine, number of 84 feeder are used. We can convert rib machine to interlock machine and interlock to rib machine to change the number of feeder.

To change the needle and cylinder dial we can convert rib to interlock and interlock to rib.

machine gauge=24

Needle distance

Number of needle per inch=24*3.1416

=76

Needle per mm =2.54 *10/76

=0.33mm

3.8 End product :

3.8.1 Rib machine :

- ❖ 1*1 rib Fabric
- ❖ 2*2 rib Fabric
- ❖ 1*3 rib Fabric
- ❖ 4*2 rib Fabric
- ❖ 6*3 rib Fabric
- ❖ Honeycomb
- ❖ Separation Fabric

3.8.2. Interlock machine :

- ❖ Eyler Fabric
- ❖ Interlock pique
- ❖ Mash Fabric
- ❖ Honeycomb Fabric
- ❖ Face/Back Fabric.

3.9.Difference between rib & interlock circular knitting machine

RIB	INTERLOCK
Cord appearance of rib has vertical	On both sides interlock has the technical face of plain fabric
Face and back side are different	Face and back side both are similar
Uses one type of latch needle	Uses two types of latch needle
In this machine cylinder & dial is used	In this machine cylinder & dial is used
There is no curling tendency in rib	No curling tendency
At yarn feeding one feeder is used	At least two feeder is used
Production rate is high	Production rate is low
In same sequence cylinder needle & dial are opposite	Dial and cylinder needle are opposite and alternatively placed
Synchronized timing.	Delay timing.
The structure of rib is not so heavy and thick	This structure is thick and heavy
In this machine side creel are used	In this machine side/over head creel is used
Sleeves, socks, cuffs, bottom edges of sweaters ,knit hats ,means hosiery are used to produce	Underwear, shirts, suits, trouser suits,sports wear are used to produce

chapter -04

Discussion

In rib machine face side and back side are different and interlock machine face and back side are similar.

The dia of rib machine are 30 ,36 40 inch and the dia of interlock machine are basically 28,34 and 36.

The finished diameter of fabric per inch are 20/1 Ne , 24/1Ne,26/1Ne and 30/1Ne. and the GSM are 270-280, 230-240 and 215-225.

In interlock fabric when machine gauge 24 then yarn count are 46,44,36,34. And in 1*1 rib fabric when machine gauge are 16 and 18 then yarn count are 30 , 28 ,24.

In 1*1 fabric types finished fabric are 280 ,yarn count 26, machine dia 40*18, feeder diameter 30 t, and GSM /S.L 2.95

In interlock, finished fabric are 290 , yarn count 28, machine dia 30, feeder diameter 40 and GSM/S.L 2.2

In rib fabric WPI are 40%, CPI are 54, stitch length 2.765 and GSM are 217.33 and in interlock fabric WPI are 66 ,CPI 80, sticch length 1.67, and GSM are 225.54.

In rib machine 100% needle are work and in interlock machine 50% needle are work.

To change the needle and cylinder dial we can convert rib machine to interlock machine and interlock machine to rib machine.

The end product of rib machine are 1*1 rib,2*2 rib, 1*3 rib , 4*2 rib, 6*3 rib ,honeycomb rib fabric and separation rib fabric.

The end product of interlock machine are interlock pique , eyler fabric , Mash fabric and honeycomb fabric.

To compare the rib and interlock fabric we know that the production rate of rib fabric are high and interlock fabric are less. Basically in rib machine one set of needle are used and in interlock machine two or more needle are used.

The structure of rib fabric are not so heavy but the structure of interlock fabric are very high.

The product of rib machine are socks, sleeves ,cuff, bottoms edge of sweaters knit hates etc. the product of interlock fabric are underwear, shirts, spurts wear etc.

Chapter-5

Conclusion :

By the grace of almighty Allah , we complete our study successfully . this following study can be helped form the outcome obtained from our study.

The production process of double jersey circular knitting are analyzed and compare between the rib and interlock are done. We have observed different types of knitting machine and this machine how to produce different types of product. Wastage is major problem in knitting machine, we observed how many fabric are wastage in knitting machine and we also study how can we reduced this wastage. The different types of machine are work different way. If we control it properly we can get good outcome.

Referance :

1. file:///C:/Users/DIU/Documents/Downloads/10.5923.j.textile.20170602.06.
2. <http://www.mediafire.com/file/k6zawvij6txdops/Textile+Sizing>.
3. Lecture sheet Fabric design and analysis ,,Fahmida siddique, senior lecturer ,,DIU
4. Fabric structure and design by N.Gokarneshan book
5. <https://textilelearner.blogspot.com/2012/01/rib-circular-knitting-machine-interlock.html?m=1>
6. <https://textilestudycenter.com/colio/reference-books-of-textile-technologies-knitting>
7. <https://textilestudycenter.com/library>.
8. <https://textilestudycenter.com/colio/knitting-technology-by-david-j-spencer>
9. different types of knitting machine by uses of magpie knit composite limited
10. the production data of magpie knit composite limited.
11. <https://textilestudycenter.com/colio/handbook-of-textile-fibres-volume-2-man-made-fibres>