Project On

"Study on various knit fabric and machine efficiency"

Course Title: Project/ Thesis

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This project presented in partial fulfillment of requirement for the degree of Bachelor of Science in Textile Engineering

Declaration

We attest that, this project has been done by us under the supervision of **Asit Ghosh, Assistant Professor,** Department of Textile Engineering, Faculty of Engineering, Daffodil International University. We also declare that, if we do anything which is going to breach the first declaration, the examiner/supervisor has the right to cancel my report at any point of time.

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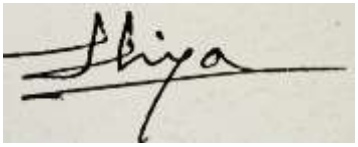

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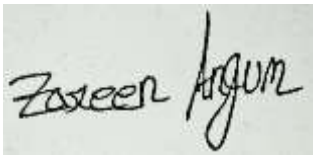

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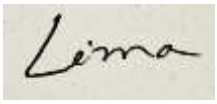

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Approval Sheet

This research entitled "**Analysis of different type of weft knitted fabric And Machine Efficiency"** at Daffodil International University, November 2019. Prepared and submitted by **Hridhya Paul (161-23-4630), Zareen Angum (161-23-4655) and Lima Akhtar (161-23-46)** in partial fulfillment of the requirement for the degree of BACHELOR OF SCIENCE IN TEXTILE ENGINEERING has been examined and hereby recommended for approval and acceptance.

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Acknowledgement

At first, we thank to almighty God for enabling us to complete this project work successfully.

We would like to show our deepest respect to our project supervisors **Mr. Asit Ghosh, Assistant Professor, Department of Textile Engineering, Daffodil International University**, for his caring and constant guidance and supervision throughout our project work.

We are indebted to **Prof. Dr. Md. Mahbubul Haque, Professor & Head of Textile Engineering department At Daffodil International University** for providing us necessary permission to use machine and materials at the beginning of the project.

ABSTRACT

At first, we collect some of knitted fabric samples along with required data which are needed to commence our project work with effective analysis. We also separate the fabrics according to their class so that we can establish an acceptable result which will be perfect for effective use and will help to carry out further activities depending on the established form of work. During our industrial attachment we manage to watch carefully and effectively the knitted fabric specification along with machine specification and the major factor which are necessary to calculate different types of variation ad variable on which the whole fabric construction depends. Our efforts were to develop a dependable way so that we cane easily visualize or can forecast the resulting fabric specification with required configuration. We have tried our best to emphasize on the adjustable points on which fabric G.S.M, stitch length, fabric width & compactness directly or indirectly depends. The theoretic alas well as the practical knowledge that we gathered from our classes and in the industry, help us to perform our project with credit and for this we specially convey thanks to our honorable teachers.

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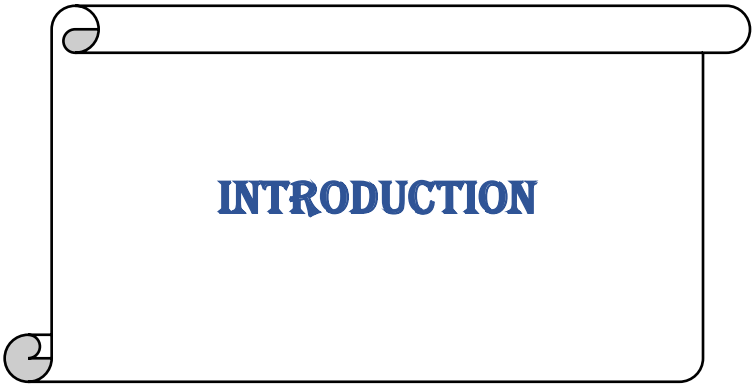
CHAPTER ONE



1.1 Introduction: Fabric is a manufactured assembly of fabrics and yarns that has substantial surface area in relation to its thickness and sufficient cohesion to give the assembly useful mechanical strength.

Our project basically is on knitted fabric specification and machines which are related to knitted fabric production. A precise statement of a set of requirements to be satisfied by a material, product and any system or service that indicates the procedures for determining whether each of the requirements is satisfied. In the analysis of knit fabric specification, we considered wales per inch, course per inch, yarn count, M/C dia, fabric dia, gauge, GSM, stitch length, fabric color, yarn type and many other things.

The title of our project work is analysis of knitted fabric specification, GSM, stitch length, yarn count and machine efficiency. there are problem in our industries to produce knitted fabrics of required GSM. Other specification like fabric width, fabric thickness is generally maintained by previous data sheet. For this reason, there are problem if any order comes which did not produced in previous.

Our target is to find out the easy process to get decision about yarn count selection, machine diameter selection & machine gauge selection and machine efficiency.

We strongly think that by this process we can get decision about yarn count, loop length, machine gauge, and machine diameter for the Single jersey, Rib, Interlock, Fleece, Terry fabric.

CHAPER TWO

2.1) Introduction: A discussion about knitting technology must be dealt both as an analysis of the technical cycles of knitting as an analysis of the technology of knitted fabric in terms of their in its simplest form a knit fabric is made by the longitudinal and vertical repetition of the same element ,the loop which is the basic element of the fabric.

Weaving is a process of fabric forming by the interlasment of warp and weft yarns .knitting is a process of fabric forming by the intermeshing of loop of yarns .When one loop is drawn though another loop stitch is formed.

2.2) Fabric: Fabric is one Kind of yarn sheet that have a bond which might be made by chemical or mechanical bond and for that which wins quality and show numerous properties.

2.2.1) Fabric Types: In today's modern textile, several types of fabric manufactured for woven, knit and non-woven fabric. There are mainly three types of fabric, which are in the beneath:

- Woven fabric,
- Knit or knitted fabric,
- Non-woven fabric.

2.3) Types of knitting:
They are two types of knitting:

1. Weft Knitting

2. Warp Knitting

Classification of weft knitting Machine:

- According to the design and needle arrangement
  - Circular knitting machine
  - Flat knitting machine
- According to the number of needle set used
  - Single jersey
  - Double jersey
- According to the basic structure of weft knitting machine

  - Plain single jersey knitting machine
  - Rib circular knitting machine
  - Interlock knitting machine
  - V-bed knitting machine
  -

2.3.1) Knit or knitted fabric is used for the following purposes:

- Jersey fabric used for making T-shirt, Soft jacket and Coats.
- Interlock knits are suitable for evening wear and lingerie.
- Tricot fabric is used for bathing suits.
- Sweater knits can be used to make tops, sweater dresses and skirt.

2.4) weft Knit: Weft knitting is a method of forming a fabric in which the loops are made in horizontal way from a single yarn and intermeshing of loops take place in a circular or flat form on across wise basis. A method of making a fabric by normal knitting means in which the loops made by each weft thread are formed substantially across the width of the fabric characterized by the fact that each weft thread is fed more or less at right angle to the direction in which the fabric is produced.

2.5) Knitting Elements:

Knitting elements are three types.

- Needle
- Cam
- Sinker

2.5.1) Needle: The needles are the most important stitch forming elements. They are displaced vertically up and down and mounted into the tricks or cuts of the knitting cylinder. The hooked metal needle is the principal knitting element of the knitting machine. Prior to yarn feeding the needle is raised to clear the old loop from the hook and to receive the new loop above it on the needle stem.

2.5.2) Functions of needle: A knitting needle is a tool to produce knitted fabrics. Needle is raised up to clear the old loop from the hook and to receive the new loop.

2.5.3) Types of needle: Generally, three type of needle are used in knitting machine. They are-

- Latch needle
- Breaded needle
- Compound needle

In circular knitting m/c latch needle are used. According to the butt position it is four type. They are-

- One butt latch needle
- Two butt latch needle
- Three butt latch needle
- Four butt latch needle

2.5.4) Needle Operation:

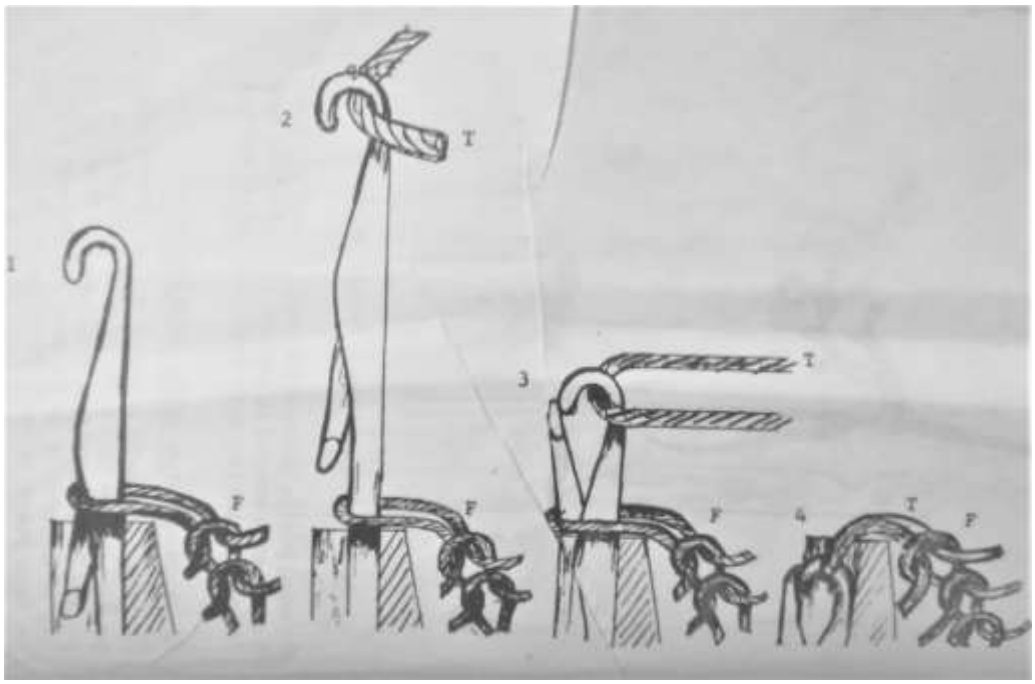
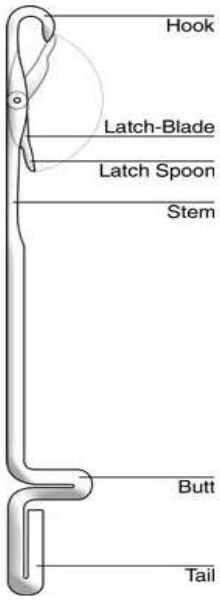


Fig 1: Needle operation

The latch needle is shown at 1 in a partially raised position. The last loop in the fabric is on the needle. At point 2, the needle has been raised up so that the last loop of the fabric is on the stem and the new yarn T has been positioned of the hook of the needle. At position 3, the needle has been dropped. Its latch has been shut by the loop of the fabric. When the needle is more dropped the last loop is thrown over the top of the hook and the thread T is drawn into the fabric as a new loop. The cycle is continued.

2.5.5) Picture of needle:



2.5.6) Parts name of needle:(Latch Needle)

1. Butt
2. Butt height
3. Stem
4. Groove
5. Hook
6. Hook width
7. Latch
8. Rivet

2.5.7) The latch needle:

The needles are the most important stitch forming elements. It consists of hook portion at the top and a latch riveted at certain distance from the needle head. Latch needles are given sliding movements in individual grooves called tricks of the cylinder. Mainly the latch needle is used in weft knit.

2.5.8) Cam:

Cams are the devices which alter the rotary machine drive into an appropriate reciprocating action for the needles and other elements.

Types of cam: Basically, cam two type. They are-

- ❖ Engineering cam

- Knitting cam

Knit cam also divided into three type. They are-

- Knit cam
- Tuck cam
- Miss cam

The functions of cam:

- To produce motion to needles.
- To drive the needles.
- Formation of loops.

2.5.9) Sinker:

The sinker is the third primary knitting element. It is a thin metal plate with an individual or a collective action operating approximately at right angles from the hook side of the needle bed, between adjacent needles. It may carry out one or more of the following functions dependent upon the machine's knitting action and consequent sinker shape and movement:

- Loop formation
- Holding-down
- Knocking-over

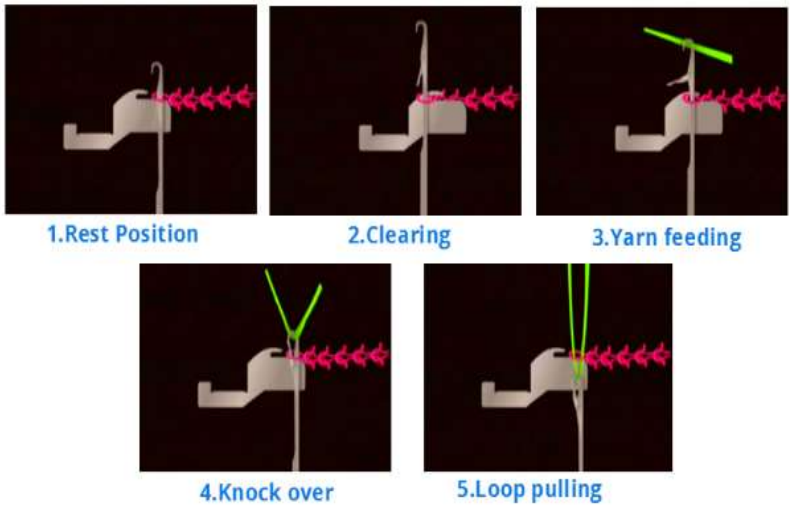


Fig 2: Sinker operation

2.6) Needle gauge and Needle pitch:

Needle gauge:

In knitting, gauge is used both in hand knitting and machine knitting. In both cases, the gauge raises to the number of Needles contained in one inch of the needle bed in knitting machine. A needle gauge makes it possible to define the size of a needle. The needle gauge of a knitting machine is a measure expressing the number of needles per a unit of the needle bed width.

Gauge, N = How many needles are used in one inch.

$$\mathbf{N} = \frac{Number\ of\ needles}{One\ inch}$$

Highest needle gauge is about 60 and lowest needle gauge is about 2 to 2.5.

Needle pitch: The needle pitch is the distance between two needles in the same needle bed, from the center of a needle to the center of the neighboring needle.

Relation between the needle gauge and the needle pitch,

$$\text{Needle pitch} = \frac{1}{Needle\ gauge}$$

2.7) Stitch Length Measurement Process:

In industry stitch length was measured physically. At first a stitch was identified and it was marked by color pen. Considering it is base stitch, then count hundred stitch and last stitch is also marked by color pen. Then the course was unloving from the fabric and measured the length by a measuring scale. Finally the length was divided by hundred and the result indicate the stitch length.

2.8) Different types of yarn in knitting process:

Table 1 **:**Different types of yarn in knitting process

SL No	Type	Yarn Type	Count
1	A	Comb	28Ne 30 Ne 40/2Ne 40 Ne(O.C)
2	B	Kard	40 Ne 34 Ne 31 Ne 30 Ne 28 Ne 26 Ne 24 Ne 22 Ne 20 Ne
3	C	PC	65/35 (30 Ne) 50/50 (28 Ne) 50/50 (24 Ne) 65/35 (16Ne)
4	D	CVC	60/40 (40 Ne slub) 60/40 (30 Ne) 60/40 (24Ne) 80/20 (24 Ne)
5	E	Grey Mellange	28 Ne >5% 20 Ne>7.5% 24 Ne>10% 30 Ne>10% 28 Ne>15% 40 Ne>20% 24 Ne>30%
6	F	Ecro Mellange	40 Ne>2% 28 Ne>0.1%
7	G	Dyed Yarn	20 Ne(fiber) 28 Ne (yarn) 26 Ne (slub yarn) 30 Ne (yarn) 30 Ne (organic yarn)

2.9) Machine name and maintenance of circular knitting machine:

2.9.1) Machine Name :

- Ta Yu –China
- Fukahara –Japan
- Fujian Taifan- China
- Pai lung-Taiwan
- Year china- china
- Juinn long- Taiwan

2.9.2) Daily maintenance of circular knitting machine:

1. Every production shift should clear the yarn fluff on the machine and yarn creel. Keep the knitting parts and winding parts clean.
2. Every production shift should check the automatic stop device and safety device. If there is any unusual situation, should repair or replace instantaneously.
3. Check the positive yarn feeders.

2.10) Parts name of single jersey and Functions of Circular knitting Machine Parts:

2.10.1) Parts name of single jersey:

1. Creel stand
2. Creel pipe
3. Cone package
4. Positive feeder
5. Feeder
6. Cam
7. Cam box
8. Needle
9. Sinker
10. Cylinder
11. VDQ pully
12. Management belt
13. Stopper
14. Oil tank
15. Knife
16. Take up roller
17. Knitted fabric

2.10.2) Functions of Circular knitting Machine Parts:
Functions of all knitting machine parts have described below:

1.creel stand: It is used for cone package. Creel is the place to hold the yarn cone. Yarn is supplied from creel to the machine through the pipe.

2.creel pipe: It is used to perfectly supply in yarn.

3.cone package: Cone is the yarn type and its into pipe the machine.

4.**Yarn Guide:** Its help the yarn to feed in the feeder.

5.Positive Feeder: It is totally related with fabric production. Yarn is feed through the feeder. If the number of feeder is higher than fabric production will be higher.

6.Feeder: Feeder is help yarn to feed in to the machine

7.Cam: Cam is device which converts the rotary machine drive in to a suitable reciprocating action for the needles and other elements.

8.Cam box: It is used to hold the cam based on the fabric design. Knitting cams are arranged according to the design.

9. Needle: Needle is the key part of knitting machine. Needle is used to knit the fabric. There are various types of needle such as latch needle, bearded needle, compound needle etc. Among those latch needle is commonly used in knitting technology

10.Sinker: During loop construction sinker is used to grip and support the thread.

11. Cylinder: Cylinder is one of the main parts of knitting machine where all the needles are set.

12. VDQ pulley: VDQ means variable dia for quality pulley. It controls the excellence of the fabric. VDQ pulley is very important in keeping proper stitch length.

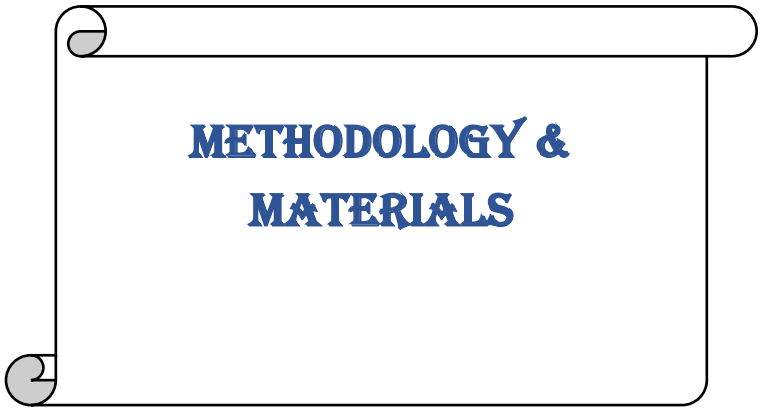
13.Auto Stopper: If knitting machine is in the defective condition then auto stopper will stops the knitting machine automatic.

14.Lycra Attachment Device: Lycra is placed hear. And feeding to the machine.

15.Adjustable Fan: This part removes lint, hairy fibre from yarn and others. To clean the dust by air flow.

16.Take up roller: It is used to wrap the fabric from the knitting machine. It Take up roller also controls the appropriate tension on the fabric.

CHAPTER THREE



3.1) Types of single jersey Fabric:

- Single Jersey
- Double Lacoste
- Single Lacoste
- Polo pique
- Terry
- Waffle
- Fleece
  - Normal Fleece
  - Baby Fleece
  - Diagonal or Cross fleece

3.2) Types of Double Jersey Fabric

- 1×1 Rib
- 2×1 Rib
- 1×1 lycra Rib
- 2×1 Lycra Rib
- Flat Back Rib
- Milano Rib
- Ottoman Rib
- Interlock

3.3) Auto Stipe Fabric

- Single jersey
- Full feeder lycra single jersey
- Heavy single jersey
- Ploy single jersey
- Double pique
- Slub double pique
- Interlock
- Poly +viscose+ lycra = vislye Rib
- Jacquard 1×1 rib

3.4) Jackard knitting machine fabric:

- Jackard jersey

V- Bed knitting machine Fabric

- Collar
- Cuff

3.5) Single jersey Derivatives: the structural modifications are used to a very great extent in designing plain-knit structures by modifying the order of knitting. the plain knit structures can be modified with the following alternatives.

- -Knit loop and miss loop
- -knit loop and tuck loop
- -knit loop, miss loop and tuck loop

3.5.1) Plain Single jersey fabric:
Plain single jersey fabric is the simplest and basic structure in the knit fabric which is also known as "single jersey fabric. Single jersey fabric is basic fabric in knitting section which is produced by the needles of only one set of needle with all the loops intermeshed in the same direction. Single jersey is a plain single knit structure with face loops on one side and back loops on other side. The structure can be of technical face or technical back.

3.5.2) Single Lacoste: Single lacost is a knit-tuck single jersey structure.one set of needle is used to produce this structure.it is a very popular structure to produce cut and sew knit wear. the repeat of the structure completes on four courses. knitting sequences for a repeat as follows-

1) First course: knit on all odd number needles and tuck on all even number needles.
2) Second course: knit on all needles.
3) Third course: tuck on all odd number needles and knit on all even number needles which is opposite of the first course.
4) Fourth course: same as second course knit on all needles.

3.5.3) Double lacoste: Double lacoste is a tuck-knit single jersey structure.so one set of needle is used to produce this structure. it is also a very popular structure to produce cut and sew knit wear. The repeat of the structure completes on six courses. knitting sequence for a repeat as follows:

1) First course: knit on all odd number needles and tuck on all even number needles.
2) Second course: Same as first course i.e. knit on all odd number needles and tuck on all even number needles.
3) Third course: knit on all needles
4) Fourth course: Tuck on all odd number needles and knit on all even number needles which is opposite of the first course.
5) Fifth course: Same as fourth course i.e. Tuck on all odd number needles and knit on all even number needles.
6) Sixth course: Similar as third course knit on all needles.

3.5.4) Polo pique: Polo pique is a knit-tuck single jersey structure. so one set of needle is used to produce this structure. It is also a very popular structure to produce cut and sew knit wear. the repeat of the structure completes on four courses. knitting sequence for a repeat as follows:

1) First course: Knit on all odd number needles and tuck on all even number needles.
2) Second course: Knit on all odd number needles and tuck on all even number needles, which is similar as the first course.
3) Third course: Tuck on all odd number needles and knit on all even number needles.

4) Fourth course: Same as fourth course i.e. Tuck on all odd number needles and knit on all even number needles.

3.5.5) Data collection for facilitate understanding of the relation between dia, Gauge, GSM, SL, Yarn count of Single jersey machine:

Table 2 :Data collection for facilitate understanding of the relation between dia, Gauge, GSM, SL, Yarn count of Single jersey machine:

SL	Dia	Gauge	Fabric Dia	GSM	Yarn Type	Count	S.L.
1	20''	24	55" open	170	Comb	26Ne	2.88
2	30''	24	31'' tube	150	Organic Comb	30Ne	2.85
3	19''	24	52" open	170	Comb	26Ne	2.88
4	38''	24	36''tube	140	Kard	32Ne	2.58
5	40''	24	76''Open	130	Kard	36Ne	2.48
6	18''	24	50" open	100	Kard	34Ne	3.40
7	20''	24	22''tube	175	Kard	24Ne	2.90
8	29''	24	30.6''tube	140	G.Mell 20%	30Ne	2.95
9	20''	18	53" open	190	Comb	18Ne	3.85

3.5.6) Three-thread Fleece: Three-thread fleece fabric produced on special single jersey circular knitting machine with 20 gauge Mayer and Cie model. Fleece fabric is a popular structure to produce garments and other items. the structure of three-thread fleece fabric is formed from knit, loop and binding. Fleece fabric can be not only different colors and patterns, but there is also different types of fleece. Basically, fleece fabric can be three types: 1. Baby fleece 2. Normal fleece 3.Cross and Diagonal fleece

Normal fleece: The repeat of the structure completes on six courses. knitting sequence for a repeat as follows:

1) First Course (Knit): Knit on all needles and knit loop are bigger than Binding
2) Second course (Binding): Knit on all needles and loop are smaller than knit
3) Third course (loop): Tuck on first needle and miss on all rest of needle.
4) Fourth course (knit): Similar as first course i.e. knit on all needles.
5) Fifth course (Binding): similar as second course i.e. knit on all needles.
6) Sixth course (loop): Miss on first two and rest of needles and tuck on third needle.

Baby fleece: The repeat of the structure completes on six courses. knitting sequence for a repeat as follows:

1) First Course (Knit): Knit on all needles and knit loop are bigger than Binding
2) Second course (Binding): Knit on all needles and loop are smaller than knit
3) Third course (loop): Tuck on all odd number needles and miss on all even number needles.
4) Fourth course (knit): Similar as first course i.e. knit on all needles.
5) Fifth course (Binding): similar as second course i.e. knit on all needles.
6) Sixth course (loop): Miss on all odd number needles and tuck on all even number needles which is opposite of the third course.

Diagonal or Cross fleece: The repeat of the structure completes on nine courses. knitting sequence for a repeat as follows:

1) First course (Knit): Knit on all needles and knit loop are bigger than Binding
2) Second course (Binding): Knit on all needles and loop are smaller than knit
3) Third course (loop): Tuck on first needle and miss on all rest of needles.
4) Fourth course (knit): Similar as first course i.e. knit on all needles.
5) Fifth course (Binding): similar as second course i.e. knit on all needles.
6) Sixth course (loop): Miss on first two needles and tuck on third needle.
7) Seventh course (Knit): Knit on all needles and knit loop are bigger than Binding
8) Eighth course (Binding): Knit on all needles and loop are smaller than knit
9) Ninth course (loop): Miss on first and third needles and tuck on second needle.

3.5.7 Data collection for facilitate understanding of the relation between dia, Gauge, GSM, SL, Yarn count of Normal Fleece machine:

Table 3: Data collection for facilitate understanding of the relation between dia, Gauge, GSM, SL, Yarn count of Normal Fleece machine

SL	Gauge	Dia	Fabric Dia	GSM	Color	Yarn Type	Count	S.L.
1	34”	20	70’’ open	270	Black	Kard Polyester c.v.c(80/20)	30Ne 75D 14Ne	4.8 3 1.6
2	32’’	20	68’’ open	220	AVG	c.v.c(60/40) c.v.c(60/40) c.v.c(60/40)	34Ne 34Ne 24Ne	4.5 4 1.6
3	38’’	20	76’’ open	260		Comb Polyester c.v.c(80/20)	30Ne 75D/36F 16Ne	4.7 3.2 1.55
4	32’’	20	68’’ open	280	Ash Mell	E.Mell 2% Polyester c.v.c(80/20)	30Ne 75D 14Ne	5 3.1 1.4

5	30''	20	70'' open	280	Navy	Kard Kard Organic Kard	34Ne 34Ne 16Ne	4.1 3.5 1.5
6	30''	20	70'' open	320	Khaki	c.v.c(60/40) c.v.c(60/40) c.v.c(60/40)	30Ne 30Ne 10Ne	4.55 5.85 1.6
7	36''	20	72'' open	245		Kard Polyester c.v.c(80/20)	32Ne 75D 20Ne	4.5 3 1.5

3.5.8) Data collection for facilitate understanding of the relation between dia, Gauge, GSM, SL, Yarn count of Diagonal or Cross Fleece machine:

Table 4: Data collection for facilitate understanding of the relation between dia, Gauge, GSM, SL, Yarn count of Diagonal or Cross Fleece machine

SL	Gauge	Dia	Fabric Dia	GSM	Yarn Type	Count	S.L.
1	20''	72''open		290	G.Mell 7.5% Polyester c.v.c(80/20)	32Ne 75D 12Ne	4.5 2.85 1.65
2	20''	75''open		320	Comb Polyester kard	28Ne 75D 12Ne	4.6 2.95 1.6
3	20''	72'' open		260	G.Mell 10% Polyester c.v.c(60/40)	34Ne 75D 16Ne	4.6 3.25 1.6
4	20''	81'' open		290	G.Mell 7.5% Polyester c.v.c(80/20)	32Ne 75D 12Ne	4.5 2.85 1.65

3.5.9) Terry: Terry fabric is a knitted fabric with ring yarn or terry covering at one or both sides. It belongs to one of the fancy knitted fabrics. Terry fabric is characterized by soft touch, thick texture, excellent water absorption and heat retention. Terry fabric after shearing or other process can be turned into fleece fabric or velvet fabric. The repeat of the structure can be completed by eight courses. The knitting sequence for a repeat as follows:

1) First course: Knit on all needles.
2) Second course: Tuck on first needle and miss on all rest of needles.

3) Third course: Similar as first course i.e. Knit on all needles.
4) Fourth course: Miss on first needle and all rest of needles, Tuck on second needle.
5) Fifth course: Similar as first course i.e. Knit on all needles.
6) Sixth course: Miss on first, second and third needle, tuck on second needles.
7) Seventh course: Similar as first course i.e. Knit on all needles.
8) Eighth course: Miss on first three needles and tuck on last needle.

3.5.10) Waffle: Waffle fabric is usually made of cotton or micro-fiber and is knitted in a way which makes it very absorbent. The waffle weave also allows air to flow through the fabric so that it dries quickly. Waffle fabrics are made in a range of weights. The repeat of the structure completes on six courses. The knitting sequence for a repeat as follows:

1) First course: Tuck on all odd number needles and knit on all even number needles
2) Second course: Similar as first course i.e. Tuck on all odd number needles and knit on all even number needles.
3) Third course: Similar as first and second course.
4) Fourth course: Knit on all odd number needles and tuck on all even number needle
5) Fifth course: Similar as fourth course i.e. Knit on all odd number needles and tuck on all even number needles.
6) Sixth course: Similar as fourth and fifth course.

3.6) Double jersey Derivatives based on Rib structure:

3.6.1) 1×1 Rib: A type of fabric construction commonly used for sleeve and neckbands that is highly elastic and retains its shape. 1x1 rib knit construction is a pattern of one rib, one flat space, one rib, one flat space, etc. Both sides of this knit fabric look identical. knitting sequence for a repeat as follows:

First course:

Cylinder needles- All odd number produce knit loop and even number produce miss loop.

Dial needles- All odd number produce knit loop and even number produce miss loop.

Second course:

Cylinder needles- Same as first course.

Dial needles- Same as first course.

3.6.2) 1×1 Lycra Rib: knitting sequence for a repeat as follows:

First course:

Cylinder needles- All odd number produce knit loop and even number produce miss loop.

Dial needles- All odd number produce knit loop and even number produce miss loop.

Second course:

Cylinder needles- Same as first course.

Dial needles- Same as first course.

3.6.3) 2×1 Rib : A type of fabric construction commonly used for sleeve and neckbands that is highly elastic and retains its shape. 2×1 rib knit construction is a pattern of one rib, two flat spaces, one rib, two flat spaces, etc. knitting sequence for a repeat as follows:

First course:

Cylinder needles- First two needles are producing knit loop and last one needle produce miss loop.

Dial needles- First two needles are producing miss loop and last one needle produce knit loop.

Second course:

Cylinder needles- Same as first course.

Dial needles- Same as first course.

3.6.4) 2×1 Lycra Rib: knitting sequence for a repeat as follows:

First course:

Cylinder needles- First two needles are producing knit loop and last one needle produce miss loop.

Dial needles- First two needles are producing miss loop and last one needle produce knit loop.

Second course:

Cylinder needles- Same as first course.

Dial needles- Same as first course.

3.6.5) Interlock: Interlock fabric is a variation of rib knit construction. Similar to a Jersey knit except both front and back of the fabric look identical. Double knit construction makes this a thicker knit fabric. Interlock is the tightest weave, gives the smoothest surface and the finest hand. The fabric is extremely soft, firm and absorbent. knitting sequence for a repeat as follows:

First course:

Cylinder needles: All odd number needles are producing knit loop and even needle are producing miss loop.

Dial needles: All odd number needles are producing miss loop and even number needles are producing knit loop.

Second course:

Cylinder needles: All odd number needles are producing miss loop and even number needles are producing knit loop.

Dial needles: All odd number needles are producing knit loop and even needle are producing miss loop.

3.6.6) Milano Rib: Milano rib is a weft knitted rib-based fabric. the appearance and characteristics of the fabrics are related to the ratio of the course lengths of two rows. The knitting sequence for a repeat as follows:

First course: Cylinder needles: knit on all odd number needles.

Dial needles: knit on all even number needles.

Second course: Cylinder needles: knit on all even number needles.

Dial needles: knit on all odd number needles.

Third course: Cylinder needles: knit on all needles.

Dial needles: miss on all needles.

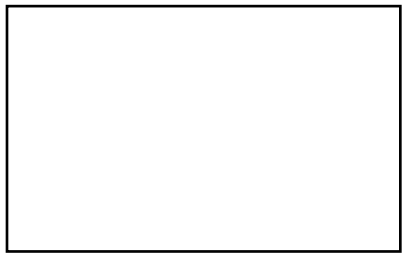
Fourth course: Cylinder needles: miss on all needles.

Dial needles: knit on all needles.

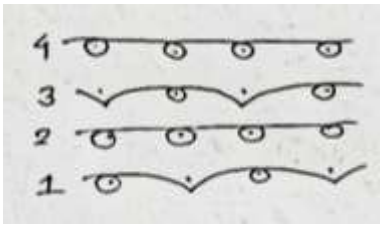
3.6.7) Flat back Rib:

3.6.8) Ottoman Rib:

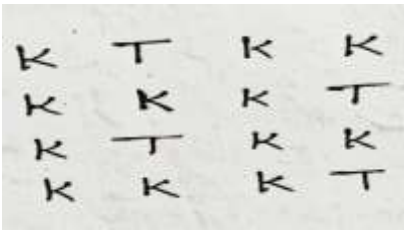
Face side



Back side



Notation Diagram



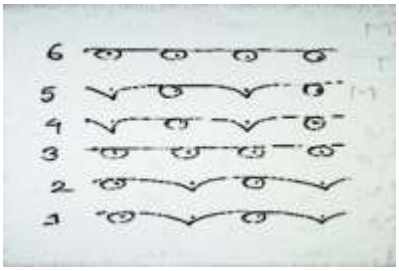
Cam Arrangement

Figure 3. 1 Single Lacoste

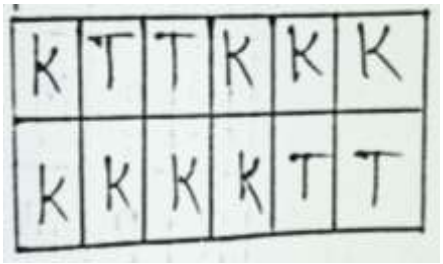
Double Lacoste

Face side

Back side



Notation Diagram

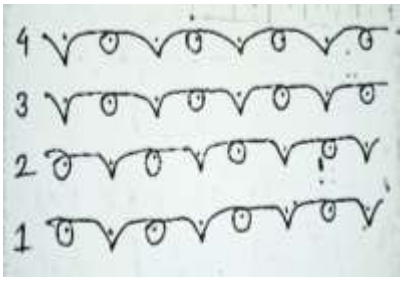


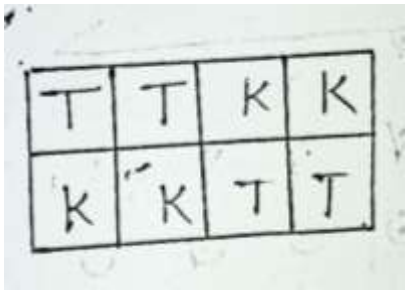
Cam Arrangement

Figure 3. 2 Double Lacoste

Face side

Back side





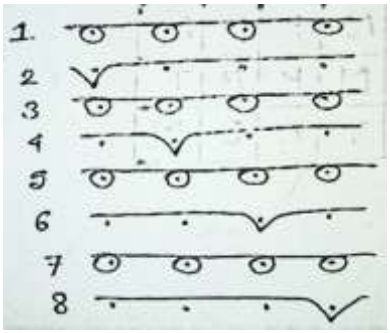
Notation Diagram

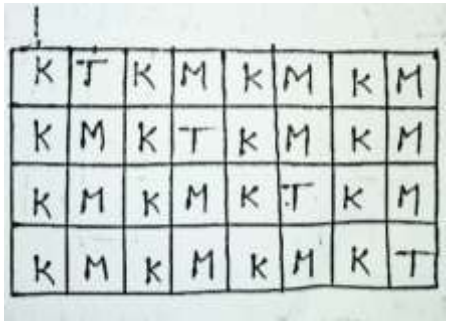
Cam Arrangement

Figure 3. 3 Polo pique

Face side

Back side



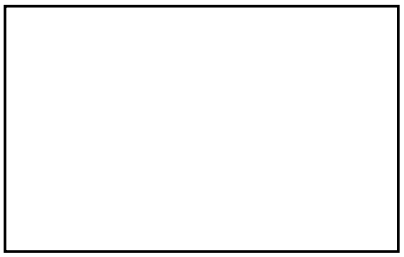


Notation Diagram

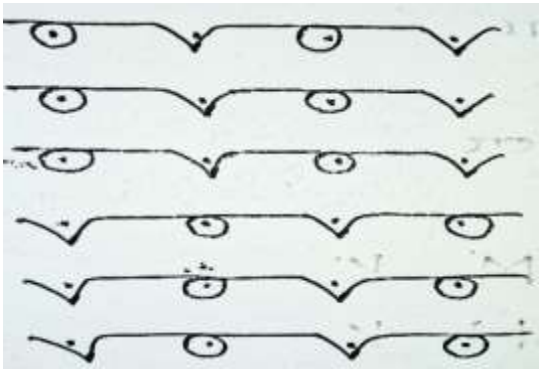
Cam Arrangement

Figure 3. 4 Terry

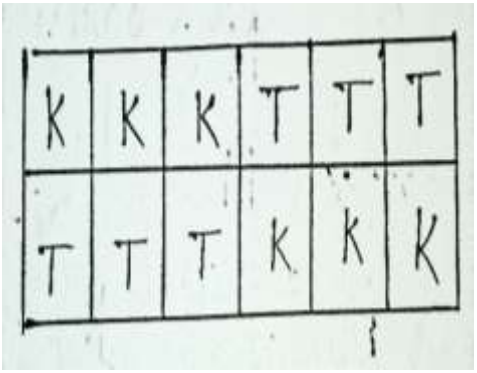
Face side



Back side



Notation Diagram

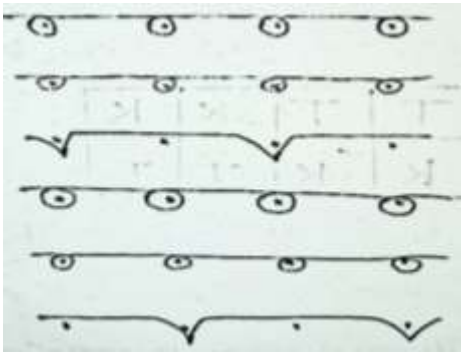


Cam Arrangement

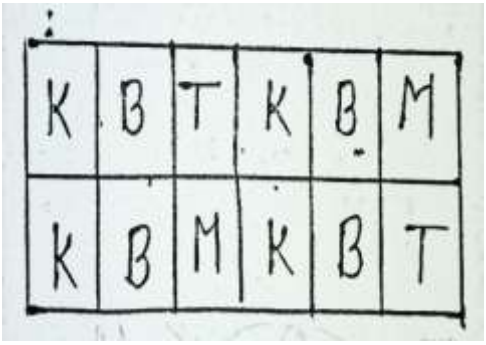
Figure 3. 5 Waffle

Face side

Back side



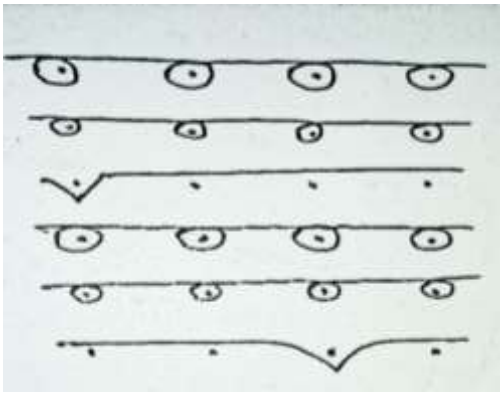
Notation Diagram

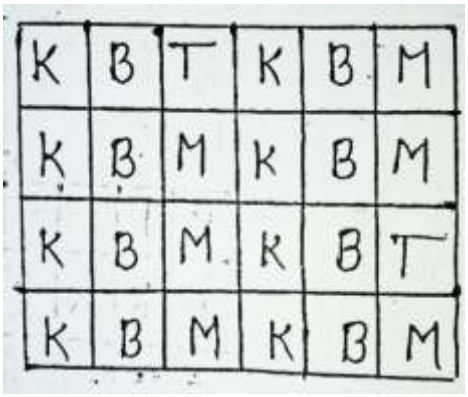


Cam Arrangement

Figure 3. 6 Baby fleece

Face side **Back side**

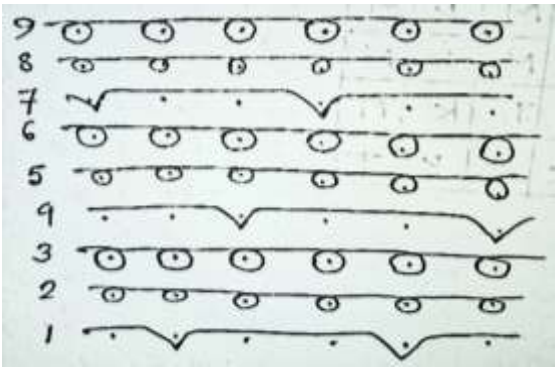


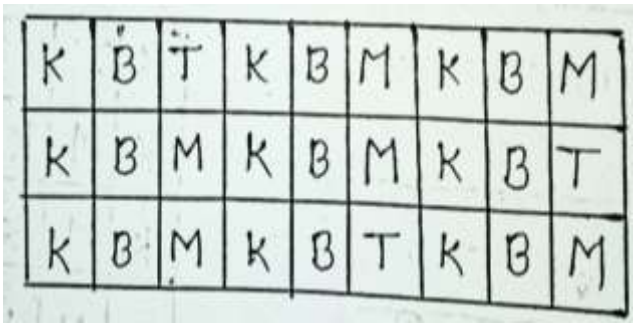


Notation Diagram **Cam Arrangement**

Figure 3. 7 Normal fleece

Face side **Back side**

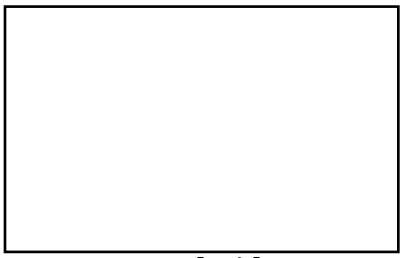




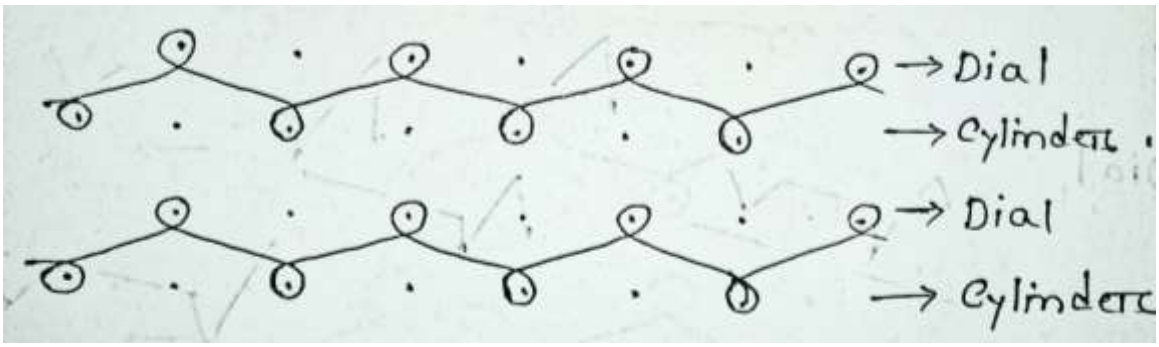
Notation Diagram **Cam Arrangement**

Figure 3. 8 Diagonal or Cross fleece

Face side

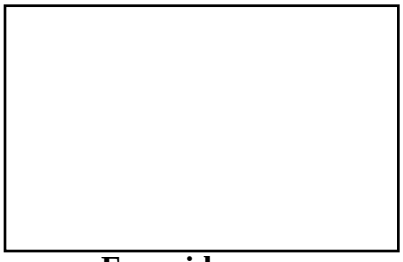


Back side

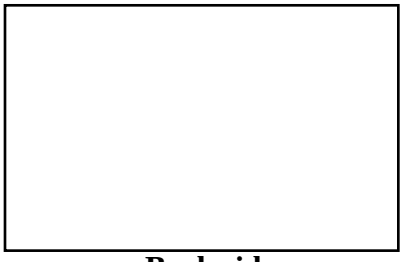


Notation Diagram

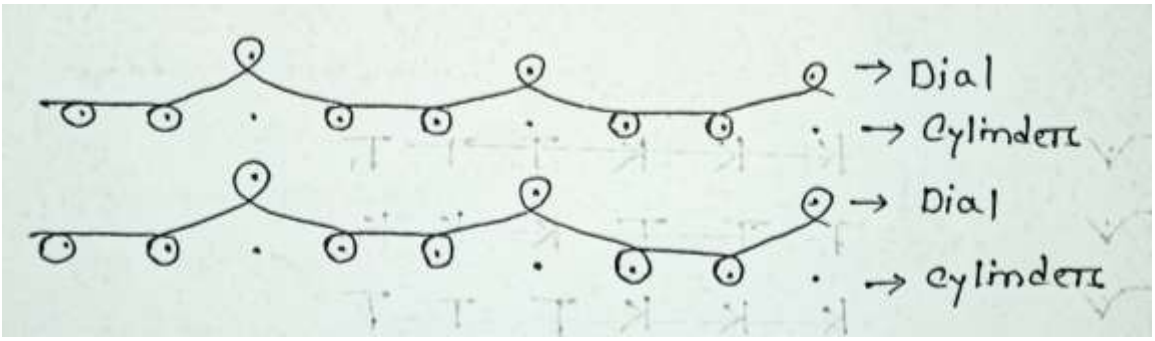
Figure 3. 9 1×1 Rib



Face side



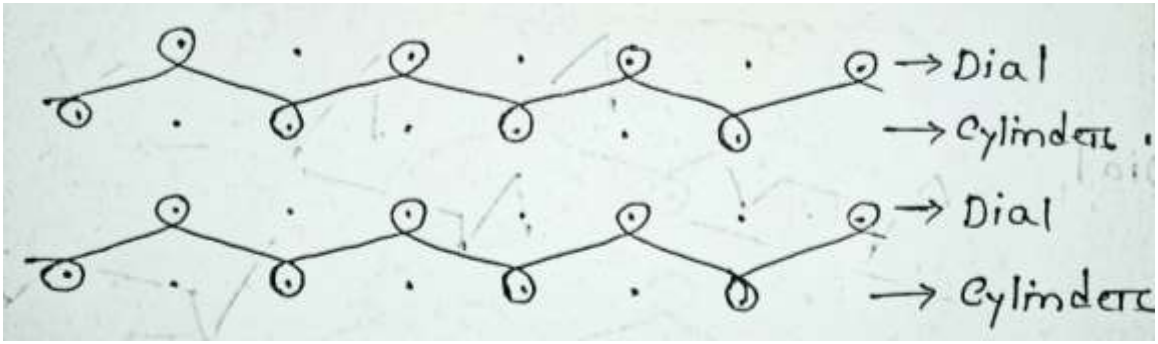
Back side



Notation Diagram

Figure 3. 10: 2×1 Rib

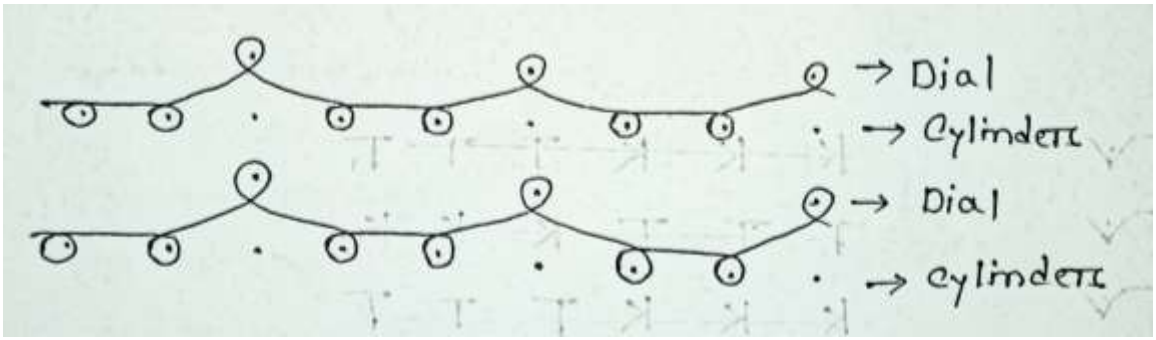
Face side **Back side**



Notation Diagram

Figure 3. 11: 1×1 Lycra Rib

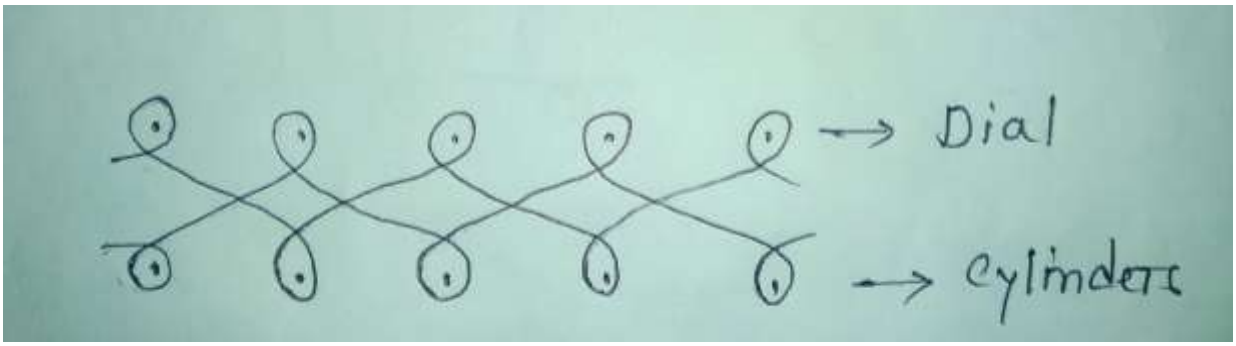
Face side **Back side**



Notation Diagram

Figure 3. 12: 2×1 Lycra Rib

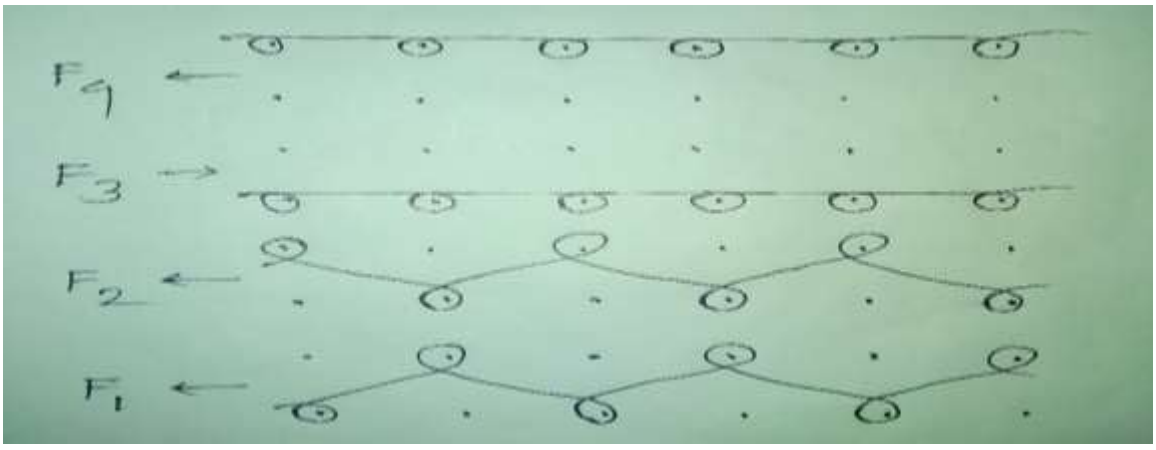
Face side **Back side**



Notation Diagram

Figure 3. 13: Interlock

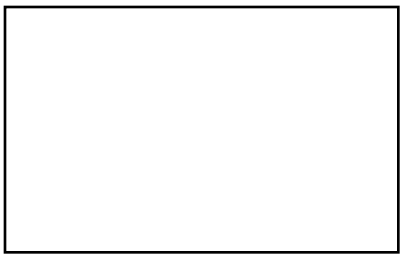
Face side **Back side**



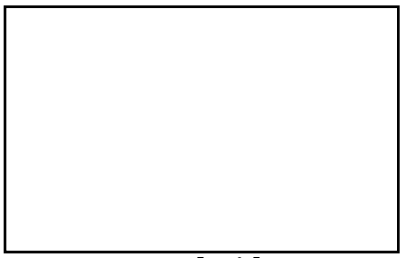
Notation Diagram

Figure 3. 14: Milano Rib

Ottoman Rib



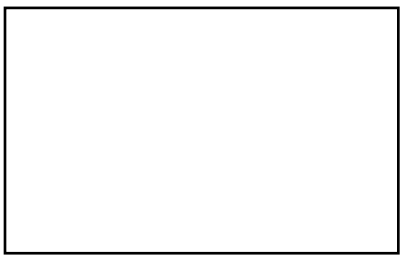
Face side



Back side

Flat Back Rib

Face side



Back side

3.6.9) Data collection for facilitate understanding of the relation between dia, Gauge, GSM, SL, Yarn count of Rib machine:

Table 5: Data collection for facilitate understanding of the relation between dia, Gauge, GSM, SL, Yarn count of Rib machine

Sl No.	Dia	Gauge	Fabric Dia	GSM	Yarn type	Count	S.L.
1	34''	18	71'' open	180	Kard	30 Ne	2.7
2	36''	18	72'' tube	200	Organic mell	32 Ne	2.5

3.7) Difference between single jersey and double jersey:

Table 6: Difference between single jersey and double jersey

Single jersey	**Double jersey**
1. Formed by one set of needle.	1. Formed by two set of needle.
2. Face side and back side appearance is different.	2. Face and back side appearance is same.
3. Low GSM.	3. High GSM.
4. Mostly used for making T-Shirt.	4. Mostly used for making Heavy garments.
5. Tend to curl.	5. Does not curl.
6. Less Expensive.	6. More Expensive than single jersey.
7. Less elasticity.	7. More elasticity.
8. Less Stable Fabric.	8. More stable fabric.

3.8) Difference between Rib and Interlock:

Table 7: Difference between Rib and Interlock

Rib	**Interlock**
1. It has vertical cord appearance.	1. It has the technical face of plain fabrics on both side.
2. One types of latch needle is used	2. Two types of latch needles are used
3. One feeder is used at yarn feeding	3. At least two feeders are used
4. Not so thick and heavy structure.	4. So thick and heavy structure.
5. Used to produce tops of socks, cuffs, sleeves, bottom edges of sweaters, knit hats and hosiery.	5. Used to produce underwear, shirts, suits, trousers suits, sportswear and dress.
6. More production rate.	6. Less production rate.

3.9) Relation between stitch length, GSM & yarn Count of Single Jersey:

Table 8: Relation between stitch length, GSM & yarn Count of Single Jersey

SL	Yarn Count	GSM	Light color S.L.	Medium Color S.L.	Deep Color S.L.
1	40 Ne	110-120	2.40	2.45	2.50
2	36 Ne	130	2.45	2.50	2.55
3	34Ne	135	2.50	2.55	2.60
4	32 Ne	140	2.55	2.60	2.65
5	30 Ne	145	2.80	2.85	2.90
6	30 Ne	150	2.70	2.75	2.80
7	28 Ne	160	2.70	2.75	2.80
8	26 Ne	170	2.75	2.80	2.85
9	24 Ne	180	2.80	2.85	2.90
10	22 Ne	190	2.90	2.95	3.00
11	20 Ne	200	3.05	3.10	3.15
12	20 Ne	210	3.00	3.05	3.10
13	18 Ne	220	3.25	3.30	3.35

3.10) Relation between stitch length, GSM & yarn Count of Lycra Single Jersey:

Table 9: Relation between stitch length, GSM & yarn Count of Lycra Single Jersey

SL No.	Yarn count	GSM	Average color S.L.(mm)
1	40 Ne+20D	160	2.85
2	34 Ne+20D	170	2.90
3	32 Ne+20D	180	2.90
4	30 Ne+20D	200	3.00
5	28 Ne+20D	210	3.00
6	28 Ne+30D	220	3.00
7	28 Ne+40D	230	3.10
8	26 Ne+30D	240	3.10

3.11) Relation between stitch length, GSM & yarn Count of 1×1 Rib:

Table 10: Relation between stitch length, GSM & yarn Count of 1×1 Rib

Sl No.	Count	GSM	Light color S.L.	Medium color S.L.	Deep color S.L.
1	36 Ne	170	2.45	2.50	2.55
2	34 Ne	180	2.50	2.55	2.60
3	32 Ne	190	2.50	2.55	2.60
4	30 Ne	200	2.60	2.65	2.70
5	30 Ne	210	2.55	2.60	2.65
6	28 Ne	220-225	2.55	2.60	2.65
7	26 Ne	230-235	2.60	2.65	2.70
8	24 Ne	240-250	2.65	2.70	2.75
9	22 Ne	260-270	2.70	2.75	2.80
10	20 Ne	280-290	2.80	2.85	2.90

3.12) Relation between stitch length, GSM & yarn Count of 2×1 Rib:

Table 11: Relation between stitch length, GSM & yarn Count of 2×1 Rib

SL No.	Count	GSM	Average color S.L.(mm)
1	40 Ne	170- 180	2.50
2	34 Ne	190-200	2.55
3	30 Ne	205-220	2.65
4	26 Ne	225-240	2.70
5	24 Ne	250-260	2.80
6	20 Ne	265-270	2.90

3.13) Collar and cuff

3.13.1) V bed knitting fabric:

Flat knitting is usually contrasted with circular knitting, in which the fabric is always knitted from the same side. Flat knitting can complicate knitting somewhat compared to circular knitting, since the same stitch (as seen from the right side) is produced by two different movements when knitted from the right and wrong sides.

3.13.2) Parts name of V – bed knitting machine:

1. Yarn package
2. Torsion spring
3. Yarn take up
4. Back needle bed
5. Front needle bed
6. Yarn carrier
7. Inactive needle butt line
8. Fabric comb
9. Carriage

10. Feeder
11. Needle

Fig:V-bed knitting machine

3.13.3) Difference between circular knit and v bed knit :

Table 12: Difference between circular knit and v bed knit

Circular knit	**V bed knit**
1.It is made with a machine that knits the fabric in a continuous circle / tube.	1.It's continuous is flat.
2.Its weight is light and fabric is thin.	2.It is heavy weight.
3. Circular knit fabric m/c gauge about 12 to 22.	3. It is gauge is 2 to 10
4.Ex: T shirt fabric, polo shirt fabric, towel etc.	4.Ex: collar, cuff, sweater etc.

3.13.4) V bed machine production:

1. Collar
2. Cuff
3. Sweater

3.13.5) Features of flat knitting machine:

1) Flat knitting machine has two stationary needle beds

2) Latch needles used.
3) Each needle bed has its separate cam system.
4) Machine gauge 2-10.
5) Machine width is usually up to 79 inches.

3.13.6) Collar & cuff type:

a) Solid
b) Stipe
c) 2 part
d) 1×1 Rib
e) 2×1 Rib

3.13.7) Yarn used to produce collar and cuff:

a) Kard
b) Comb
c) Dyed yarn
d) Polyester

3.13.8) Different parts name of collar:

1. Body
2. Tipping

3.13.9) Yarn consumption:
Yarn consumption Calculation = (Fabrication×0.09×quantity) ÷ 1000

Fabrication= (Length × Weight)

For stipe collar, (3 color)

Here,

Length=41

Weight= 9

1st tipping - 0.4m

2nd tipping- 0.3m

3rd tipping- 0.15m

Body= 9-0.85=8.15

Quantity = 2711

Now,

1st tipping = (41×0.4)

= (16.4×0.09×2711) ÷1000= 4kg

2nd tipping= (41×0.3)

= (12.3×0.09×2711) ÷1000=3kg

3rd tipping= (41×0.15)

= (6.15×0.09×2711) ÷1000= 1.50kg

Body= (41×8.15)

= (334.15×0.09×2711) ÷1000= 81.52kg

Total yarn needed= (81.52+4+3=1.5) = 90kg

3.14) Machine Efficiency:

3.14.1) Efficiency:

The efficiency of weft knitting machine is related to knitting parameter, yarn quality, human skill. It is assumed that poor quality of yarn appearance, improper machine parameter causes fabric faults, yarn breakages, ultimately its effect on efficiency.

3.14.2) Different kind of causes of losing efficiency:

- The factors affect the efficiency of knitting production are beneath:
- Model to Model
- Machine to Machine
- Different model of same manufacture
- Skill of operator
- Faulty yarn

3.14.3) For single jersey production and machines efficiency calculation formula:

Production/ hour = $\frac{No\ of\ needle \times No\ of\ feeder \times Stitch\ length(mm) \times RPM \times work.hour \times 60 \times 1.09}{1000 \times 840 \times Count \times 2.2046}$

Machine Efficiency=$\frac{Actual\ production}{Calculated\ production} \times 100$

Calculation no 01
Brand: Pai Long

Origin: China

Fabric type: Single Jersey

Dia : 25”

Gauge: 24G

Total number of Feeders: 72

RPM: 36.6

Stitch Length: 2.70

Yarn count: 30 Ne

Now,

Total number of needle = π×D×G

=3.1416×25×24 = 1884

Production/shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM ×8×60×1.09) / (Count× 1000 ×840 ×2.204)

= (1884×72×2.7×36.6×8×60×1.09)/(30 ×1000×840×2.204)

=126.27 kg

∴ Actual production/shift = 84.600 kg

Efficiency = (Actual production/Calculated production) × 100

= (84.600/126.27) ×100

= 67%

∴Machine Efficiency= 67%

Total stop Time= 2 hour 57 Min

Table 13: Efficiency loosing time for calculation 01

00:00 = Min: Sec

Serial No	Yarn breakage	Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change	Power off	M/C Service
01	00:20	00:30	00:57	02:45	00:08	05:34	00:35	03:15	09:54
02	00:36	00:45	00:13	02:54	00:10	04:10	00:54	05:27	
03	00:11	00:53	00:29		00:05	07:12	01:13	03:48	
04	00:26	00:36	01:07		00:06	00:19	01:27	01:06	
05	00:35	01:12	00:41		00:09	05:23	00:43	00:26	
06	00:22	00:58	00:10		00:05	04:23	05:42	01:54	
07	00:13	00:42	00:24		00:08	02:31	08:42		
08	02:27		00:09				02:57		
09	00:29		00:10				04:34		
10	00:26		00:43				03:47		
11	04:12		00:54				01:34		
12	00:43		02:37						
13	00:57								

14	00:28								
15	01:09								
16	02:35								
17	03:34								
18	03:49								
19	02:59								
20	01:54								
TOTAL	**28:42**	**05:36**	**08:34**	**05:39**	**00:51**	**29:40**	**32:08**	**15:56**	**09:54**
Total stopped time: 2 hour 38 min									

Calculation no 02:
Brand: Fukahara

Origin: China

Fabric type: Single Jersey

Dia : 38”

Gauge: 24G

Total number of Feeders: 120

RPM: 30.6

Stitch Length: 2.80

Yarn count: 28 Ne

Now,

Total number of needle = $\pi \times G \times d$

$= 3.1416 \times 24 \times 38 = 2864$

Production/shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM×8×60×1.09) /

(Count× 1000 ×840 ×2.204)

=(2864×120×2.8×30.6×8×60×1.09) /(28×1000×840×2.204)

=297.12 kg/shift

Actual production = 259.2 kg/shift

Machine Efficiency = (Actual production /Calculated production) ×100

= (259.2/297.12)×100

= 87 %

∴Machine Efficiency= 87%

Total stop time= 1 hour 1 Min

Table 14: Efficiency losing time for calculation 02

00:00 = Min: Sec

Serial No	Yarn breakage	Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change
01	00:45	00:34	02:09	02:05	00:08	02:04	02:10
02	00:32	00:24	01:43	01:32	00:10	01:53	03:05
03	01:54	00:42	03:20	03:23	00:05	03:47	01:53
04	02:03	00:20		01:56	00:06	01:18	02:15
05	00:41	00:31		02:20	00:05		
06	00:20	00:20		04:51	00:07		
07	00:15	00:30		02:01	00:06		
08	00:34			01:36	00:11		
09	00:45				00:16		
10	00:23						
11	00:31						
12	00:47						
13	00:21						
14	01:13						
Total	**11:04**	**03:21**	**07:12**	**19:44**	**01:14**	**09:02**	**09:23**
Total Stopped time: 1 hour 1 min							

Calculation No 03:
Brand: Fukahara

Origin: China

Fabric type: Single Jersey

Dia : 32″

Gauge: 24G

Total number of Feeders: 104

RPM: 34.5

Stitch Length: 2.76

Yarn count: 28 Ne

Now,

Total number of needle = $\pi \times d \times G$

$= 3.1416 \times 32 \times 24 = 2412$

Production/shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM ×8×60×1.09) / (Count× 1000 ×840 ×2.204)

$= (2412 \times 104 \times 2.76 \times 34.5 \times 8 \times 60 \times 1.09 / 28 \times 840 \times 1000 \times 2.2046)$

$= (12497022600.2/51852192)$

$= 241.01$ kg/shift

Actual Production=200.2 kg/hour

Machine Efficiency= (Actual production /Calculated production) ×100

$= (200.2/241.01) \times 100$

$= 83\%$

Total stopped time = 1 hour 21 min

Table 15: Efficiency losing time for calculation 03

00:00 = min: sec

Serial No	Yarn breakage	Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change	Power off
01	00:51	00:23	01:17	01:32	00:07	02:04	02:10	02:32
02	00:42	00:34	02:43	02:32	00:09	01:53	03:05	02:28
03	00:58	00:56	02:29	03:23	00:06	03:47	01:53	01:00
04	01:03	00:37	03:31	04:35	00:05	01:18	02:15	
05	00:36	00:30		03:32	00:07	01:23	02:51	
06	01:27	00:22		04:51	00:07	02:56		
07	00:19	00:39			00:08			

08	00:45	00:19			00:10			
09	02:38				00:17			
10	00:29							
11	01:33							
12	00:47							
13	00:26							
14	01:11							
Total	**13:45**	**04:20**	**10:00**	**20:25**	**01:16**	**13:21**	**12:14**	**06:00**
Total Stopped Time : 1 hour 21 min								

Machine No 04:
Brand: Fukahara

Origin: China

Dia : 44”

Gauge: 18G

Total number of Feeders: 88

RPM: 16.7

Fabric type: 1×1 Rib

Stitch Length: 2.52

Yarn count: 34 Ne

Now,

Total number of needle = (π×G×d) × 2

=(3.1416×18×44) × 2

=2488×2 =4976

Production/ shift= (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM ×8×60×1.09) / (Count× 1000 ×840 ×2.204)

=(4976×88×2.52×16.7×8×60×1.09)/(34×1000×840×2.204)

= 153.17 kg/shift

Actual production = 131.2 kg/shift

Efficiency = (actual production /calculated production ×100)

= (131.2/153.17) ×100

= 85 % (ans)

Total stop time=1 hour 10 min

Table 16: Efficiency losing time for calculation 04

Serial No	Yarn breakage	Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change	Power off
01	02:07	00:27	01:11	01:32	00:05	01:09	01:10	00:57
02	00:32	00:29	01:40	02:32	00:10	02:58	02:18	02:19
03	00:57	00:43	02:19	04:23	00:05	02:23	02:50	01:07
04	00:16	00:31	01:24	03:37	00:06	01:25	03:24	
05	00:34	00:37			00:05	02:11	02:32	
06	00:45	00:21			00:07	03:52	02:46	
07	01:21				00:09			
08	00:47							
09	02:38							
10	00:36							
11	02:56							
12	00:54							
13	00:25							
Total	**14:48**	**03:08**	**06:34**	**12:04**	**00:47**	**13:58**	**15:00**	**04:23**
Total stopped time : 1 hour 10 min								

Machine No 05:
Brand: Fukahara

Origin: China

Dia : 42”

Gauge: 18G

Total number of Feeders: 86

RPM: 19.9

Fabric type: 1×1 Rib

Stitch Length: 2.52

Yarn count: 30 Ne

Now,

Total number of needle = (π×G ×d) ×2

= (3.1416×18×42) ×2

= 4748

Production/ shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM ×8×60×1.09) /
(Count× 1000 ×840 ×2.204)

=(4748×86×2.52×19.9×8×60×1.09)/(30×1000×840×2.204)

=192 kg/shift

Actual production =151.68 kg/shift

Machine Efficiency = (Actual production /Calculated production) ×100

= (151.68 /192) ×100

=79 % (ans)

Total stop time= 1 hour 42 min

Table 17:Efficiency losing time for calculation 05

Serial No	Yarn breakage	Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change	Power off
01	00:39	01:10	1:16	02:20	00:8	07:57	01:34	02.18
02	01:27	00:45	00:10	01:19	00:5	05:50	03:05	01:45
03	00:25	00:59	1:28	01:24	00:7	02:46	02:19	
04	00:19	01:35	00:25	02:03	00:6	06:29	01:23	
05	00:32	00:57	00:47	02:26		04:27	01:45	
06	01:34		00:18				02:51	
07	01:10		2:12				02:34	
08	00:26		00:37				02:39	
09	00:38						04:47	
10	01:11							
11	01:56							
12	02:15							
13	01:18							
14	01:38							
15	01:19							
16	00:28							
27	02:58							
18	02:29							
19	02:27							
Total	**25:09**	**05:26**	**07:13**	**09:32**	**00:26**	**27:29**	**22.57**	**04:03**
Total stopped time: 1 hour 42 min								

Machine No 06:
Brand: Fukahara

Origin: China

Dia : 44”

Gauge: 18G

Total number of Feeders: 88

RPM: 17.7

Fabric type: 1×1 Lycra Rib

Stitch Length: 2.80

Yarn count: 28 Ne (Card yarn)

Lycra%= 3%

Now,

Total number of needle = (π×G×d) × 2

= (3.1416×18×44) ×2

=4976

For Card yarn,

Production/ shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM ×8×60×1.09) / (Count× 1000 ×840 ×2.204)

=(4976×88×2.8×17.7×8×60×1.09)/(28×1000×840×2.204)

=216 kg/shift

For Lycra,

Production/shift= (Lycra% × fabric weight for yarn)

= (3%×216)

= [(3/100) ×216]

= 6.48 kg

Total production/shift = (216+6.48) kg

= 222.48 kg

Actual Production/shift = 193.52 kg

Machine Efficiency = (Actual production /Calculated production) ×100

= (193.52/222.48) × 100

= 87%

Total stop time= 1 hour 2 min

Table 18: Efficiency losing time for calculation 06

Serial No	Yarn breakage	Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change	Power off
01	01:36	00:26	01:27	01:34	00:09	04:37	02:45	03:11
02	01:29	00:38	01:03	01:57	00:06	02:25	00:54	02:03
03	00:41		00:57	01:03	00:07	01:29	03:12	01:02
04	01:17			00:57	00:06	05:05	02:04	
05	00:25			00:56	00:10	03:45	01:56	
06	00:45			01:45				
07	00:32							
08	01:04							
09	00:26							
10	01:30							
11	01:11							
12	00:39							
13	00:59							
14	01:28							
15	00:58							
Total	**15:00**	**01:04**	**03:27**	**08:12**	**00:38**	**17:21**	**10:51**	**06:16**
Total Stopped time: 1 hour 2 min 49 sec								

Machine No 07:
Brand: Fukahara

Origin: China

Dia : 44”

Gauge: 18G

Total number of Feeders: 90

RPM: 15.5

Fabric type: 2×1 Lycra Rib

Stitch Length: 2.85

Yarn count: 34 Ne

Lycra %- 4%

Now,

Total number of needle = (π×G×d) ×2×2/3

= (3.1416×18×44) ×2×2/3

= (2488×2×2/3) =3316

For Cotton,

Production/ shift= (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM×8×60×1.09) /

(Count× 1000 ×840 ×2.204)

=(3316×88×2.85×15.5×8×60×1.09)/(34×1000×840×2.204)

=107.11 kg/shift

For Lycra,

Production/shift= (Lycra% × fabric weight for yarn)

= (4% × 107.11)

= 4.28 kg/shift

Total Calculated production = (107.11+4.28)

= 111.39 kg/shift

Actual production = 67.48 kg/shift

Efficiency = (Actual production /Calculated production)×100

= (70.17 /111.39) ×100

=63 % (Ans)

Total Stopped Time: 2 hour 57 min

Table 19: Efficiency losing time for calculation 07

Serial No	Yarn breakage	Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change	Power off	M/C Service
01	00:20	00:30	00:57	02:45	00:08	8:34	00:35	03:15	11:54
02	00:36	01:45	00:13	03:54	00:10	4:10	00:54	05:27	
03	01:11	00:53	00:29		00:05	9:12	01:13	03:48	
04	00:26	01:36	01:07		00:06	00:19	01:27	01:06	
05	00:35	01:12	00:41		00:09	7:23	00:43	00:26	
06	00:22	00:58	00:10		00:05	05:23	05:42	01:54	
07	00:13	01:42	00:24		00:08	02:31	08:42		
08	03:27		00:09				02:57		
09	00:29		00:10				04:34		
10	00:26		00:43				03:47		
11	06:12		00:54				01:34		
12	00:43		02:37						
13	00:57								
14	00:28								
15	01:09								
16	02:35								
17	04:34								
18	03:49								
19	03:59								
20	01:54								
TOTAL	**34:42**	**08:36**	**08:34**	**06:39**	**00:51**	**37:40**	**32:08**	**15:56**	**11:54**
Total Stopped time: 2 hour 57 min									

Machine No 08:
Brand: Fukahara

Origin: China

Dia : 36”

Gauge: 20G

Total number of Feeders: 108 (36+36+36)

RPM: 20.4

Fabric type: Cross Fleece

Stitch Length: 4.6 – combed

2.95 - polyester

1.6 – Card

Yarn count:

For combed yarn - 28 Ne

For polyester - 75D = 70.85 Ne

For card yarn - 12 Ne

Now,

Total number of needle = $\pi \times G \times d$

$= 3.1416 \times 20 \times 36 = 2262$

For Combed,

Production/shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM×8×60×1.09) / (Count× 1000 ×840 ×2.204)

=(2262×36×4.6×20.4×8×60×1.09)/(28×840×1000×2.2046)

= 77.10 kg/shift

For Polyester,

Production/ shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM ×60×1.09) / (Count× 1000 ×840 ×2.204)

= (2262×36×2.95×20.4×8×60×1.09)/(70.85×840×1000×2.2046)

=19.57 kg/shift

For Card,

Production/shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM ×8×60×1.09)/ (Count× 1000 ×840 ×2.204)

= (2262×36×1.6×20.4×8×60×1.09)/(12×840×1000×2.2046)

= 62.58 kg/shift

Total Calculated production = 77.10+19.57+62.58

= 159.25 kg/shift

Actual production = 119.44 kg/shift

Machine Efficiency = (Actual production / Calculated production)×100

= (119.44/159.25) ×100

= 75 % (ans)

Table 20: Efficiency losing time for calculation 08

Serial No	Yarn breakage	Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change
01	00:45	01:16	00:56	02:20	00:8	13:35	02:28
02	01:35	01:35	01:10	01:19	00:5	05:41	03:50
03	00:36	01:59	01:39	01:24	00:7	08:50	01:49
04	00:54	00:59	00:35	02:03	00:6	06:49	02:26
05	00:32	01:57	00:57	02:26	00:9	04:24	01:47
06	01:33	01:27	00:45				01:43
07	00:20		02:55				03:38
08	01:26		01:27				02:59
09	00:48						04:47
10	01:18						
11	00:47						
12	01:25						
13	02:18						

14	02:39						
15	01:34						
16	00:38						
17	02:59						
18	02:39						
19	02:24						
Total	**27:10**	**09:13**	**10:24**	**09:32**	**00:35**	**39:39**	**25:27**
Total Stopped Time: 2 hour 2 min							

Machine No 09:
Brand: Ta Yu

Origin: China

Dia : 36”

Gauge: 18G

Total number of Feeders: 72

RPM: 17.7

Fabric type: Separation Interlock

Stitch Length: 3.2 - cvc

Yarn count: 40 Ne

Now,

Total number of needle = ($\pi \times G \times d$) ×2

= (3.1416×18×36) ×2

=4072

Production/shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM×8×60×1.09) / (Count× 1000 ×840 ×2.2046)

=(4072×72×3.2×17.7×8×60×1.09)/(40×1000×840×2.2046)

=117.29 kg/shift

Actual production = 64.50 kg/shift

Machine Efficiency = (Actual production /Calculated production) ×100

= (64.50/117) ×100

=55 % (ans)

Total stop time= 03 hour 36 min 22 sec

Table 21: Efficiency losing time for calculation 09

Serial No	Yarn breakage		Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change	Power off	M/C Service
01	02:01	01:02	00:41	00:58	01:43	00:07	06:32	04:45	04:21	43:10
02	01:50	00:45	00:39	00:37	01:20	00:04	04:56	02:17	03:49	
03	01:05	00:57	00:23	00:53		00:05	05:50	00:58	02:45	
04	00:47	00:43	00:34	00:56		00:06	06:21	00:45	04:53	
05	01:22	02:42	01:23	01:45		00:05	03:43	01:39	02:13	
06	00:56	01:11	00:55	01:21		00:07	04:56	02:35		
07	01:11	00:57		02:46			08:05	00:48		
08	00:59	00:47		05:34				01:51		
09	03:05	00:59						02:33		
10	01:40	01:01						01:34		
11	01:22	01:21						00.35		
12	00:35	02:34						01:57		
13	01:12	01:17						03:17		
14	01:13	03:42								
15	00:34	00:35								
16	01:05	00:24								
17	03:06	02:34								
18	02:47	02:31								
19	08:58									
20	02:37									

21	01:45									
Total	**01:06:12**		**04:35**	**14:50**	**03:03**	**00:34**	**40:23**	**25:34**	**18:01**	**43:10**
Total Stopped time : 3 hour 36 min 22 sec										

Machine No 10:
Brand: Pai Lung

Origin: China

Fabric type: Waffle

Dia : 42"

Gauge: 18G

Total number of Feeders: 60

RPM: 10

Yarn count: 24 Ne (1st yarn)

: 24 Ne (2nd Yarn)

Stitch Length: 3 (1st yarn)

: 2.67 (2nd yarn)

For 1st yarn no. of feeder = 20

For 2nd yarn no. of feeder = 40

Now,

Total number of needle = $(\pi \times G \times d) \times 2 \times 2/3$

$= (3.1416 \times 18 \times 42) \times 2 \times 2/3$

$= 3164$

For 1st Grey mélange,

Production/shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM×8×60×1.09) / (Count× 1000 ×840 ×2.2046)

$=(3164 \times 20 \times 3 \times 10 \times 8 \times 60 \times 1.09)/(24 \times 1000 \times 840 \times 2.2046)$

= 22.35 kg/shift

For 2nd Grey mélange,

Production/shift = (No of Needle ×No of Feeder ×Stitch Length (mm) ×RPM×8×60×1.09) /

(Count× 1000 ×840 ×2.2046)

=(3164×40×2.67×10×8×60×1.09)/(24×1000×840×2.2046)

= 39.78 kg/shift

Total Production/shift = (22.35+39.78) kg

= 62.13 kg

Actual production/shift = 37.28 kg

Machine Efficiency = (Actual production /Calculated production) ×100

= (37.28/62.13) ×100

= 60%

Total Stopped time:

Table 22: Efficiency losing time for calculation 10

Serial No	Yarn breakage		Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change	Power off	M/C Service
01	00:34	00:43	00:30	02:27	01:34	00:06	02:32	02:54	02:12	14:10
02	00:50	01:48	00:48	04:32		00:05	08:23	03:42	05:53	
03	01:09	00:53	00:32	00:59		00:07	03:05	01:49	01:41	
04	01:35	01:33	00:43	06:56		00:08	05:27	00:54	05:05	
05	00:29	03:35	00:42	01:41		00:06	05:34	02:33	03:31	
06	00:54	01:25	00:45	01:21		00:05	09:15	02:27	01:23	
07	02:14	00:47		02:46			03:50	01:48	02:26	
08	01:59	00:36		01:34				02:15		
09	00:51	00:59		02:19				01:30		
10	00:40	02:04		02:25				00.53		
11	00:22	01:27		02:43						
12	01:37	01:34								
13	00:14	01:21								
14	01:16	02:42								
15	01:34	00:34								

16	00:28	01:19								
17	02:06	00:47								
18	01:47	02:53								
19	03:58	03:35								
20	02:37	01:42								
21	01:45	00:37								
Total	**01:01:53**		**04:00**	**29:43**	**01:34**	**00:37**	**38:06**	**20:45**	**22:11**	**14:10**

CHAPTER FOUR

4.1) Summery of Machine Efficiency:

Table 23**:** Summery of Machine Efficiency

m/c No.	Machine Name	Fabric Type	Dia × Gauge	Efficiency
1	Pai Lung	Single jersey	25’’×24	67%
2	Fukahara	Single jersey	38’’×24	87%
3	Fukahara	Single jersey	32’’×24	94%
4	Fukahara	1×1 Rib	44’’×18	85%
5	Fukahara	1×1 Rib	42”×18	79%
6	Fukahara	1×1 Lycra Rib	44”×18	87%
7	Fukahara	2×1 Lycra Rib	44”×18	63%
8	Tai fan	Cross Fleece	36”×20	75%
9	Ta yu	Separator Interlock (poly)	36”×18	55%
10	Pai Lung	Waffle	42”×18	60%

4.2) Efficiency loss % for Single jersey:

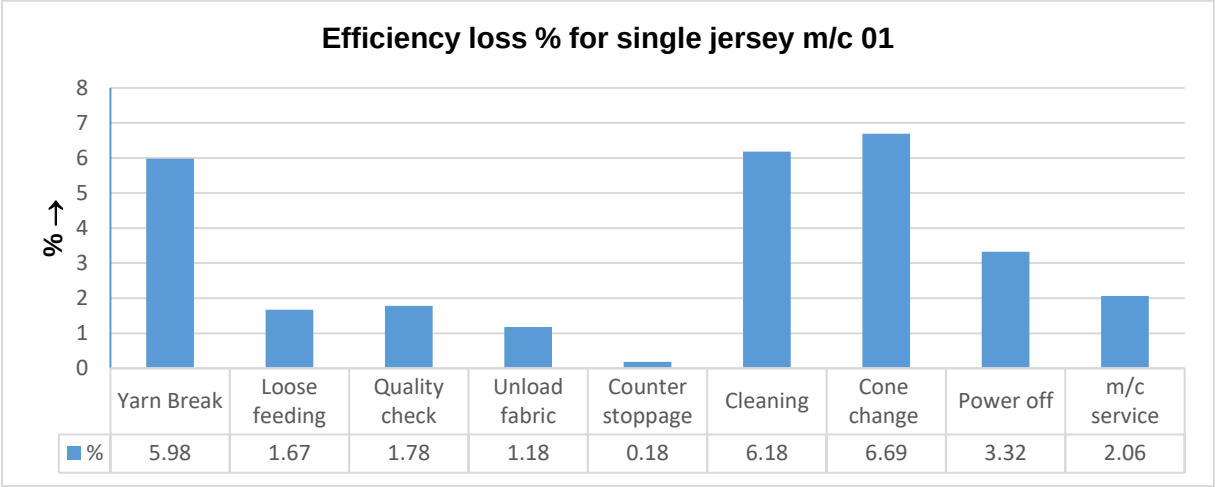


Chart 1: Efficiency loss % for single jersey m/c 01

From above analysis it clearly indicate that the efficiency loss % of single jersey machine is maximum for cone change about 6.69 % and clearing about 6.18%.That means this knitting machine have stopped more time for cone change and clearing.From knitting faults view maximum efficiency loss is found for yarn break and cone change.

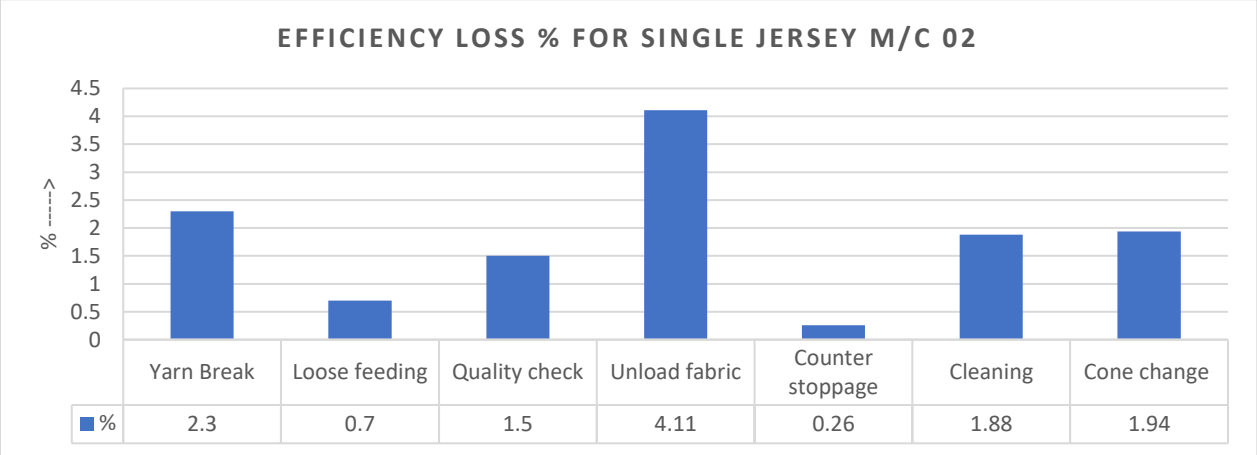


Chart 2: Efficiency loss % for single jersey m/c 02

From above analysis it clearly indicate that the efficiency loss % of this single jersey machine is maximum for unload fabric about 4.11% and yarn break about 2.3%.That means this knitting machine have stopped more time for unload fabric and Yarn breakage. From knitting faults view maximum efficiency loss is found for yarn break and cone change.

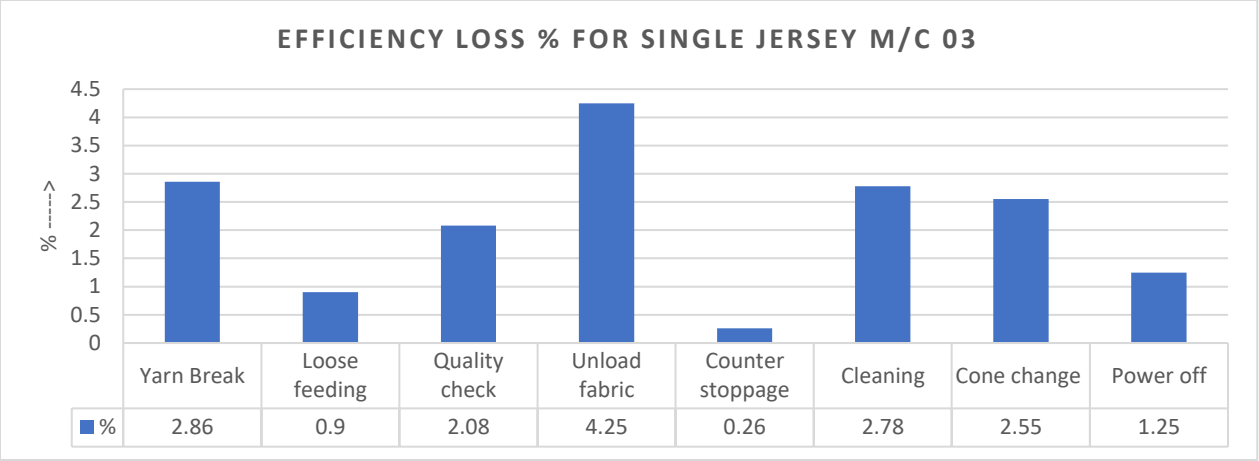


Chart 3: Efficiency loss % for single jersey m/c 03

From above analysis it clearly indicate that the efficiency loss % of single jersey machine is maximum for unload fabric about 4.25%, yarn break about 2.86% and cleaning about 2.78%. That means this knitting machine have stopped more time for unload fabric,Yarn breakage and cleaning. From knitting faults view maximum efficiency loss is found for yarn break and cone change.

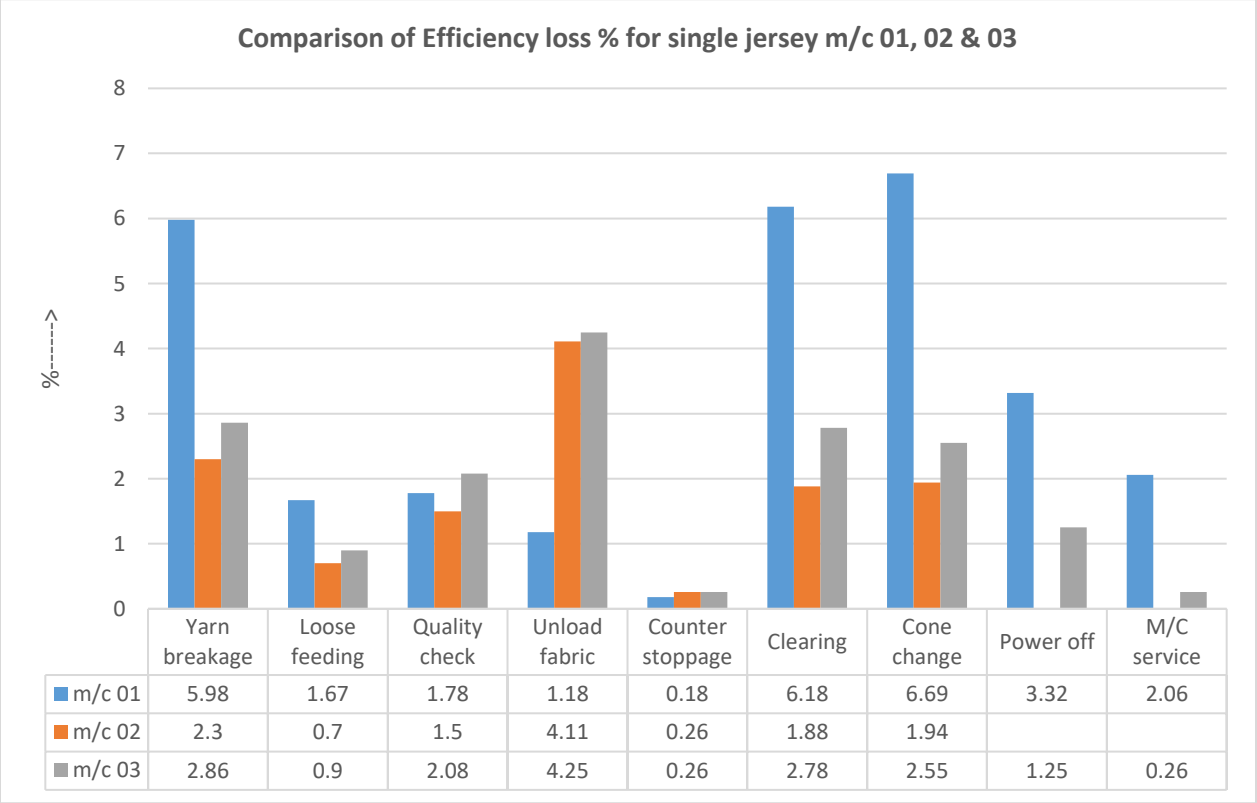


Chart 4: Comparison of Efficiency loss % for single jersey m/c 01, 02 & 03

4.3) Efficiency loss % for Double jersey:

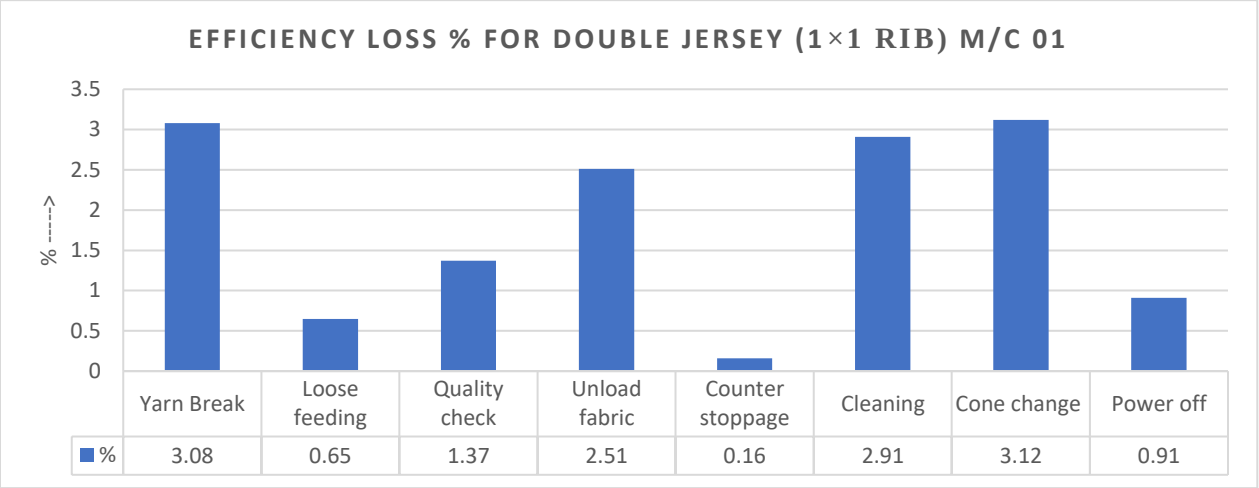


Chart 5: Efficiency loss % for double jersey (1×1 rib) m/c 01

From above analysis it clearly indicate that the efficiency loss % of this single jersey machine is maximum for cone change about 3.12%, yarn break about 3.0% and cleaning about 2.91%.That means this knitting machine have stopped more time for cone change ,Yarn breakage and cleaning. From knitting faults view maximum efficiency loss is found for yarn break and cone change.

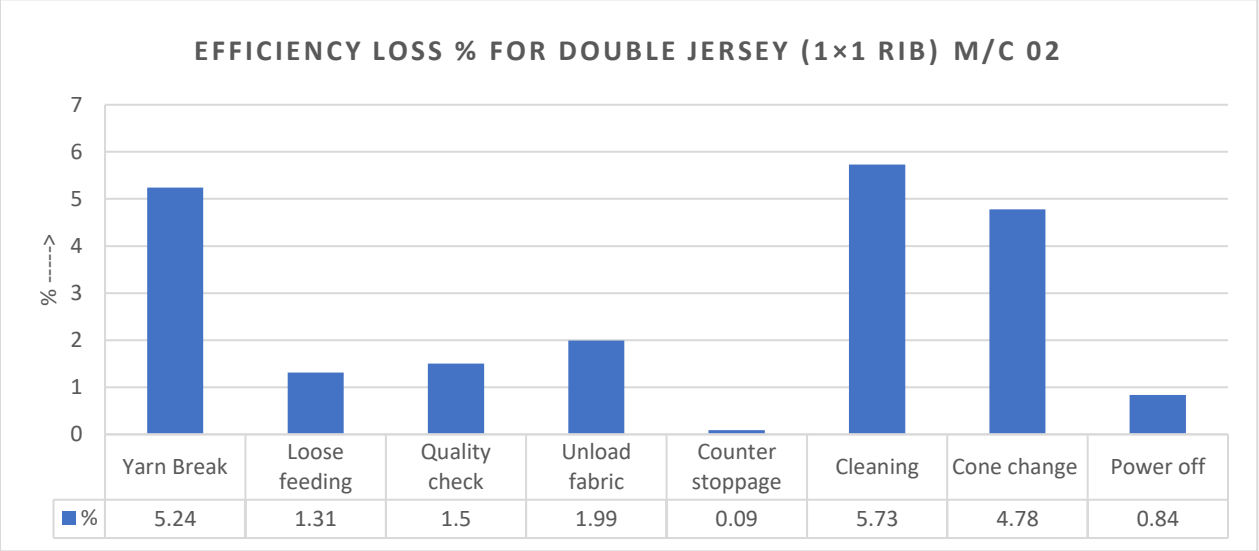


Chart 6: Efficiency loss % for double jersey (1×1 rib) m/c 02

From above analysis it clearly indicate that the efficiency loss % of this single jersey machine is maximum for cleaning about 5.73% and yarn break about 5.24%.That means this knitting machine have stopped more time for cleaning and Yarn breakage. From knitting faults view maximum efficiency loss is found for yarn break and cone change.

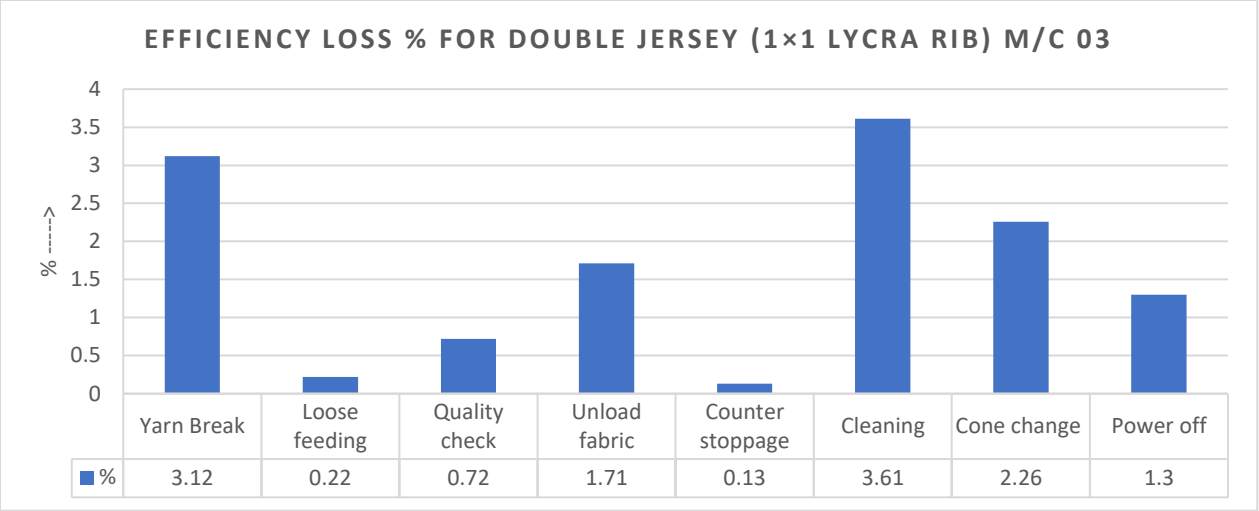


Chart 7: Efficiency loss % for double jersey (1×1 lycra rib) m/c 03

From above analysis it clearly indicate that the efficiency loss % of this single jersey machine is maximum for cleaning about 3.61% and yarn break about 3.12%.That means this knitting machine have stopped more time for cleaning and Yarn breakage. From knitting faults view maximum efficiency loss is found for yarn break and cone change.

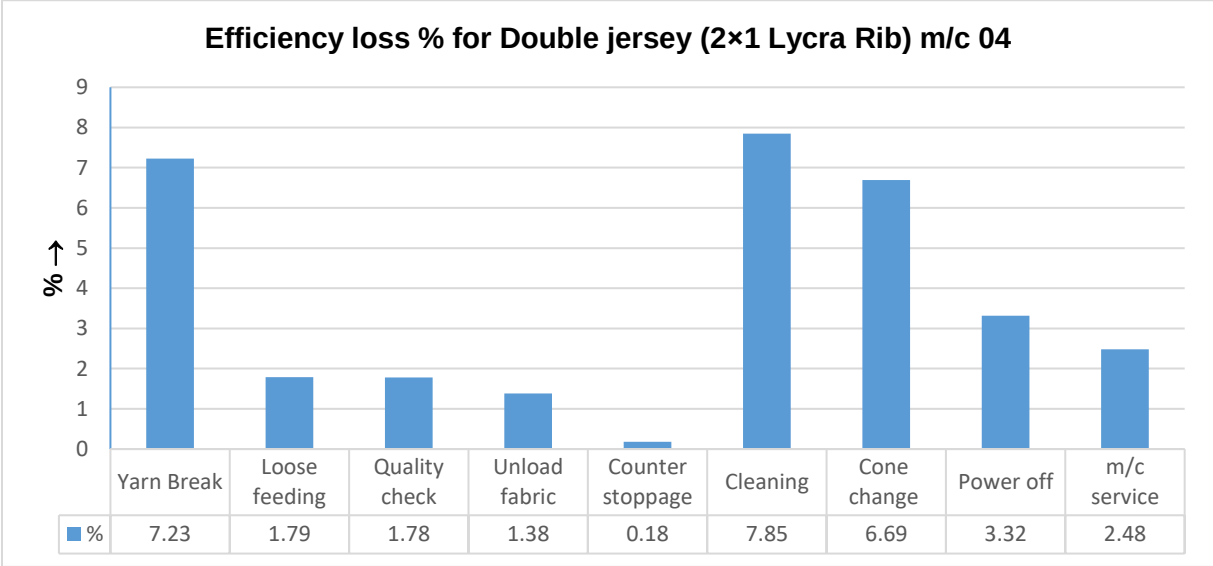


Chart 8: Efficiency loss % for Double jersey (2×1 Lycra Rib) m/c 04

From above analysis it clearly indicate that the efficiency loss % of single jersey machine is maximum for cleaning about 7.85%,yarn break about 7.23% and cone change 6.69% .That means this knitting machine have stopped more time for cleaning, yarn breakage and cone change. From knitting faults view maximum efficiency loss is found for yarn break and cone change.

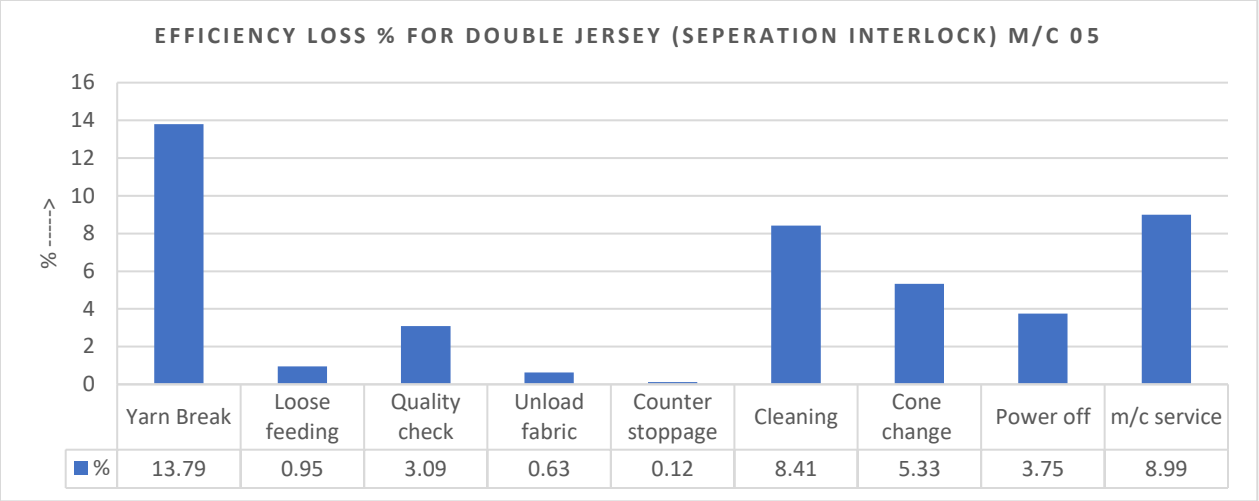


Chart 9: Efficiency loss % for double jersey (separation interlock) m/c 05

From above analysis it clearly indicate that the efficiency loss % of this single jersey machine is maximum for yarn break about 13.79% and cleaning about 7.23%.That means this knitting machine have stopped more time for yarn breakage and cleaning. From knitting faults view maximum efficiency loss is found for yarn break and cone change.

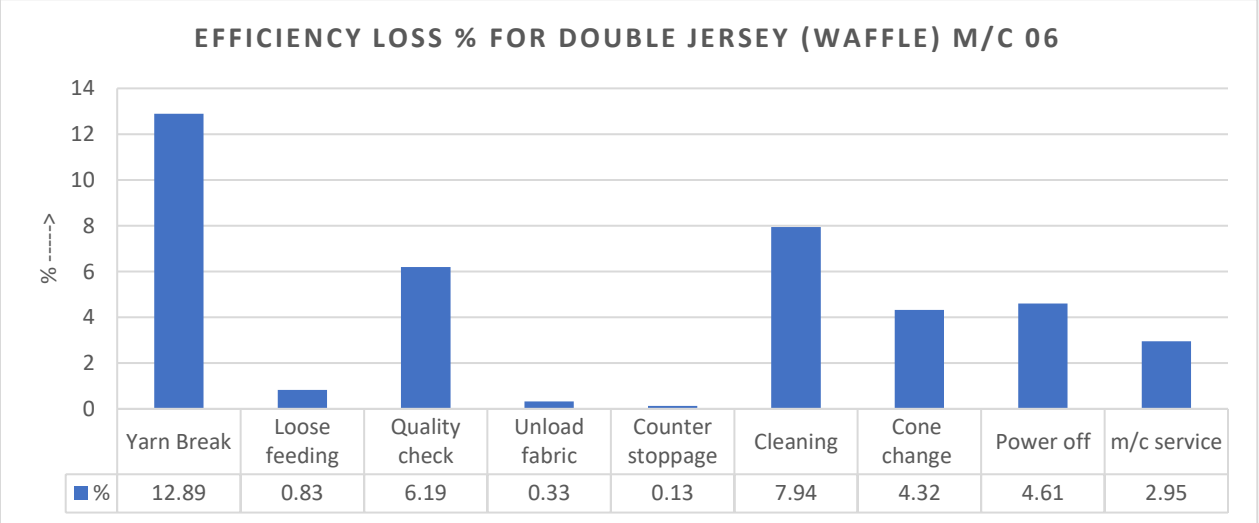
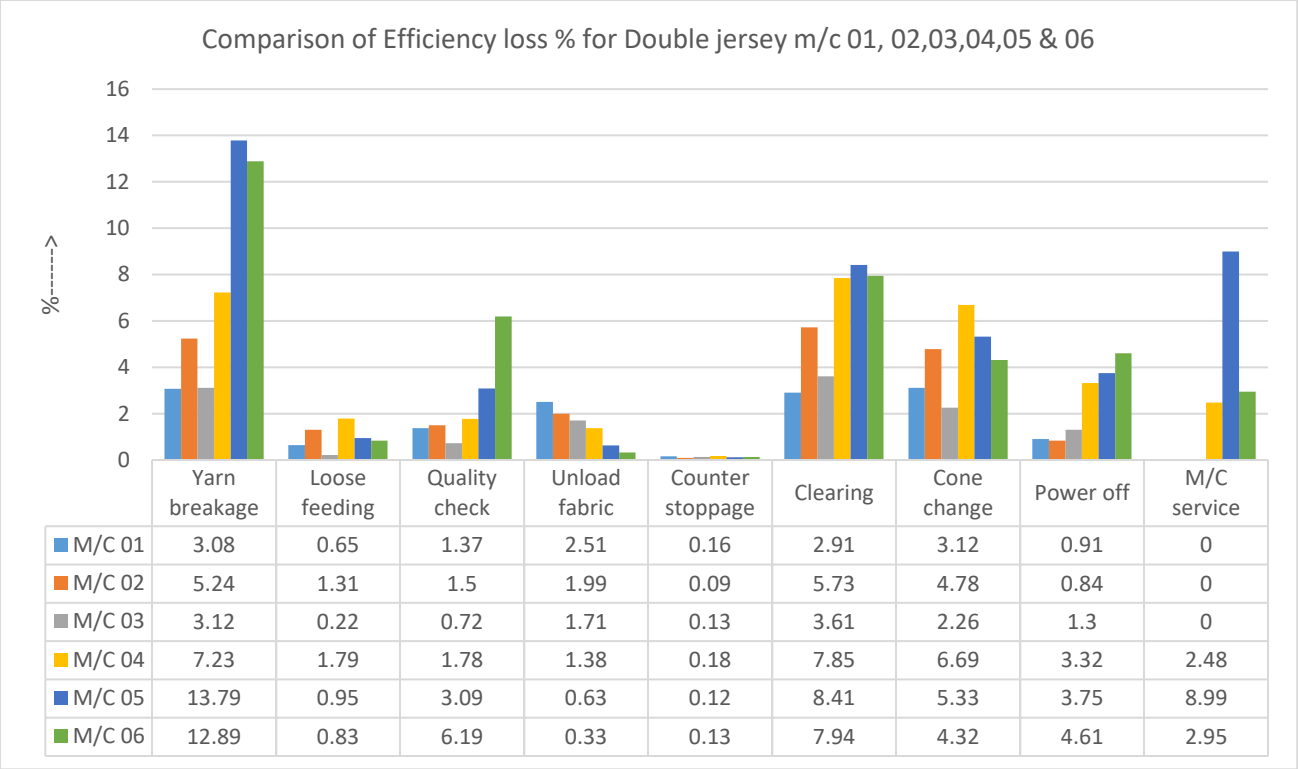


Chart 10: Efficiency loss % for double jersey (waffle) m/c 06

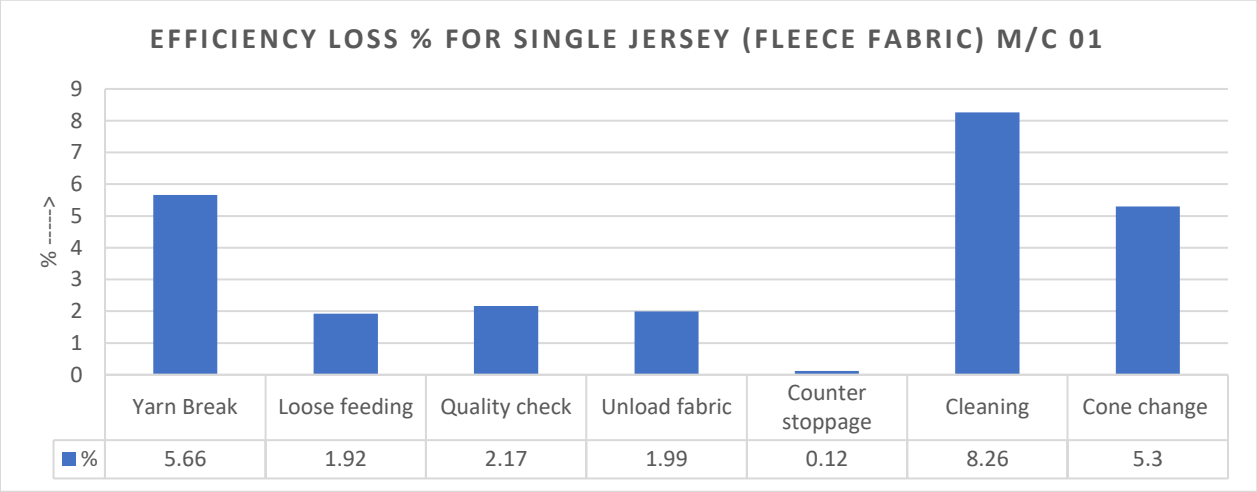
From above analysis it clearly indicate that the efficiency loss % of this single jersey machine is maximum for yarn break about 12.89% and clearing about 7.94%.That means this knitting machine have stopped more time for yarn breakage and clearing. From knitting faults view maximum efficiency loss is found for yarn break and cone change



	Yarn breakage	Loose feeding	Quality check	Unload fabric	Counter stoppage	Clearing	Cone change	Power off	M/C service
M/C 01	3.08	0.65	1.37	2.51	0.16	2.91	3.12	0.91	0
M/C 02	5.24	1.31	1.5	1.99	0.09	5.73	4.78	0.84	0
M/C 03	3.12	0.22	0.72	1.71	0.13	3.61	2.26	1.3	0
M/C 04	7.23	1.79	1.78	1.38	0.18	7.85	6.69	3.32	2.48
M/C 05	13.79	0.95	3.09	0.63	0.12	8.41	5.33	3.75	8.99
M/C 06	12.89	0.83	6.19	0.33	0.13	7.94	4.32	4.61	2.95

Chart 11: Comparison of Efficiency loss % for Double jersey m/c 01, 02,03,04,05 & 06

4.4) Efficiency loss % for Fleece fabric:

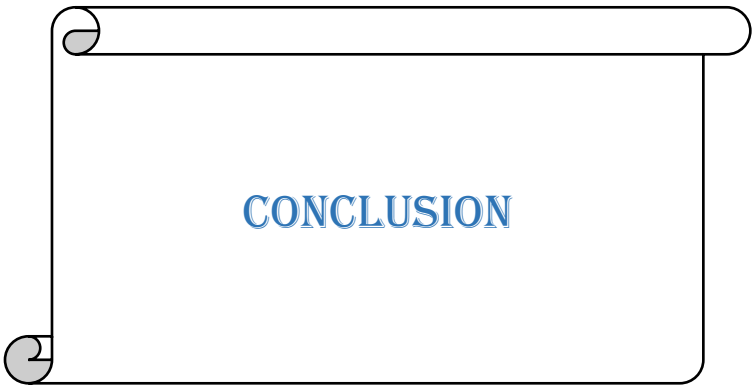


	Yarn Break	Loose feeding	Quality check	Unload fabric	Counter stoppage	Cleaning	Cone change
%	5.66	1.92	2.17	1.99	0.12	8.26	5.3

Chart 12: Efficiency loss % for Fleece fabric

From above analysis it clearly indicate that the efficiency loss % of this single jersey machine is maximum for cleaning about 8.26% and yarn break about 5.66%. That's means this knitting machine have stopped more time for cleaning and Yarn breakage. From knitting faults view maximum efficiency loss is found for yarn break and cone change.

CHAPTER FIVE



Through the project work on "**Analysis of different weft knitted fabric And Machine Efficiency"** We have gained a complete practical knowledge about knit fabrics, its properties, machine setup, historical development, state of knit fabric manufacturing companies in home, types, raw materials requirement, its manufacturing & processing procedure, parameters of manufacturing, processing and quality control.

We are really lucky that we have got chance to conduct our project work on a specialized field of textile processing. During conduction our project work we have practically worked in knitting & wet processing floor. We have also performed almost all the quality tests of knit fabrics in the testing lab. We have collected from different books & different personal.

We think that through this practical work and studies we have gained a sound technical knowledge about knit fabric manufacturing process. We believe our achievement through the project work will help us all the way to face the challenges of our future life.

We are concluding here thanking again all the peoples who have helped us during performing our project work.

References:

1.Engr. Shah Alimuzzaman Belal, Understanding Textiles For a Merchandiser. Published by BMN^3 foundation Dhaka, Bangladesh.

2.Engr. M. A. Malak, Knitting and knit dyeing technology. Published by Grohontonir prokashoni, Dhaka, Bangladesh.