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International
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Faculty of Engineering

Department of Textile Engineering

**Topic: Study on stoppage time in various circular
weft knitting machine**

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Bachelor of Science in Textile Engineering)

Advanced in Fabric Manufacturing

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DECLARATION

We hereby state that, This work has been done by us under the supervision of Ms. Shamima Akter Smriti, Senior Lecturer of the Department, Department Of Textile Engineering, Daffodil International University and Professor Dr. Md. Mahbubul Haque, Head of the Department, Department of Textile Engineering, Daffodil International University, Dhaka.

We also announce that neither this thesis work nor any portion of this report has been submitted somewhere else for award of any degree.

It is only submitted in partial contentment of the necessity of Bachelor of Science in Textile Engineering degree of Daffodil International University and we also remain responsible for the insufficiencies & faults.

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Again we representative our sincerest gratitude to Prof. Dr. Md. Mahbubul Haque, Head of Textile Engineering Department, Daffodil International University, for giving us the opportunity to carry out this report.

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Finally, we would like to recognize with due respect the continuous support and patients of our parents.

Letter of Approval

11th December, 2018

Shamima Akter Smriti

Academic Supervisor

Department of Textile Engineering, Daffodil International University

Subject: Submission of the thesis work on ‘Study on stoppage time in various circular weft knitting machine’.

Dear Madam,

With due respect, as student of Daffodil International University, we have prepared our thesis work on ‘Study on stoppage time in various circular weft knitting machine’.

We have tried our level best to follow your procedures in every part of planning of this thesis work. We have also collected what we trust to be the most significant data to make this work specific and clear as possible. We appreciated the challenge of preparing the thesis as it provided us with a chance to increase knowledge. We are honestly thankful for your guidance during the research of this thesis report. It is true that, it could have been done in a better way if there were not limitations. We hope you will evaluate our report considering the limitations of the study.

Yours sincerely,

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Abstract

As Bangladesh is a growing nation there should be some source which directly ensure the effective growing. Textile is a sector which is doing it well. Knitting is the main fabric production which backward linkage is stronger than others. So, there is some easy way to the production of knitting fabric. But some difficulties also found, like efficiency. The term efficiency mainly depends on the time of machine run in a shift. Which means if the machine stops for a certain time for any reason there should be time loss also production reduced. During this research it has been found that the stoppage time of machine depends some important reasons like, yarn breakage, package change, needle break, worker idle time, Lycra breakage, roll change etc. The most effective reason found is worker idle time which cause more stoppage time. There were also findings the idle time varies with their experience. Yarn breakage found as next important effective element of machine stoppage. There was also some reason found behind more yarn breakage. Design is an important issue in machine stoppage. During this project it was found more complex design cause more machine stoppage time. So, this thesis work will help to understand the stoppage time of distinguished knit product. Also, it displays the decrease rate of production from machine to machine due to various unwanted circumstances.

Table of Contents

List of contents

Chapter – 1	1
1.Introduction	2
1.1 Objectives of this thesis	3
Chapter – 2	4
2. Literature review	5
Chapter – 3	6
3. Theoretical Background	7
3.1 Fabric:	7
3.1.1 Weaving:	7
3.1.2 Knitting:	7
3.2 Classification of knitted fabrics	8
3.3 Classification of knitting machine:	9
3.3.1 Weft knitting machine:	10
3.4 Single jersey Circular knitting machine:	10
3.4.1 Needle	11
3.4.1.2 Types of knitting needle	11
3.4.2 Sinker:	12
3.4.3 Cam:	13
3.5 Some important elements of circular knitting machine:	14
3.6.1 Machine parts:	16
3.7 Knitting action of double jersey circular knitting machine:	16

3.8 Some important term and definitions:	17
3.9 Efficiency:	18
3.9.1 Time efficiency	18
Chapter -- 4	19
4.Materials and Methods:	20
4.1 Machine	20
4.2 Stop watch	22
Chapter 5	32
5. Results and discussions	33
Chapter – 6	42
Conclusion:	43
Chapter-07	44
References	44
References	45
Chapter-08	46
Appendices	47

Chapter – 1
Introduction

1.Introduction

The RMG and Textile industries deliver the main foundation of development in Bangladesh's economy. Which is the backbone of our economy. Exports of garments and textile are the major source of external exchange earnings. In 2002 transfers of textiles, wear, and RMG accounted 77% of Bangladesh's whole merchandise distributes. In 1970-72, World Bank said, USD 6.29 billion gross domestic product (GDP) of Bangladesh.

After that which raised to USD 173.82 billion in 2014, where \$31.2 billion of that made by exports, where 80-85% from ready-made garments. In 2016 Bangladesh became the 2nd highest garments producing. Now Bangladesh is the 2nd largest clothing exporter in the world. 60% of the export agreements of western brands and with the European buyers and rest of the 40% with American's. Where 95% of textile factories are owned by internal investors, and only 5% owned by outsiders. In the economic year 2016-2017 the RMG manufacturing produced \$28.14 billion, that was about 80.7% of the total export incomes in exports. Now we visualize forward to achieving the middle-income economic status within 2021. And we believe that we can make it through.

If we see we can understand in ready made garments about 60% of cost is for fabric, so fabric manufacturing is very important for RMG. To minimize cost and make it easy to use for everyone we have to find the way where fabric manufacturing cost should be low. If it is possible then we can provide more low cost products so we can make more buyer attraction.

Now in our country we produce mainly two types of fabrics,

1.Woven Fabric

2.Knitted Fabric

If we follow up we can understand knitting production is more than weaving. Lots of industries produce knitting fabrics, they use different types of machine, different worker and different strategies. So there production also different. The machines have very much effects on production rate. It may contain it speed, efficiency, stoppage etc. Also it varies with the worker efficiency and worker idle time.

The following explanations will give the overall idea about the production efficiency and time efficiency of textile knitting industries.

1.1 Objectives of this thesis

- To know about time loss in different machine due to different reasons.
- To determine which machine consumes more time loss during production.
- To know which reason is more responsible for highest time loss.
- To determine the time efficiency.
- Effects of worker idle time according to their experience in production.
- To know about recent work in this topic and finds the limitations.
- To know the stoppage time difference between simple design and complex design.

Chapter – 2
Literature review

2. Literature review

D.J. Spencer, Which is published by Wood Head Publication Ltd., April 2001. Needle , Sinker , Cam , mechanism of fabric take-down, lubricator , yarn breakage indicator , creel , storage device , Feeder are the parts of knitting machine written by him . knit fabric production are increase or decrease by this elements. Some time machine are stopped by the machine parts problems. Efficiency of machine are reduce by those problem.(Spencer, April,2001)

Reza,M.H said in 2015 that ,the efficiency of machine are reduce by worker idleness, machine stoppage , loose yarn and machine fault. (M.H Reza, 2015)

Spencer,D.J was written that some machine efficiency are high then others which has more than one ring . Some machine has good efficiency by born like as Raschel , Jacquard and double needle bar. (Spencer, 1998)

Ahmed,M.T & Islam,M.R studied that knitting efficiency is vary various factor . Machine dimeter, machine gauge, stitch length, Machine RPM, Fabric type, Yarn type, yarn count. (Islam, 2017)

Hasan,M.H & Rahman,M.M studied on knitting machine efficiency. It identify by defect correction time and machine down time. Efficiency are reduced by needle break, yarn break , technical problem . During those problem knit fabric productivity and quality loss. (Rahman, 2015)

In 1995,The second edition of Circular knitting written by Mammel, Iyer, Schach. Weft knitting and warp knitting are the types of knit fabric. Yarn are presented horizontally in weft knitting and kinked into a row of loops.(Mammel, 1995)

Fleece, terry, Rib , double lacoste fabrics have low efficiency because of there sophisticated method and there design .RPM of machine has to slow down reduce yarn breakage in that case reduce productivity . Less yarn breakage with high RPM machine are produced by some company and quality fabric are provided. (A.Bentur, 2002)

Chapter – 3
Theoretical Background

3. Theoretical Background

3.1 Fabric:

Textile fabrics can be made in mainly two ways,

1. Weaving

2. Knitting

But if we classify fabric we get 4 types,

1. Woven fabric
2. Knitted fabric
3. Non-woven fabric
4. Bearded fabric.

But knitting and weaving is produced more than the others.

So, discuss will be about majority productions.

3.1.1 Weaving:

Here 2 sets of yarn used to produce fabric by interlacing each other at right angle. Where weft and warp are the 2 sets of yarn.

3.1.2 Knitting:

Knitting is a process by which yarn follow interloping to make a fabric. Which is use in many types of garments manufacturing.

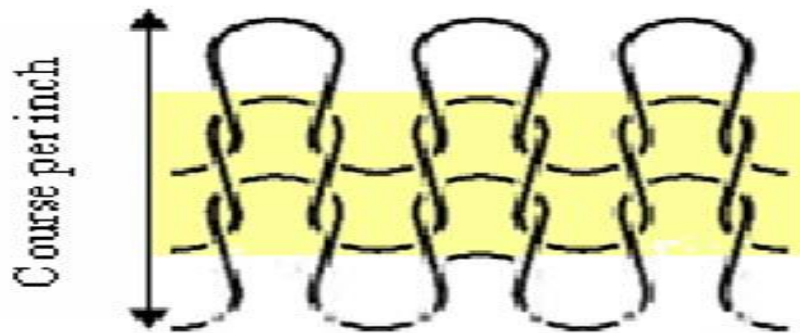
Here one sets of yarn produce fabric by interloping. The basic and main elements of knitting are Needle, sinker, cam and of course the yarn. The yarn pass through different mechanism and meet the needle which create the loop and produce fabric. Knitting can be done by hand or by machines. There are lots of examples of hand made knit fabrics. But they are slow to produce and also not possible for huge production within short time. That's why we are using automatic machine for producing fabrics. Where knitting machines contains a cylinder and others elements which is essential for knitting process.

In knitting wales and course are notified similar to warp and weft but the difference is here yarn is one set.

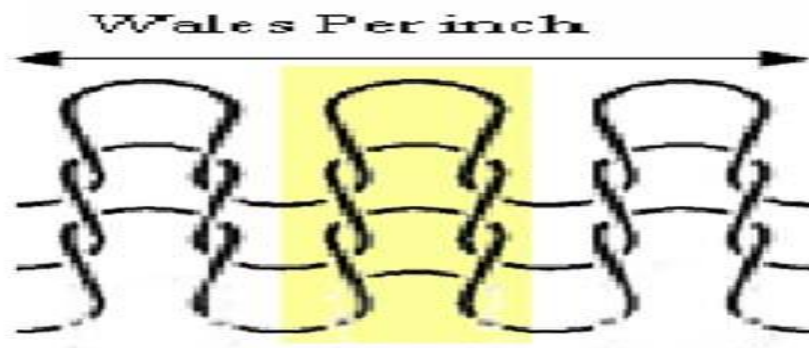
Course: In knitted fabric the total number of horizontal rows is known as course.

Wales: In knitted fabric the total number of vertical rows is known as wale.

Course per inch: The number of course in one inch is called course per inch CPI.



Wales per inch: The amount of wales in one inch in the fabric is called wales per inch WPI.

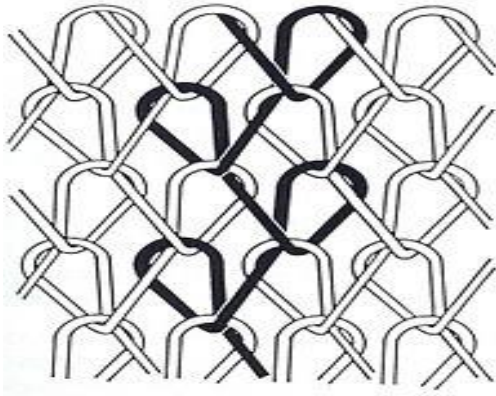


3.2 Classification of knitted fabrics

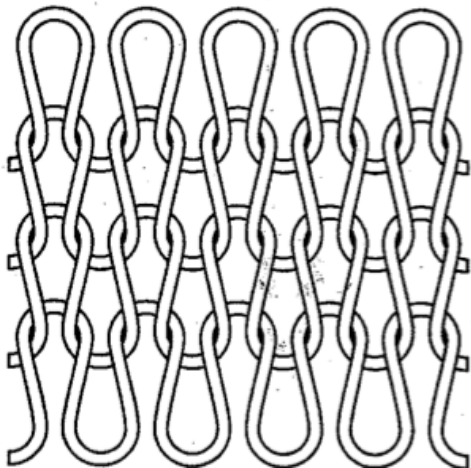
Mainly two types of knitted fabrics. They are

- ☐ Weft Knitting
- ☐ Warp knitting

3.2.1 Warp knit: In warp knitting each loop is in horizontal direction is produce from different yarn. Sweater is made by this way.



3.2.2 Weft knit: In weft knitted structure the loops of horizontal directions can be made by using one thread and they run into same horizontal directions.



Although two types of knitting are available but mostly weft knitting is used. The area of warp knitting is low.

3.3 Classification of knitting machine:

Knitting machine is primarily divided into three types,

- Warp knitting machine,
- Weft knitting machine,

3.3.1 Weft knitting machine:

It is also two types,

1. Independent needle,
2. United needle.

Where Independent needle is two types,

- a) Flat bed
- b) Circular.

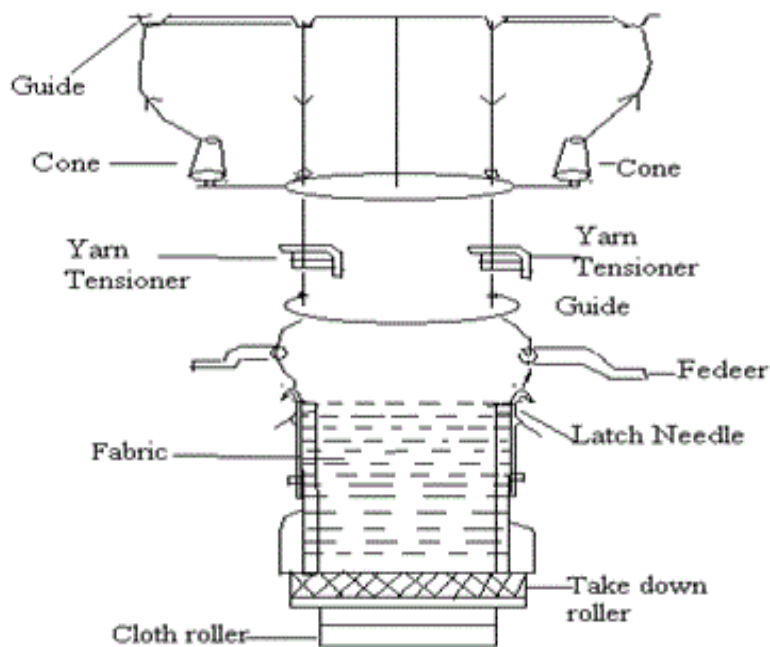
These are the types of knitting machines but mostly we use Circular knitting machine in weft knitting, which is mainly two types

- Single jersey Circular knitting machine.
- Double jersey Circular knitting machine.

3.4 Single jersey Circular knitting machine:

It's a type of weft knitting machine. In single jersey machine one sets of needle is used for knitting. The main part of this machine which is essential for knitting are,

- Needle
- Sinker
- Cam



3.4.1 Needle: It is the basic elements of knitting. Its long, thin, usually metal sticks which are pointed at one end and used for knitting.

3.4.1.1 Function of needle:

- Loop formation.
- Hold the old loop and receive new loop.
- Push away the already produce fabric.

3.4.1.2 Types of knitting needle,

It is mainly three types

- Latch needle
- Bearded needle
- Compound Needle

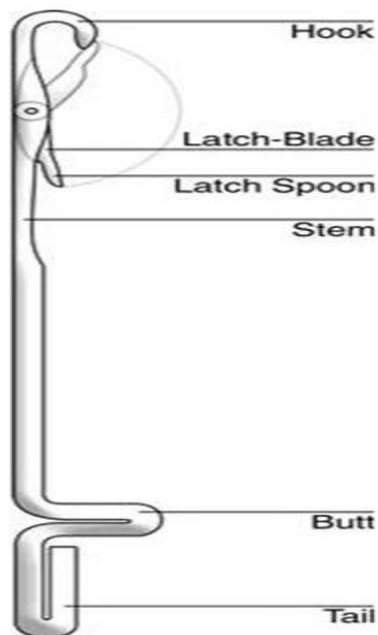
Latch needle is mostly used needle in present time. Because of its effectiveness as a self-acting needle so it has individual movement and control over stitch length. It is ideal to use in computerized method. Here the old loop is cleared automatically when needle is lifted.

3.4.1.3 Latch needle:

It has two main part latch and hook also have butt and tail.

Hook catches a new yarn during knitting process,

Latch is freely rotating about the axle and strictly closing the hook.



3.4.2 Sinker:

Sinker is the second key knitting element. Made of thin metal plate with separate action operating about at right angles from the hook of the needle bed, between next to needles. It helps to hold the yarn also hold the yarn when there is no loop form.

3.4.2.1 Function of sinker:

- Hold the loop.
- Support needle during knitting.
- Action took in loop formation.

3.4.3 Cam:

It is the devices which transfer the rotary motion drive into a appropriate reciprocating motion for the needles, sinker and other elements.

Cam is classified in 2 types,

- Engineering cam.
- Knitting cam.

3.4.3.1 Knitting cam:

It is used in weft knitting machine. In other word it is track for needle and sinker. It is angular type and acts directly on the butt of needle or sinker or other elements. It is the track by which the needle and sinker move in reciprocating motion. Cam is set into a cam box. Normally a cam box can contain 4 cams but now a days it can be 6.

Knitting cam is three types,

- Knit cam
- Miss cam
- Tuck cam



Knit

Tuck

miss



Objects of cam:

- Drive the needles and sinker.
- Give motion to needle and sinker.
- Helps in Loop formation.

3.5 Some important elements of circular knitting machine:

Creel: It is an essential part of knitting machine which hold the yarn package and make sure the smooth and uniform tension of yarn delivery.

Guide: By which yarn are pass the distance through pipe.

Pipe: It is used to smooth and dirt, dust free yarn feeding.

Yarn tensioner: By this element maintains uniform yarn tension of yarn.

Feeder: Feeder is used to feed the yarn. It may be varies due to different fabric design.

Cylinder: It is the main part of machine where all the basic elements are set. It holds the all elements and help in knitting.

VDQ pulley: It is used to control and maintain the stitch length followed by the G.S.M of the fabric. It is very important elements which is need to every different type of fabric.

Take down roller: After completing the knitting this roller is used to take down and wrap into a steel roll. After certain time when the fabric roll is full then the roll is taken down and cut it to pass the inspection unit.

Positive feeder: Positive feed device is used to remove slippage of yarn during yarn feed. It is constructed by rubber wheel containing a toothed track. By this toothed track a toothed belt is worked to circulate the feeder.

3.6 Double jersey Circular knitting machine

There are two sets of needle, one is on the circumference of a vertical dial cylinder and a other set of needles position perpendicular to the 1st set and riding on a horizontal dial.

On the most of the circular knitting machineries, dial and cylinder rotates where cams, yarn feeder and guides stay inactive.

In case of double jersey circular knitting machine, the dial needle holds its motion for loop formation by its butt that ultimately covers into a cam track.

The tuck cam is designed by cam parts which in turn are secure to a cam dial plate.

All through the revolution of the dial and the cylinder of the cylinder needle is transfered vertically and the dial is horizontally.

It requires fine yarn than single jersey machine.

In yarn feeding, single feeder is used.

Double jersey Circular machine can manufacture tops of socks, sleeves, cuffs, rib border of clothes.

Cylinder and Dial are reverse but located in same arrangement.

Needle on a bed is functioned by one category of needle systems.

Production is high in double jersey machine.

3.6.1 Machine parts:

- Motor
- Motor pulley
- Pulleys
- Gears
- Yarn career
- Stop break motion
- Guides
- Dial
- Dial cams
- Dial needles
- Cylinder
- Cylinder cams
- Cylinder needles
- Oiling and air subsequent devices
- Sensors
- Take down rollers
- Batch rollers

All the parts are similar to single jersey circular knitting machine except in double jersey doesn't have sinker to support the knitting. Here the dial needle support knitting process.

Also, it has dial cams which is use as a track for dial needle.

3.7 Knitting action of double jersey circular knitting machine:

Basically, it has three actions, they are

3.7.1 Clearing action: The dial and cylinder needles interchange to clear the plain and loops formed in the former cycle.

3.7.2 Yarn feeding action: Needles are reserved into their trickeries that's why old loops are enclosed by the open latch and then the new yarn is fed to the open hooks.

3.7.3 Knocking Over action: The action is done here is almost similar to previous one difference tricks are withdrawn by the needles so that the old loops can cast off and new loops can drawn through them.

3.8 Some important term and definitions:

Yarn break: During knitting there are lots of yarn breakage is occur due to various reason. It is very harmful for high productions.

Lycra break: Its similar to yarn break but difference is it's occur more than yarn break.

Package change: We know cone is used as yarn package in knitting machine, so after certain time the yarn will be finish so it needs to change for continuous yarn feeding.

Cleaning: In knitting floor there are lots of dirt and dust are around the machine which make the machine dirty and can cause various problem in the machines like yarn break, parts decay high tension etc. So, to prevents those problem the machine needs to clean after every certain time.

Roll change: The fabric roller can hold a certain amount of fabric, after that it needs to release the fabric to roll the new produced fabric. So, roll needs to change.

Worker idle time: When worker do not work even machine stops then the time spend by the worker is known as worker idle time.

Tension loose: During knitting there are many ways that yarn are loose from the expected tension, then the tension device stops the machine.

Fabric check: Sometime operator stops the machine and does the inspection of the fabric to find out is there any fault found in the fabric.

Cone fall: When cone is loose then it needs to rotate more than the normal time so, sometimes cone fall from the creel.

Needle break: Needle break is occur due to various reason like, faulty needle setting, dirt and dust, improper tension, improper oiling etc. If needle breaks it breaks with large numbers so to adjust it took long time which is very harmful for production.

Beyond above reasons there are some other reason which stops the machine like, inverter fail, improper oiling etc.

3.9 Efficiency:

Efficiency is the ability of machine to perform without wasting its working power including money, time, energy etc. It is actually comparison between what is actually produced and what is the calculated production.

So, efficiency is equal to,

$$\frac{\text{Actual production} \times 100}{\text{Calculated production}} \%$$

3.9.1 Time efficiency: The term time efficiency is how much time a machine spent in production and calculated total time in the shift/day in ratio. The time efficiency is very important portion of high production. If time efficiency is more then production will be more.

So, time efficiency is equal to,

$$\frac{\text{Actual production time} \times 100}{\text{Calculated production time}} \%$$

Now if we want to calculate the efficiency loss due to time loss then,

Efficiency loss is equal to,

$$(1 - \text{Time efficiency}) \%$$

Time efficiency loss occur due to various reasons. So, we need the calculate all the reasons time loss and its percentage over the total time loss.

The formula is=
$$\frac{\text{Efficiency loss} \times \text{Machine stoppage time in that perticular reason}}{\text{Total stoppage time}} \%$$

Chapter-04
Material and Method

4. Materials and Methods:

During the thesis projects there are some materials that are used. Main materials is machines and stop watch.

4.1 Machine: There are two types of machine used,

1. Single jersey circular knitting machine.
2. Double jersey circular knitting machine.

Those single jersey machines are also has two derivatives,

1. Single jersey
2. Double Lacoste



Figure 4.1: Single jersey circular knitting machine.

Total number of machines which is used to collect data for this work, here in this work there are 16 machines are followed to collect the data, their specifications are given below,

Table 4.1: Specification of knitting machine

Machine No.	Brand	Origin	Dia	Gauge	RPM	Fabric type	S/L	Count
1	Mayer&Cie	Germany	30"	24	18	S/J	2.85	24/s
2	Mayer&Cie	Germany	26"	24	19	S/J	3.1	24/s
3	Mayer&Cie	Germany	30"	24	20	S/J	2.9	24/s
4	Mayer&Cie	Germany	34"	24	18	S/J	2.9	24/s
5	Mayer&Cie	Germany	26"	22	18	S/J	2.85	32/s
6	Mayer&Cie	Germany	26"	24	18	S/J	3.15	24/s
7	Mayer&Cie	Germany	30"	22	20	S/J	2.8	24/s
8	Mayer&Cie	Germany	30"	24	18	S/J	2.85	24/s
9	Mayer&Cie	Germany	26"	24	18.5	S/J	3.1	24/s
10	Mayer&Cie	Germany	38"	18	9	2/1 Rib	2.85	30/s
11	Mayer&Cie	Germany	38"	18	9	2/1 Rib	2.85	30/s
12	Terrot	Germany	30"	16	10	2/1 Rib	3.1	24/s
13	Mayer&Cie	Germany	26"	22	18	Double Lacoste	2.55	150D
14	Mayer&Cie	Germany	22"	22	16	Double Lacoste	2.95	24/s
15	Mayer&Cie	Germany	22"	22	16	Double Lacoste	2.95	24/s
16	Mayer&Cie	Germany	26"	22	18	Double Lacoste	2.55	150D

4.2 Stop watch: To measure stoppage time there should be some materials which can perform as counter of time. Stop watch is ideal for this job. Here mobile stop watch is used for counting stoppage time due to different reasons.



Figure 4.2: **Picture of stop watch which was used during this work**

The data that are collected from the machines given below,

Table 4.2: Specification of machine no.1

Machine No.	1
Dia	30"
Gauge	24
RPM	18
Brand	Mayer&Cie
Origin	Germany
Needle	2260
Yarn count	24/s
S/L	2.85
Fabric type	S/J
Worker Name	Sharif
Age	52
Join	2006
Years of Experience	12
Shift	A

Table 4.3: Data collected from machine No.1

	Reasons with time															Total Stoppage time
Time period	Yarn breakage		Cone change		Needle brake		Cleaning		Roll change		Tension loose		Others		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
6:00-7:00 AM	1	45	0	0	0	0	0	0	0	0	0	0	0	0	0	
7:00-8:00 AM	1	96	0	0	0	0	1	65	1	38	0	0	0	0	0	
8:00-9:00 AM	0	0	2	245	0	0	0	0	0	0	0	0	0	0	40	
9:00-10:00 AM	2	122	1	130	0	0	1	80	1	45	0	0	0	0	0	
10:00-11:00 AM	2	98	0	0	0	0	0	0	0	0	1	25	0	0	122	
11:00-12:00 PM	0	0	0	0	0	0	0	0	1	66	0	0	0	0	15	
12:00-1:00 PM	1	48	0	0	0	0	1	45	0	0	0	0	0	0	0	
1:00-2:00 PM	3	135	1	90	0	0	1	35	1	59	1	12	0	0	25	
Total	10	544	4	465	0	0	4	225	4	208	2	37	0	0	202	1681
Time loss in min		9.067		7.75		0		3.75		3.467		0.617		0	3.366666667	28.01666667

4.3 Calculation: Here all the stoppage time data are collected in seconds, so for this reason there is a extra conversion seconds into minutes.

Total time waste/loss for yarn breakage,

$$= \frac{\text{Total time in breakage}}{60} \text{ min}$$

$$= \frac{544}{60} \text{ min}$$

$$= 9.06667 \text{ min}$$

Similarly,

Total stoppage time for cone change = 7.75 min

Total stoppage time for needle break = 0 min

Total stoppage time for cleaning = 3.75 min

Total stoppage time for roll change = 3.47 min

Total stoppage time for tension loose = 0.62 min

Total stoppage time for worker idle time = 3.37 min

Now,

Total stoppage/loss time

= Sum of all stoppage time

$$= (9.067+7.75+3.75+3.47+0.62+3.37)$$

$$= 28.02 \text{ min}$$

Now,

For machine stoppage in percentage,

Total stoppage time = 28.02 min

Calculated production time per shift = (60 X 8) = 480 min

Actual production time

= (Calculated time – Total stoppage time)

= (480-28.02)

= 451.98 min

So,

Time efficiency

$$= \frac{\text{Actual production time X 100}}{\text{Calculated production time}}$$

$$= \frac{451.98 \times 100}{480} \%$$

= 94.16%

Now,

Total machine stoppage in percentage

$$= \frac{\text{Total stoppage time X 100}}{\text{Calculated production time}}$$

$$= \frac{28.02 \times 100}{480} \%$$

= 5.84 %

Calculation for time loss in percentage due to different reasons,

For yarn breakage,

$$= \frac{\text{Total stoppage time in \% X Stoppage time in yarn breakage}}{\text{Total stoppage time}}$$

$$= \frac{5.84 \times 9.067}{28.02}$$

$$= 1.89 \%$$

Similarly,

For Cone change = 1.61%

For Cleaning = 0.78%

For Roll change = 0.72%

For Tension loose = 0.13%

For Needle break = 0.00%

For Worker Idle Time = 0.70%

For Others = 0.00%

Total = 5.84 %

Similarly,

All the machine data calculation is calculated which are given below,

4.4 Data of Other Machines are Given Below

M/C No	Yarn breakage	Cone change	Cleaning	Roll change	Tension loose	Needle break	Worker Idle Time	Others	Inverter fail	Lycra Break	L Package change	Cone fall
2	2.40%	0.00%	1.50%	0.69%	0.00%	0.00%	4.14%	0.02%	0.00%	0.00%	0.00%	0.00%
3	0.73%	0.00%	0.94%	0.52%	0.00%	0.00%	6.73%	0.00%	0.00%	0.00%	0.00%	0.00%
4	4.09%	0.90%	1.06%	1.01%	0.00%	0.00%	2.73%	0.00%	0.00%	0.00%	0.00%	0.00%
5	2.00%	6.00%	1.06%	0.43%	0.00%	0.00%	2.30%	0.00%	2.11%	0.00%	0.00%	0.00%
6	1.79%	0.35%	3.28%	0.68%	0.00%	0.00%	2.72%	0.00%	0.00%	0.00%	0.00%	0.00%
7	0.57%	0.16%	1.50%	0.65%	0.00%	0.00%	0.90%	0.00%	0.00%	0.00%	0.00%	0.00%
8	0.72%	0.00%	0.70%	0.72%	0.00%	0.00%	3.31%	0.00%	0.00%	0.00%	0.00%	0.00%
9	1.46%	0.71%	0.88%	0.59%	0.00%	0.00%	0.93%	0.00%	0.00%	0.00%	0.00%	0.00%
10	4.16%	1.28%	1.88%	0.34%	0.00%	0.00%	4.11%	0.00%	0.00%	1.20%	0.75%	0.00%
11	3.77%	1.85%	0.63%	0.33%	0.00%	0.00%	2.75%	0.00%	0.00%	1.53%	1.42%	0.00%
12	1.93%	0.63%	0.38%	0.18%	0.00%	37.50%	0.47%	0.00%	0.00%	1.18%	1.16%	0.00%
13	4.49%	5.05%	0.00%	0.57%	0.00%	0.00%	4.13%	0.00%	0.00%	0.00%	0.00%	4.08%
14	4.26%	2.53%	1.18%	0.43%	0.00%	0.00%	2.17%	0.00%	0.49%	0.00%	0.00%	0.00%
15	4.05%	1.54%	0.79%	0.45%	0.86%	0.00%	1.83%	0.00%	0.69%	0.00%	0.00%	0.00%
16	3.26%	2.28%	0.86%	0.48%	0.00%	0.00%	2.55%	0.00%	0.00%	0.00%	0.00%	2.59%

Table 4.5: All single jersey machine and their time loss percentage in average.

Single jersey			
Machine Number	Dia & Gauge	Needle	Machine stoppage time %
1	30"24	2260	5.8
2	26"24	1960	8.6
3	30"24	2260	8.9
4	34"24	2562	9.8
5	26"22	1798	13.9
6	26"24	1960	8.8
7	30"22	2072	3.8
8	30"24	2260	5.4
9	26"24	1960	4.6
Avg. Machine stoppage time %			7.7

4.4 Average stoppage time %

$$= \frac{\text{Sum of all single jersey stoppage time \%}}{\text{Number of machine}}$$

$$= \frac{5.8+8.6+8.9+9.8+13.9+8.8+3.8+5.4+4.6}{9}$$

$$= 7.7 \%$$

Similarly,

All calculation is done in below table.

Table 4.6: All double jersey machine and their machine stoppage time percentage in average.

Double jersey (Rib)			
Machine Number	Dia & Gauge	Needle	Machine stoppage time%
10	38"18	3844	13.72
11	38"19	3844	12.26
12	38"16	3014	43.42
Average (M/C 1&2)			12.99

Table 4.7: All double Lacoste machine and their time loss percentage in average.

Double Lacost			
Machine Number	Dia&Gauge	No of needle	Machine stoppage time%
13	26"22	1798	18.31
14	22"22	1658	11.07
15	22"23	1659	10.22
16	26"22	1798	12.02
Average			12.91

Table 4.8: Different machine and their average time loss percentage.

Machine type	Average Machine stoppage %
Single jersey	7.8
Double jersey (Rib)	12.99
Double Lacoste	12.91

Table 4.9: Data table of worker experience and their idle time.

Worker Experience (years)	Idle time (minutes)
3	32.28
3	19.83
6	19.73
6	19.85
8	13.1
8	13.07
8	2.26
8	12.25
9	15.88
12	3.36
12	13.18
13	4.3
13	4.47
14	8.8
14	10.41
14	11.01

Chapter 5

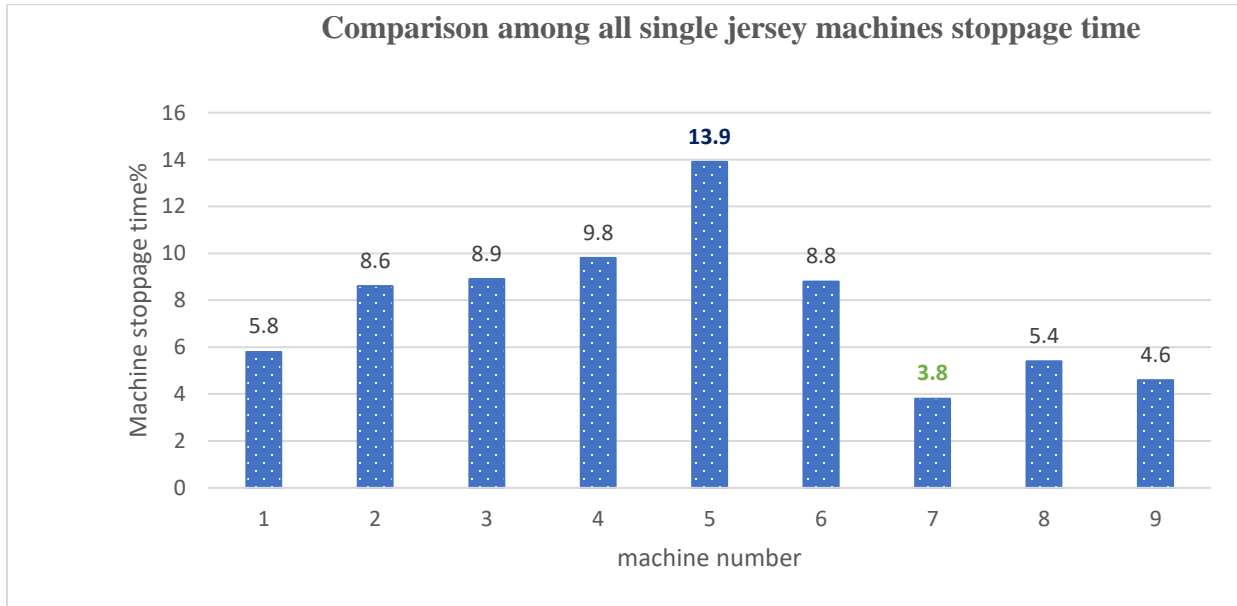
Results and Discussions

5. Results and discussions:

Table 5.1: Single jersey machine and their time loss percentage.

Single jersey			
Machine Number	Dia & Gauge	Needle	Machine stoppage time%
1	30"24	2260	5.8
2	26"24	1960	8.6
3	30"24	2260	8.9
4	34"24	2562	9.8
5	26"22	1798	13.9
6	26"24	1960	8.8
7	30"22	2072	3.8
8	30"24	2260	5.4
9	26"24	1960	4.6
Average Machine stoppage%			7.7

Comparison among all single jersey machines stoppage time



Graph 5.1: Graphical representation of stoppage time in single jersey machine.

From graph 1 it is observed that most of the machine stoppage time are around 8-10 %. But, in machine No.5 having highest time loss about 14% which is more than others. The

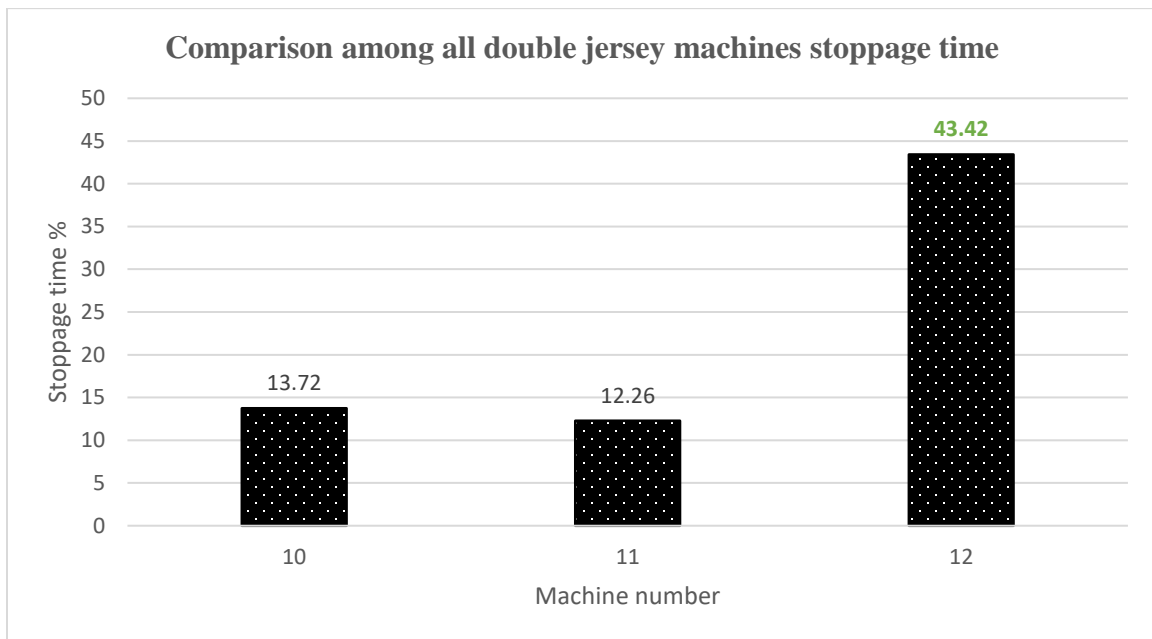
reason was found that, In machine No.5 most of the cone was loose so that there was more cone change as a result time loss was more.

And machine No.7 having less time wastage among all. The reason behind this, there was all full cone used as a result less cone change was done also for this less yarn breakage was occur.

Table 5.2: Double jersey machine and their time loss in percentage.

Double jersey (Rib)			
Machine Number	Dia & Gauge	Needle	Machine stoppage time%
10	38"18	3844	13.72
11	38"19	3844	12.26
12	38"16	3014	43.42
Average (M/C 1&2)			12.99

All double jersey machine stoppage time



Graph 5.2: Graphical representation of double jersey machines time loss percentage.

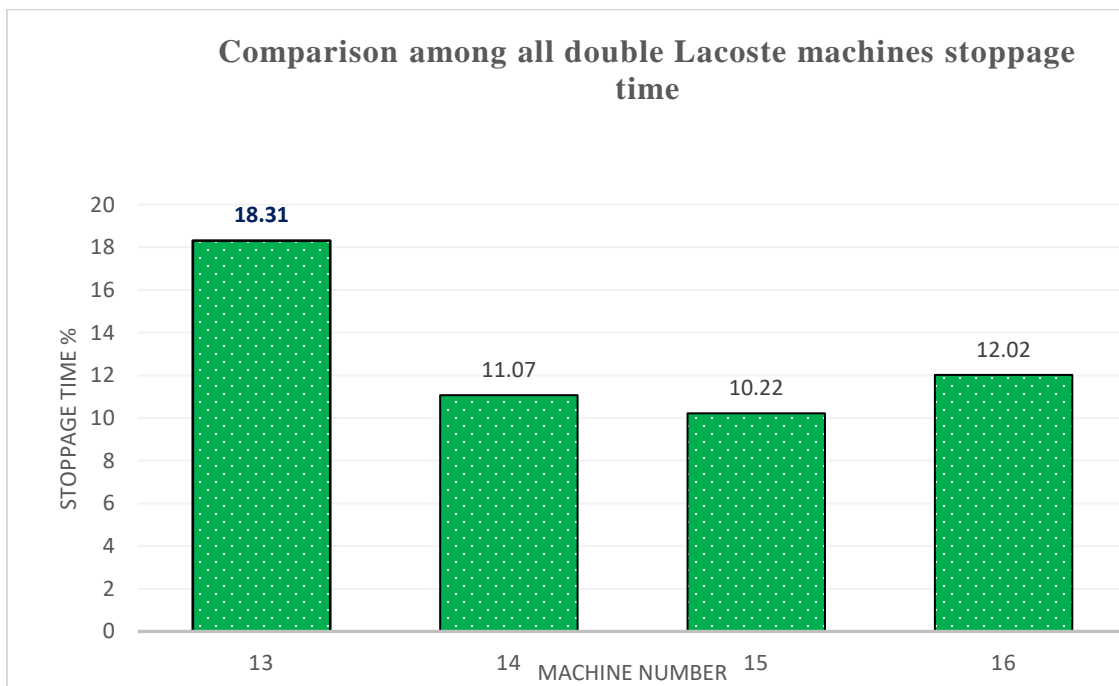
From graph 2 it was observed that machine 10 and 11 having almost near time loss, but in machine 12 there was huge time loss percentage. The reason behind this huge time loss is

needle break. In machine 12 there was 128 needle break, for this reason the machine was not running about 3 hours. Therefore the time loss% is highest.

Table 5.3: All double jersey machines and their stoppage time.

Double Lacoste			
Machine Number	Dia&Gauge	No of needle	Machine stoppage time%
13	26"22	1798	18.31
14	22"22	1658	11.07
15	22"23	1659	10.22
16	26"22	1798	12.02
Average			12.91

Graphical presentation of all double Lacoste machine



Graph 5.3: Graphical representation of double Lacoste machines time loss percentage.

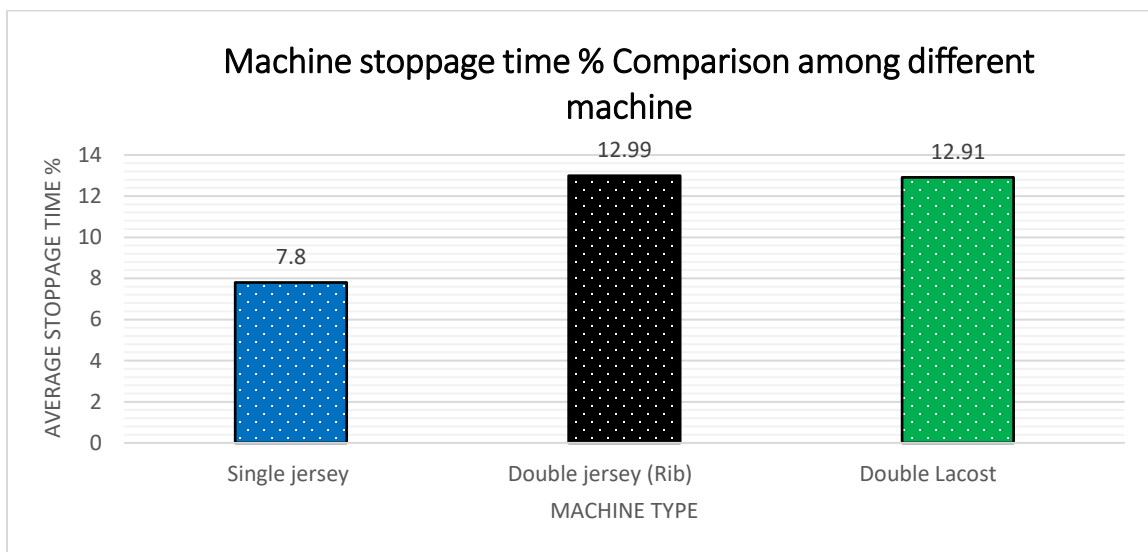
From the graph 3 it was observed that in double Lacoste machine time loss percentage in 14,15 and 16 no. machine were almost near but in machine no. 13 it was highest time loss.

The reason was more cone change due to more loose cone was used. Also, there was cone fall from the creel due to loose cone.

Table 5.4: Average stoppage time % in different circular knitting machine

Machine type	Average time loss %
Single jersey	7.8
Double jersey (Rib)	12.99
Double Lacoste	12.91

Compression among different types of machine stoppage time



Graph 5.4: Graphical representation of stoppage time % Comparison among single jersey, Rib and Double Lacoste.

From the above graph 4 it is found that single jersey machines are having less time loss percentage compared to double Lacoste and Rib machines.

Reasons:

- 1.Simple design cause less yarn break so, time loss is also less.
- 2.Complex design cause more yarn break.

3.Package change: Mostly cotton/PC/CVC yarn package is used in single jersey design, Where Rib & Lacoste cotton/PC/CVC and Lycra package used. As a result less package change required in single jersey where time loss is less.

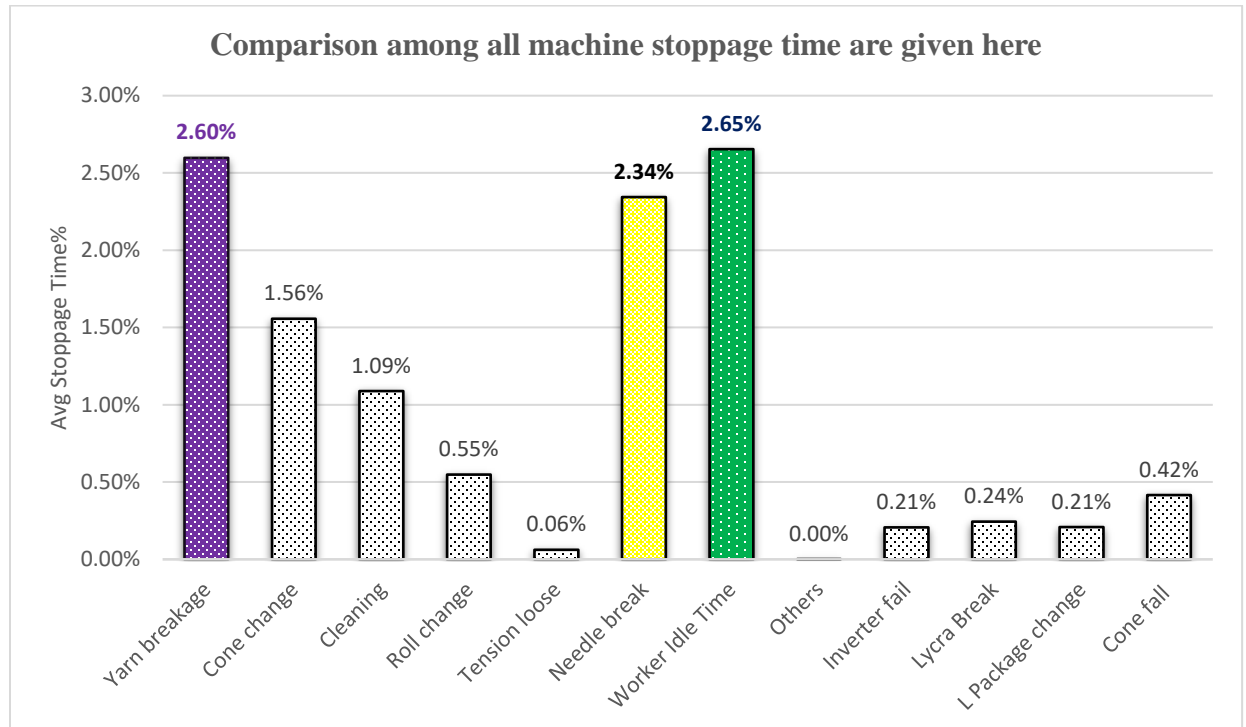
4. Also Lycra package run less time as compered to normal cotton cone that's why more time required to change package.

Double Lacoste and Rib both are complex design and also Lycra was used so both of them having high time loss compared to single jersey.

Table 5.5: Average machine stoppage time due to different reason

M/C No	Yarn breakage	Cone change	Cleaning	Roll change	Tension loose	Needle break	Worker Idle Time	Others	Inverter fail	Lycra Break	L Package change	Cone fall
1	1.89%	1.61%	0.78%	0.72%	0.13%	0.00%	0.70%	0.00%	0.00%	0.00%	0.00%	0.00%
2	2.40%	0.00%	1.50%	0.69%	0.00%	0.00%	4.14%	0.02%	0.00%	0.00%	0.00%	0.00%
3	0.73%	0.00%	0.94%	0.52%	0.00%	0.00%	6.73%	0.00%	0.00%	0.00%	0.00%	0.00%
4	4.09%	0.90%	1.06%	1.01%	0.00%	0.00%	2.73%	0.00%	0.00%	0.00%	0.00%	0.00%
5	2.00%	6.00%	1.06%	0.43%	0.00%	0.00%	2.30%	0.00%	2.11%	0.00%	0.00%	0.00%
6	1.79%	0.35%	3.28%	0.68%	0.00%	0.00%	2.72%	0.00%	0.00%	0.00%	0.00%	0.00%
7	0.57%	0.16%	1.50%	0.65%	0.00%	0.00%	0.90%	0.00%	0.00%	0.00%	0.00%	0.00%
8	0.72%	0.00%	0.70%	0.72%	0.00%	0.00%	3.31%	0.00%	0.00%	0.00%	0.00%	0.00%
9	1.46%	0.71%	0.88%	0.59%	0.00%	0.00%	0.93%	0.00%	0.00%	0.00%	0.00%	0.00%
10	4.16%	1.28%	1.88%	0.34%	0.00%	0.00%	4.11%	0.00%	0.00%	1.20%	0.75%	0.00%
11	3.77%	1.85%	0.63%	0.33%	0.00%	0.00%	2.75%	0.00%	0.00%	1.53%	1.42%	0.00%
12	1.93%	0.63%	0.38%	0.18%	0.00%	37.50%	0.47%	0.00%	0.00%	1.18%	1.16%	0.00%
13	4.49%	5.05%	0.00%	0.57%	0.00%	0.00%	4.13%	0.00%	0.00%	0.00%	0.00%	4.08%
14	4.26%	2.53%	1.18%	0.43%	0.00%	0.00%	2.17%	0.00%	0.49%	0.00%	0.00%	0.00%
15	4.05%	1.54%	0.79%	0.45%	0.86%	0.00%	1.83%	0.00%	0.69%	0.00%	0.00%	0.00%
16	3.26%	2.28%	0.86%	0.48%	0.00%	0.00%	2.55%	0.00%	0.00%	0.00%	0.00%	2.59%
Average	2.60%	1.56%	1.09%	0.55%	0.06%	2.34%	2.65%	0.00%	0.21%	0.24%	0.21%	0.42%

Comparison among all machine stoppage time are given here



Graph 5.5: Graphical representation of overall average stoppage time % due to different reason

From the graph 5 it was observed that there were various reasons who are behind the time loss of production. Some of them were very high compered to others. The highest time loss was due to worker idle time. Most of the worker did not play their actual role during working. They were gossiping each other even some them were not present in front of machine as a result when machine stops due to any reason they did not able to solve the problem quickly. Some of them were actually lazy to do their work. So, worker idle time was big issue of time loss.

The second highest time loss% due to yarn breakage. This reason really hampers the production badly. Also waste of yarn at a same time. The main reason was that, most of the machines were very old almost 20-25 years of age so their working ability is less as well as their effectiveness. This was the main reason of more yarn break. Also, it was about yarn type, low quality yarn cause high yarn break.

The third important reason was needle break. Because if needle breaks then that took more time than any other things. Also, one needle break can cause several needle breaks. To run the machine it needs to find out where the break actually happened then need to open the cam remove the broken needle set up new. So, huge time consumed here. But it was not regularly occurring reason for time loss.

Rest of the reasons were not bothering much. They were under control.

Table 5.6: Data of worker experience and their consumed idle time

Worker Experience (years)	Idle time (minutes)
3	32.28
3	19.83
6	19.73
6	19.85
8	13.1
8	13.07
8	2.26
8	12.25
9	15.88
12	3.36
12	13.18
13	4.3
13	4.47
14	8.8
14	10.41
14	11.01

Comparison among worker idle time according to their experience



Graph 5.6: Graphical representation of worker experience and their consumed idle time

From graph 6 it was found that the less experienced worker consumed more time loss as compared to more experienced worker. The main reason was found that new worker were less active in their work also their problem solving time was more like yarn knotting, cleaning and others which cause time loss. But in case of experienced worker they were more effective in their work and shows more responsibilities that less experienced worker. So, for less time loss and more production highly experience worker is suitable.

Chapter – 6
Conclusion

6.Conclusion:

The above thesis work is about time efficiency and time loss occurred in knitting due to different reasons. The work is trying to explain why time loss is occurred, which reason is mostly cause for time loss, comparison between them and find out the more and less effective reasons. Here also defined that why one reason cause more time loss also find out the solutions for less time loss to improve production.

Here 16 different machine used to collect data so that it can clearly shows the variations of different time loss in different situations. Also shows the effect of simple and complex design in time loss.

Time loss in any factory is a big issue because it directly effects on production. So, to gain high production of machine there should be less time loss%.

Due to shortage of machine and less design in the factory it was not possible to discuss about various types of fabric like pearl, fleece, stripe etc. So if someone works in this topic in next they can work those different design and different machine.

For additional theoretical background and information one can follow the book called “knitting technology” by David Spencer. In this book there is huge information about knitting technology which is stored as a PDF format in Daffodil International University as a project format anyone can also download for this purpose.

After all in this work all the information are given very clearly so that anyone can understand. And also anyone can use these data to improve their production.

Chapter-07

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Chapter-08
Appendices

8. Appendices

In this thesis work the data are mainly collected from the single jersey and double jersey knitting machine. The design of those machines are different but type of collecting data and insert data in table are same. So, only no.1 machine data are given above method part. Rest of the machine data are showing here in appendices.

Table 8.1: Machine No.2

Machine No.	2
Dia	26"
Gauge	24
RPM	19
Brand	Mayer&Cie
Origin	Germany
Needle	1960
Yarn count	24/s
S/L	3.1
Fabric type	S/J
Worker Name	Al-amin
Age	30
Join	2012
Years of Experience	6
Shift	A

Table 8.2: Data collected from machine No.2

	Reasons with time															Total Stoppage time	
Time period	Yarn breakage		Cone change		Needle brake		Cleaning		Roll change		Tension loose		Others		Worker idle time		
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)		
6:00-7:00 AM	2	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7:00-8:00 AM	4	180	0	0	0	0	1	58	0	0	0	0	0	0	0	438	
8:00-9:00 AM	2	65	0	0	0	0	0	0	1	58	0	0	0	0	0	580	
9:00-10:00 AM	2	122	0	0	0	0	1	65	0	0	0	0	0	0	0	0	
10:00-11:00 AM	1	38	0	0	0	0	0	0	1	65	0	0	0	0	0	0	
11:00-12:00 PM	3	75	0	0	0	0	1	130	0	0	0	0	1	7	7	120	
12:00-1:00 PM	0	0	0	0	0	0	0	0	1	38	0	0	0	0	0	35	
1:00-2:00 PM	2	103	0	0	0	0	1	180	1	39	0	0	0	0	0	18	
Total	16	690	0	0	0	0	4	433	4	200	0	0	1	7	7	1191	2521
Time loss in min		11.5		0		0		7.21667		3.33333		0		0.11667		19.85	42.0167

Table 8.3: Calculated result from above table

Total stoppage min	42.0167
Calculated production time	480
Actual production time	437.983
Time Efficiency	91.25%
Stoppage time %	8.75%
Stoppage time due to	
Yarn breakage	2.40%
Cone change	0.00%
Cleaning	1.50%
Roll change	0.69%
Tension loose	0.00%
Needle break	0.00%
Worker Idle Time	4.14%
Others	0.02%
Total	8.75%

Table 8.4: Specification of machine no.3

Machine No.	3
Dia	30"
Gauge	24
RPM	20
Brand	Mayer&Cie
Origin	Germany
Needle	2260
Yarn count	24/s
S/L	2.9
Fabric type	S/J
Worker Name	Milon mia
Age	25
Join	2015
Years of Experience	3
Shift	A

Table 8.5: Data collected from machine No.3

Time period	Reasons with time															Total Stoppage time	
	Yarn breakage		Cone change		Needle brake		Cleaning		Roll change		Tension loose		Others		Worker idle time		
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)		
6:00-7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7:00-8:00 AM	0	0	0	0	0	0	2	98	1	39	0	0	0	0	0	15	
8:00-9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	180	
9:00-10:00 AM	1	38	0	0	0	0	0	0	1	28	0	0	0	0	0	124	
10:00-11:00 AM	1	24	0	0	0	0	1	36	0	0	0	0	0	0	0	745	
11:00-12:00 PM	0	0	0	0	0	0	0	0	1	24	0	0	0	0	0	380	
12:00-1:00 PM	2	148	0	0	0	0	0	0	0	0	0	0	0	0	0	128	
1:00-2:00 PM	0	0	0	0	0	0	1	138	1	58	0	0	0	0	0	365	
Total	4	210	0	0	0	0	4	272	4	149	0	0	0	0	0	1937	2568
Time loss in min		3.5		0		0		4.53333		2.48333		0		0	32.28333333	42.8	

Table 8.6: Calculated result from above table

Total Stoppage time	42.8
Calculated production time	480
Actual production time	437.2
Time Efficiency	91.08%
Stoppage time	8.92%
Stoppage time due to	
Yarn breakage	0.73%
Cone change	0.00%
Cleaning	0.94%
Roll change	0.52%
Tension loose	0.00%
Needle break	0.00%
Worker Idle Time	6.73%
Others	0.00%
Total	8.92%

Table 8.7: Specification of machine no.4

Machine No.	4
Dia	34"
Gauge	24
RPM	18
Brand	Mayer&Cie
Origin	Germany
Needle	2562
Yarn count	24/s
S/L	2.9
Fabric type	S/J
Worker Name	Md. Limon

Age	24
Join	2010
Years of Experience	8
Shift	A

Table 8.8: Data collected from machine No.4

Time period	Reasons with time															Total Stoppage time
	Yarn breakage		Cone change		Cone fall		Cleaning		Roll change		Tension loose		Others		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
6:00-7:00 AM	1	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00-8:00 AM	2	124	0	0	0	0	0	0	1	45	0	0	0	0	0	124
8:00-9:00 AM	5	380	0	0	0	0	1	125	0	0	0	0	0	0	0	142
9:00-10:00 AM	0	0	2	120	0	0	0	0	1	125	0	0	0	0	0	240
10:00-11:00 AM	3	79	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00-12:00 PM	2	178	0	0	0	0	0	0	1	75	0	0	0	0	0	280
12:00-1:00 PM	1	254	1	140	0	0	1	180	0	0	0	0	0	0	0	0
1:00-2:00 PM	2	125	0	0	0	0	0	0	1	45	0	0	0	0	0	0
Total	16	1178	3	260	0	0	2	305	4	290	0	0	0	0	786	2819
Time loss in min		19.6333		4.33333		0		5.08333		4.83333		0		0	13.1	46.98333333

Table 8.9: Calculated result from above table

Total loss	46.98333
Calculated production time	480
Actual production time	433.0167
Time Efficiency	90.21%
Time loss	9.79%
Time loss due to	
Yarn breakage	4.09%
Cone change	0.90%
Cleaning	1.06%
Roll change	1.01%
Tension loose	0.00%

Cone fall	0.00%
Worker Idle Time	2.73%
Others	0.00%
Total	9.79%

Table 8.10: Specification of machine no.5

Machine No.	5
Dia	26"
Gauge	22
RPM	18
Brand	Mayer&Cie
Origin	Germany
Needle	1798
Yarn count	32/s
S/L	2.85
Fabric type	S/J
Worker Name	Md. Sharif
Age	40
Join	2004
Years of Experience	14
Shift	A

Table 8.11: Data collected from machine No.5

Time period	Reasons with time															Total Stoppage time
	Yarn breakage		Cone change		Cone fall		Cleaning		Roll change		Tension loose		Others		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
6:00-7:00 AM	2	45	4	150	2	38	1	38	0	0	0	0	0	0	0	45
7:00-8:00 AM	1	19	5	198	1	25	0	0	0	0	0	0	0	0	0	125
8:00-9:00 AM	0	0	3	180	2	120	1	220	1	35	0	0	0	0	0	45
9:00-10:00 AM	3	185	5	350	2	98	0	0	0	0	0	0	0	0	0	125
10:00-11:00 AM	2	124	4	203	3	165	0	0	1	46	0	0	0	0	0	65
11:00-12:00 PM	3	78	3	60	2	78	0	0	0	0	0	0	0	0	0	28
12:00-1:00 PM	1	36	5	234	1	18	0	0	0	0	0	0	0	0	0	132
1:00-2:00 PM	2	90	6	352	3	65	1	48	1	42	0	0	0	0	0	96
Total	14	577	35	1727	16	607	3	306	3	123	0	0	0	0	661	4001
Time loss in min		9.616667		28.78333		10.11667		5.1		2.05		0		0	11.01666667	66.68333333

Table 8.12: Calculated result from above table

Total loss	66.68333
Calculated production time	480
Actual production time	413.3167
Time Efficiency	86.11%
Time loss	13.89%
Time loss due to	
Yarn breakage	2.00%
Cone change	6.00%
Cleaning	1.06%
Roll change	0.43%
Tension loose	0.00%
Inverter fail	2.11%
Worker Idle Time	2.30%
Others	0.00%
Total	13.89%

Table 8.13: Specification of machine no.6

Machine No.	6
Dia	26"
Gauge	24
RPM	18
Brand	Mayer&Cie
Origin	Germany
Needle	1960
Yarn count	24/s
S/L	3.15
Fabric type	S/J
Worker Name	Md. Motin mia
Age	45
Join	2003
Years of Experience	15
Shift	A

Table 8.14: Data collected from machine No.6

Time period	Reasons with time															Total Stoppage time
	Yarn breakage		Cone change		Cone fall		Cleaning		Roll change		Tension loose		Others		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
6:00-7:00 AM	2	75	0	0	0	0	0	0	0	0	0	0	0	0	0	15
7:00-8:00 AM	1	60	1	22	0	0	1	150	1	45	0	0	0	0	0	25
8:00-9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00-10:00 AM	1	60	1	35	0	0	1	255	1	54	0	0	0	0	0	12
10:00-11:00 AM	2	135	0	0	0	0	0	0	0	0	0	0	0	0	0	54
11:00-12:00 PM	1	45	0	0	0	0	1	280	1	46	0	0	0	0	0	58
12:00-1:00 PM	0	0	1	45	0	0	0	0	0	0	0	0	0	0	0	140
1:00-2:00 PM	2	140	0	0	0	0	1	260	1	50	0	0	0	0	0	480
Total	9	515	3	102	0	0	4	945	4	195	0	0	0	0	0	784
Time loss in min		8.583333		1.7		0		15.75		3.25		0		0	13.06666667	42.35

Table 8.15: Calculated result from above table

Total loss	42.35
Calculated production time	480
Actual production time	437.65
Time Efficiency	91.18%
Time loss	8.82%
Time loss due to	
Yarn breakage	1.79%
Cone change	0.35%
Cleaning	3.28%
Roll change	0.68%
Tension loose	0.00%
Inverter fail	0.00%
Worker Idle Time	2.72%
Others	0.00%
Total	8.82%

Table 8.16: Specification of machine no.7

Machine No.	7
Dia	30"
Gauge	22
RPM	20
Brand	Mayer&Cie
Origin	Germany
Needle	2072
Yarn count	24/s
S/L	2.8
Fabric type	S/J
Worker Name	Liakot ali

Age	47
Join	2005
Years of Experience	13
Shift	A

Table 8.17: Data collected from machine No.7

Time period	Reasons with time															Total Stoppage time	
	Yarn breakage		Cone change		Cone fall		Cleaning		Roll change		Tension loose		Others		Worker idle time		
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)		
6:00-7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
7:00-8:00 AM	1	45	0	0	0	0	2	250	1	48	0	0	0	0	0	10	
8:00-9:00 AM	2	85	0	0	0	0	0	0	0	0	0	0	0	0	0	78	
9:00-10:00 AM	0	0	1	45	0	0	0	0	1	46	0	0	0	0	0	35	
10:00-11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11:00-12:00 PM	0	0	0	0	0	0	1	78	1	58	0	0	0	0	0	15	
12:00-1:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1:00-2:00 PM	1	35	0	0	0	0	1	105	1	35	0	0	0	0	0	120	
Total	4	165	1	45	0	0	4	433	4	187	0	0	0	0	0	258	1088
Time loss in min		2.75		0.75		0		7.216667		3.116667		0		0		4.3	18.1333333

Table 8.18: Calculated result from above table

Stoppage time	18.13333
Calculated production time	480
Actual production time	461.8667
Time Efficiency	96.22%
Stoppage time	3.78%
Stoppage time due to	
Yarn breakage	0.57%
Cone change	0.16%
Cleaning	1.50%

Roll change	0.65%
Tension loose	0.00%
Inverter fail	0.00%
Worker Idle Time	0.90%
Others	0.00%
Total	3.78%

Table 8.19: Specification of machine no.8

Machine No.	8
Dia	30"
Gauge	24
RPM	18
Brand	Mayer&Cie
Origin	Germany
Needle	2260
Yarn count	24/s
S/L	2.85
Fabric type	S/J
Worker Name	Md. Aslam
Age	44
Join	2005
Years of Experience	13
Shift	B

Table 8.20: Data collected from machine No.8

Time period	Reasons with time																Total Stoppage time
	Yarn breakage		Cone change		Needle brake		Cleaning		Roll change		Tension loose		Others		Worker idle time		
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(sec)	
2:00-3:00 PM	0	0	0	0	0	0	1	120	0	0	0	0	0	0	0	15	
3:00-4:00 PM	1	38	0	0	0	0	0	0	1	38	0	0	0	0	0	0	
4:00-5:00 PM	1	45	0	0	0	0	1	45	0	0	0	0	0	0	0	350	
5:00-6:00 PM	0	0	0	0	0	0	0	0	1	45	0	0	0	0	0	46	
6:00-7:00 PM	1	45	0	0	0	0	0	0	0	0	0	0	0	0	0	150	
7:00-8:00 PM	0	0	0	0	0	0	0	0	1	66	0	0	0	0	0	320	
8:00-9:00 PM	0	0	0	0	0	0	1	36	0	0	0	0	0	0	0	34	
9:00-10:00 PM	2	79	0	0	0	0	0	0	1	59	0	0	0	0	0	38	
Total	5	207	0	0	0	0	4	201	4	208	0	0	0	0	0	953	1569
Time loss in min		3.45		0		0		3.35		3.466667		0		0		15.88333333	26.15

Table 8.21: Calculated result from above table

Stoppage time	26.15
Calculated production time	480
Actual production time	453.85
Time Efficiency	94.55%
Stoppage time	5.45%
Stoppage time due to	
Yarn breakage	0.72%
Cone change	0.00%
Cleaning	0.70%
Roll change	0.72%
Tension loose	0.00%
Needle break	0.00%
Worker Idle Time	3.31%
Others	0.00%
Total	5.45%

Table 8.22: Specification of machine no.9

Machine No.	9
Dia	26"
Gauge	24
RPM	18.5
Brand	Mayer&Cie
Origin	Germany
Needle	1960
Yarn count	24/s
S/L	3.1
Fabric type	S/J
Worker Name	Md. Aminul Islam
Age	42
Join	2005
Years of Experience	13
Shift	B

Table 8.23: Data collected from machine No.9

	Reasons with time															Total Stoppage time
Time period	Yarn breakage		Cone change		Needle brake		Cleaning		Roll change		Tension loose		Others		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
2:00-3:00 PM	3	96	0	0	0	0	1	85	0	0	0	0	0	0	19	
3:00-4:00 PM	2	101	0	0	0	0	0	0	1	45	0	0	0	0	0	
4:00-5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	
5:00-6:00 PM	0	0	2	130	0	0	0	0	1	55	0	0	0	0	20	
6:00-7:00 PM	2	75	0	0	0	0	1	48	0	0	0	0	0	0	0	
7:00-8:00 PM	2	75	0	0	0	0	0	0	1	29	0	0	0	0	0	
8:00-9:00 PM	1	45	0	0	0	0	0	0	0	0	0	0	0	0	49	
9:00-10:00 PM	1	28	1	75	0	0	1	120	1	42	0	0	0	0	135	
Total	11	420	3	205	0	0	3	253	4	171	0	0	0	0	268	1317
Time loss in min		7		3.416667		0		4.216667		2.85		0		0	4.466666667	21.95

Table 8.24: Calculated result from above table

Total Stoppage time	21.95
Calculated production time	480
Actual production time	458.05
Time Efficiency	95.43%
Stoppage time	4.57%
Stoppage time due to	
Yarn breakage	1.46%
Cone change	0.71%
Cleaning	0.88%
Roll change	0.59%
Tension loose	0.00%
Needle break	0.00%
Worker Idle Time	0.93%
Others	0.00%
Total	4.57%

Table 8.25: Specification of machine no.10

Machine No.	10
Dia	38"
Gauge	18
RPM	9
Brand	Mayer&Cie
Origin	Germany
Needle	3844
Yarn count	30/s
S/L	2.85
Fabric type	2/1 Rib
Worker Name	Milon mia

Age	25
Join	2012
Years of Experience	6
Shift	A

Table 8.26: Data collected from machine No.10

	Reasons with time															Total Stoppage time
Time period	Yarn breakage		Cone change		Needle brake		Cleaning		Roll change		Lycra Break		L Package change		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
6:00-7:00 AM	2	135	0	0	0	0	0	0	0	0	1	10	0	0	20	
7:00-8:00 AM	1	35	0	0	0	0	0	0	0	0	3	38	2	48	142	
8:00-9:00 AM	3	258	1	52	0	0	1	250	0	0	2	29	1	20	125	
9:00-10:00 AM	4	378	2	130	0	0	0	0	1	43	4	45	3	78	145	
10:00-11:00 AM	2	140	0	0	0	0	0	0	0	0	1	8	2	35	38	
11:00-12:00 PM	2	78	1	86	0	0	1	165	0	0	5	98	0	0	26	
12:00-1:00 PM	2	95	0	0	0	0	0	0	0	0	2	36	1	36	38	
1:00-2:00 PM	1	79	2	102	0	0	1	125	1	54	3	82	0	0	650	
Total	17	1198	6	370	0	0	3	540	2	97	21	346	9	217	1184	
Time loss in min	19.9667		6.16667		0		9		1.61667		5.76667		3.61667		19.73333333	
	65.86666667															

Table 8.27: Calculated result from above table

Total Stoppage time in min	65.86667
Calculated production time	480
Actual production time	414.1333
Time Efficiency	86.28%
Stoppage time	13.72%
Stoppage time due to	
Yarn breakage	4.16%
Cone change	1.28%

Cleaning	1.88%
Roll change	0.34%
Lycra Break	1.20%
Needle break	0.00%
Worker Idle Time	4.11%
L Package change	0.75%
Total	13.72%

Table 4.28: Specification of machine no.11

Machine No.	11
Dia	38"
Gauge	18
RPM	9
Brand	Mayer&Cie
Origin	Germany
Needle	3844
Yarn count	30/s
S/L	2.85
Fabric type	2/1 Rib
Worker Name	Liton Ahmed
Age	38
Join	2006
Years of Experience	12
Shift	B

Table 8.29: Data collected from machine No.11

Time period	Reasons with time															Total Stoppage time
	Yarn breakage		Cone change		Needle brake		Cleaning		Roll change		Lycra Break		L Package change		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
2:00-3:00 PM	2	130	1	38	0	0	1	15	0	0	2	40	2	29	10	
3:00-4:00 PM	2	92	0	0	0	0	0	0	0	0	2	44	1	20	0	
4:00-5:00 PM	3	98	2	66	0	0	0	0	1	55	1	35	3	65	45	
5:00-6:00 PM	3	205	1	25	0	0	0	0	0	0	3	69	2	65	49	
6:00-7:00 PM	4	202	2	78	0	0	1	35	0	0	2	78	1	36	120	
7:00-8:00 PM	4	178	0	0	0	0	0	0	0	0	4	105	2	48	0	
8:00-9:00 PM	3	107	2	120	0	0	0	0	1	39	2	50	3	90	47	
9:00-10:00 PM	2	73	3	205	0	0	1	130	0	0	1	20	2	56	520	
Total	23	1085	11	532	0	0	3	180	2	94	17	441	16	409	791	3532
Time loss in min	18.08333		8.86667		0		3		1.56667		7.35		6.81667		13.18333333	58.86666667

Table 8.30: Calculated result from above table

Total Stoppage time in min	58.86667
Calculated production time	480
Actual production time	421.1333
Time Efficiency	87.74%
Stoppage time	12.26%
Stoppage time due to	
Yarn breakage	3.77%
Cone change	1.85%
Cleaning	0.63%
Roll change	0.33%
Lycra Break	1.53%
Needle break	0.00%
Worker Idle Time	2.75%
L Package change	1.42%
Total	12.26%

Table 8.31: Specification of machine no.12

Machine No.	12
Dia	30"
Gauge	16
RPM	10
Brand	Terrot
Origin	Germany
Needle	3014
Yarn count	24/s
S/L	3.1
Fabric type	2/1 Rib
Worker Name	Rubel Rana
Age	28
Join	2010
Years of Experience	8
Shift	B

Table 8.32: Data collected from machine No.12

	Reasons with time																Total Stoppage time
Time period	Yarn breakage		Cone change		Needle brake		Cleaning		Roll change		Lycra Break		L Package change		Worker idle time		
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(sec)	
2:00-3:00 PM	1	25	2	85	0	0	1	60	0	0	2	45	2	78		10	
3:00-4:00 PM	3	90	1	45	0	0	0	0	0	0	2	65	2	65		24	
4:00-5:00 PM	2	120	0	0	0	0	0	0	0	0	4	152	2	67		102	
5:00-6:00 PM	3	125	0	0	0	0	1	50	1	52	2	78	4	124		0	
6:00-7:00 PM	4	195	1	50	128	10800	0	0	0	0	0	0	0	0		0	
7:00-8:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	
8:00-9:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	
9:00-10:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	
Total	13	555	4	180	0	10800	2	110	1	52	10	340	10	334		136	12507
Time loss in min		9.25		3		180		1.833333		0.866667		5.666667		5.566667		2.266666667	208.45

Table 8.33: Calculated result from above table

Total Stoppage time in min	208.45
Calculated production time	480
Actual production time	271.55
Time Efficiency	56.57%
Stoppage time	43.43%
Stoppage time due to	
Yarn breakage	1.93%
Cone change	0.63%
Cleaning	0.38%
Roll change	0.18%
Lycra Break	1.18%
Needle break	37.50%
Worker Idle Time	0.47%
L Package change	1.16%
Total	43.43%

Table 8.34: Specification of machine no.13

Machine No.	13
Dia	26"
Gauge	22
RPM	18
Brand	Mayer&Cie
Origin	Germany
Needle	1798
Yarn count	150D

S/L	2.55
Fabric type	Double Lacoste
Worker Name	Md. Limon
Age	24
Join	2015
Years of Experience	3
Shift	A

Table 8.35: Data collected from machine No.13

Time period	Reasons with time															Total Stoppage time
	Yarn breakage		Cone change		Cone fall		Cleaning		Roll change		Tension loose		Others		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
6:00-7:00 AM	3	165	2	300	0	0	0	0	0	0	0	0	0	0	120	
7:00-8:00 AM	2	120	1	120	0	0	0	0	1	45	0	0	0	0	15	
8:00-9:00 AM	3	180	2	320	1	180	0	0	0	0	0	0	0	0	45	
9:00-10:00 AM	2	120	1	80	2	340	0	0	0	0	0	0	0	0	20	
10:00-11:00 AM	1	29	4	350	0	0	0	0	1	75	0	0	0	0	10	
11:00-12:00 PM	3	148	1	140	1	124	0	0	0	0	0	0	0	0	280	
12:00-1:00 PM	4	172	2	145	3	180	0	0	0	0	0	0	0	0	40	
1:00-2:00 PM	5	358	0	0	2	350	0	0	1	45	0	0	0	0	660	
Total	23	1292	13	1455	9	1174	0	0	3	165	0	0	0	0	1190	5276
Time loss in min		21.53333		24.25		19.5667		0		2.75		0		0	19.83333333	87.93333333

Table 8.36: Calculated result from above table

Total loss	87.93333
Calculated production time	480
Actual production time	392.0667
Time Efficiency	81.68%
Time loss	18.32%
Time loss due to	

Yarn breakage	4.49%
Cone change	5.05%
Cleaning	0.00%
Roll change	0.57%
Tension loose	0.00%
Cone fall	4.08%
Worker Idle Time	4.13%
Others	0.00%
Total	18.32%

Table 8.37: Specification of machine no.14

Machine No.	14
Dia	22"
Gauge	22
RPM	16
Brand	Mayer&Cie
Origin	Germany
Needle	1658
Yarn count	24/s
S/L	2.95
Fabric type	Double Lacoste
Worker Name	Md. Ashraful Islam
Age	45
Join	2004
Years of Experience	14
Shift	A

Table 8.38: Data collected from machine No.14

Time period	Reasons with time															Total Stoppage time
	Yarn breakage		Cone change		Inverter fail		Cleaning		Roll change		Tension loose		Others		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
6:00-7:00 AM	2	86	0	0	2	34	0	0	0	0	0	0	0	0	0	78
7:00-8:00 AM	4	176	2	345	2	38	1	120	0	0	0	0	0	0	0	35
8:00-9:00 AM	3	128	0	0	1	15	0	0	1	48	0	0	0	0	0	132
9:00-10:00 AM	2	101	2	120	0	0	0	0	0	0	0	0	0	0	0	147
10:00-11:00 AM	5	365	0	0	2	45	1	35	1	42	0	0	0	0	0	45
11:00-12:00 PM	3	125	2	125	0	0	0	0	0	0	0	0	0	0	0	82
12:00-1:00 PM	4	149	1	140	1	10	1	185	0	0	0	0	0	0	0	32
1:00-2:00 PM	3	98	0	0	0	0	0	0	1	35	0	0	0	0	0	74
Total	26	1228	7	730	8	142	3	340	3	125	0	0	0	0	0	625
Time loss in min		20.46667		12.16667		2.366667		5.666667		2.083333		0		0	10.41666667	53.16666667

Table 8.39: Calculated result from above table

Total Stoppage time	53.16667
Calculated production time	480
Actual production time	426.8333
Time Efficiency	88.92%
Stoppage time	11.08%
Stoppage time due to	
Yarn breakage	4.26%
Cone change	2.53%
Cleaning	1.18%
Roll change	0.43%
Tension loose	0.00%
Inverter fail	0.49%
Worker Idle Time	2.17%
Others	0.00%
Total	11.08%

Table 8.40: Specification of machine no.15

Machine No.	15
Dia	22"
Gauge	22
RPM	16
Brand	Mayer&Cie
Origin	Germany
Needle	1658
Yarn count	24/s
S/L	2.95
Fabric type	Double Lacoste
Worker Name	Md. Ali Afsar
Age	52
Join	2004
Years of Experience	14
Shift	B

Table 8.41: Data collected from machine No.15

Time period	Reasons with time															Total Stoppage time
	Yarn breakage		Cone change		Inverter fail		Cleaning		Roll change		Tension loose		Others		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
6:00-7:00 AM	2	66	1	48	1	10	1	38	0	0	0	0	0	0	10	
7:00-8:00 AM	3	98	3	120	3	25	0	0	0	0	2	45	0	0	45	
8:00-9:00 AM	3	108	2	75	2	20	0	0	1	35	0	0	0	0	0	
9:00-10:00 AM	4	220	0	0	3	35	2	154	0	0	1	32	0	0	78	
10:00-11:00 AM	4	214	1	38	1	12	0	0	1	42	1	46	0	0	102	
11:00-12:00 PM	5	258	0	0	2	25	0	0	0	0	0	0	0	0	0	
12:00-1:00 PM	3	98	2	98	3	28	0	0	0	0	2	85	0	0	173	
1:00-2:00 PM	3	105	1	65	4	45	1	35	1	52	1	40	0	0	120	
Total	27	1167	10	444	19	200	4	227	3	129	7	248	0	0	528	2943
Time loss in min		19.45		7.4		3.333333		3.783333		2.15		4.133333		0	8.8	49.05

Table 8.42: Calculated result from above table

Total loss	49.05
Calculated production time	480
Actual production time	430.95
Time Efficiency	89.78%
Time loss	10.22%
Time loss due to	
Yarn breakage	4.05%
Cone change	1.54%
Cleaning	0.79%
Roll change	0.45%
Tension loose	0.86%
Inverter fail	0.69%
Worker Idle Time	1.83%
Others	0.00%
Total	10.22%

Table 8.43: Specification of machine no.16

Machine No.	16
Dia	26"
Gauge	22
RPM	18
Brand	Mayer&Cie
Origin	Germany
Needle	1798
Yarn count	150D
S/L	2.55
Fabric type	Double Lacoste

Worker Name	Md. Belal Hossain
Age	48
Join	2002
Years of Experience	16
Shift	B

Table 8.44: Data collected from machine No.16

Time period	Reasons with time															Total Stoppage time
	Yarn breakage		Cone change		Cone fall		Cleaning		Roll change		Tension loose		Others		Worker idle time	
	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	No	Time(Sec)	Time(sec)	
6:00-7:00 AM	3	98	1	65	2	20	0	0	0	0	0	0	0	0	10	
7:00-8:00 AM	2	78	3	148	2	35	1	45	0	0	0	0	0	0	140	
8:00-9:00 AM	3	123	0	0	1	65	0	0	1	48	0	0	0	0	0	
9:00-10:00 AM	2	82	2	98	3	102	0	0	0	0	0	0	0	0	125	
10:00-11:00 AM	3	141	0	0	1	43	1	120	0	0	0	0	0	0	35	
11:00-12:00 PM	4	200	2	132	0	0	0	0	1	52	0	0	0	0	45	
12:00-1:00 PM	3	131	4	213	4	215	0	0	0	0	0	0	0	0	15	
1:00-2:00 PM	2	86	0	0	4	265	1	83	1	39	0	0	0	0	365	
Total	22	939	12	656	17	745	3	248	3	139	0	0	0	0	735	3462
Time loss in min		15.65		10.9333		12.4167		4.13333		2.31667		0		0	12.25	57.7

Table 8.45: Calculated result from above table

Total Stoppage time	57.7
Calculated production time	480
Actual production time	422.3
Time Efficiency	87.98%
Stoppage time	12.02%
Stoppage time due to	
Yarn breakage	3.26%
Cone change	2.28%

Cleaning	0.86%
Roll change	0.48%
Tension loose	0.00%
Cone fall	2.59%
Worker Idle Time	2.55%
Others	0.00%
Total	12.02%