



Faculty of Engineering  
Department of Textile  
Engineering

**Factors affecting air-jet looms weaving efficiency and  
productivity**

Course Code: TH-518 Course Title: Project (M. Sc. Engg.)

**Submitted by:  
Tanvir Ahmed  
ID: 181-32-374**

**Supervised by:  
Tanvir Ahmed Chowdhury  
Assistant Professor**

A project submitted in partial fulfillment of the requirements for the  
degree of  
**Master of Science in Textile Engineering**

**Spring-2018**

## DECLARATION

I hereby declare that this project has been done by me under the supervision of **Tanvir Ahmed Chowdhury, Assistant Professor and head**, Department of Textile Engineering, Faculty of Engineering, Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.



**Tanvir Ahmed**

ID: 181-32-374

Department of Textile

Engineering Daffodil

International University

## LETTER OF APPROVAL

This project report, prepared by Tanvir (ID: 181-32-374), is approved as partial fulfillment of the requirements for the degree of Master of Science in Textile Engineering. I have supervised the student throughout his project work, and during the research period, I found Tanvir to be sincere, hardworking, and enthusiastic.

A handwritten signature in black ink, appearing to read 'Tanvir', is written over a horizontal line. The signature is stylized and somewhat cursive.

Tanvir Ahmed Chowdhury  
Assistant Professor  
Department Of Textile Engineering  
Faculty Of Engineering  
Daffodil International University

## ACKNOWLEDGEMNT

Firstly, I express my gratitude to Almighty Allah for His divine blessings that have made it possible for me to successfully complete this project.

I am grateful to my supervisor, Tanvir Ahmed Chowdhury, Assistant Professor & head, Department of Textile Engineering, Faculty of Engineering, Daffodil International University. His deep knowledge and keen interest in the field of textile weaving have influenced and inspired me throughout this project. I am thankful for his endless patience, scholarly guidance, continual encouragement, energetic supervision, constructive criticism, valuable advice, and his dedication to reading and correcting multiple drafts at every stage, which have played a significant role in the completion of this project. I would like to extend my thanks to all my course mates at Daffodil International University who participated in discussions and provided valuable insights during the completion of the coursework. Finally, I would like to express my heartfelt gratitude to my beloved parents and friends and college of Ha-meem Textiles Ltd. for their unwavering support, strength, and assistance throughout the process of writing this project report. Firstly, I express my gratitude to Almighty Allah for His divine blessings that have made it possible for me to successfully complete this project.

I am grateful to my supervisor, **Tanvir Ahmed Chowdhury, Assistant Professor & head**, Department of Textile Engineering, Faculty of Engineering, Daffodil International University. His deep knowledge and keen interest in the field of textile weaving have influenced and inspired me throughout this project. I am thankful for his endless patience, scholarly guidance, continual encouragement, energetic supervision, constructive criticism, valuable advice, and his dedication to reading and correcting multiple drafts at every stage, which have played a significant role in the completion of this project.

.

## DEDICATION

*This project report is dedicated to my  
beloved Daughter Amayra Ayatul  
Iyaana*

## **ABSTRACT**

Airjet weaving is a type of weaving in which the filling yarn is inserted into the warp shed with the help of compressed air. It is a shuttle less loom and is capable of weaving at very high speed. Airjet looms have become very popular in recent years. The airjet weaving machine is considered as one of the top innovations of the last decade by the Textile World magazine.

Nowadays the number of airjet looms manufacturers is increasing day by day. Intense research and development carried out very often on this loom. As a result, air jet looms are getting a wider usable capacity, faster, more informative data sharing and becoming more economical. The Textiles Company shows more interest to plant airjet looms in their new project nowadays. My objective was to find out the factors which affect airjet looms performance and efficiency. By carefully studying the fabric construction, fabric type, yarn quality, spinning problem, sizing quality, warping performance, fabric design, looms running condition, mechanical parts problem and excessive loom RPM, I was able to understand the correlation between these factors with the weaving efficiency and productivity.

Subsequently, there are some other problems which generally create problems in airjet weaving performance. I discuss them also. I analyzed the efficiency and productivity after solving the factor and discussed it.

This study provided me with valuable insights into the interactions between airjet looms efficiency and productivity with various factors. The findings I obtained are essential for optimizing the loom RPM and achieving the best efficiency and productivity in the airjet weaving process.

## TABLE OF CONTENTS

CHAPTER-1 INTRODUCTION.....	1
1.1 Introduction .....	2
1.1.1 The Specific objectives of this study are as follows:.....	2
CHAPTER-2 LITERATURE REVIEW .....	3
2.1 Weaving: .....	4
Figure: 2.1 weaving loom .....	4
2.2 Flow Chart of Weaving .....	5
2.2.1 Yarn from Spinning Section .....	6
Figure: 2.2 spinning of yarn .....	6
2.2.2 Winding.....	6
Figure: 2.3 Winding Picture .....	6
2.2.3 Creeling .....	7
Figure: 2.5 Creeling .....	7
2.2.4 Warping.....	7
Figure: 2.6 Warping Process .....	7
2.2.5 Sizing .....	8
Figure: 2.7 Sizing Process.....	8
2.2.6 Drawing.....	8
Figure: 2.8 Drawing process and drawing hook.....	8
2.2.7 Denting.....	9
Figure: 2.9 Denting Process and Denting Hook.....	9
2.2.8 Looming .....	9
Figure: 2.10 Looming Process.....	9
2.2.9 Weaving .....	10
2.2.10 Inspection.....	10
Figure: 2.11 Inspection of Greige fabric .....	10
2.2.11 Folding and Packing .....	10
Figure: 2.12 Packing section .....	11
2.2.12 Delivery .....	11
Figure: 2.13 Delivery Process .....	11
2.3 Classification of Looms.....	12
1. Manual Looms (Handlooms): .....	12
2. Mechanical Looms (Power looms): .....	12
2.3.1 Handloom .....	12

2.3.2 Power-loom.....	12
2.3.3 Projectile Loom.....	12
2.3.4 Rapier Loom .....	13
2.3.5 Airjet Loom .....	13
2.3.6 Water Jet Loom.....	13
2.4 Different Parts name of weaving Machine: .....	13
2.5 Function of different parts of weaving machine .....	14
2.5.1 Weaver's Beam: .....	14
Figure: 2.14 Weaver's Beam.....	14
2.5.2 Heald Frame .....	14
Figure: 2.15 Heald Frame.....	14
2.5.3 Heald Eye .....	15
Figure: 2.16 Heald Eye .....	15
2.5.4 Drop wire.....	15
Figure: 2.17 Drop Wire bar .....	15
2.5.6 Weft yarn stand:.....	15
Figure: 2.18 Weft Yarn Stand.....	16
2.5.7 Pre- Winder.....	16
Figure: 2.19 Pre- Winder .....	16
2.5.8 Main nozzle/ Move nozzle .....	17
Figure: 2.20 Main Nozzle (upper Image) and Move Nozzle (Lower image) .....	17
2.5.9 Relay nozzle .....	17
Figure: 2.21 Relay Nozzle.....	17
2.5.10 Reed.....	18
Figure: 2.22 Reed .....	18
2.5.11 Filling Detector .....	18
Figure: 2.25 Filling Detector .....	18
2.5.12 Filling Cutter .....	19
Figure: 2.26 Filling Cutter.....	19
2.5.13 Temple .....	19
Figure: 2.27 Temple .....	19
2.5.14 Take up roller .....	20
Figure: 2.28 Take up roller (Upper on padding Roller, Lower one emery roller) .....	20
2.5.15 Cloth Roller.....	20
Figure: 2.29 Cloth Roller .....	20
2.5.16 Leno bobbin box.....	21

Figure: 2.30 Leno bobbin box .....	21
2.5.17 Backrest roller .....	21
2.5.18 Tension Roller .....	21
Figure: 2.31 Tension roller (Top) and backrest roller (bottom) .....	21
2.6 Working Principle of weaving looms .....	22
Figure: 2.32 Basic Structure of weaving looms.....	22
2.6.1 Primary motions of loom .....	22
2.6.2 Secondary motions of loom .....	23
2.6.3 Tertiary motion or Stop motions of loom .....	23
2.7 Operating/controlling parameters of weaving Machine .....	23
2.8 Checking parameters before production .....	24
2.9 Operation Procedure of Weaving .....	24
2.10 Manpower Required.....	25
2.11 Utility .....	25
2.12 Basic Weave Design .....	25
2.12.1 Plain weave .....	25
Figure: 2.33 Plain Weave.....	25
2.12.2 Twill weave.....	26
Figure: 2.34 Twill Weave.....	26
2.12.3 Satin & Sateen weave .....	26
CHAPTER-3 METHODOLOGY .....	28
1.1 Machine:.....	29
Table: 3.1 Air jet Looms used for data collection.....	29
1.2 Method of data collection: .....	29
Figure: 3.1 Three Shifts sequence.....	30
1.2.1 Fabric construction which was taken for consideration for yarn slub problem.....	30
Table: 3.2 A fabric Construction and parameters in which yarn slub effect were visible. ....	30
1.2.2 Fabric construction which was taken for consideration for yarn snarl problem.....	30
Table: 3.3 A fabric Construction and parameters in which weft yarn snarl effect were found. .....	31
1.2.3 Fabric construction which was taken for consideration for warping knott problem ....	31
Table: 3.4 A fabric Construction and parameter in which warping knott found. ....	31
1.2.4 Fabric construction which was taken for consideration for weft yarn ratio problem. ...	31
Table: 3.5 A Fabric construction with weft yarn ratio. ....	31
1.2.5 Fabric construction which was taken for consideration for higher EPI at selvages.....	31
Table: 3.6 A Fabric construction with higher EPI at selvages side.....	32

1.2.6 Fabric construction which was taken for consideration for reed deflection.....	32
Table: 3.17 A fabric Construction and parameter in which reed deflection was found. ....	32
1.2.7 Fabric construction which was taken for consideration for reed wear out problem. ....	32
Table: 3.8 A fabric Construction and parameter in which reed wear out occurs. ....	33
1.2.8 Fabric construction which was taken for consideration for reed rust problem.....	33
Table: 3.9 A fabric Construction and parameter in which reed rust found.....	33
1.2.9 Fabric construction which was taken for consideration for reed rust problem. ....	33
Table: 3.10 A fabric Construction and parameter where different count reed used.....	33
1.3 Calculation of weaving production: .....	34
Calculation of weaving efficiency: .....	34
Calculation of number of pick insertion:.....	34
CHAPTER-4 DISCUSSION OF RESULTS .....	35
4.1 Yarn Problem.....	36
4.1.1 Yarn Slub effect .....	36
Figure: 4.1 Figure of yarn slub. ....	36
Table: 4.1 Performance of weaving with slub yarn problem. ....	37
Graph: 4.2 Graphical representation of loom RPM due to yarn slub problem. ....	38
Graph: 4.3 Graphical representation of loom efficiency due to yarn slub problem. ....	39
4.1.1.1 Suggested solution regarding observation.....	39
4.1.2 Weft Yarn snarls problem.....	40
Figure: 4.2 Figure of weft yarn snarl problem. ....	40
Table: 4.2 Performance of weaving with weft snarl problem. ....	41
Graph: 4.5 Graphical representation of loom efficiency due to weft yarn snarl problem.....	42
Graph: 4.6 Graphical representation of loom RPM due to weft yarn snarl problem.....	43
4.1.2.1 Suggested solution regarding observation.....	43
4.2 Warping Problem: .....	43
4.2.1 Warping knott .....	44
Figure: 4.3 Figure of Warping Knott .....	44
Table: 4.3 Performance of weaving with warping knott problem. ....	45
Graph 4.8 Graphical representation of decreasing RPM due to warping knott. ....	46
Graph: 4.9 Graphical representation of weaving efficiency % due to warping knott. ....	47
4.2.1.1 Suggested solution regarding observation.....	47
4.2.2 Warping tension: .....	48
4.3 Drawing Problem: .....	48
Figure: 4.5 Mixed of drop wire bar.....	49
4.4 Fabric design:.....	49

4.4.1 Increased of frame number .....	50
Graph: 4.11 Graphical representation of the relation between number of frame and weft CMPX.....	53
Graph: 4.12 Graphical representation of the relation between number of frames and warp CMPX.....	53
Graph: 4.13 Graphical representation of the relation between number of frame and weaving loom efficiency %.....	54
4.4.1.1 Suggested solution regarding observation.....	54
4.4.2 Weft Yarn ratio: .....	55
Table: 4.7 Performance of weaving loom with weft yarn ratio. ....	55
Graph: 4.15 Graphical representation of shift wise loom efficiency with weft ratio. ....	56
4.4.2.1 Suggested solution regarding observation.....	57
4.4.3 Higher EPI or ends per dent at selvages side: .....	57
Figure: 4.6 Warp bunch breakages at selvage's side. ....	57
Figure: 4.7 Selvage sides higher EPI impart Yarn shed crossing is lower than fabric body. ....	58
Table: 4.8 Performance of weaving with higher EPI at selvages side.....	58
Graph: 4.17 Graphical representation of shift wise weft CMPX with higher EPI at selvages side. ....	59
Graph: 4.18 Graphical representation of shift wise weaving efficiency %.....	60
4.4.3.1 Suggested solution regarding observation.....	60
4.5 Reed space:.....	61
Table: 4.9 Relation of RPM with Reed space. ....	61
4.5.1 Suggested solution regarding observation .....	62
4.6 Sizing take up % effect air jet loom performance: .....	62
Graph: 4.20 A graphical representation of the relation between Sizing % with weaving efficiency %.....	63
Graph: 4.21 A graphical representation of the relation between Sizing % with end breakage %.....	64
4.6.1 Suggested solution regarding observation .....	64
4.7 Reed Problem .....	65
4.7.1 Deflection of reed: .....	65
Figure: 4.8 A figure of Deflection of the weaving reed. ....	66
Table: 4.10 Performance of weaving with reed wear out problem. ....	66
Graph 4.24 Graphical representation of weft CMPX due to deflection of reed.....	67
4.7.1.1 Suggested solution regarding observation.....	68
4.7.2 Reed wears out:.....	68
Figure: 4.9 A figure of wear out of the weaving reed. ....	68
Table: 4.11 Performance of weaving with reed wear out problem. ....	69

Graph: 4:26 Graphical representation of weaving RPM due to reed wear out problem.....	70
4.7.2.1 Suggested solution regarding observation.....	70
4.7.3 Reed vibration:.....	70
4.7.4 Reed dent rust: .....	71
Table: 4.12 Performance of weaving with reed rust problem.....	73
Graph: 4.28 Graphical representation of weft CMPX due to reed rust problem.....	74
4.7.4.1 Suggested solution regarding observation.....	74
4.7.5 Lower count of reed: .....	75
Graph: 4.30 A graphical representation of RPM variation of two different reed counts of same fabric construction. ....	77
4.7.5.1 Suggested solution regarding observation.....	77
4.8 RH % & Temperature:.....	77
Table: 4.15 Atmospheric conditions while collecting data. ....	78
Table: 4.16 weaving floor RH% for analysis. ....	78
Table: 4.17 Weaving Efficiency .....	79
Table: 4.18 Weaving Efficiency .....	79
Table: 4.19 Weaving Efficiency .....	80
4.8.1 Suggested solution regarding observation .....	81
4.9 Moisture regains: .....	81
4.10 Yarn characteristic:.....	81
4.11 Loom Setting Adjustment:.....	82
4.12 Sizing chemical impact on loom performance.....	83
4.13 Warp tension impact on performance.....	84
CHAPTER-5 CONCLUSION.....	85
REFERENCE.....	88

# **CHAPTER-1**

## **INTRODUCTION**

# CHAPTER-1

## INTRODUCTION

### 1.1 Introduction

In textile manufacturing weaving is the vital section where raw fabric is produced. Without proper support from the weaving section other processes cannot run with their full potentiality. Weaving is the process where two sets of yarns are interlaced among them at their right angle to form a fabric construction. There are several types of looms with different mechanisms to form a weave. Among them a big pile of looms is the airjet looms. In this loom filling passes through the warp shed with the help of compressed air.

Sometime during the filling passing time by air these looms are facing some problem. This problem I mentioned as a factor. These factors directly impact on air jet looms efficiency and productivity. This can lead to lower the weaving production, increase the fabric rejection, unpredicted production scenario, not to meet with the delivery schedule type major problem.

The main object of this study is to find out the factors which impact on airjet looms efficiency and productivity.

#### 1.1.1 The Specific objectives of this study are as follows:

- To understand the whole weaving process.
- To learn the factors which cause lowering the airjet looms efficiency.
- To understand what to do to improve efficiency after getting those factors.
- To make a statement before even looms are in running condition.
- To calculate approximately down time report and give proper estimated or predicted weaving production to the planning and marketing team in order to meet delivery schedule.
- To take negotiation action before facing any problem that causes lowering the weaving efficiency.
- To explore the relation between higher RPM with warp and weft CMPX.
- To control warp and weft CMPX in running condition after facing problems.
- To find out section wise (Spinning, Warping, Drawing, and sizing) factors which cause airjet looms weaving performance.
- Not only find the factor but also discuss about their solution

**CHAPTER-2**  
**LITERATURE REVIEW**

## CHAPTER-2

### LITERATURE REVIEW

#### 2.1 Weaving:

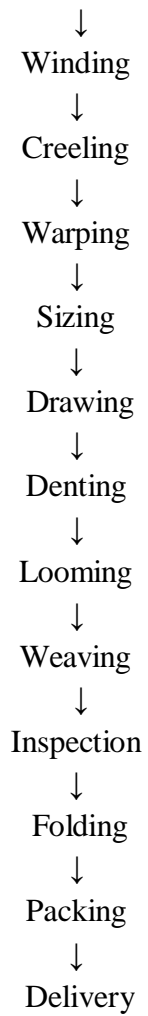
Weaving is a process of making a fabric structure by means of interlacing two sets of yarns. In weaving these two sets of yarn are known as warp and weft yarn. They are interlacing between them at the right angle to each other in order to form a fabric structure. The warp yarn runs on the length wise or parallel of the machine and the weft yarn basically runs horizontally. The interlacement among two sets of yarn determines on the type of the weave. Here warp threads are called ends and weft threads are called picks of filling yarn. The yarn count and the number of warp and weft yarns per square inch of fabrics determine the closeness or looseness of a weave. Woven fabrics normally made with outer hard edges in a manner that to avoid revealing, they are known as selvages. They run lengthwise, parallel to the warp yarns. There are three basic weaves: plain, twill, and satin. Fancy weaves—such as pile, Jacquard, dobby, and leno—require more complicated looms or special loom attachments for their construction. Woven fabrics may also be varied by the ratio of warp yarns to filling yarns. Some effects are achieved by the selection of yarns or of combinations of yarns. In textile, weaving is referred to as textile art.



**Figure: 2.1 weaving loom**

## 2.2 Flow Chart of Weaving

Yarn from Spinning Section



### 2.2.1 Yarn from Spinning Section

Yarn from Spinning Section: The major raw material for weaving is yarn. Yarn comes from the spinning section to the weaving section. Spinning section, they supplied varieties of type of yarn count and different types of yarn according to the requirements of the weaving section.

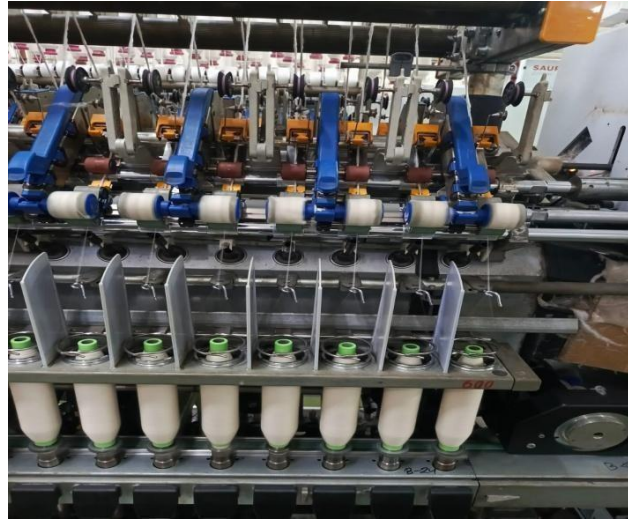


Figure: 2.2 spinning of yarn

### 2.2.2 Winding

**Winding:** Winding is required for preparing suitable yarn packages. The winding yarn from the ring or roving section got winding in a package. Yarn wind into a package. Packages such as Cone, Cheese, Spool, Flange, Bobbin etc. The weft yarn wind into the Prin package for conventional loom. But the cone package is basically used in modern looms.



Figure: 2.3 Winding Picture

### 2.2.3 Creeling

**Creeling:** The process for holding supplied packages on creel is called creeling. In another word, Creeling is the process of placing the complete yarn packages in a place in order to be unwound for warping operation. In the creeling section proper yarn guides and tensioner are used to obtain compact warping beams.



**Figure: 2.5 Creeling**

### 2.2.4 Warping

**Warping:** Warping is the process of preparing the warp yarn for weaving in the textile industry. In the warping section, warping beams are produced. The warp threads are arranged in parallel and placed on a warp beam, and then these warping beams are going for sizing.



**Figure: 2.6 Warping Process**

### 2.2.5 Sizing

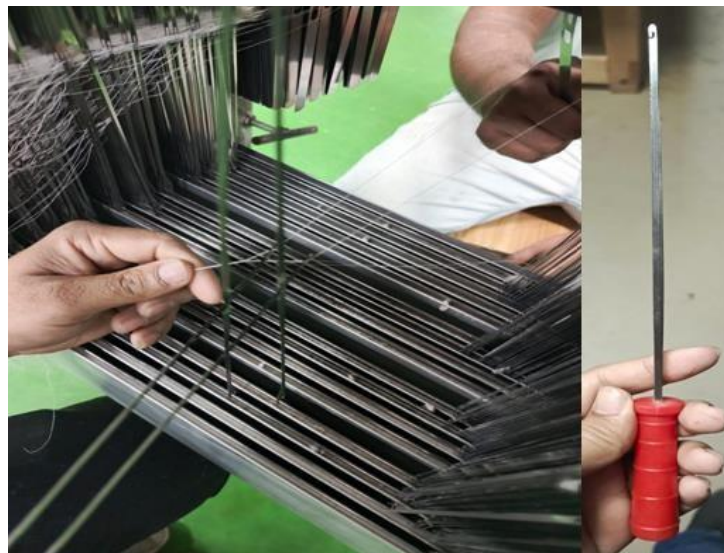
**Sizing:** The process of applying a protective adhesive coating material on the yarn's surface is called sizing. Among the warp and weft yarn sizing chemical is applied only on warp yarn. It is the most important operation for the weaving section. Weaving efficiency depends on sizing quality. Because due to sizing chemicals applied on warp yarn, it creates an impact on elasticity, strength, frictional resistance and smoothness of warp yarn.



**Figure: 2.7 Sizing Process**

### 2.2.6 Drawing

**Drawing:** Warp yarns are drawn through the heald eye by the drawing hook according to the design or pattern of the fabric is called drawing or draw-in.



**Figure: 2.8 Drawing process and drawing hook.**

### 2.2.7 Denting

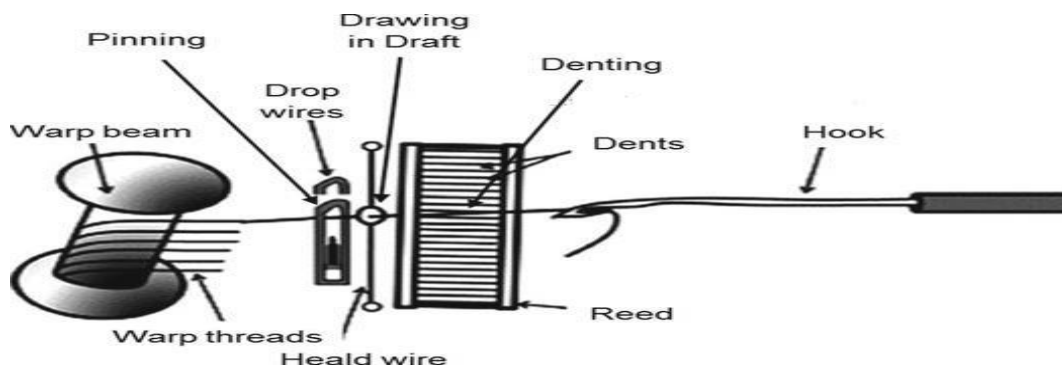
**Denting:** The warp yarns are drawn through the dent of the reed by the denting hook according to the design or pattern of fabrics is called denting. Denting hook has a range of thickness from 0.2mm to 2.5 mm according to the basis of reed count.



**Figure: 2.9 Denting Process and Denting Hook.**

### 2.2.8 Looming

**Looming:** The process of preparing a loom before starting the weaving process is commonly known as looming. It includes Drawing, Denting, Pinning, Gaiting, and knotting of warp threads by using different looming elements such as drawing hook, denting hook, knotting machine etc. Here a looming process tries to illustrate below in figure.



**Figure: 2.10 Looming Process**

### 2.2.9 Weaving

**Weaving:** Weaving is the process of interlacement of two sets of yarn in order to obtain a fabric construction.

### 2.2.10 Inspection

**Inspection:** Inspection of greige fabric is important after weaving of fabric, so that we can find out problems regarding weaving and solve this problem. In inspection several fabric parameters were maintained and checked according to the buyer requirements. Also, fabric grading is also done in inspection. Grading is done by a 4-point system nowadays.



**Figure: 2.11 Inspection of Greige fabric**

### 2.2.11 Folding and Packing

**Folding and Packing:** Folding and packaging are required before delivery. Packaging depends on where the fabrics are delivered either within the country or overseas.



**Figure: 2.12 Packing section**

### **2.2.12 Delivery**

**Delivery:** Finally, delivery done.



**Figure: 2.13 Delivery Process**

## 2.3 Classification of Looms

Looms can be classified into two broad categories based on their operation:

1. **Manual Looms (Handlooms):**

Operated entirely by hand, these looms are commonly used in traditional weaving methods, producing unique and often complex designed fabrics.

2. **Mechanical Looms (Power looms):**

This loom runs with an external energy source such as water, steam, or electricity. Power looms are operated automatically and capable of mass production. Within these categories, various modern looms have emerged, each designed for specific types of fabric production. Below I am going to discuss some of the key types of looms vastly used nowadays.

### 2.3.1 Handloom

While the power-loom transformed industrial textile production, the handloom became a symbol of traditional craftsmanship. Handlooms are commonly used in producing intricate and artisanal fabrics. Each piece created on a handloom is unique, with a delicate variation in texture and design that reflect the skill and artistry of the weaver. Handloom weaving plays a significant role in the cultural heritage of many countries, particularly in Bangladesh, where it supports millions of artisans and weavers. Though handloom weaving is a slow process it allows the creation of fabric with detailed patterns and design. Hand looms often use natural fibers such as cotton and silk.

### 2.3.2 Power-loom

The power-loom was invented during the Industrial Revolution. It was one of the most significant advancements in the textile industry. It is powered by electricity and introduces automation in the weaving process. It highly reduces the need for manual labor. Power-loom can run at high RPM, they were used for large-scale production in textile mills. This power loom revolutionized the whole textile industry by means of increased production capacity, lowering the fabric cost and producing more uniform fabric than ever. However, this automation also influences to not to use of handlooms in many regions, as machine-made textiles became easier to afford.

### 2.3.3 Projectile Loom

The projectile loom is a type of shuttle less loom in which the weft is inserted by a small, bullet-like projectile. These weaving looms were introduced by Sulzer (a Swiss company), in the mid-20th century. This loom is known for its versatility and ability to handle a wide range of yarns and fabrics. Projectile looms are highly efficient and vastly used in the production of heavy textiles, such as denim, canvas, and technical fabrics. The projectile carrying the weft yarn is reusable and travels across the warp threads at high speed, making the weaving process faster

than traditional shuttle looms.

### 2.3.4 Rapier Loom

Rapier looms are another popular type of shuttle less loom. These looms run with a pair of rapiers (thin, rigid or plastic rods) to carry the weft yarn across the warp. One rapier known as gripper which picks up the weft yarn from the finger and carried it to the middle of the loom and another rapier known as receiver which received it from the gripper and take it to the other side of the loom across warp yarn, which then completes the insertion. Rapier looms are known for their versatility, able to weave a wide variety of fabrics, including delicate and high-end materials like silk and wool. Their ability to handle different types of weft yarns with ease makes them ideal for weaving complex designs of fabrics.

### 2.3.5 Airjet Loom

In the airjet loom, the weft yarn is inserted using compressed air pressure. This type of loom is one of the fastest weaving machines nowadays; it can insert 1500 picks per minute. Airjet looms are highly efficient and are widely used in the production of lightweight fabrics such as cotton, polyester, and some yarn blends. One of the advantages of airjet looms is that they consume lower energy compared to the other high-speed looms. Also, they produce lower noise and are considered environmentally friendly. However, they are best suited for fabrics that use low-density yarns, as heavier yarns may be difficult to propel with air.

### 2.3.6 Water Jet Loom

Similar to airjet looms, Waterjet looms use a jet of water to insert the weft yarn across the warp. These looms are used to weave synthetic fabrics, such as polyester and nylon, which do not absorb water during the weaving process. Waterjet looms offer high production speeds and lower energy consumption, making them cost-effective for specific applications. However, they are generally not suitable for natural fibers like cotton, as moisture can damage the fiber's properties.

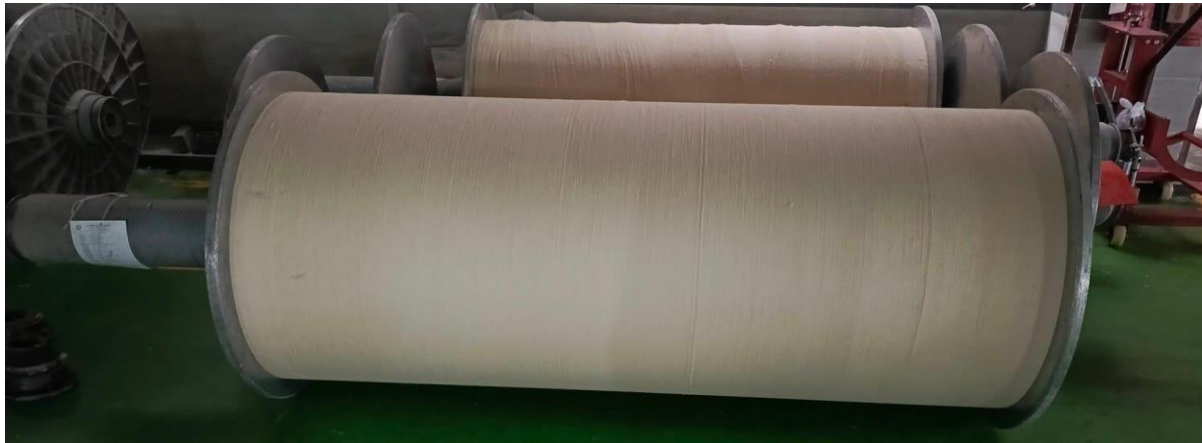
## 2.4 Different Parts name of weaving Machine:

1	Weaver's beam	10	Filling Detector
2	Heald Frame	11	Filling Cutter
3	Heald Eye	12	Temple
4	Drop wire bar	13	Take up roller
5	Weft Yarn Stand	14	Cloth roller
6	Pre-winder	15	Leno bobbin Box
7	Move nozzle or main nozzle	16	Tension Roller
8	Rely nozzle		
9	Reed		

## 2.5 Function of different parts of weaving machine

### 2.5.1 Weaver's Beam:

The weaver's beam, the warp yarns are wound on it. It is located at the back of the machine. It delivers yarn to the weaving area in a controlled way as the loom requires. This beam is produced in sizing. The length of warp in the beam may be more than a thousand of meters.



**Figure: 2.14 Weaver's Beam**

### 2.5.2 Heald Frame

It is also known as harness. The metal frame that holds the heald eye in a certain position in the loom is called heald frame. Numbers of heald frames available in loom usually have more than one.



**Figure: 2.15 Heald Frame**

### 2.5.3 Heald Eye

A heald eye is a wire with a hole or eye in its center through which a warp yarn is inserted. There are as many heald eyes as there are warp yarns in the cloth, and the heald eyes are held in two or more heald frames. It also helps in shed formation.



**Figure: 2.16 Heald Eye**

### 2.5.4 Drop wire

Drop wire is also known as dropper. It is an essential part of weaving looms. It indicates warp breakage and gives a signal to warp stop motion to stop the weaving machine. The number of drop wires is proportional to the number of warp yarn.



**Figure: 2.17 Drop Wire bar**

### 2.5.6 Weft yarn stand:

Weft yarn stands normally hold the weft yarn packages. It helps to supply weft yarn in pre-winder. It has a spring tensioner zone and several guides of yarn path which ensure uniform supply of yarn to the pre-winder.



**Figure: 2.18 Weft Yarn Stand**

### **2.5.7 Pre- Winder**

Pre winder has a rotating drum where it reserves weft yarn of a specific length from the yarn package before picking. It ensures proper supply of weft yarn during the picking process.



**Figure: 2.19 Pre- Winder**

### 2.5.8 Main nozzle/ Move nozzle

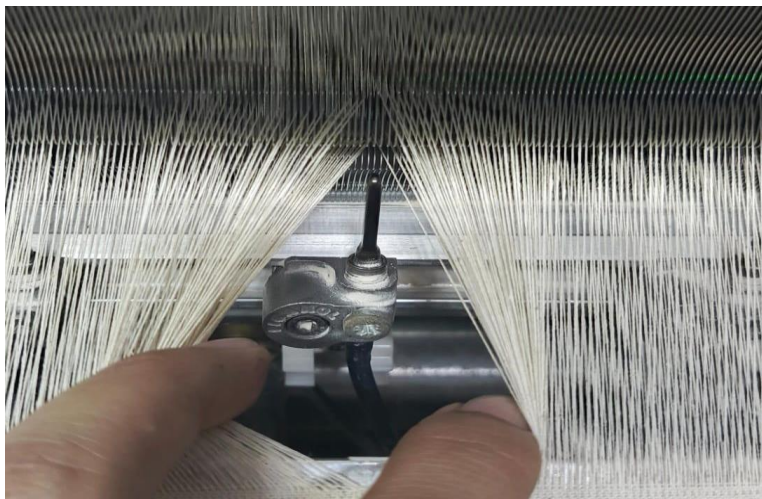
The main nozzle is attached with the same holder where reed is attached. This is fixed. But a move nozzle has a same motion like reed in order to supply weft yarn from pre-winder to fabric width by means of air flow.



**Figure: 2.20 Main Nozzle (upper Image) and Move Nozzle (Lower image)**

### 2.5.9 Relay nozzle

The relay nozzles are positioned in front of the reed holder. There are several relay nozzles present in the full width of the loom. They help to pass weft yarn through the reed groove from one end to another end of fabric which comes from the main nozzle by means of supplying air flow. The Relay nozzle provides lower pressured air flow than the main nozzle.



**Figure: 2.21 Relay Nozzle**

### 2.5.10 Reed

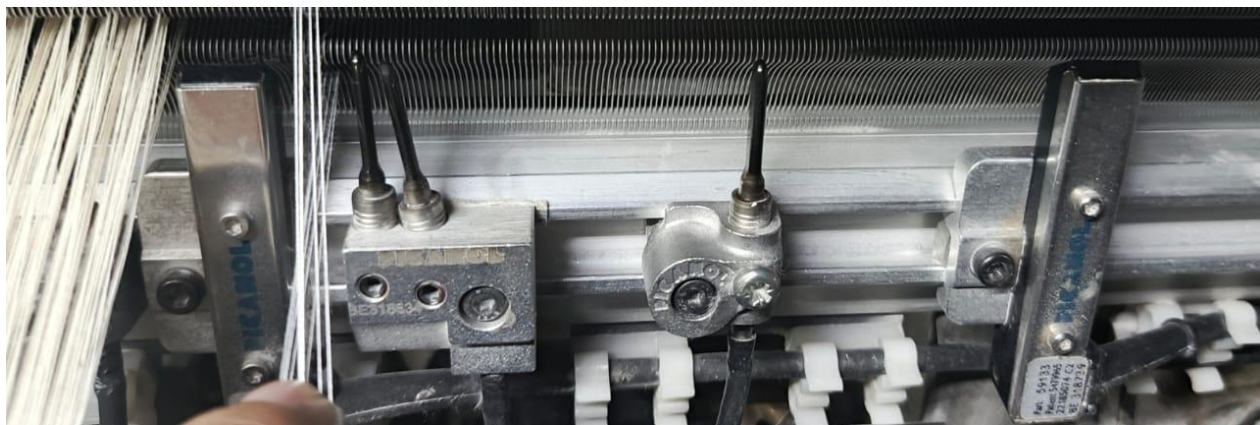
Reed is one of the key equipment in the textile weaving process. Its function is to push weft yarn into the fell of the cloth after picking. Also arrange warp & weft yarn according to certain regularity and density in order to achieve the required weft density and width.



**Figure: 2.22 Reed**

### 2.5.11 Filling Detector

Filling detector positioned at the right side of the loom. It has an optical sensor. Its position is adjustable according to the basis of fabric width. After picking, the filling detector ensures that picks are inserted successfully and available. If weft yarns do not reach the filling detector, then the filling detector gives signal to the weft stop motion and stop weaving machine. It also helps to solve broken pick issues in fabric and automatic pressure set up for any count of yarn.



**Figure: 2.25 Filling Detector**

### 2.5.12 Filling Cutter

There are two filling cutters positioned at both the left and right side of the loom. The main function of a filling cutter is, after inserting a filling cutter, cut the rest of the filling. It helps to get optimum fringe length of selvages.



**Figure: 2.26 Filling Cutter**

### 2.5.13 Temple

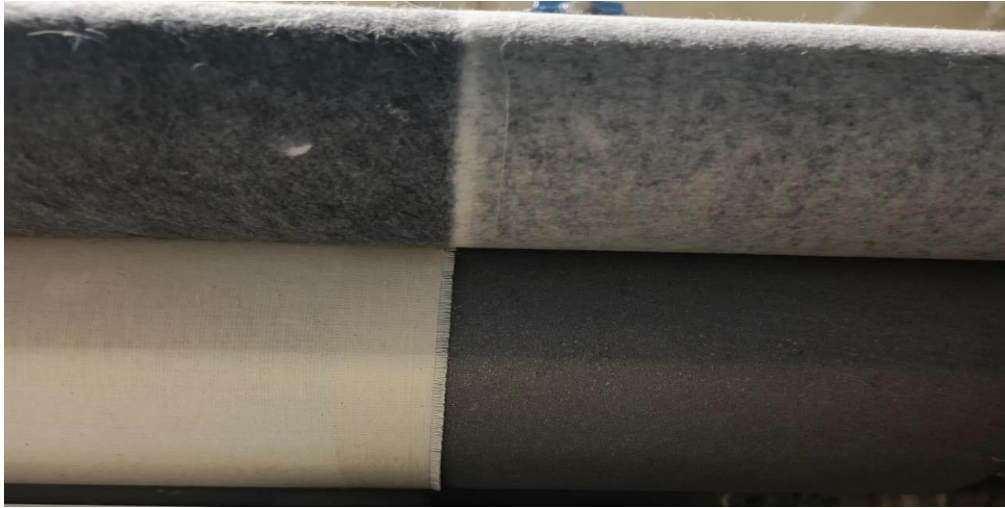
Temple is also known as a weaving stretcher or a temple stake. It is a device that is used in weaving looms to maintain the tension along the width of the woven fabric. The primary purpose of the temple is to prevent the selvages of the fabric from drawing in or becoming uneven during the weaving process. And hold the fabric at the fell of the cloth position after picking.



**Figure: 2.27 Temple**

### 2.5.14 Take up roller

The main function of the take up roller is to take fabric from the woven zone after beat up. There are two roller (Emery roller and padding roller) face to face positioned in the take up roller mechanism to create a squeezing pressure to the fabric so that fabric cannot slip back.



**Figure: 2.28 Take up roller (Upper on padding Roller, Lower one emery roller)**

### 2.5.15 Cloth Roller

It is located at the front of the loom, holding the completed fabric.



**Figure: 2.29 Cloth Roller**

### **2.5.16 Leno bobbin box**

In the leno bobbin box there are two leno bobbins. There is a rotation mechanism in leno bobbin which helps to catch the filling yarn after picking.



**Figure: 2.30 Leno bobbin box.**

### **2.5.17 Backrest roller**

It is a fixed bar or roller placed above the weaver's beam and acts as a guide for the warp yarns from the warp beam to pass through the drop wire bar and eyes of the heald and dents of the reed, then over the front rest to the cloth beam.

### **2.5.18 Tension Roller**

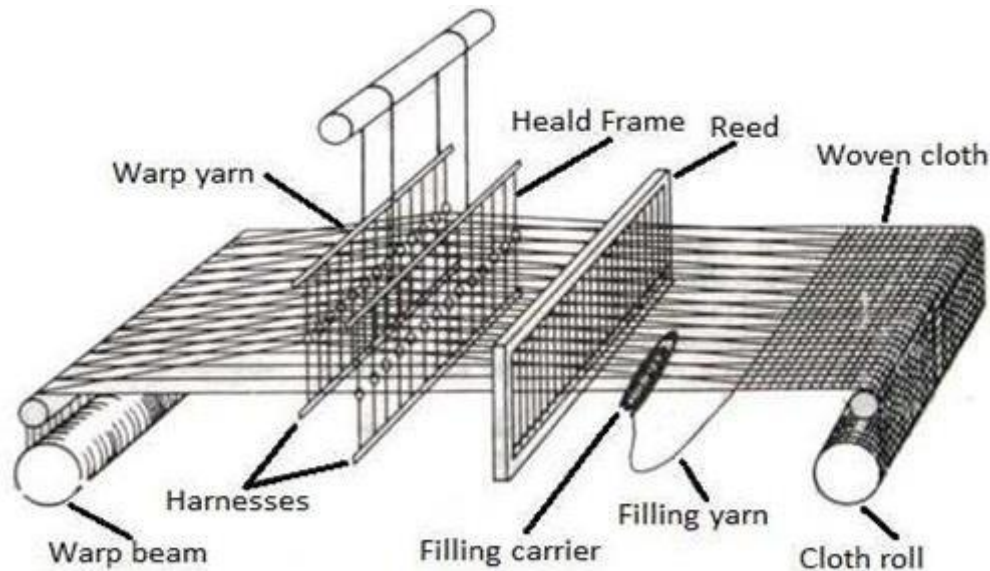
The main function of the tension roller is to impart a uniform tension by means of vibrating to the warp yarn presented on the backrest roller.



**Figure: 2.31 Tension roller (Top) and backrest roller (bottom)**

## 2.6 Working Principle of weaving looms

The process of making woven fabric by means of interlacing warp and weft yarn requires the basic operations to be carried out on loom in a specific order. It involves the primary motions, secondary motions and the stop motions.



**Figure: 2.32 Basic Structure of weaving looms.**

Basically, looms have three types of motion:

1. Primary motion
2. Secondary motion
3. Tertiary motion or Stop motion

### 2.6.1 Primary motions of loom

The primary loom motions include the following three operations:

1. **Shedding:** - The process of making a shed is called shedding. It is the process of separating the warp yarn into two layers to form a tunnel which is known as a shed.
2. **Picking:** - The method of passing the weft yarn through the shed of warp yarn is called picking.
3. **Beat up:** - The process in which yarns are sent to the fell of the cloth is called beat up.

This operation is occurring continually in a circulating way to maintain a perfect timing, the relation between one another has an extreme importance in the weaving process.

### 2.6.2 Secondary motions of loom

The secondary motions facilitate the weaving of fabric in a continuous way. These are:

1. **Let off:** This motion supplies the warp yarn from the weaver's beam to the weaving area. With a proper tension and a specific rate of yarn unwind from the weaver's beam.
2. **Take-up:** This motion helps to draw fabric from the weaving area with a uniform rate to produce the fabric with required pick density and to wind the fabric on a roller.

### 2.6.3 Tertiary motion or Stop motions of loom

Tertiary motion is not necessary for fabric production. But these motions are used to maintain quality of productivity. It helps to stop the loom immediately in case of some problem. The tertiary motions are:

1. Warp stop motion.
2. Weft stop motion.
3. Reed stop motion.

The warp stop motion will stop the loom if any warp yarn breaks during weaving, to avoid excessive damage to the warp yarn. Similarly, weft stop motion will come into action in the absence of weft yarn, and stop the loom.

Weaving motions controls the fabric production. By using this motion, it is possible to produce different types of fabrics.

## 2.7 Operating/controlling parameters of weaving Machine

1. Fabric Type
2. Yarn type
3. Yarn Count
4. Yarn Ratio
5. Repeat Ratio
6. Reed count
7. Type of reed
8. Floor temperatures
9. Loom RPM
10. Moisture regains
11. Fabric width

## **2.8 Checking parameters before production**

Before starting the weaving process, the operator must check the following items:

1. Ensure that looms running with the specific program.
2. Ensure the fabric design is matched with the given design in the program.
3. Confirm the availability of weft yarn with the mentioned yarn lot, yarn supplier and yarn count in the program card.
4. Check the fabric has any faults such as double ends, wrong denting, and wrong drawing etc. problems before running.
5. Clean the loom before running.
6. Place an empty cloth roller in the take up roller position.
7. The Mechanical department should ensure that spare parts for the weaving machine are readily available for any potential replacements or maintenance needs.

## **2.9 Operation Procedure of Weaving**

Weaving has a vital role in the textile industries. All the after process deeply relies on it. Dyeing, finishing, printing, clothing depends on it. Therefore, it is very essential to establish a standard operating procedure (SOP) for weaving.

To follow the SOP, the following guidelines should be observed:

1. According to the planning program, set the working plan for operation and provide guidelines to the subordinates accordingly.
2. According to the planning program, give a program for pattern making, and take yarn from the yarn store.
3. Stored and maintained all documents and technical records properly so that anything can be retrieved easily with tracking records.
4. Have to come on the floor by wearing a clean dress with PPE (ear plug, musk, safety shoe).
5. Have to take necessary steps that a stopped loom can run within a standard time.
6. Ensure fabric quality and parameters including performance of running looms.
7. Maintain proper deployment and controlling of manpower as per given plan and system.
8. Maintain good housekeeping and cleanliness of all machines.
9. To ensure fabric quality strictly control all types of mechanical and weaver's fault.
10. Ensure the quality of first roll while a new style runs.
11. Follow up for all troubleshooting tasks for the machine when required.
12. Have to follow up RPM, Efficiency, CMPX accordingly with proper necessary action.
13. Regular loom maintenance should be carried out.

## 2.10 Manpower Required

- Worker : 01 for every 06 looms
- Mechanical fitter : 01 for every 36 looms
- Supervisor : 01 for every 36 looms
- Helper : 01 for every 72 looms

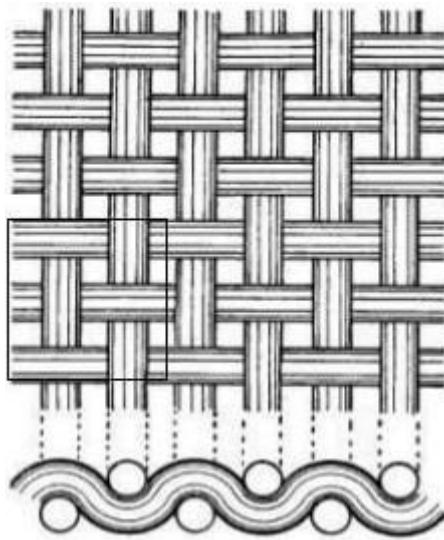
## 2.11 Utility

1. Compressed air
2. Electricity
3. Gas

## 2.12 Basic Weave Design

### 2.12.1 Plain weave

Plain weave is the simplest weave, there the warp and the weft yarn interlace in an alternate manner as shown below figure, giving maximum number of interlacements. This maximum interlacement imparts consistency and stability to the fabric structure. At least two ends and two picks are required to weave its basic unit. A minimum of two heald frames are required for this weave. It is used in cambric, muslin, blanket, canvas, dhoti, saree, shirting, suiting etc.



**Figure: 2.33 Plain Weave**

### 2.12.2 Twill weave

Twill weave is another basic weave, which is well known for its diagonal line formation in the fabric due to its interlacing pattern. This weave is used for ornamental purposes. Twill has a closer setting of yarns. Due to less interlacement, it can impart greater weight and good drape as compared to the plain weave. The direction of the twill line classifies twill into right-hand or left-hand twill. Twill weaves find a wide range of applications such as drill cloth, khaki uniforms, denim cloth, blankets, shirting, hangings and soft furnishings etc.

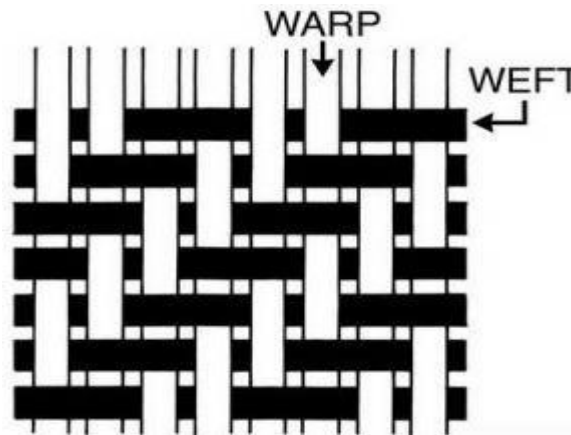
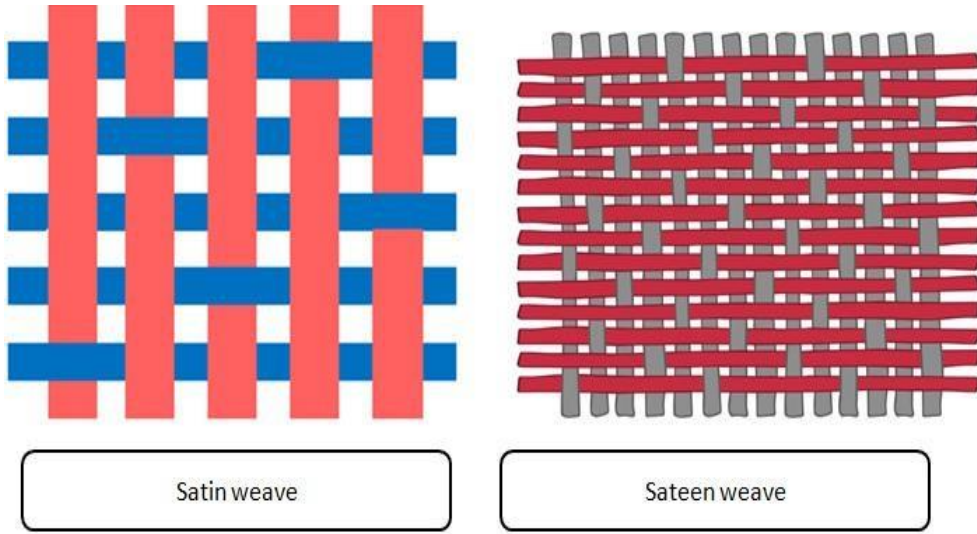


Figure: 2.34 Twill Weave

### 2.12.3 Satin & Sateen weave

Satin/sateen is a basic weave that does not have any regular pattern like twill. The surface of the fabric is either warp or weft faced. Satin is warp faced, which means that all the surface of the fabric will show the warp threads except for the one thread interlacement with other series of yarn. If it is weft faced, then it will be known as sateen, which means that the fabric surface will show the weft threads mostly. These weaves have the least interlacement points among the basic weaves. Due to this reason, it gives the surface of fabric more luster and smoothness. With this weave it is possible to use a cotton warp and silk filling, having most of the silk appearance on the surface of the fabric. It is used in saree, blouse materials, dress materials, bed spreads, furnishing fabrics, curtain fabrics etc.



**Figure: 2.35 Satin Weave**

## **CHAPTER-3**

### **METHODOLOGY**

## CHAPTER-3 METHODOLOGY

### 1.1 Machine:

In this whole study it was hardly tried to maintain the information about the factors which basically only impact on the air jet looms efficiency and productivity. The entire factors considering mooting points and data were collected from 02 types of air jet looms. The machine specification is given below...

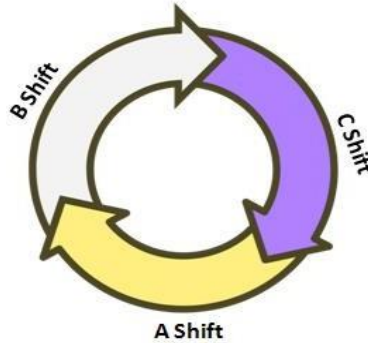
<b>Brand name</b>	<b>Picanol</b>	<b>Picanol</b>
Model	Optimax I Connect	Optimax I Connect Dobby
Origin	Belgium	Belgium
Max RPM	1050	1000
Reed Type	Profile Reed	Conical Reed
Shedding Mechanism	Cam	Electronic Dobby
Average Power consumption	4	5
Number Of relay valve	20	20
Number Of heald frame	8	16
Weft color Capacity	2	4
Let off motion	Electronic	Electronic
Take off motion	Electronic	Electronic
Reed width	220 cm	220 cm

**Table: 3.1 Air jet Looms used for data collection.**

### 1.2 Method of data collection:

In the weaving floor when 02 looms were running with the same style and design but among these looms when one of the looms RPM or efficiency found lower than other looms then in the problematic looms selected for further observation. Each time 3 shifts observations were taken for consideration. Here it needed to mention that, after finding any factor which causes productivity or efficiency loss in one shift, necessary action was taken to improve the looms performance in order to get good performance in other two shifts. Also, the shift wise improved performances were showed as table format and graphical representation way with discussion about it. Though higher breakages impact looms RPM and Efficiency, so CMPX were also bring for consideration. To find out the productivity improvements, a calculated pick insertion per shift were also showed in every collected performance data. Here data is collected by last 3 shifts, it

also should mention that running shifts performance were not bring for consideration. Shift Schedule or sequence is given below...



**Figure: 3.1 Three Shifts sequence**

**1.2.1 Fabric construction which was taken for consideration for yarn slub problem**

Here a construction is given below in which yarn slub effects were found from the weft yarn...

Fabric construction	16KW+12KWx16KW/11 3x64
Weave	2/1 Z TWILL
Greige PPI	64
Griege Width	67
Total Ends	7500
Reed Count	37.5
Ends/ Dent	6
Reed Space	66

**Table: 3.2 A fabric Construction and parameters in which yarn slub effect were visible.**

**1.2.2 Fabric construction which was taken for consideration for yarn snarl problem**

Here a fabric construction is given below in which weft yarn snarl effects were found ...

Fabric construction	12 OE x 16+70D/60x59
Weave	2/2 Matt
Greige PPI	59
Greige Width	74
Total Ends	4890
Reed Count	30
Ends/ Dent	4
Reed Space	81

**Table: 3.3 A fabric Construction and parameters in which weft yarn snarl effect were found.**

**1.2.3 Fabric construction which was taken for consideration for warping knott problem**

Here a fabric construction is given below where warping knott were found.

Fabric construction	16OEx16L+70D/84x56
Weave	3/1 S-Twill
Greige PPI	56
Greige Width	73
Total Ends	6800
Reed Count	42
Ends/ Dent	4
Reed Space	80

**Table: 3.4 A fabric Construction and parameter in which warping knott found.**

**1.2.4 Fabric construction which was taken for consideration for weft yarn ratio problem.**

Here a construction is given below where two different types of weft yarn counts were used.

Fabric construction	30CWCx20 OE+30L+40D/93x94
Weave	Dobby
Greige PPI	94
Greige Width	76
Total Ends	7780
Reed Count	62
Ends/ Dent	3
Reed Space	82

**Table: 3.5 A Fabric construction with weft yarn ratio.**

**1.2.5 Fabric construction which was taken for consideration for higher EPI at selvages.**

Here a construction is given below which selvages have higher EPI construction.

Fabric construction	20 OE x 16+70D/108x62
Weave	2/1 S twill
Greige PPI	63
Greige Width	67
Total Ends	8150
Reed Count	72
Ends/ Dent	3
Selvages ends/dent	<b>5</b>

**Table: 3.6 A Fabric construction with higher EPI at selvages side.**

### 1.2.6 Fabric construction which was taken for consideration for reed deflection.

Here a construction is given below where in weaving floor reed deflection was found.

Fabric construction	20 T x 20+70D/71x58
Weave	2/1 S Twill
Greige PPI	58
Greige Width	64
Total Ends	5450
Reed Count	47.3
Ends/ Dent	3
Reed Space	75

**Table: 3.17 A fabric Construction and parameter in which reed deflection was found.**

### 1.2.7 Fabric construction which was taken for consideration for reed wear out problem.

Here a construction is given below in which 10 RSL weft yarn is used and in the weaving floor some times in this construction reed wear out found.

Fabric construction	10OE+10RSLx16L+70D/60x46
Weave	3/1 S-Twill
Greige PPI	46
Greige Width	71
Total Ends	4870
Reed Count	60
Ends/ Dent	3
Reed Space	80

**Table: 3.8 A fabric Construction and parameter in which reed wear out occurs.**

**1.2.8 Fabric construction which was taken for consideration for reed rust problem.**

Here a construction is given below where reed dent rust was found.

Fabric construction	60CWC x 60CWC/74x87
Weave	Plain
Greige PPI	87
Greige Width	64
Total Ends	5150
Reed Count	74
Ends/ Dent	2
Reed Space	68

**Table: 3.9 A fabric Construction and parameter in which reed rust found.**

**1.2.9 Fabric construction which was taken for consideration for reed rust problem.**

For analysis of the above statements two different looms with different reed count of the same fabric construction were brought for consideration.

Fabric construction	16OEx16L+70D/84x56
Weave	3/1 S-Twill
Greige PPI	56
Greige Width	73
Total Ends	6800
Reed Count	56
Ends/ Dent	3
Reed Space	80

**Table: 3.10 A fabric Construction and parameter where different count reed used.**

### 1.3 Calculation of weaving production:

In order to order follow up and meet to delivery requirement production calculation is required. In Bangladesh maximum textile factory deliver or produce fabric by yards. Here a production calculation theory is given below. From this theory we will get calculated production.

$$\text{Fabric Production In Yards} = \frac{\text{RPM} \times \text{Number of looms} \times \text{Time in minute} \times \text{efficiency \%}}{\text{PPI} \times 39.37 \times 100}$$

### Calculation of weaving efficiency:

From loom monitor actual production can be found.

$$\text{Weaving Loom Efficiency \%} = \frac{\text{Actual Production}}{\text{Calculated Production}} \times 100$$

### Calculation of number of pick insertion:

$$\text{Pick Insertion} = \frac{\text{RPM} \times \text{Time in minute} \times \text{Efficiency}}{100}$$

### CMPX calculation:

To calculate warp and weft breakages CMPX below theory were applied. Here it needs to be mentioned that warp and weft CMPX was calculated individually.

$$\text{CMPX} = \frac{\text{Number of breakages} \times \text{Total Pick inserted}}{100000}$$

**CHAPTER-4**  
**DISCUSSION OF RESULTS**

## **CHAPTER-4**

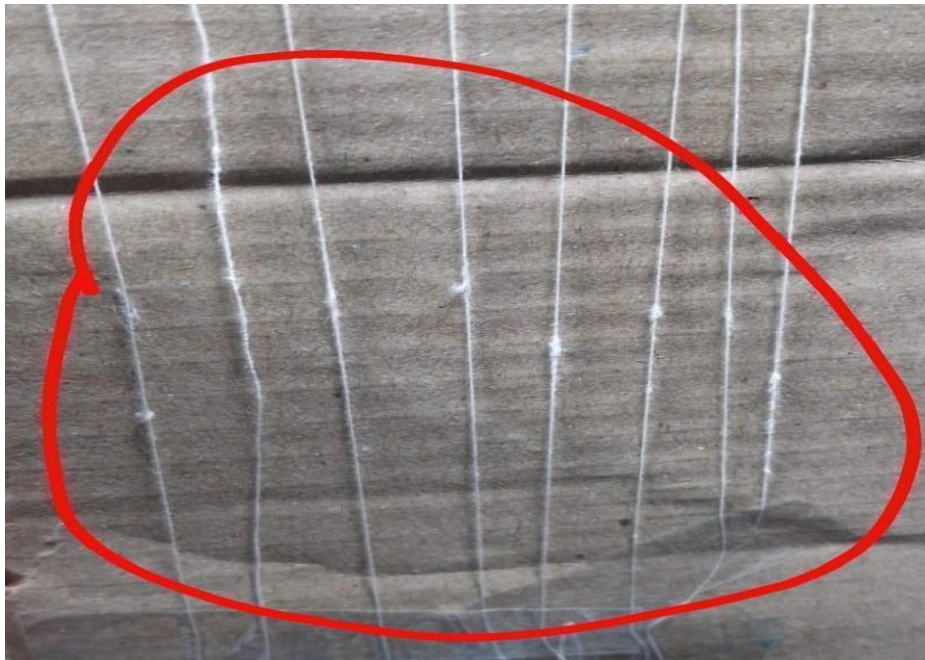
### **DISCUSSION OF RESULTS**

#### **4.1 Yarn Problem**

##### **4.1.1 Yarn Slub effect**

Basically, slub yarn is a mechanical fault. During the spinning process while roving goes through the drafting zone the speed variation between back roller and middle roller creates a slub problem. Though slub yarn becomes now a trendy characterized yarn & it's not counted as a fault right now. It has good tensile strength and can be used to obtain various types of fabric design and washing and finishing effects. Slub yarn is nowadays produced in bulk way. A separate sumo motor is used to create slub effect by controlling the middle and back roller in the drafting zone. Slub effects are four types. They are...

1. Regular slub yarns
2. Irregular slub yarns
3. Multi-count slub yarns
4. Mixing of regular and irregular slub.



**Figure: 4.1 Figure of yarn slub.**

In the weaving process none of the mentioned slub yarn effects impact on loom RPM and efficiency. For slub yarn there is a separate mechanical and electrical setting in the weaving loom. So, before the loom runs the specific setting needs to be adjusted.

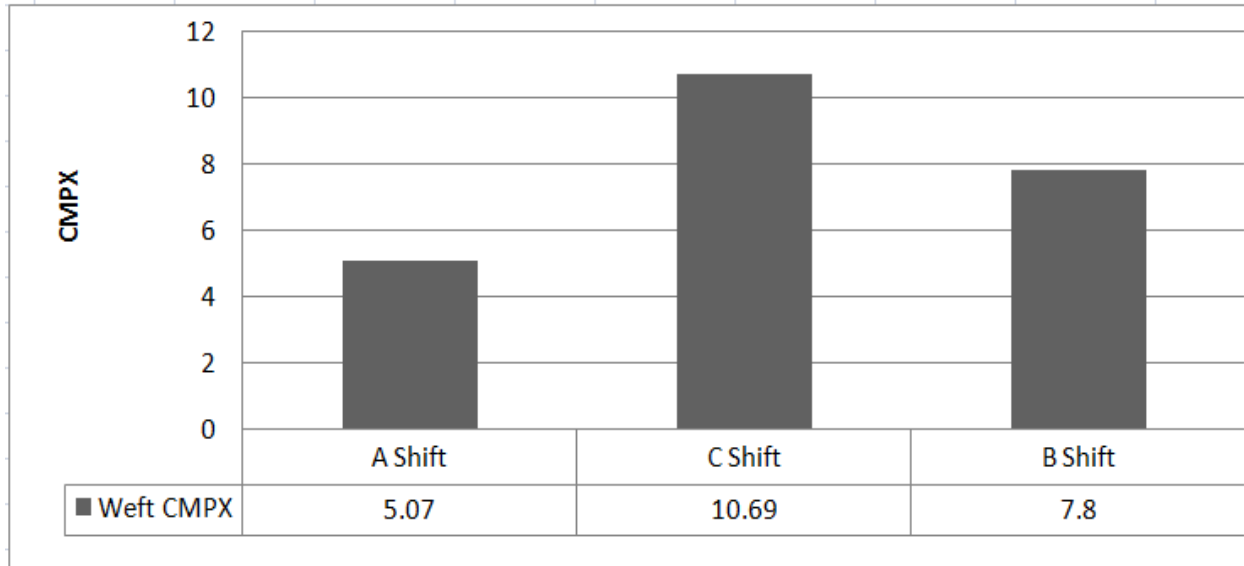
But problems arise while yarn slub comes as a problematic way. When slub effect is seen in weavers' beam or in warp yarn in a non slub constructed weaver's beam then during weaving in the picking process weft yarn gets obstructed by slub yarn's thick portion and filling occurs. Also, when slub yarn is used as a weft yarn there is a clear yarn diameter variation seen along the length of the yarn. So, when weft yarn goes from one side to another side of the fabric during the picking process by means of air pressure that times a un uniform air pressure is imparted on that yarn. That leads to a filling problem.

So, both of these reasons weft CMPX got higher and in order to get slightly uniform air pressure and optimum weaving efficiency loom RPM needed to be reduced.

To prove the above statements some analytic data were collected from the weaving floor.

Yarn slub problem (Loom no 119)				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	87	85.3	80.6	84.3
RPM	850	799	829	826.0
Pick Inserted	35487 4	32729 1	32079 9	334321. 3
Warp breakages	12	7	8	9.0
Warp CMPX	3.38	2.13	2.49	2.7
Weft breakages	18	35	25	26.0
Weft CMPX	5.07	10.69	7.8	7.9
Bobbin breakages	1	3	0	1.3

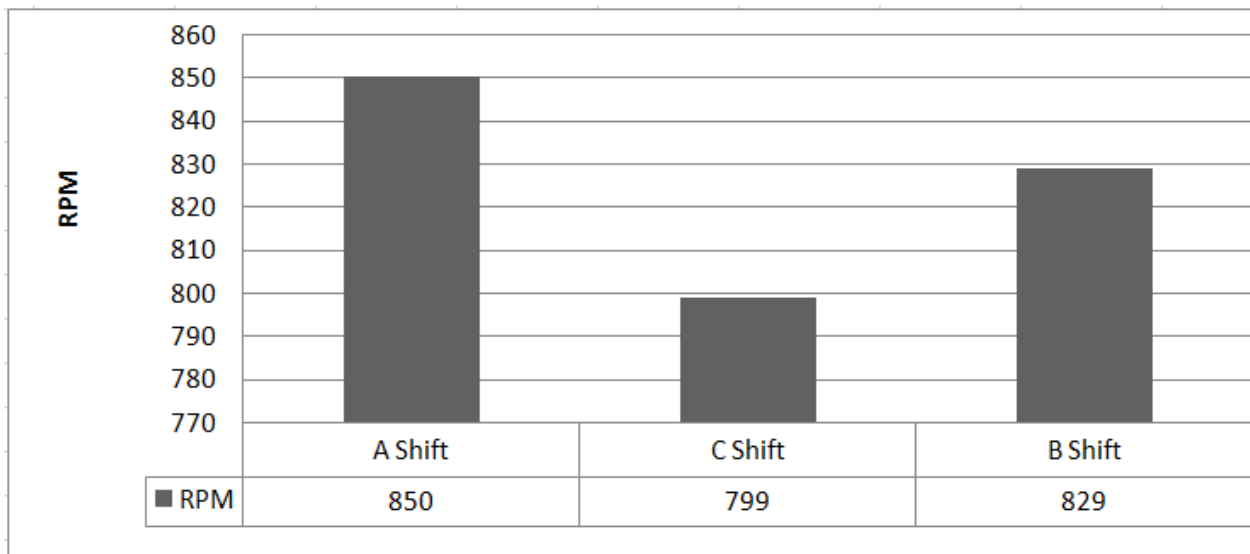
**Table: 4.1 Performance of weaving with slub yarn problem.**



**Graph: 4.1 Graphical representation of weft CMPX due to yarn slub problem.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents the weft CMPX.

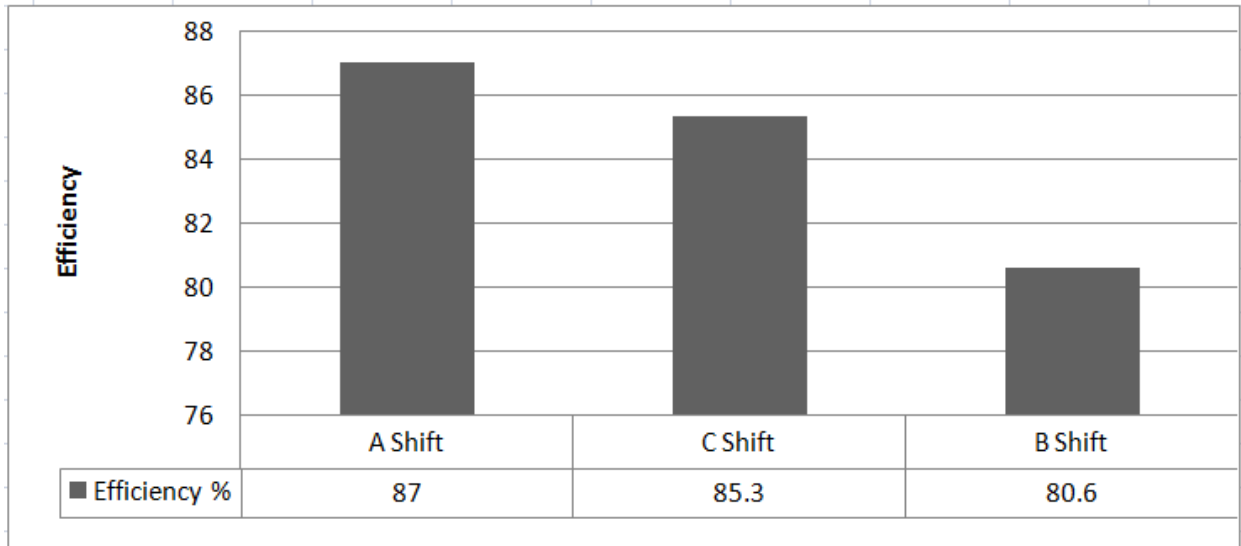
From graph 1 it was observed that due to slub yarn problem weft CMPX is getting continually higher from one shift to another. At C shift weft CMPX found at its peak position 10.69. Which may certainly refer to fabric downgrade.



**Graph: 4.2 Graphical representation of loom RPM due to yarn slub problem.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents looms RPM.

From graph 2 it was observed that due to slub yarn problems higher filling occurs starting from A shift. In order to get improvements in B shift RPM reduced to 850 to 829. But due to not getting any improvements in filling breakage control again in C shift RPM reduced to 829 to 799. Here it was seen that RPM needs to be reduced in order to control breakages of the weft CMPX and obtain optimum weaving production efficiency. At that time the total RPM reduction was 150.



**Graph: 4.3 Graphical representation of loom efficiency due to yarn slub problem.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents looms Efficiency%.

From graph 3 it was observed that due to slub yarn problem efficiency is down in both 3 shifts.

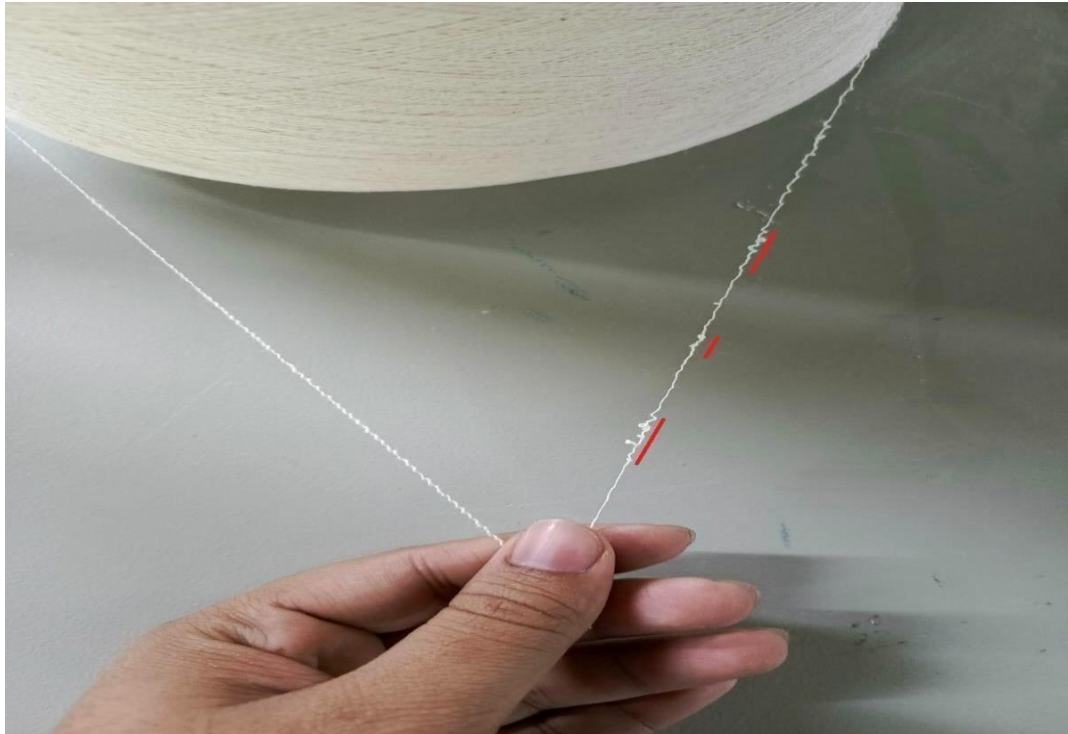
But due to presence of slub effect in warp yarn RPM was lowered in C shift comparatively helps to get more efficiency than A shift and B shift.

#### **4.1.1.1 Suggested solution regarding observation**

From the above analyzed study, it has been concluded that due to yarn slub problem, higher filling occurs and weaving looms efficiency gets down. Though lower the RPM can slightly solve this problem but it is not the permanent solution. Permanent solution is to change the slub yarn immediately. Higher weft CMPX, lower RPM and lower efficiency due to yarn slub problem directly impact on air jet weaving looms productivity.

#### 4.1.2 Weft Yarn snarls problem

Weft yarn Snarls occur during the spinning process, they are caused by uneven twisting and tension. In spinning while twist multiplier applied in drafting zone, if excess twist multiplier applied in drafting zone, then higher delivery speed needs to ensure. If delivery speed is not properly synchronized with a twist multiplier, then yarn snarl occurs. Other hand, mixing of different fiber lengths of cotton can also impart snarling problems, because the yarn with mixed fiber length cannot hold the same twisting all over the length that's why tension variation occurs in yarn and snarl form.



**Figure: 4.2 Figure of weft yarn snarl problem.**

In the above figure the right side yarn has a snarl problem and the left side yarn has no snarl effect. For open end and spandex composition yarn in the spinning process this problem is also known as the “spandex off centering” problem. During spandex insertion, if spandex is not inclined with the core of the yarn then spandex off centering problems occur. Though by heating off centering yarn packages, this problem can slightly be eliminated. Snarl can also be caused by long time storing of yarn packages after the spinning process.

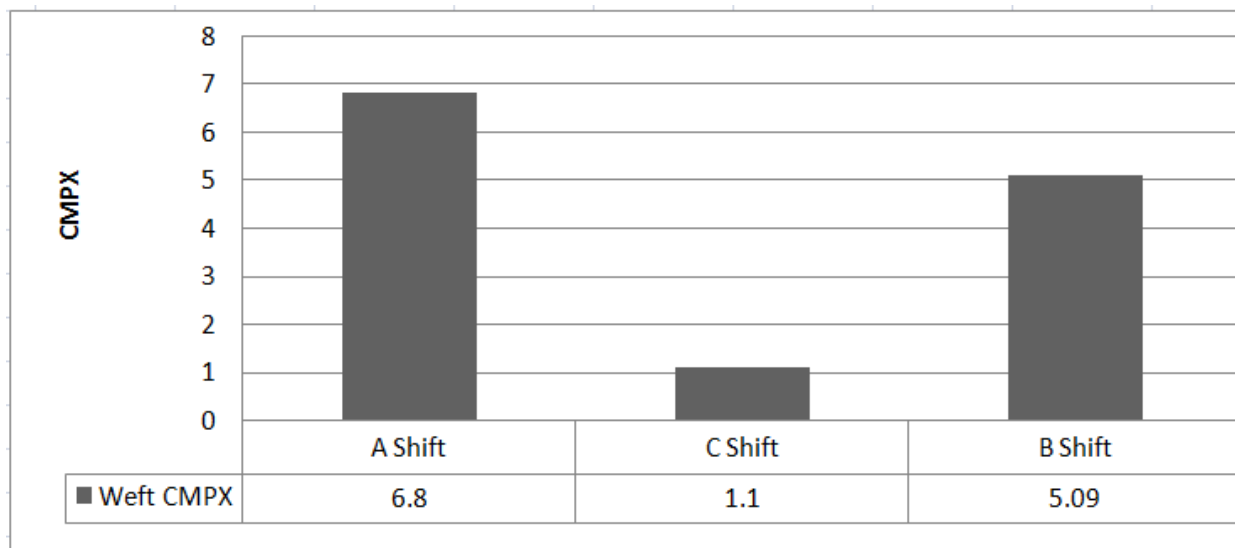
A regular yarn has a uniform curling effect which helps to get optimum air pressure. But in the snarl effect containing yarn, thick and thin yarn & twisted yarn are seen at a time and that's why it is not possible to maintain optimum air pressure due to their constructional deformity. In regular yarn, higher RPM can easily be imparted during weaving production due to uniform diameter of the yarn and the yarn body.

Snarls in weft yarn create a significant problem in weaving production. Presence of too many thick and thin places with loops in the yarn the air pressure frequently fluctuates which cause several weft breakages and filling problems. During the loom running conditions broken picks are also seen in fabric. So in order to reduce air pressure fluctuation weaving looms RPM needs to be reduced. Which directly impacts on reducing the air jet looms productivity also.

To prove the above statements some analytic data were collected from the weaving floor.

Weft Snarl Problem				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	80.3	94.4	81.7	85.5
RPM	800	950	800	850.0
Pick Inserted	30835	43046	31372	350848.
	2	4	8	0
Warp breakages	7	10	15	10.7
Warp CMPX	2.27	2.32	4.78	3.1
Weft breakages	21	5	16	14.0
Weft CMPX	6.8	1.1	5.09	4.3
Bobbin breakages	4	3	0	2.3

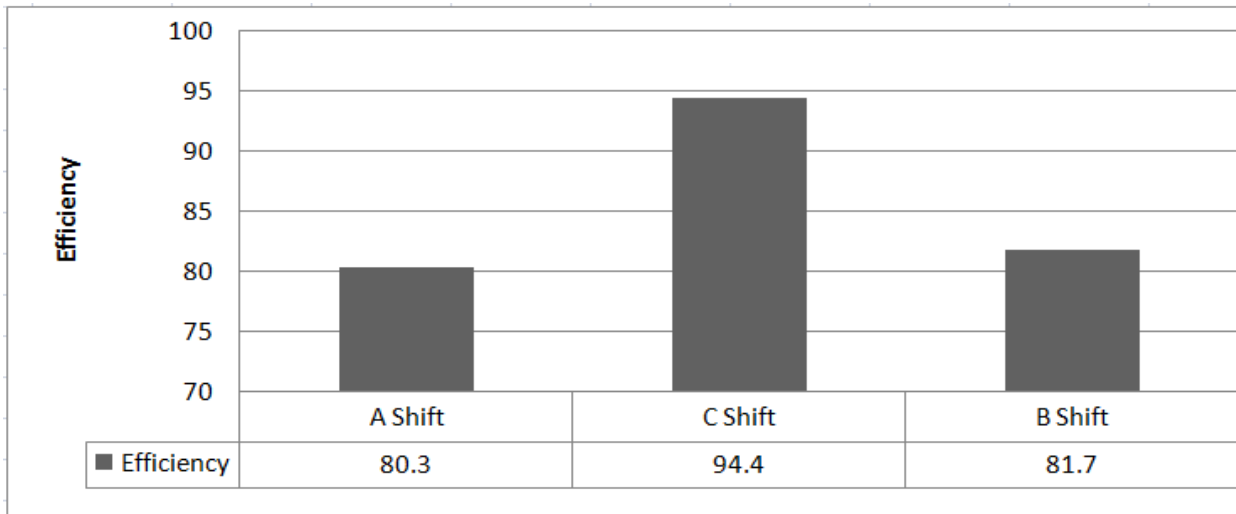
**Table: 4.2 Performance of weaving with weft snarl problem.**



**Graph: 4.4 Graphical representation of weft CMPX due to weft yarn snarl problem.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents the weft CMPX. In A and B shift looms run with snarl consisting of weft yarn. After finding out the

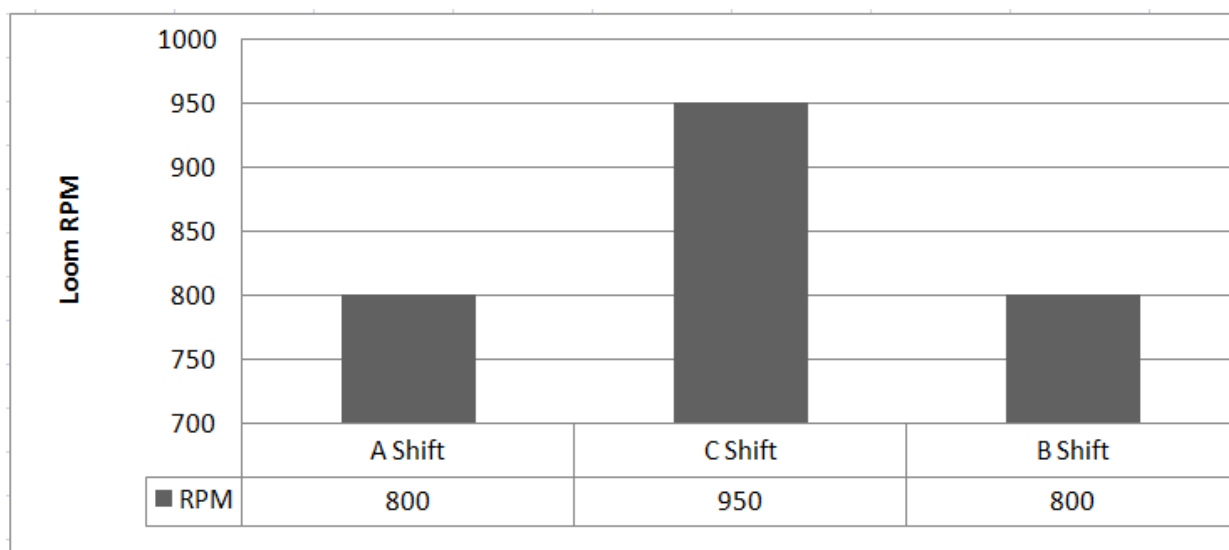
problem, in order to get improvements in weft CMPX and efficiency yarn changes done at the end of the B shift. And after changing problematic yarn packages at the end of B shift weft CMPX also reduced. From graph 1 it was observed that due to the weft yarn snarl problem Weft CMPX raises in A and B shifts they are approximately 6.8 and 5.09. At that time several broken picks were also found. After changing problematic yarn packages at the end of the B shift, weft CMPX also found reduced, again due to changes of the weft yarn we found weft CMPX in C shift was only 1.1 with only one broken pick problem.



**Graph: 4.5 Graphical representation of loom efficiency due to weft yarn snarl problem.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents looms Efficiency%.

From graph 3 it was observed that due to weft yarn slub problem efficiency is down in A and B shifts. They are 80.3 % and 81.7 %. And change of snarl weft yarn in C shift helps to give more efficiency then A and B shift which is 94.4 %



**Graph: 4.6 Graphical representation of loom RPM due to weft yarn snarl problem.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents looms RPM.

From graph 2 it was observed that due to weft yarn slub problems loom RPM were 800 at A and B shift. But in C shift with the changing of weft yarn RPM also increased to 950 with an efficiency of 94.4%

#### **4.1.2.1 Suggested solution regarding observation**

From the above analyzed study, it has been concluded that due to weft yarn snarl problem, higher filling occurs and weaving looms efficiency also down. But without weft snarl yarn problem, higher RPM and lower weft CMPX were found. So higher weft CMPX and lower RPM with weft yarn snarl problem directly impacts on air jet looms performance and efficiency. A heat setting process can be carried out in spinning section which can reduce this problem.

#### **4.2 Warping Problem:**

It's been said that good warping is half sizing. Sometimes due to warping problems weaving performance also gets down. Due to less observation during warping operation warping beams can get too hard or too soft which refuse to intake the proper amount if sizing chemicals. Both of these reasons impact more warp breakages in the weaving process. There is a creel tension option seen in warping creel mechanism. This tension varies according to yarn counts. If yarn count is high creel tension will be low and if yarn count is low creel tension will be high. Also, there is a specific creel tension present of a specific range of yarn count. If the proper creel tension is not maintained during warping operation warping beams can get too hard or too soft and this also influences the refusal to intake the proper amount of sizing chemicals. Both of these reasons impact more warp breakages in the weaving process. Sometimes baby cones are used in the selvage portion of warping beams, which impart higher twisting during unwinding of yarn

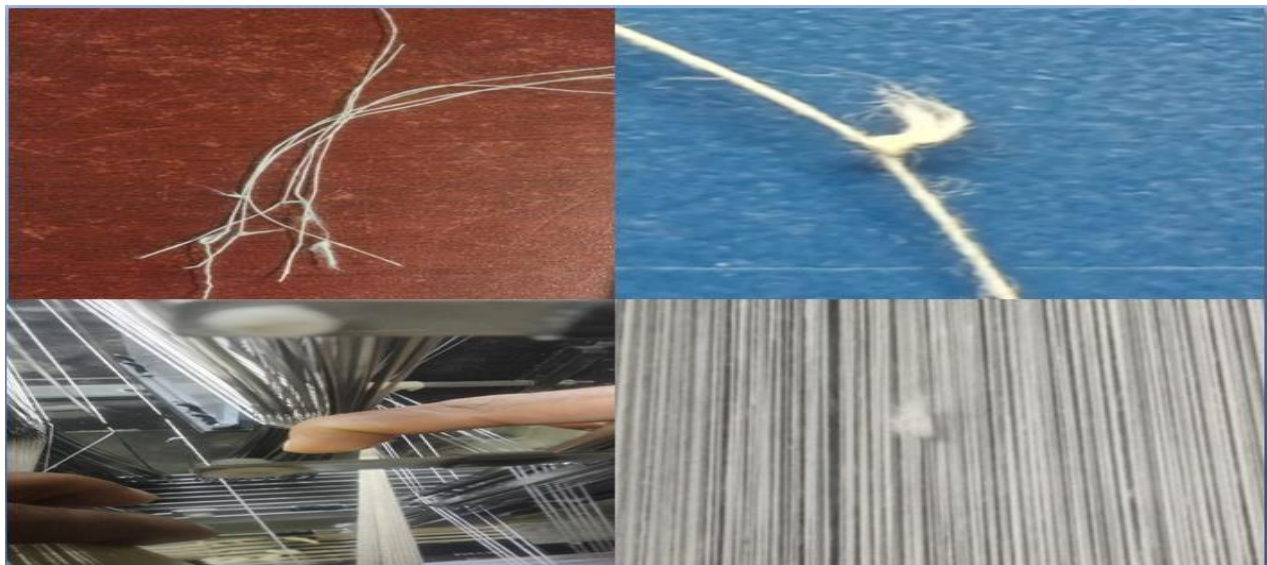
in the creel section which leads to breakages of more warp yarn in the weaving process. So, it can clearly be seen that warping plays a vital role in weaving production efficiency.

Some warping problems which directly impact on weaving looms RPM are mentioned below...

1. Warping knott
2. During warping yarn tension imposes on warping beams which create more breakages in the weaving process.
3. Warping RPM

#### 4.2.1 Warping knott

In the Warping process when a yarn package finishes, in order to continue the warping process another new yarn package is used. And a knott has been given between old and new yarn it's known as warping knott. Generally, these knott are given by hand. During knotting it should ensure that knott size is small. But some time warping operators make a big size of warping knott which causes problems during the weaving process. In weaving when these big handmade knott pass through the reed profile or reed groove portion filling yarn gets obstructed & filling occurs. In the weaving process when beam tension is applied on weaving beams those big knott show less resistance to hold yarn together and then breakages occur more. It can also be added that due to higher friction between warping knott and reed & warping knott and heddle frame a bunch of warp breakage occurs frequently at the knotted portion. Due to higher breakages of warp yarn and filling problem weaving loom efficiency % also gets down. So, in order to achieve more weaving efficiency and loom productivity the loom RPM needs to be reduced. Here some pictures of warping knott are given below which cause less weaving performance.



**Figure: 4.3 Figure of Warping Knott**

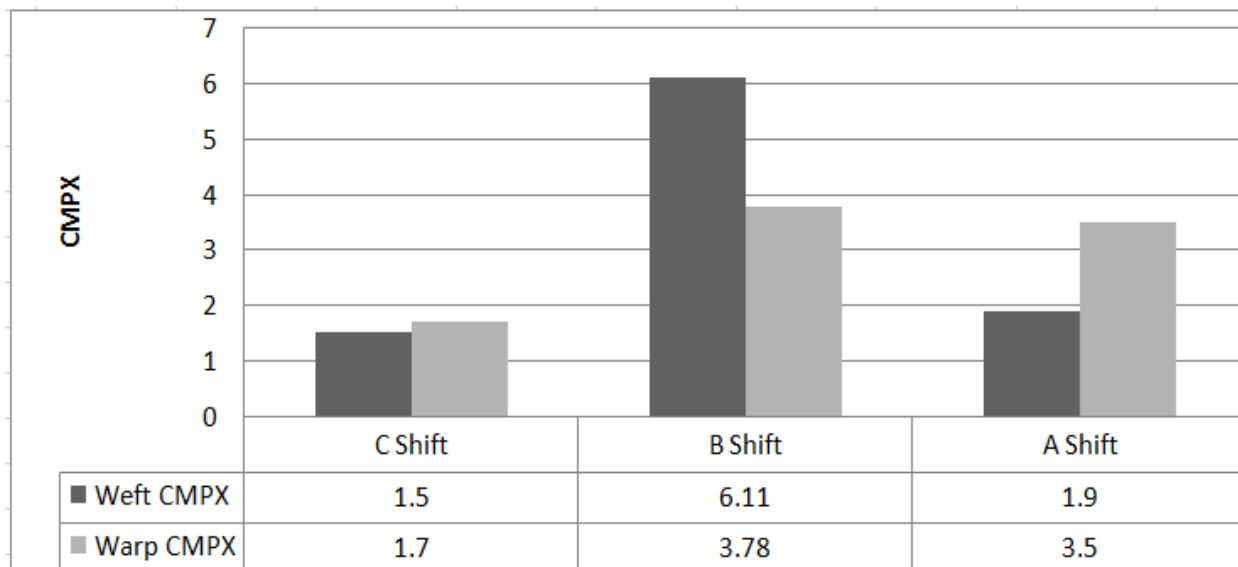


**Figure: 4.4 Figure of warp yarn bunch breakage due to warping knots.**

For analysis of the above fabric construction with warping knott problem 24 hours (3 Shifts) observation taken for consideration.

Warping Knott				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	58.8	91.6	81.1	77.2
RPM	899	900	887	895.3
Pick Inserted	253740	395414	343456	330870
Warp breakages	9	7	13	9.7
Warp CMPX	3.5	1.7	3.78	3.0
Weft breakages	5	6	21	10.7
Weft CMPX	1.9	1.5	6.11	3.2
Bobbin breakages	7	3	2	4.0

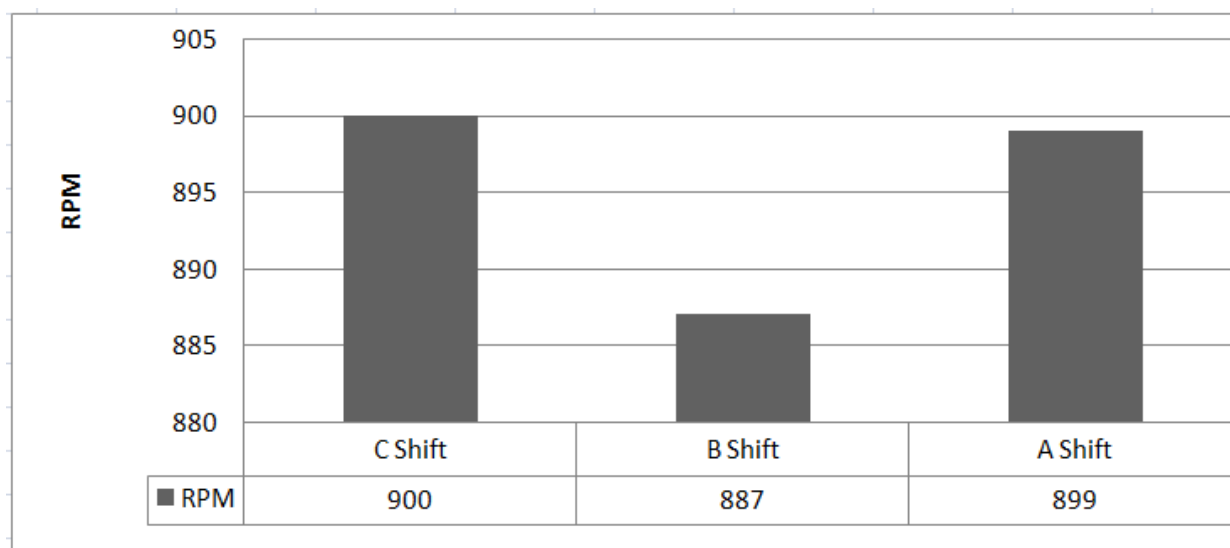
**Table: 4.3 Performance of weaving with warping knott problem.**



**Graph: 4.7 Graphical representations of increasing warp and weft breakage CMPX in the presence of warping knott.**

In this bar diagram, the "X" axis represents shifts name, and in the "Y" axis the black bar represents weft CMPX and the grey bar represents warp CMPX.

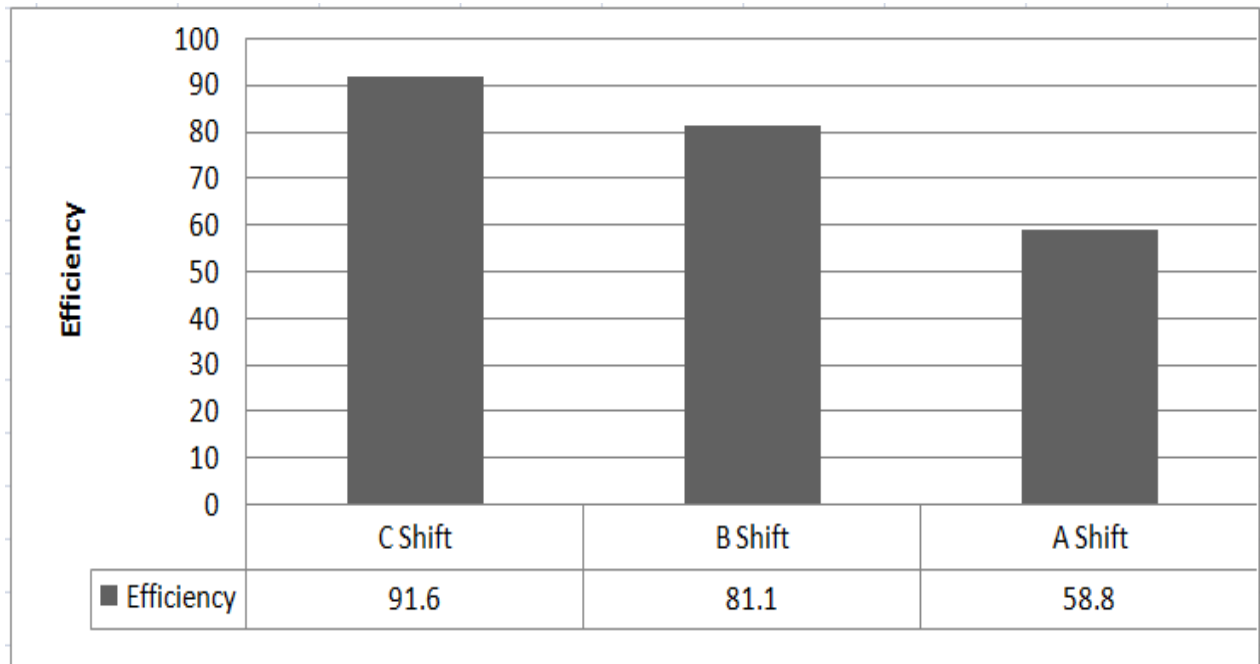
From the graph 4 it was observed that In A & B shift warp and weft CMPX was high as a result of facing warping knots during weaving. Though A shifts CMPX is comparatively lower than B Shift, but due to several warp bunch breakage from the table it has seen that in A Shift, efficiency was down then B and C shift.



**Graph 4.8 Graphical representation of decreasing RPM due to warping knott.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents the weaving looms RPM.

From graph 5 it was observed that to reduce aggressive amounts of friction RPM needs to reduce. In A & C shift RPM was around 900 but in B shift RPM reduced to 850. (887 were whole shifts average RPM).



**Graph: 4.9 Graphical representation of weaving efficiency % due to warping knott.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents the weaving efficiency %.

From graph 3 it was observed that looms RPM reduced due to reduction of high friction between warping knott and reed and heald frame.

#### **4.2.1.1 Suggested solution regarding observation**

From the above analyzed study it has been concluded that due to warping knott problem in weaving beam, higher warp breakages and filling breakages occurs more that's why weaving looms efficiency also gets down. Though lower the RPM can slightly solve this problem but it is not the permanent solution. During knotting in warping section knott should be more compact and small thus problem can be solved. So, higher weft CMPX with lower RPM and having lower efficiency due to warping knott problem cause a direct impact on air jet weaving looms productivity.

#### **4.2.2 Warping tension:**

During warping to ensure uniform warping process, tension applied on the warping beam. Excessive tension on warping beams helps to produce hard sizing beams. Which increases warp breakages in weaving.

Tension applied on weaver's beam from warping section

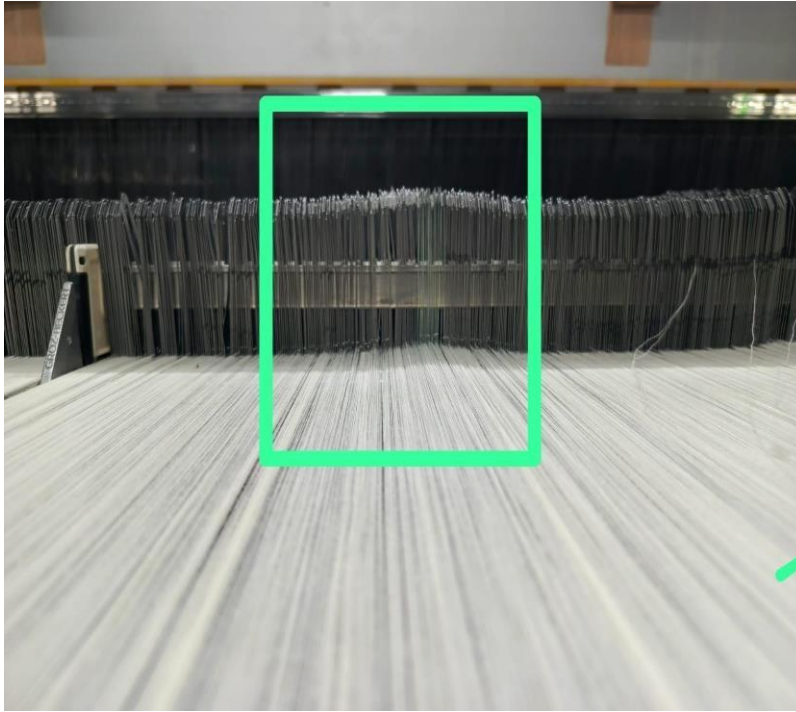
1. Creel tension: Creel tension applied in the creel section while unwinding of yarn from the yarn package is done. According to yarn count creel tension applied on yarn. Lower Count Yarn required higher creel tension while higher count yarn required lower creel tension. Excessive higher and lower creel tension makes a more compact warping beam. More compact beams create more warp breakages in weaving production.
2. Drum tension: Drum tension is provided on the warper beam while the warping beam produces. The tension also varies on yarn count.

#### **4.3 Drawing Problem:**

In the drawing section during the drawing process the drawer man sometimes by mistake used some mixed drop wire or held eye. Due to their moment of inertia shed angle reduced and filling breakages occur more. In drawing section 4 types of drop wire used. They are classified by their thickness such as ...2mm, 3mm, 4mm and 5mm. The more the thickness of the drop wire, the more the weight. According to the basis of yarn count and yarn density of a pattern they are selected. For finer count of yarn 2mm used for lower count of yarn 4mm to 5mm.

But when thicker drop wire mixed with the finer drop wire or while the finer drop wire mixed with the thicker drop wire then problems arise. When thicker drop wire is found mixed with the finer drop wire then during shedding thicker drop wire faces more gravitational force than the finer drop wire, and pulls the yarn down due to their moment of inertia thus shed angle becomes lower that portion where thick drop wire is found. The portion where shed angle is lower during picking weft yarn gets hindered and filling occurs more. Reduction of loom RPM helps to reduce the gravitational force on thick drop wire bars and due to having much more time than higher RPM, their rate of moment of inertia also becomes reduced. So, filling occurs less that time.

Due to higher filling breakages problem weaving loom efficiency % also gets down. So, in order to achieve more weaving efficiency and loom productivity the loom RPM needs to be reduced. Here a picture is given below where a mix of drop wire found, during shedding process higher thickness drop wire comes down lately then finer count due to their moment of inertia.



**Figure: 4.5 Mixed of drop wire bar.**

#### **4.4 Fabric design:**

Fabric design is the process of creating and preparing designs for fabric production. The designs themselves can be observed by physically or seeing through the eyes. Before going to further discussion some general concepts about woven fabric discussed below.

1. Woven fabric is produced by interlacing two sets of yarns, the warp and the weft, which are at the right angle to each other in the plane of the fabric.
2. The warp is oriented in the direction of the length of the fabric and the weft in that of its width.
3. Individual warp and weft yarns are called “Ends” and “Picks” respectively.
4. Interlacing the ends and picks with each other produces a coherent structure.
5. The repeating pattern of interlacing is called the “Weave”.

Classification of Woven Fabric: Considering the woven structure, the woven fabric may be conveniently divided into two principal categories:

1. Simple Structure
2. Compound Structure

### Features of Simple Structure:

1. The ends and picks are interlaced with one another at right angles.
2. In the fabric, threads of each group are respectively parallel to each other.
3. Only one series of ends and one series of picks are used in this construction.
4. All the constituent threads are equally responsible for both the aspect of utility or performance in a fabric and the aspect of aesthetic appeal.

### Features of Compound Structure:

1. More than one series or set of ends and picks are used in this structure.
2. Some of the threads may be responsible for the body of the fabric, such as ground yarns, whilst some may be employed entirely for ornamental purposes such as “Figuring” or “Face” yarns.
3. In this structure, some threads may be found not to be parallel formation one to Another in either plane and indeed there are many pile surface constructions in which some threads may project out at right angles to the general plane of the fabric. E.g.: Pile, Towel etc.

In weaving there are a variety of designs of fabric running in a weaving floor at a time. Design can be imparted by the number of frames, yarn ratio (either warp or weft ratio or both of them), yarn type, pick density, Pick ratio, EPI, PPI etc.

Sometimes the design repeat is so big that un uniform warp tension create among two sets of yarn, higher friction occurs, different count weft yarn causes different air pressure values, normally in compound structure looms RPM need to keep lower to avoid filling and warp breakages all of them reducing the loom productivity.

#### **4.4.1 Increased of frame number**

Due to higher friction of warp yarn causes more warp breakage. In compound structured fabric, uneven tension rises on the specific set of warp yarn during the shedding process. Due to higher tension with higher beat-up force imparted on warp yarn that time warp breakage occurs more. This is the reason why RPM needs to lower down to reduce warp breakages. Weaving floor efficiency will go down if compound structured fabric looms maintain a high RPM loom speed. Again, due to uneven tension rises of the specific set of warp yarn during shedding process shed angle needs to get lower, in lower shed filling yarn gets so close to warp ends and sometimes get hindered by warp yarn and create more filling or weft breakages problem during picking process.

To prove the above statements a couple of looms with different compound construction with different frame numbers were analyzed, and by collecting their 24 hours weaving performance discussion were made.

For analysis fabric construction with three different frame numbers are brought for consideration. They are...

1. 4 frame plain design
2. 8 frame rib stop design
3. 16 frame dobby design

4 Frame				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	96	97	95	96.0
RPM	950	950	950	950.0
Pick Inserted	43776 0	44232 0	43320 0	437760.0
Warp breakages	4	6	4	4.7
Warp CMPX	0.91	1.35	0.92	1.1
Weft breakages	6	1	2	3.0
Weft CMPX	1.37	0.22	0.46	0.7
Bobbin breakages	2	1	1	1.3

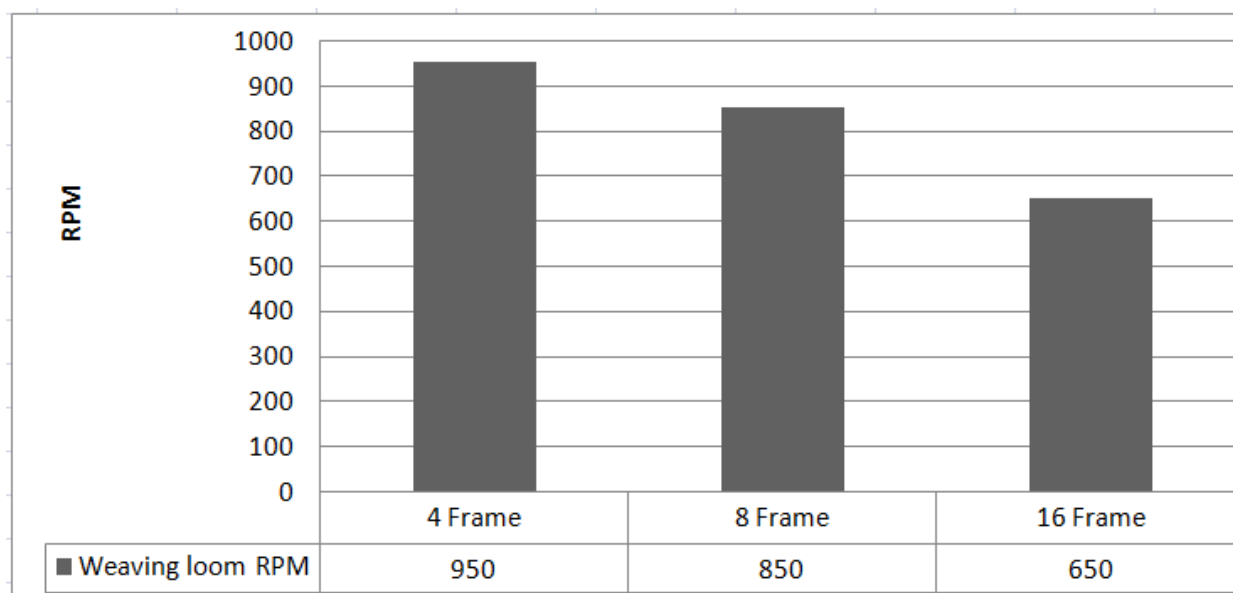
**Table: 4.4 Performance of weaving loom with 4 frame.**

8 Frame				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	84.6	92.4	88.6	88.5
RPM	850	850	850	850.0
Pick Inserted	32819 0	37680 4	36151 5	355503.0
Warp breakages	6	9	6	7.0
Warp CMPX	1.8	2.4	1.7	2.0
Weft breakages	10	8	14	10.7
Weft CMPX	3	2.1	3.9	3.0
Bobbin breakages	1	3	0	1.3

**Table 4.5 Performance of weaving loom with 8 frames.**

16 Frame				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	86	85	82	84.3
RPM	650	650	650	650.0
Pick Inserted	268320	265200	255840	263120.0
Warp breakages	4	3	2	3.0
Warp CMPX	1.4	1.13	0.78	1.14
Weft breakages	10	9	15	11.3
Weft CMPX	3.72	3.39	5.86	4.3
Bobbin breakages	2	3	1	2.0

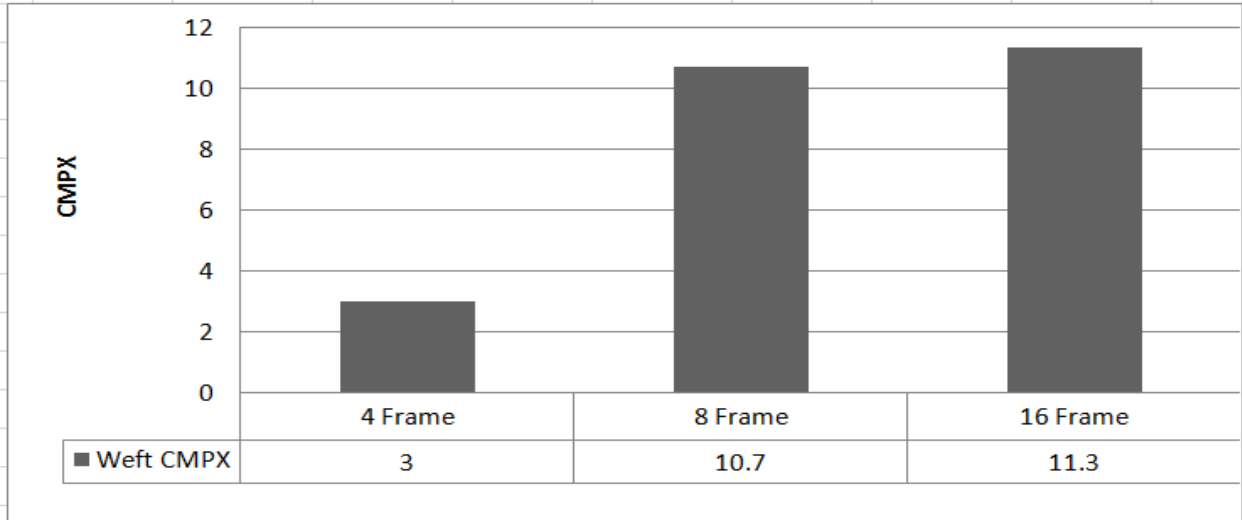
**Table: 4.6 Performance of weaving loom with 16 frames.**



**Graph 4.10 Graphical representation of the relation between numbers of frame and loom RPM.**

In this bar diagram, the "X" axis represents the number of frames used, and the "Y" axis represents the weaving loom RPM.

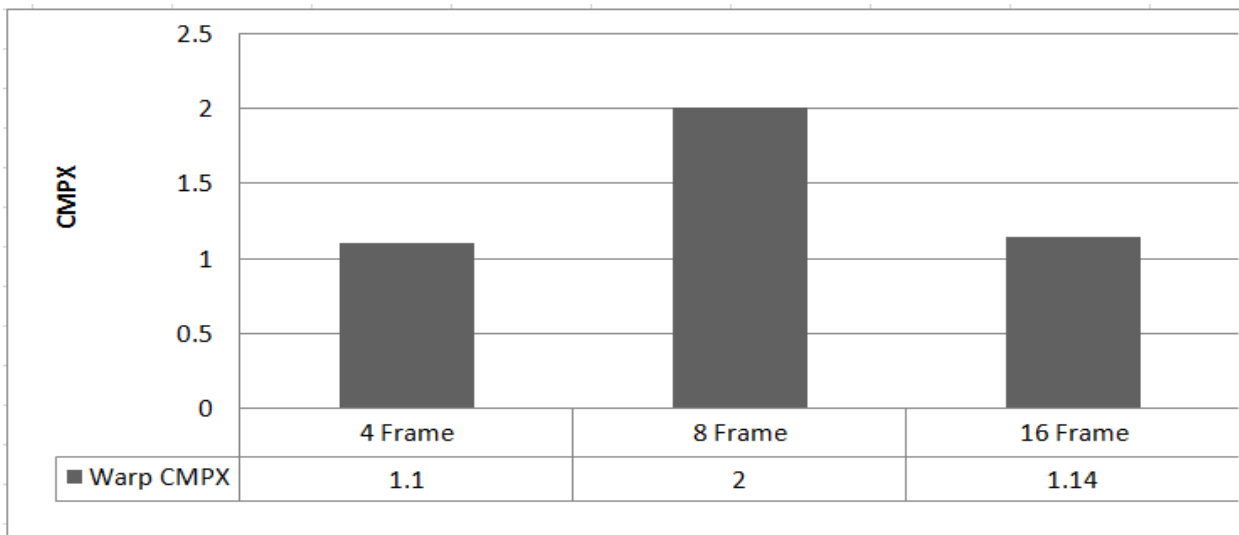
From graph 1 it was observed that with the increase of number of held frames weaving RPM gets down. With 4 frame design of fabric loom RPM is 950, with 8 frame design of fabric loom RPM is 850 and with 16 frame design of fabric loom RPM is 650. That clearly represents that, in order to achieving the more compound structure the number of frame increases and with the increase of number of frame the loom RPM gets lower.



**Graph: 4.11 Graphical representation of the relation between number of frame and weft CMPX.**

In this bar diagram, the "X" axis represents the number of frames used, and the "Y" axis represents the weft CMPX.

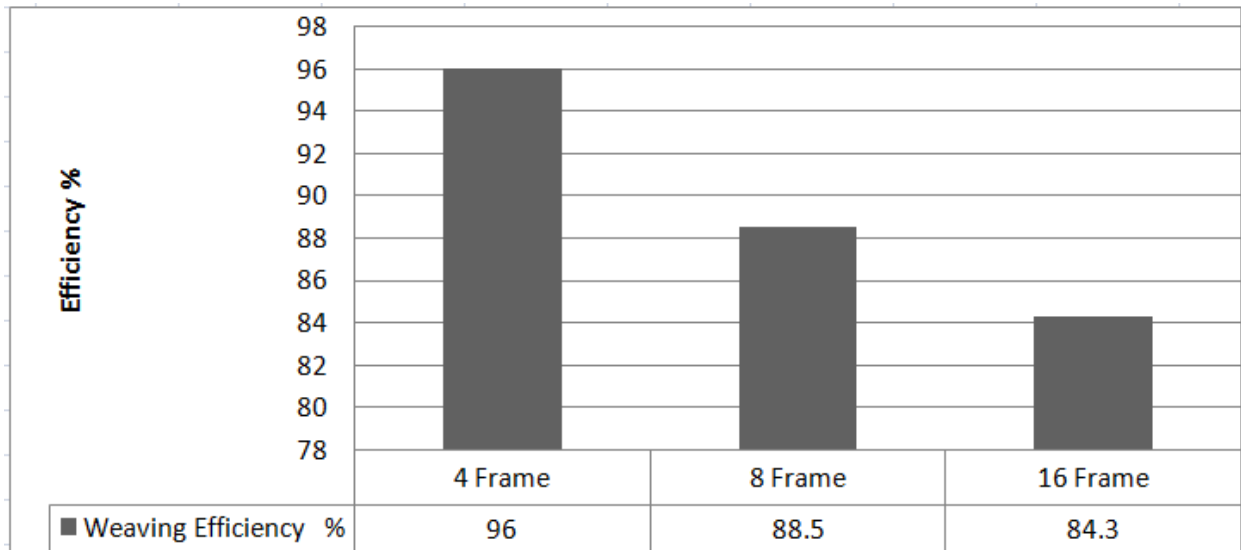
From graph 2 it was observed that with the increase of number of held frame weft CMPX increased. With 04 frame design of fabric weft CMPX is 3, with 8 frame design of fabric weft CMPX is 10.7 and with 16 frame design of fabric weft CMPX increased to 11.3



**Graph: 4.12 Graphical representation of the relation between number of frames and warp CMPX.**

In this bar diagram, the "X" axis represents the number of frames used, and the "Y" axis represents the warp CMPX.

From graph 3 it was observed that with the increase of the number of held frame warps CMPX increased. With 04 frame design of fabric warp CMPX is 1.1, with 8 frame design of fabric warp CMPX is 2 and with 16 frame design of fabric warp CMPX increased to 1.14. This can be simplified as with the increase the number of frame warp CMPX increased.



**Graph: 4.13 Graphical representation of the relation between number of frame and weaving loom efficiency %.**

In this bar diagram, the "X" axis represents the number of frames used, and the "Y" axis represents the weaving %. From graph 4 it was observed that with the increase of number of held frame weaving efficiency decreases. With 04 frame design of fabric weaving efficiency is 96%, with 8 frame design of fabric weaving efficiency was 88.5% and with 16 frame design of fabric weaving efficiency reduced to 84.3%.

#### 4.4.1.1 Suggested solution regarding observation

From the above analyzed study, it has been concluded that as a result of increased number of frame looms RPM needs to lower to ensure lower warp and weft CMPX. Higher number of frame or designs of the fabric has a higher friction ratio. In order to get optimum loom efficiency and CMPX reduction of friction per minute on yarn need to be controlled by reducing loom rpm. That's directly impact on air jet looms weaving productivity. This problem can only be solved by using higher strength yarn along with good sizing chemical and good waxing on warp yarns.

#### 4.4.2 Weft Yarn ratio:

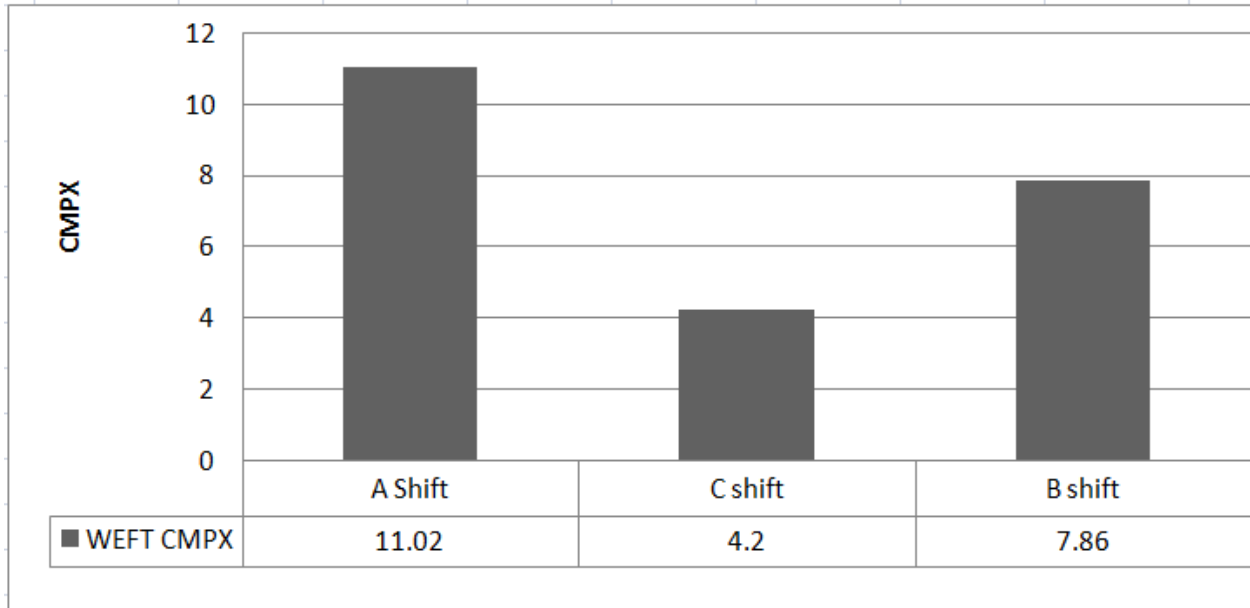
To meet variable design, special texture, strength and other features characteristic, sometimes more than two types of weft yarn are used at a time. Their count, Characteristic, constructive design may be different from one another.

In weaving for optimum picking process different air pressure needs to be set for different yarn types, due to air pressure variation weft breakages occur more. Other hand, while picking a long ratio weft pattern one IRO becomes standstill for more than a couple of seconds. That time in the main nozzle with the interaction between flow of air and yarn the remaining weft yarn becomes fluffier and it loses its strength and breakages occur. To overcome this situation, the RPM needs to be reduced to obtain good productivity.

To prove the above statements some analytic data was collected from the weaving floor.

Weft yarn ratio (3:1)				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	70.2	90.6	77.5	79.4
RPM	700	600	649	649.7
Pick Inserted	23587 2	26074 5	24142 8	246015. 0
Warp breakages	3	9	2	4.7
Warp CMPX	1.27	3.5	0.82	1.9
Weft breakages	26	11	19	18.7
Weft CMPX	11.02	4.2	7.86	7.7
Bobbin breakages	2	1	2	1.7

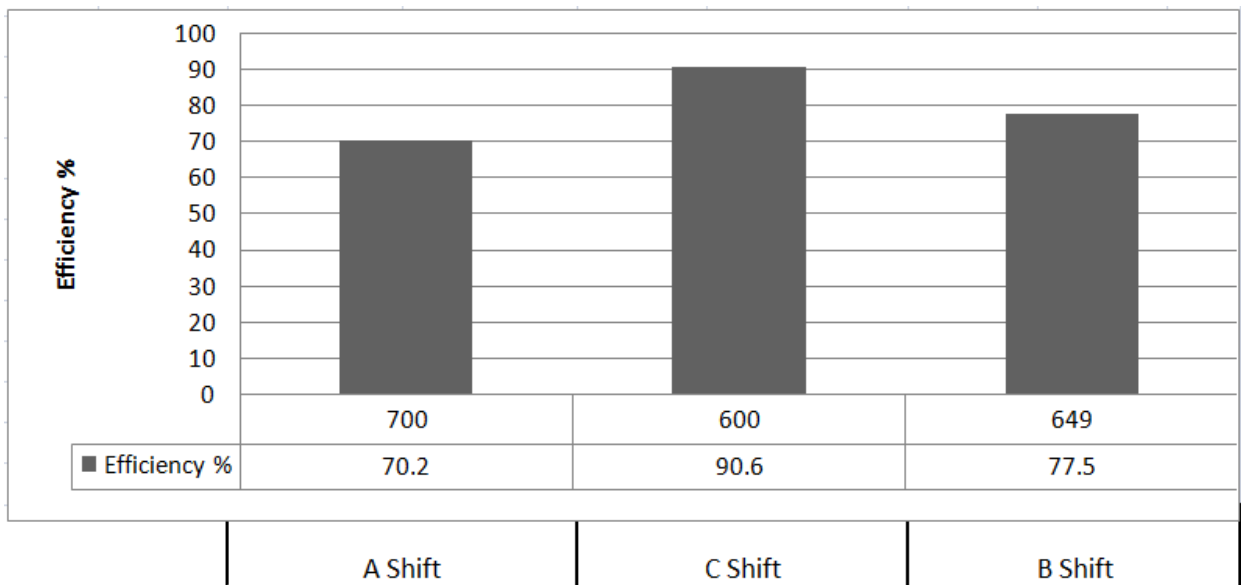
**Table: 4.7 Performance of weaving loom with weft yarn ratio.**



**Graph: 4.14 Graphical representation of shift wise weft CMPX with weft ratio.**

In this bar diagram, the "X" axis indicates shift name and the "Y" axis represents the weft CMPX.

From this graphical representation it's been observed that comparatively C shifts weft CMPX is 4.2 which is intensely lower than A and B shift.



**Graph: 4.15 Graphical representation of shift wise loom efficiency with weft ratio.**

In this bar diagram, the "X" axis indicates shift name along with RPM, and the "Y" axis represents the looms efficiency%.

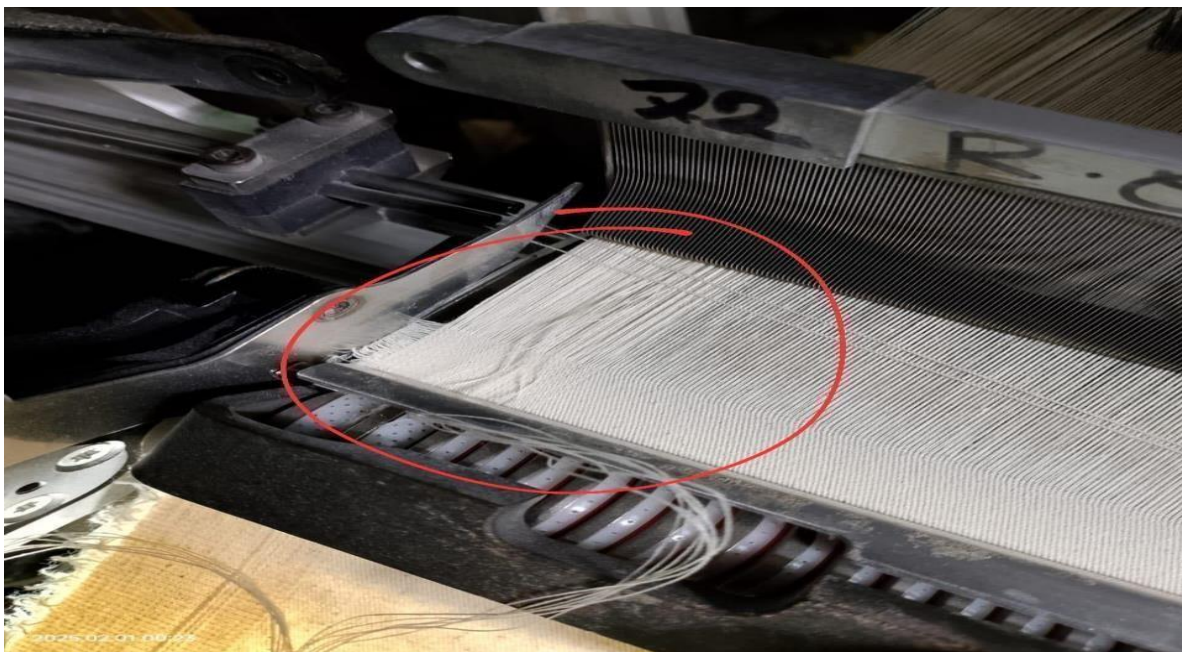
From this graphical representation it's been observed that comparatively C shift Efficiency is higher than A and B shift. Here it was observed that with the reduction of loom RPM loom efficiency increase, hence productivity increase with the reduction of RPM.

#### **4.4.2.1 Suggested solution regarding observation**

From the above analyzed study, it has been concluded that with the decrease of RPM in weft ratio constructed looms, it helps to get higher efficiency, lower the weft CMPX. Though higher pick numbers are inserted at lower RPM, so productivity also improves. Now it can be said that the consistent weft ratio in design directly impacts on the air jet looms productivity. During picking PFT (Programmable filling tension) can slightly solve the issue.

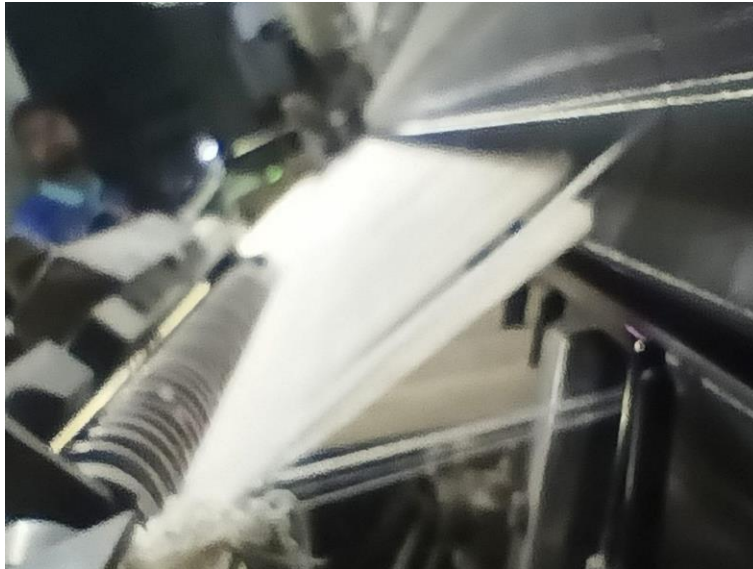
#### **4.4.3 Higher EPI or ends per dent at selvages side:**

If a fabric has a compact or very high tight selvage construction, then higher warp breakage and filling breakages occur at the selvage's side. In selvages where EPI is higher, the beating-up force generated in both edges of the reed dents and higher compactness of warp yarn in selvages increase higher warp breakages problem. Due to higher friction among warp yarn and reed dent in selvage's side during weaving, the sizing coating on warp yarn falls down and the warp yarn strength becomes poor. So, warp breakages increase. Sometimes bunch breakages occur.



**Figure: 4.6 Warp bunch breakages at selvage's side.**

During the shedding process while shed open in the selvages side the warp set is not fully separated into two parts due to compactness of warp yarn. In that semi open portion of shed filling yarn got stuck during picking so filling breakages occurred more at selvage's side. Again, in that case of sizing coating fall down, warp yarn becomes hairy due to higher friction and then filling breakages occur more. So, to reduce rapid beating up force in order to control warp and filling breakage, RPM needs to reduce. Which directly reduces air jet loom productivity.



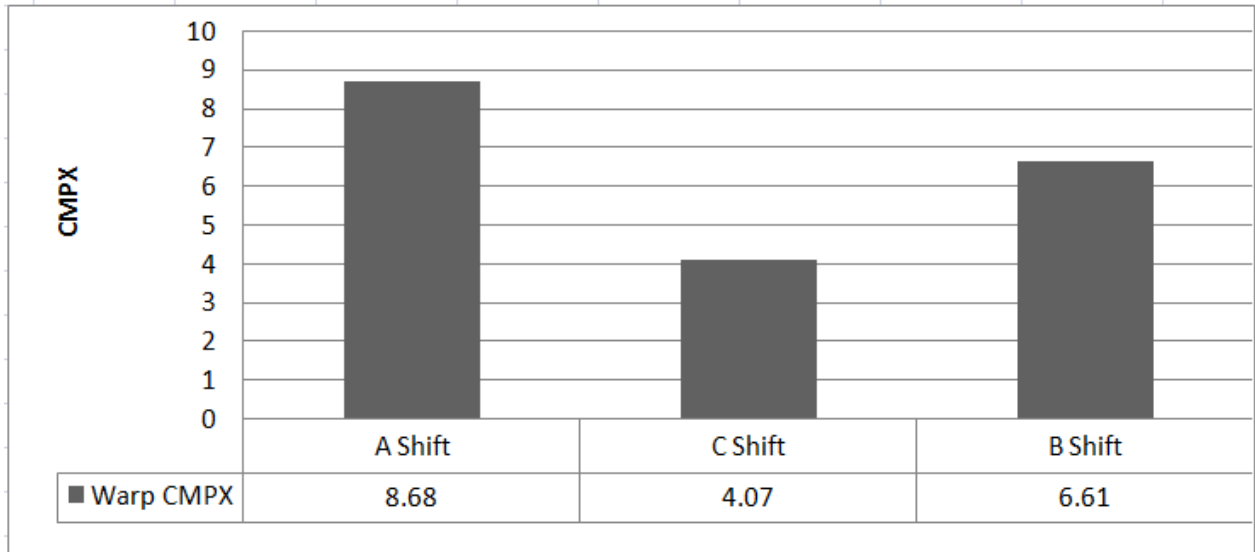
**Figure: 4.7 Selvage sides higher EPI impart Yarn shed crossing is lower than fabric body.**

Now let's focus on table 3.2.5

Here from the table, it is noticeable that ends per dent in selvage is comparatively higher than fabric body. On the other hand, the reed count is also higher, around 72/3.

Performance of looms with higher EPI at Selvedges side				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	51.4	85.2	72	69.5
RPM	700	600	700	666.7
Pick Inserted	17270 4	24537 6	24192 0	220000. 0
Warp breakages	15	10	16	13.7
Warp CMPX	8.68	4.07	6.61	6.5
Weft breakages	7	10	17	11.3
Weft CMPX	4.05	4.07	7.03	5.1
Bobbin breakages	8	6	9	7.7

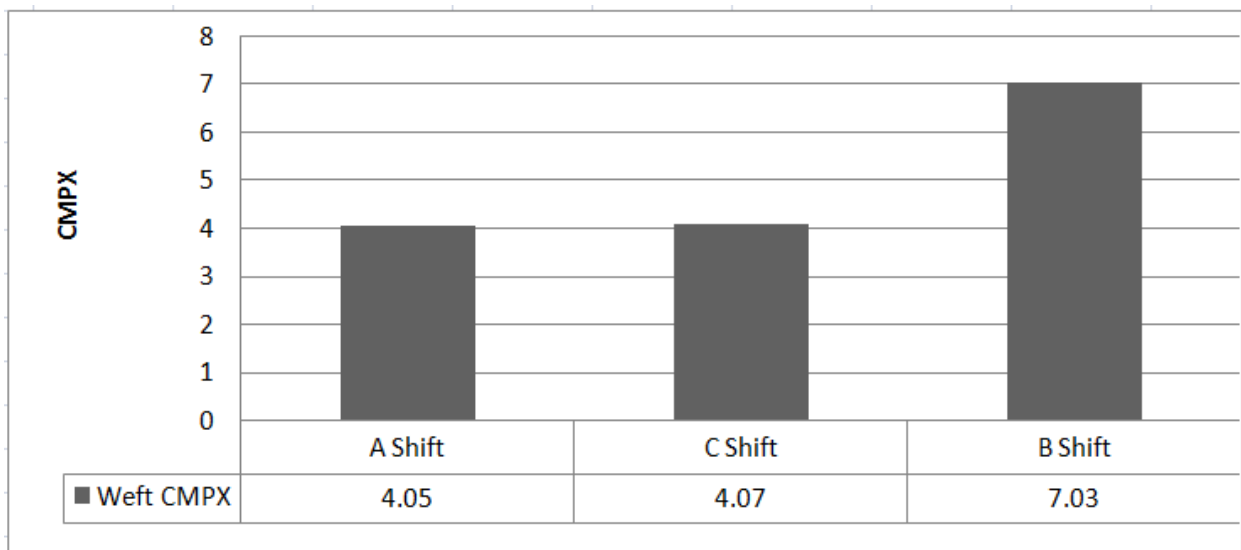
**Table: 4.8 Performance of weaving with higher EPI at selvages side.**



**Graph: 4.16 Graphical representation of shift wise warp CMPX with higher EPI at selvages side.**

In this bar diagram, the "X" axis indicates shift name and the "Y" axis represents the looms warp CMPX.

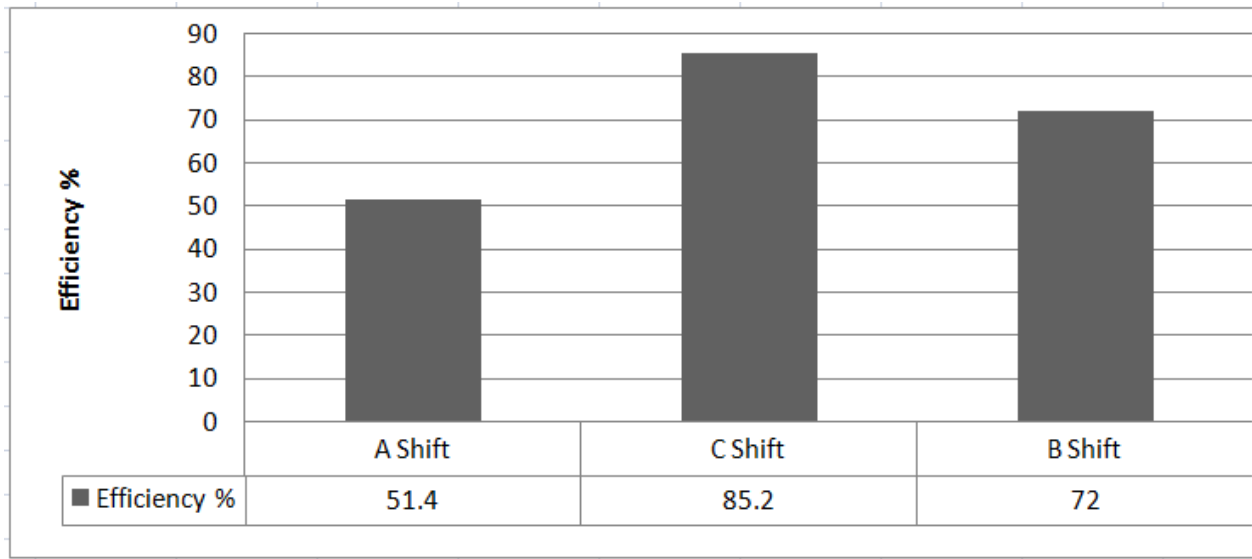
From this graphical representation it's been observed that in A shift warp CMPX was high 8.68, In B shift several times mechanical work was done then warp CMPX slightly improved to 6.61. But still not improved hence RPM reduced which help to reduce warp CMPX to 4.07



**Graph: 4.17 Graphical representation of shift wise weft CMPX with higher EPI at selvages side.**

In this bar diagram, the "X" axis indicates shift name and the "Y" axis represents the looms weft CMPX.

From this graphical representation it's been observed that in A shift weft CMPX was high, so various mechanical settings change in order to improve weft CMPX. But not improved, it is clearly visible in B shift weft CMPX it's almost 7.03. But after reducing RPM in C shift weft CMPX reduced to 4.07 alongside with improved warp breakage.



**Graph: 4.18 Graphical representation of shift wise weaving efficiency %.**

In this bar diagram, the "X" axis indicates shift name and the "Y" axis represents the weaving efficiency %.

From this graphical representation it's been observed that with the improvement of controlled warp and weft CMPX in C shift, efficiency is higher than other two shifts around 85.2 %. Other two shifts show efficiency consequently A= 51.4%, B=72%.

#### **4.4.3.1 Suggested solution regarding observation**

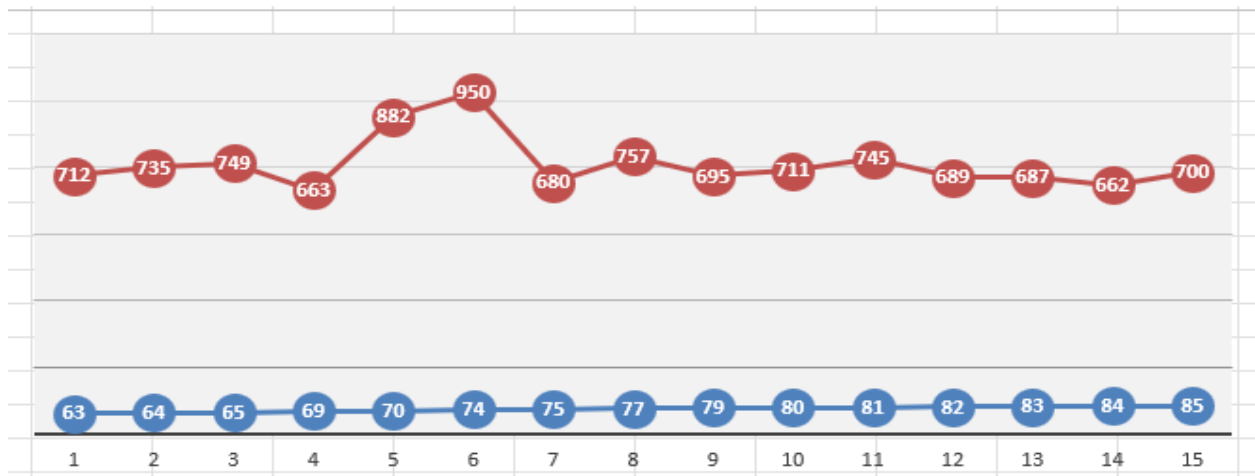
From the above analyzed study, it has been concluded that with the decrease of RPM in highly tight and compacted selvages fabric, it helps to get higher efficiency with lower the warp and weft CMPX. Though higher pick numbers are inserted at lower RPM, so productivity also improves. Now it can be said that higher EPI or ends per dent at selvages side directly impacts on air jet looms productivity. This problem can only by two ways, first reducing the yarn per dent in selvages and second use extra frame for selvages and 2 yarns per held eye should use in selvages side.

#### 4.5 Reed space:

Fabrics with higher reed space loom RPM need to be reduced. Due to higher reed spacing during the picking process weft yarn have to stay a long time under flow of air pressure in reed profile zone and comparatively higher air pressure required for long reed spaced fabric. That's why weft breakage & reverse pick problem occurs more. In this study more than 350 looms with different reed space .In here for analysis purposes some fabric construction along with their reed space loom RPM and efficiency average shows in a table.

Construction	Reed Space	Average RPM	Average Efficiency
30CWCX20KW/144X84	63	712	90.76
20KWX16KW/102X54	64	735	92.62
16OEX12KW/124X56	65	749	94.5
60CWCX60CWC/74X87	69	663	92.33
20PCx20PC/93x50	70	882	90.78
20RX16+70D/110X59	74	950	93.98
20TX20+70D/71X58	75	680	92
7OEX8+70D/50X43	77	757	93.87
20OEX16+70D/102X53	79	695	92.52
20OEX20+70D/86X49	80	711	88.8
12OEX16+70D/60X59	81	745	94.3
50CWCX40+40D/96X84	82	689	93.1
20PCX16+70/84X50	83	687	95.95
40CWCX40+40D/84X60	84	662	93.58
20OEx20+70D/81x49	85	700	95.1

**Table: 4.9 Relation of RPM with Reed space.**



**Graph: 4.19 Graphical representation of Reed space wise RPM variation.**

In this graphical representation there were two horizontal lines shown. Where the blue zigzag line indicates reed space of looms and upper red horizontal zigzag line express looms RPM. Here it was shown that the lower inclination of the upper zigzag line increases with the increase of reed space. From RS 63 to 74 looms RPM were at maximum position. But after fabric reed space between 74 to 85 loom RPM gets lower. Here it should be declared that the RPM was lower because of maintaining optimum weaving efficiency%. From the above table it was ensured that RPM were high above 90% in both lower and higher reed space.

#### 4.5.1 Suggested solution regarding observation

So, from this above analysis it's been concluded that with the increase of reed space loom RPM needs to be reduced in order to get lower weft breakage and optimum weaving efficiency%. Lower the RPM directly impacts air jet looms production. Good strength of weft yarn should use for higher reed spaced fabric.

#### 4.6 Sizing take up % effect air jet loom performance:

Basically, there are 4 types of sizing. They are,

1. Pure sizing: Application of the size ingredients up to 7-10 % of total yarn weight. Normally this type of sizing used to produce unbleached fabric.
2. Light sizing: Application of the size ingredients up to 11-15% of total yarn weight. Normally this type of sizing is used for dyeing and printing purposes.
3. Medium sizing: Application of the size ingredients up to 16-40% of total yarn weight. Normally this type of sizing used to increase the weight of yarn and strength.
4. Heavy sizing: Application of the size ingredients up to 40% to above of total yarn weight. Normally this type of sizing is used on lower count and twisted yarn.

Size takes up%: On the yarn surface the amount of the size material added is called size takes up percentage.  $\text{Size takes up\%} = (\text{Weight of size yarn} - \text{weight of unsized yarn}) / \text{Weight of unsized yarn} * 100\%$ .

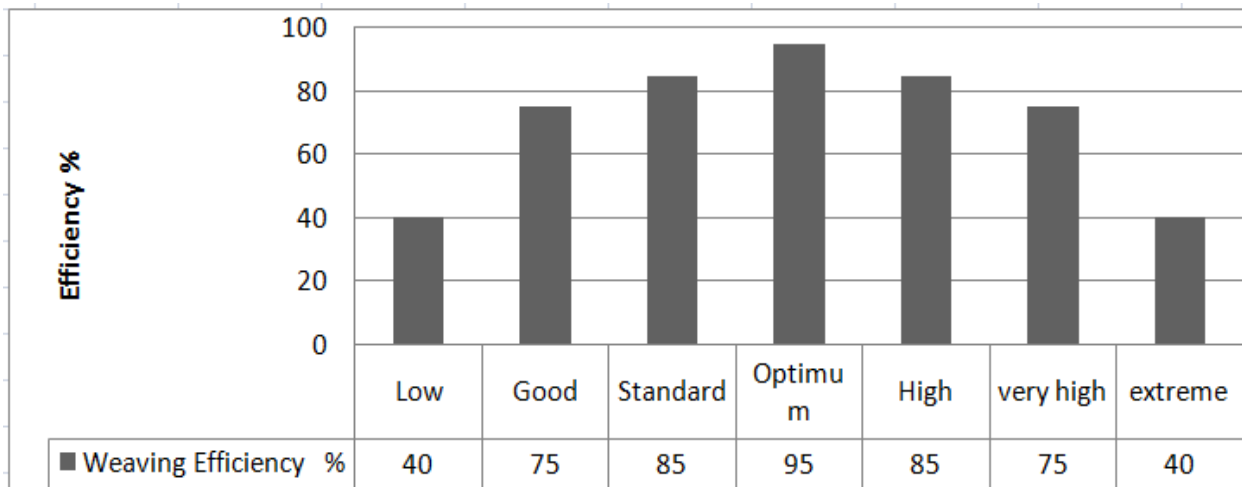
Normally the amount of sizing chemical applied on a weaver's beam is based on yarn structure, sizing recipe, squeezing roller pressure, Machine RPM. If the proper amount of sizing chemical is not applied on the weaver's beam during sizing, then weaving performance will be poor.

Effects of adding sizing chemicals is more, then...

- Yarn will become stiffer & breakage will be high during the beat-up process.
- The yarn become less extensible so bunch breakage will occur
- The yarn becomes more difficult to weave due to dry sizing chemicals.

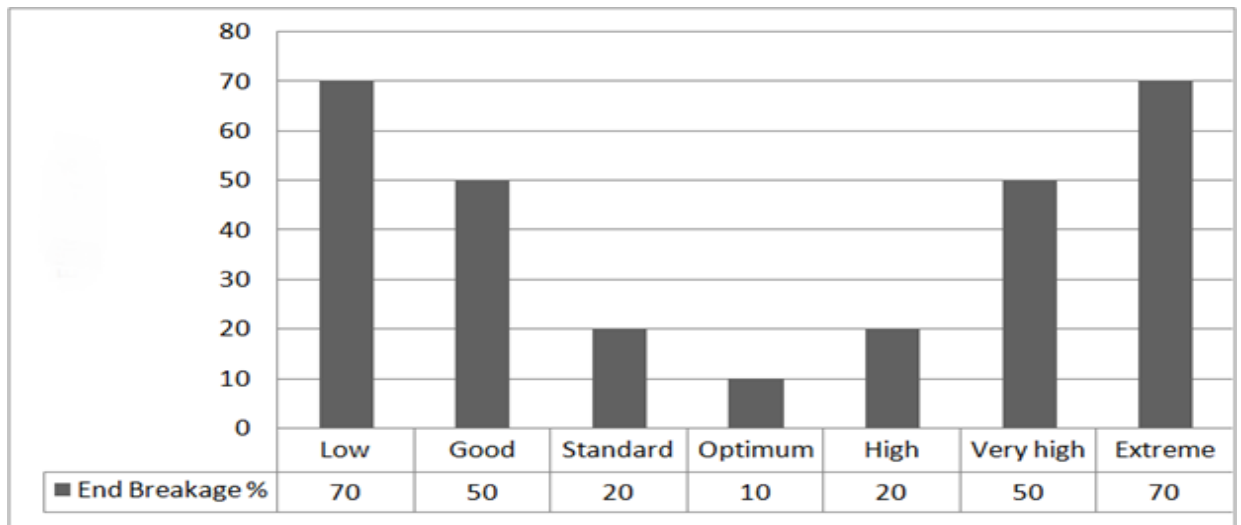
If the sizing chemical is added lower than required...

- The yarn becomes hairy, ball formation will occur and entanglement with other yarn will create more breakage.
- The yarn strength will be low and breakage will occur more.
- The yarn becomes more difficult to weave as hairiness rises.
- The Weaving Floor will be dusty.



**Graph: 4.20 A graphical representation of the relation between Sizing % with weaving efficiency %.**

In this bar diagram, the "X" axis represents the amount of sizing chemical applied on the sizing beam, and the "Y" axis represents the weaving %.



**Graph: 4.21 A graphical representation of the relation between Sizing % with end breakage %.**

In this bar diagram, the "X" axis represents the amount of sizing chemical applied on the sizing beam, and the "Y" axis represents the end breakage %.

Weaving performance & efficiency will be down and breakage will be high if during sizing some very essential parameters are not followed properly. A sizer and the sizing chemical recipe maker must keep in mind during the sizing process. They are given below...

1. If the hairiness of the yarn is high then the sizing concentration would be high.
2. If the twisting of the yarn is high (30 TPI to 75 TPI) then the sizing concentration would be high.
3. If the yarn count is high (Finer) then the sizing concentration would be high.
4. If the yarn count is low (Coarser) then the sizing concentration would be low.
5. If the temperature of the size bath is high then the viscosity or concentration of size would be low or equal.
6. If cooking time is more than the viscosity would be less.

#### **4.6.1 Suggested solution regarding observation**

From the above analyzed study, it has been concluded that sizing is the heart of weaving. Either excess amount of sizing chemical or lower amount of sizing chemical on weaver's beam provide good performance. An optimum amount of sizing chemical is required to get good weaving performance. So, sizing takes up% directly impact on air jet weaving loom performance.

## **4.7 Reed Problem**

Weaving reed is one of the key equipment in the textile weaving process. Its function is to push weft yarn into the fell of the cloth after picking. Also arrange warp & weft yarn according to certain regularity and density in order to achieve the required weft density and width.

Weaving reeds are generally classified into their shapes. They are...

1. Flat reeds and
2. Profile reeds.

Profile reeds are used in airjet looms and weft insertion carried out by main nozzles and auxiliary relay nozzles, this type of reed has reed grooves. The quality of air jet looms reed directly affects the weaving efficiency, quality and cost of the fabric.

Some defects of reed cause higher filling breakages. Which referred to lower productivity. They are...

1. Deflection of reed
2. Reed wear out
3. Vibration of reed
4. Reed dent rust

Rather than above physical deformity one other reed characteristic directly causes more filling problems. That is...

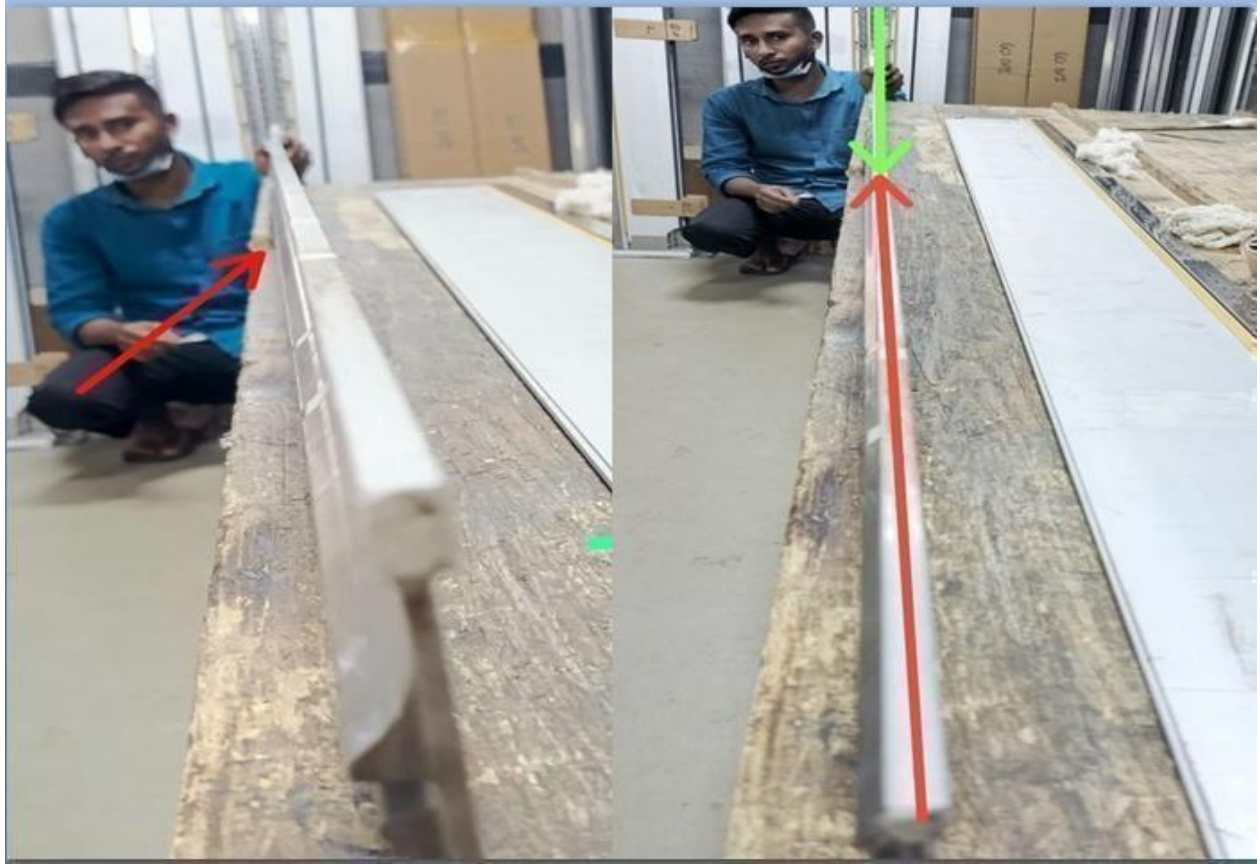
1. Lower count of reed.

A light discussion is described below...

### **4.7.1 Deflection of reed:**

A very slight deflection of reed may cause more filling. The direction of weft insertion may be changed and yarn cannot pass smoothly through the profile. Yarns get obstructed due to bending of the reed body. Normally the reed got deflected during...

1. Pattern save & Pattern mount time
2. In appropriate handling
3. By accidental cause
4. Reed to reed joining time
5. In appropriate storing

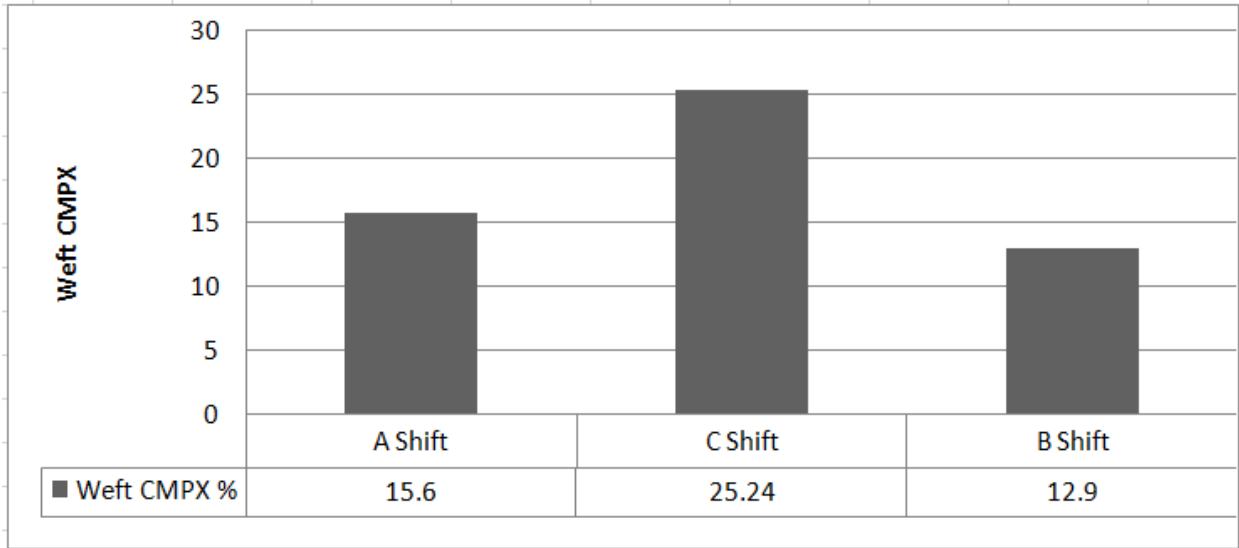


**Figure: 4.8 A figure of Deflection of the weaving reed.**

To prove the statements some analytic data was collected from the weaving floor.

Reed deflection problem				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	73.5	72.4	69.7	71.9
RPM	855	863	883	867.0
Pick Inserted	10252	28516	29439	227363.
	7	9	3	0
Warp breakages	2	2	2	2.0
Warp CMPX	1.95	0.7	0.7	1.1
Weft breakages	16	72	38	42.0
Weft CMPX	15.6	25.24	12.9	17.9
Bobbin breakages	0	3	1	1.3

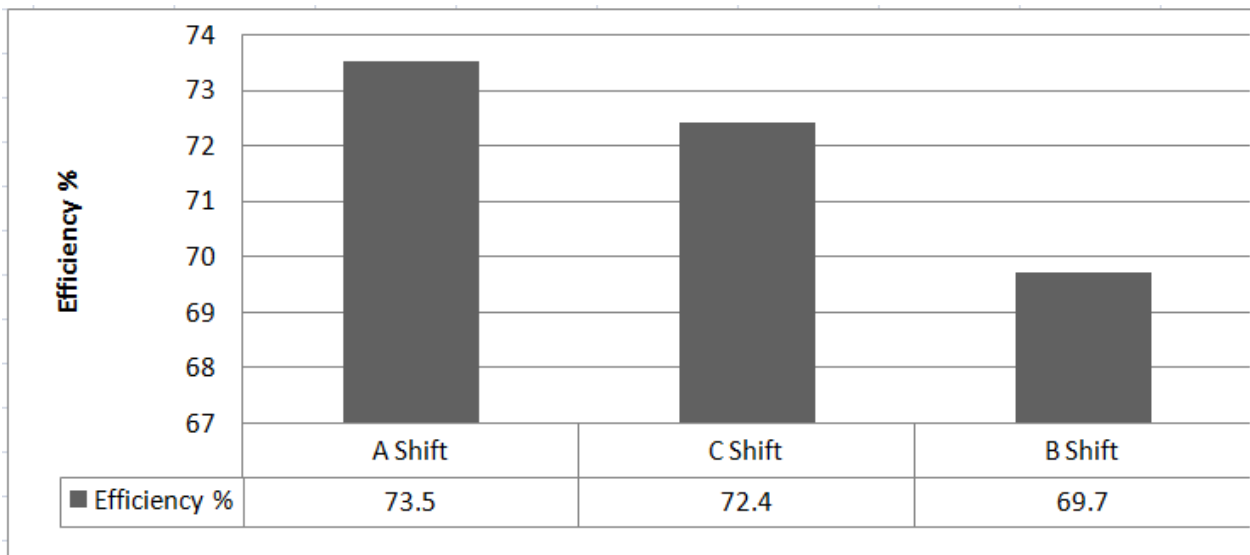
**Table: 4.10 Performance of weaving with reed wear out problem.**



**Graph: 4.23 Graphical representation of weft CMPX due to deflection of reed.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents the weft CMPX.

From graph 3 it was observed that weft CMPX was very high in every shift due to reed deflection problem. In which 25.24 was the highest weft CMPX.



**Graph 4.24 Graphical representation of weft CMPX due to deflection of reed.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents weaving efficiency%.

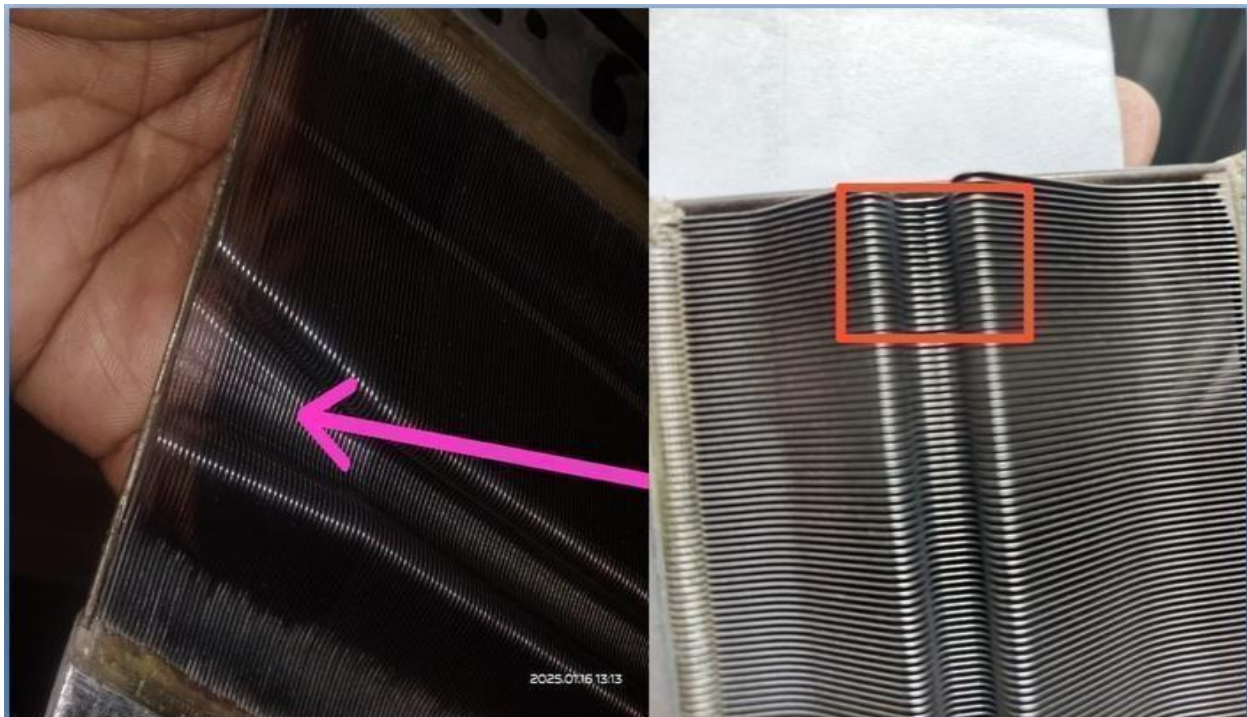
From graph 3 it was observed that weaving efficiency % was remarkably low in every shift due to reed deflection problems. Average efficiency %= 71.9%

#### 4.7.1.1 Suggested solution regarding observation

From the above analyzed study, it has been concluded that due deflection of reed, higher filling occurs and weaving looms efficiency also down. Though lower the RPM can slightly solve this problem but it is not the permanent solution. Higher weft CMPX, lower RPM and lower efficiency due to deflection of reed problem directly impact on air jet weaving looms productivity. Careful handling of reed during work can only solve this problem.

#### 4.7.2 Reed wears out:

During the weaving process warp yarns from weaver's beam inclination width is more than the fell of the cloth. That's why in the beating-up process the tension of the side warp yarn is much greater than that of the middle warp yarn, so the friction with the reed dents is very intense at the edge of the reed. Even In the production of some kinds of fabrics, the beating-up force generated in both edges of the reed dents is 12-17 times higher than the middle of the reed dents. Due to this higher friction between reed and yarn causes reed to wear out. In this wear out portion weft yarn gets stuck in the picking process and then filling occurs. So immediately reeds need to change, if not possible to change the reed looms RPM need to reduce.

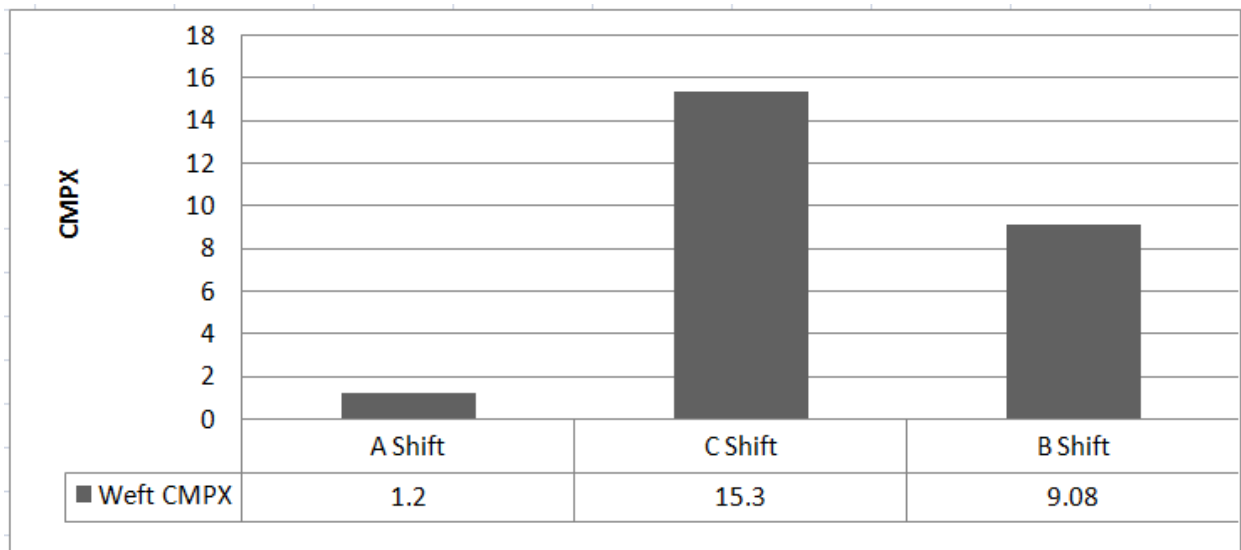


**Figure: 4.9 A figure of wear out of the weaving reed.**

To prove the above statements some analytic data was collected from the weaving floor.

Reed Wear out (Loom 20)				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	95.7	80.1	92.8	89.5
RPM	700	696	700	698.7
Pick Inserted	166218	261072	99018	175436
Warp breakages	0	2	0	0.7
Warp CMPX	0	0.76	0	0.3
Weft breakages	2	40	9	17.0
Weft CMPX	1.2	15.3	9.08	8.5
Bobbin breakages	1	2	1	1.3

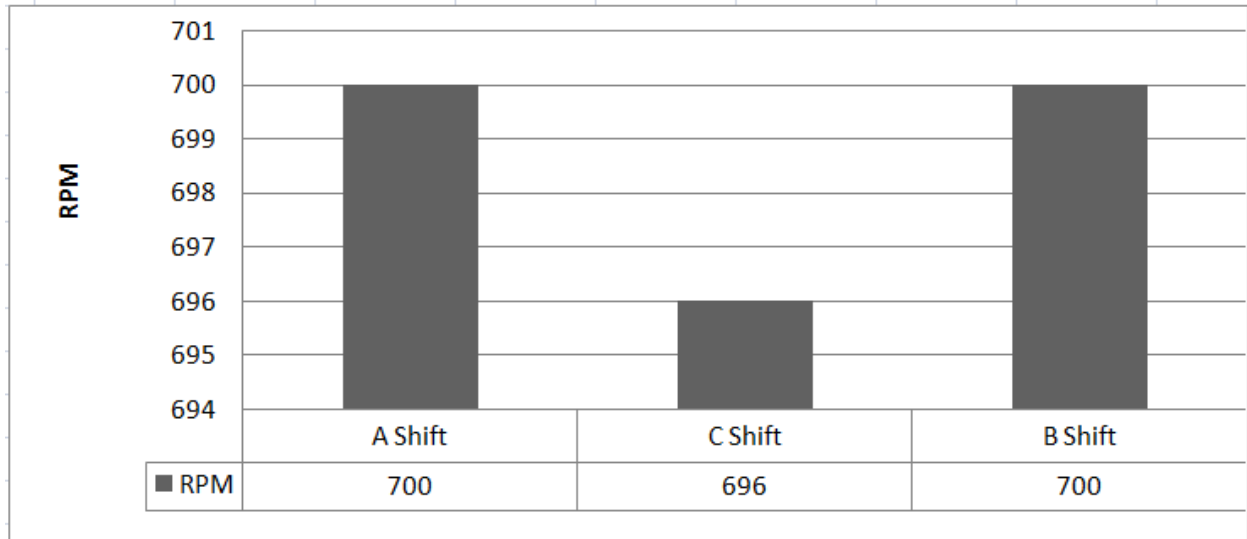
**Table: 4.11 Performance of weaving with reed wear out problem.**



**Graph: 4.25 Graphical representation of weaving efficiency % due to reed wear out problem.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents the weft CMPX.

From graph 3 it was observed that the loom reed wears out problem started from the end of the B shift, that's why B shift weft CMPX is 9.08. And in C shift CMPX was very high, around 40 fillings occurred. In A shift reed change was done and eventually CMPX lowered to 1.2.



**Graph: 4:26 Graphical representation of weaving RPM due to reed wear out problem.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents the looms RPM.

From graph 3 it was observed that due to reed were out problem in C shift (night shift) looms RPM reduced to 700 to 650 (696 is the average RPM). So due to performance with reed wear out problems RPM needs to be reduced. Hence, these phenomena directly impact on air jet looms productivity.

#### 4.7.2.1 Suggested solution regarding observation

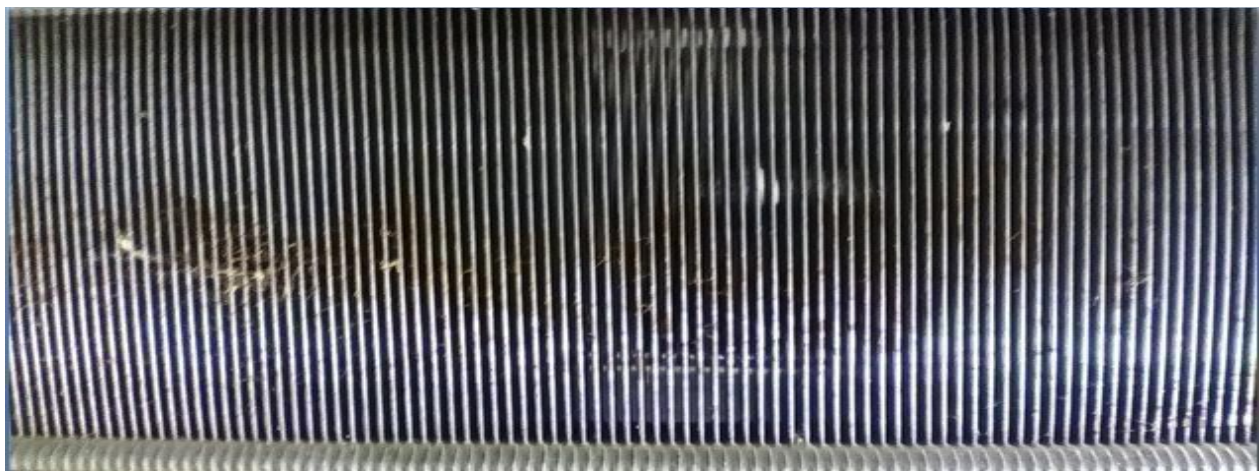
From the above analyzed study, it has been concluded that due to reed wear out problem higher filling occurs. So, to come out from this situation reed need to be changed or repaired, on the other hand lowering the RPM can slightly solve this problem. Both of the mentioned procedures directly impact on air jet weaving looms productivity.

#### 4.7.3 Reed vibration:

Due to composition of reed material a low to heavy vibration seen during the weaving process. This causes more filling problems. Normally steel, standard stainless steel, carbon steel and sometimes customized composition of reed material are used in weaving floor. Each of them individually shows a slight variation of weaving efficiency with one another.

#### 4.7.4 Reed dent rust:

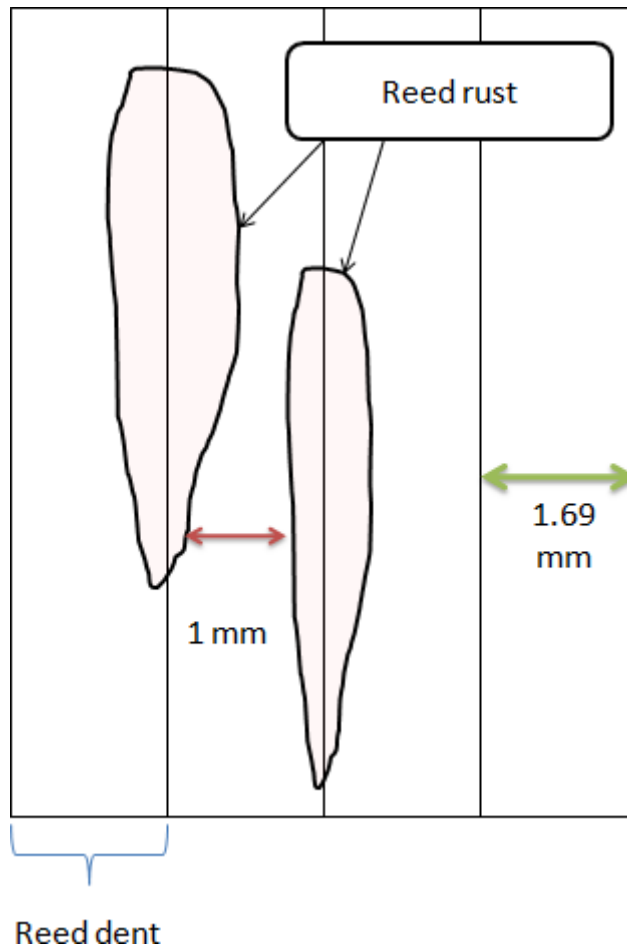
When reed keeps store for long-time rust will occur on reed dent. Some chemical treatment has been done nowadays to overcome this situation. But due to higher friction the protective anti-rust coating fallout from reed dent and due to exposure with humidity reed dent rust occurs. Reed dent rust will lead to warp fluffing and breakage. When reed rust occurs the rusting dent becomes thicker that's why distance between two dent reduces, so there will be more friction between reed dent and warp yarn that's why warp becomes fluffy and loses its strength and breakage occurs. If the reed surface is seriously uneven, the direction of weft insertion may be changed and cause more weft breakage problems. Though running for a couple of shifts this rust is reducing gradually as a result of higher friction between dent rust with warp yarn.



**Figure: 4.10** Figure of reed dent rust of weaving reed.



**Figure: 4.11** A figure of fluffy warp yarn which is produced by friction between reed dent and warp yarn during the beating process.



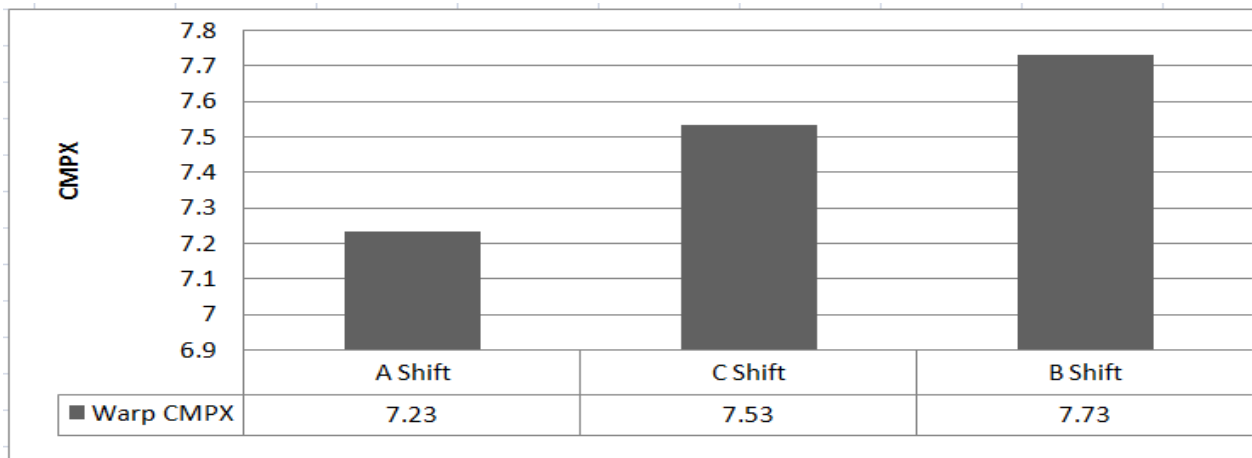
**Figure 4.12** A figure of reed rust in reed dent

In this figure it is trying to illustrate that, let us consider the reed is 30 counts, so distance from one reed dent to another dent is 1.69 mm. but due to rusting problem in some places reed dent thickness reduced to 1 mm. In this 1 mm thickness portion of reed dent warp yarn faces higher friction in between two reed dents. And then warp breakage increased more. Even due to lower distance between two dents while shedding process running, in this 1 mm thickness portion of reed dent, shed not open fully that's why filling problem occurs more.

To prove the above statements some analytic data was collected from the weaving floor.

Reed rust Problem				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	88.4	88.5	73.3	83.4
RPM	750	750	750	750.0
Pick Inserted	317929	318456	258475	298286.7
Warp breakages	23	24	20	22.3
Warp CMPX	7.23	7.53	7.73	7.5
Weft breakages	8	15	9	10.7
Weft CMPX	2.51	4.71	3.48	3.6
Bobbin breakages	1	4	1	2.0

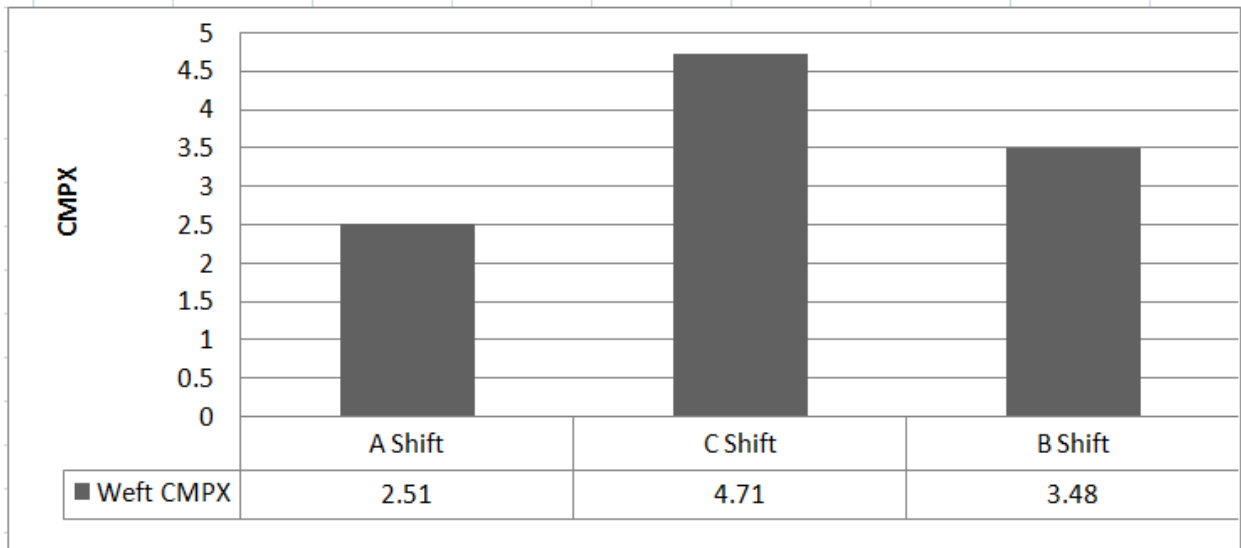
**Table: 4.12 Performance of weaving with reed rust problem.**



**Graph: 4:27 Graphical representation of warp CMPX due to reed rust problem.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents the looms warp CMPX.

From graph 3 it was observed that due to reed rust problem 03 shifts warp CMPX is high, but due to higher friction between reed dent and warp yarn, rust is reducing gradually that's why CMPX is gradually down C shift CMPX > B shift CMPX > A Shift CMPX. Due to higher WARP CMPX efficiency is down. So, this problem directly impacts air jet production.



**Graph: 4.28 Graphical representation of weft CMPX due to reed rust problem.**

In this bar diagram, the "X" axis represents shifts name, and the "Y" axis represents the looms weft CMPX.

From graph 3 it was observed that due to reed rust problem 03 shifts weft CMPX is high, but due to higher friction between reed dent and warp yarn, rust is reducing gradually and in shedding process carried out comparatively smoothly that's why C shift weft CMPX > B shift CMPX > A Shift CMPX. As a result of higher weft CMPX looms efficiency is down. So, this problem directly impacts air jet production.

#### **4.7.4.1 Suggested solution regarding observation**

From the above analyzed study, it has been concluded that due to reed rust problem, higher warp breakage and filling breakages occurs and weaving looms efficiency also down. Higher warp CMPX & weft CMPX cause lower efficiency. So, the reed rust problem directly impacts on air jet weaving looms productivity.

#### 4.7.5 Lower count of reed:

Sometimes in weaving, due to shortage of reed count availability during huge order pressure, alternative reed count is used. A same construction of fabric can easily be run with two different reed counts. Procedure of selecting alternative reed count is given below. Reed count alternation theory...

$$\frac{\text{Recent Reed Count} \times \text{Recent yarn per dent}}{\text{Alternative reed Yarn per dent}} = \frac{56 \times 3}{4} = 42$$

So, alternative reed count will be 42/4.

But comparatively lower reed count shows more filling problem, weft breakage and broken pick problem.

Air gets passed through the reed due to higher reed dent gap so more air pressure is required than normal, so yarn breakage occurs, for that reason we cannot increase air jet looms RPM.

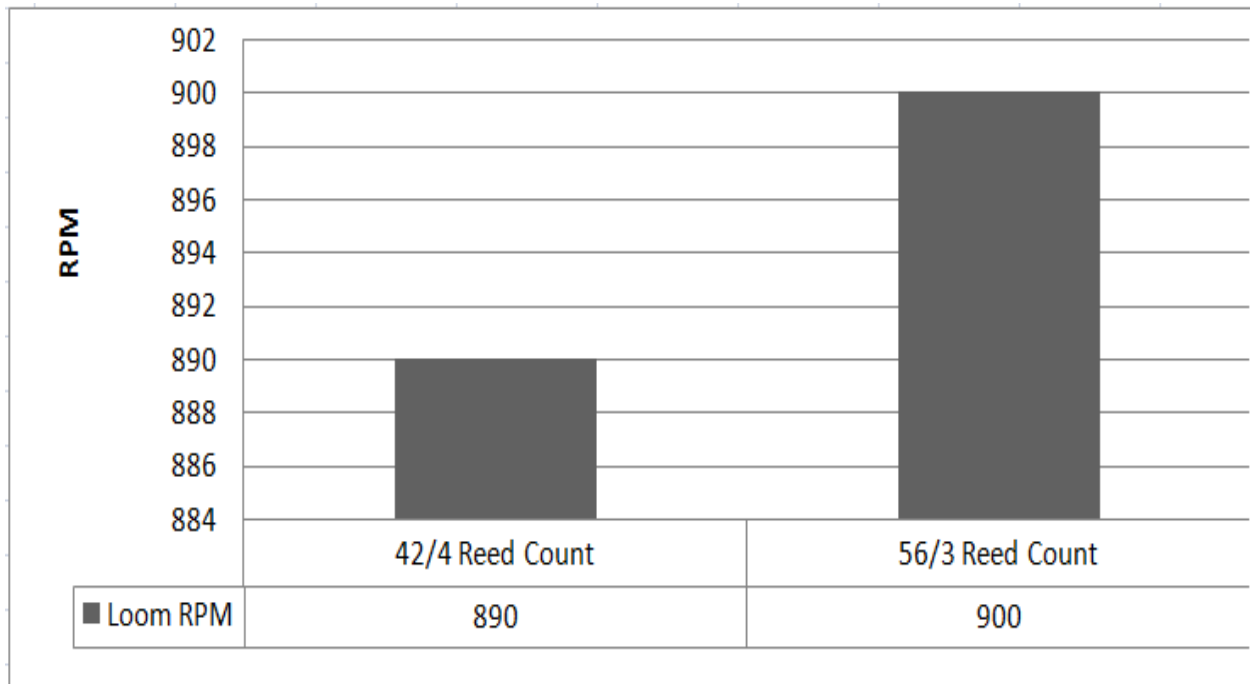
To prove the above statements an analytic data was collected from the weaving floor...

REED COUNT 56/3				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	96.9	97.4	95.9	96.7
RPM	900	900	900	900.0
Pick Inserted	41860 8	42076 8	41428 8	417888.0
Warp breakages	1	1	1	1.0
Warp CMPX	0.24	0.23	0.24	0.2
Weft breakages	4	4	11	6.3
Weft CMPX	0.95	0.95	2.65	1.5
Bobbin breakages	4	3	4	3.7

**Table: 4.13 Performance of weaving loom with 56/3 reed count.**

REED COUNT 42/4				
Shift name	A Shift	C Shift	B Shift	Average
Efficiency	82.2	95.4	69.7	82.4
RPM	873	900	899	890.7
Pick Inserted	330499	409428	301004	346977.0
Warp breakages	6	3	7	5.3
Warp CMPX	1.81	0.73	2.32	1.6
Weft breakages	3	12	12	9.0
Weft CMPX	0.9	2.93	3.98	2.6
Bobbin breakages	2	1	6	3.0

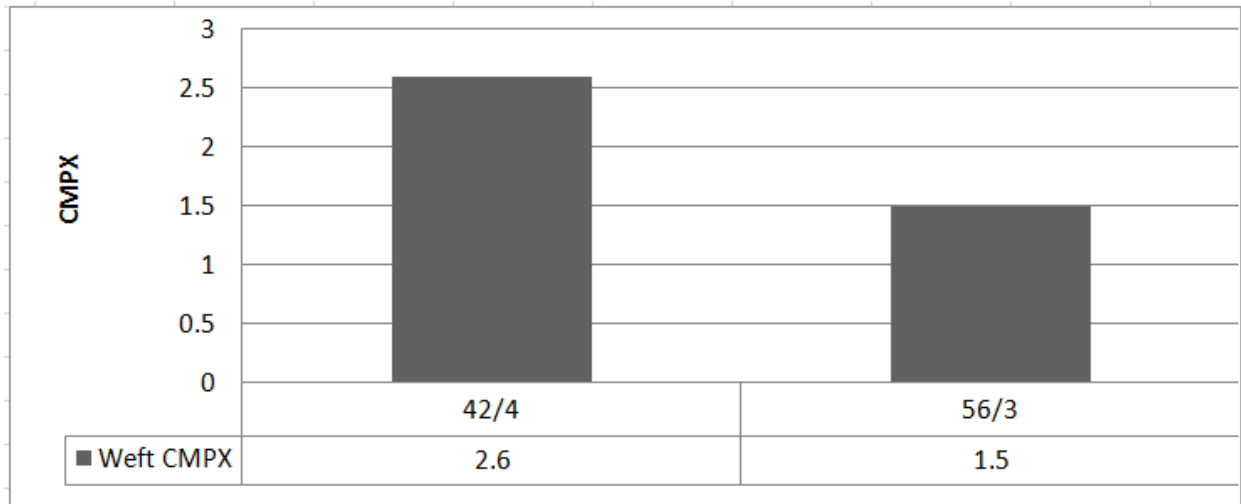
**Table: 4.14 Performance of weaving loom with 42/4 reed count.**



**Graph: 4.29 A graphical representation of RPM variation of two different reed counts of same fabric construction.**

In this bar diagram, the "X" axis indicates reeds count, and the "Y" axis represents the weaving looms RPM.

From graph 3 it was observed that with the reduction of reed count RPM needs to be lower just to prevent weft breakages.



**Graph: 4.30 A graphical representation of RPM variation of two different reed counts of same fabric construction.**

In this bar diagram, the "X" axis indicates reeds count, and the "Y" axis represents the weft CMPX.

From graph 4 it was observed that with the reduction of reed weft CMPX increased.

#### 4.7.5.1 Suggested solution regarding observation

From the above analyzed study, it has been concluded that due to lower reed count a large amount of air pressure is required then a higher reed count, so weft breakages get higher. Due to higher breakages of weft yarn, in order to reduce air pressure loom RPM needs to be reduced. Hence this issue directly impacts air jet looms production which reduces productivity of weaving looms.

#### 4.8 RH % & Temperature:

The ratio of the amount of water vapor present in a given volume of air at a given temperature to the amount of water vapor required to saturate that volume of air is called relative humidity. It is expressed as a percentage. The humidity of a particular place or area depends on the temperature and pressure of that place or area. The same amount of water vapor creates more relative humidity in cold air than in warm air. For the weaving floor it is very essential to maintain RH% to get optimum loom speed. Normally 70-80% RH% is required for weaving. But looms create a significant amount of heat signature which reduces the relative humidity below 70%. Lower humidity refers to higher temperature which increases warp & weft yarn breakage occurs in a

significant range. In weaving floor with the help of chiller & Ac plant floor RH% & temperature being maintained.

The main reason why RH% and temperature is maintained in the weaving factory...

1. Dry air causes lower moisture regain and this contributes to poor quality and lower weaving performance.
2. Yarns with lower moisture content are weaker, thinner, more brittle, and less elastic, create more friction and are more prone to static electrification.
3. Yarns at optimum moisture regain are less prone to breakage and create lower heating issues against higher friction during the weaving process.
4. Higher humidity reduces static problems. Due to static problems, the yarn's hairy fiber got entangled among them and created ball formation problems which increased warp breakages. Reduced static makes materials more manageable and increases loom RPM.
5. Humidification reduces fly and micro dust which gives a healthier and more comfortable working environment.

To prove the above statements an analytic data was collected from the weaving floor...

Relative humidity and temperature in weaving floor:

Yarn Count	RH%	Temperature
Any count	$70 \pm 2$	$25 \pm 2$ C

**Table: 4.15 Atmospheric conditions while collecting data.**

For collecting data, a fabric construction was selected which is mentioned below:

Warp count – 20s Ne

Weft count- 12s Ne

Ends per inch – 100

Picks per inch – 57

Weave – 2/2 Matt

Fabric width – 58 inches

For analysis of the above fabric construction three different RH % values were brought for consideration. They are...

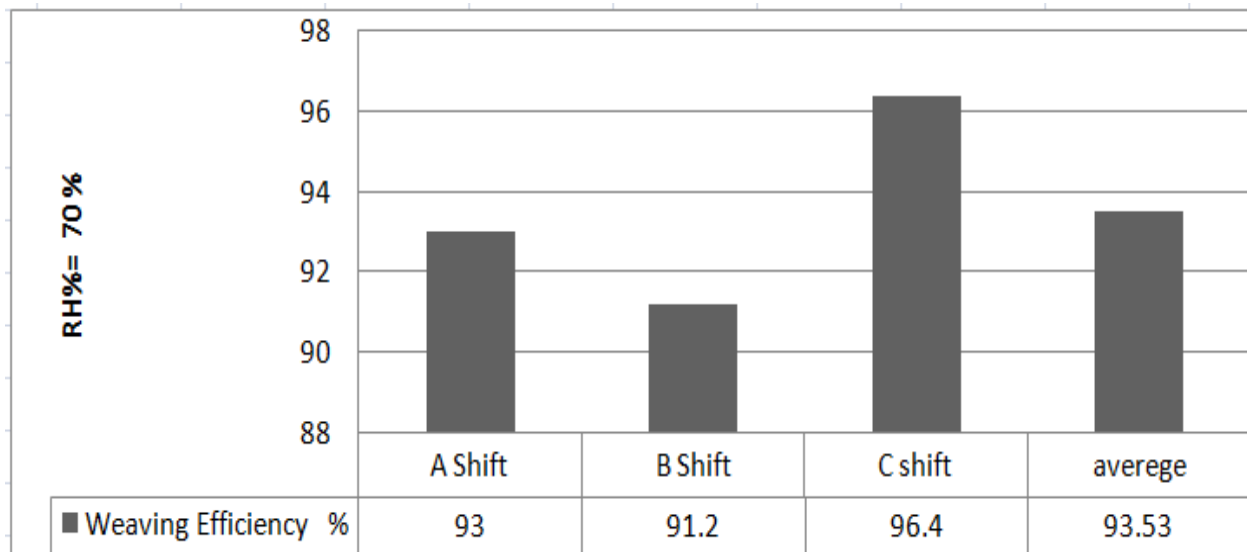
	A	B	C
RH%	70	68	72

**Table: 4.16 weaving floor RH% for analysis.**

By maintaining the Relative Humidity at 70 % average weaving efficiency was found as follows...

Loom Efficiency %			
A Shift	B Shift	C Shift	Average Efficiency
93%	91.20 %	96.40 %	93.53%

**Table: 4.17 Weaving Efficiency**



**Graph: 4.31 Graphical representation of weaving efficiency at RH=70%**

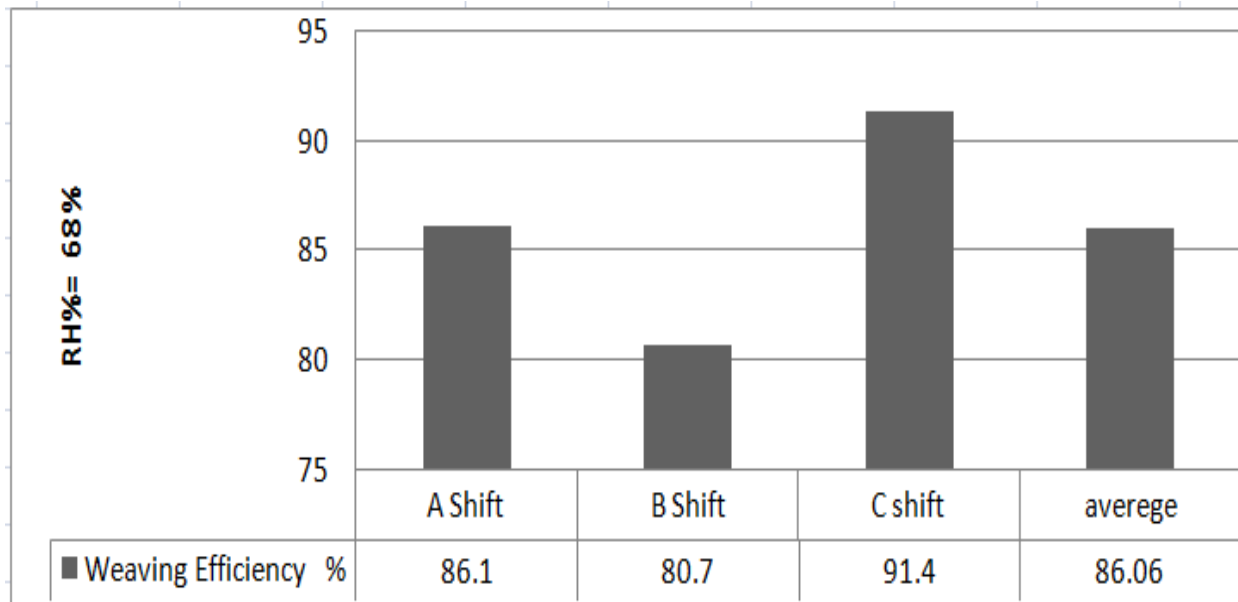
In this bar diagram, the "X" axis indicates shift name, and the "Y" axis represents the weaving floor's overall efficiency at RH%= 70%.

From graph 3 it was observed that with maintaining RH%=70% a good overall weaving floor efficiency can achieve about = 93.53%

By maintaining the Relative Humidity at 68 % average weaving efficiency was found as follows...

Loom Efficiency %			
A Shift	B Shift	C Shift	Average Efficiency
86.1 %	80.70 %	91.40 %	86.06 %

**Table: 4.18 Weaving Efficiency**



**Graph: 4.32 Graphical representation of weaving efficiency at RH=68%**

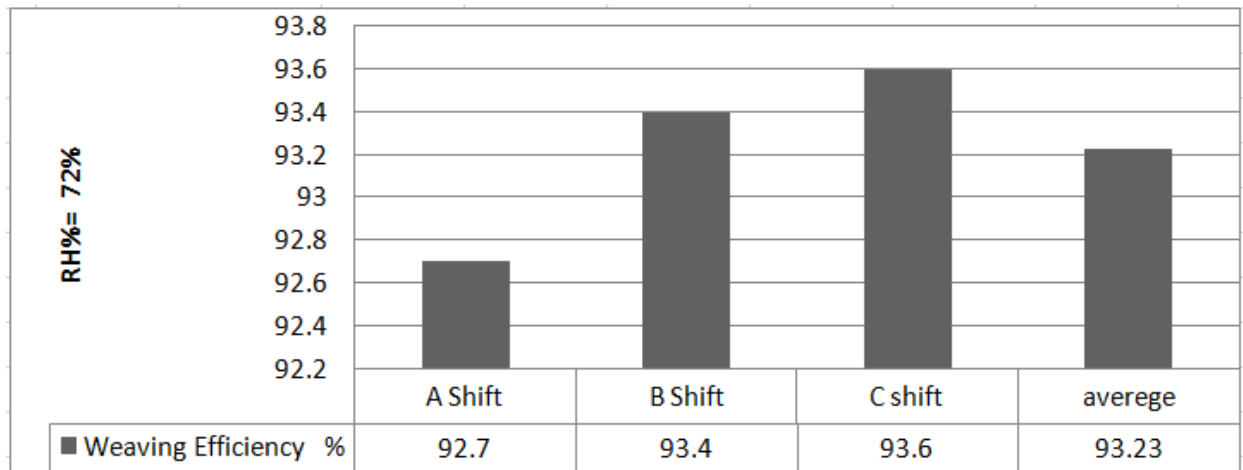
In this bar diagram, the "X" axis indicates shift name, and the "Y" axis represents the weaving floor's overall efficiency at RH%= 68%.

From graph 3 it was observed that with maintaining RH%=68% a poor overall weaving floor efficiency can achieve about = 86.06%

By maintaining the Relative Humidity at 72 % average weaving efficiency was found as follows...

Loom Efficiency %			
A Shift	B Shift	C Shift	Average Efficiency
92.7 %	93.40 %	93.60 %	93.23 %

**Table: 4.19 Weaving Efficiency**



**Graph: 4.33 Graphical representation of weaving efficiency at RH=72%**

In this bar diagram, the "X" axis indicates shift name, and the "Y" axis represents the weaving floor's overall efficiency at RH%= 72%.

From graph 3 it was observed that with maintaining RH%=70% a good overall weaving floor efficiency can achieve about = 93.23%

#### **4.8.1 Suggested solution regarding observation**

From the above analyzed study, it has been concluded that an increase in the relative humidity leads to increase in weaving efficiency in the weaving floor, due to significant reduction in the warp breakages. And at a same time, reduction of RH% leads to lower the weaving efficiency as a result of increased warp breakages. So, proper RH% should maintain in the weaving floor.

#### **4.9 Moisture regains:**

Sometimes textile mill factory owners buy extra yarn for future uses, and keep stores for a long time in place. That's why yarn quality got loosen in strength. Yarn moisture regain gets high. Normally for cotton yarn moisture regain 8.5 is required for optimum performance. Higher or lower than this range cause more breakage. Which promotes not to increase RPM.

#### **4.10 Yarn characteristic:**

Loom RPM needs to lower due to warp & weft yarn characteristics. Due to different fiber characteristics of nature with nature and nature with synthetic yarn we found difficulties in air jet looms while air pressure setting.

Some natural and synthetic combined yarn names are

1. PC (Polyester cotton) yarn
2. Cl (Cotton Linen) yarn

3. WS (Wool silk) yarn
4. CW (Cotton wool) Yarn
5. HC (Hemp Cotton) yarn
6. BC (Bamboo cotton) yarn
7. Melange yarn (Melange yarn is produced with a mixture of raw and dyed fibers)

#### **4.11 Loom Setting Adjustment:**

The proper mechanical adjustment impacts on looms weaving performance. Some of the loom setting parameters is given below...

1. Properly set beam length: If beam length is not set on the loom monitor then loom will stop unwontedly due to achieving the wrong weave length. After stopping, a mechanical person is required to open the looms monitor lock and set the remaining yarn length in the weaver's beam and it takes several minutes and causes loss in production.
2. Zero (0) setting adjustment: After proper beam length setup, zero adjustment setting is required. Zero adjustment setting is referred to as proper yarn tension setting on a weaver's beam which is automatically set by the tension roller with the help of a load cell/ sensor. This setting is set manually on the loom monitor. Without proper zero adjustment, weaving tension variation is found during the weaving process which causes starting mark problems and higher warp breakages problem. That reduces weaving efficiency%.
3. Proper article needs to be done width wise: Article referred as set the proper positioning of the two filling detectors. One filling detector (FD1) ensures filling presence in the fabric body during picking and another filling detector (FD2) ensures the weft yarn does not get out from the fabric after picking.
4. Proper Shedding angle selection: According to EPI and PPI shed angle increase or decrease, again on the basis of warp yarn count shed angle increase or decrease. Lower the yarn count higher the shed angle and higher the yarn count lower the shed angle. Again, higher the EPI shed angle should be lower otherwise warp and weft breakages will be high.
5. Proper cam setting is required in the cam box: Cam gear should be mounted on sumo motor gear at 299 degree angle. If cam position does not match with machine position then filling breakages will increase.
6. Proper frame height set up.

7. Proper drop wire box set up: The function of drop-wire box is to hold drop wire. Their position is seen between the tension roller and heald frame. Excessive close to the held frame might impact on reduced the shed angle and create filling. Again excessive close to backrest cause to more warp breakages because they impart extra weight on warp yarn.

8. Proper second roller position set up

9. Filling cutter or weft cutter angle determination: After inserting a filling there are two filling cutters which are positioned on the two sides of the fabric and function is to cut the filling ends. Filling cutter has a cutting angle. When a sumo motor reaches a specific angle, cutter comes in action. But if picking angle match with the cutting action then filling yarn may get hindered with cutter blade and filling breakages occurs.

10. Set correction factor: According to fabric pick density weaving correction factors need to be selected.

11. Select a suitable position for the sumo motor.

1. AMP= Automatic machine position
2. ASO= automatic start offset
3. ASP= Automatic start Position
4. PFT= Programmable filling tensioner
5. ELCA= Electronic Low continuous air flow determine

#### **4.12 Sizing chemical impact on loom performance**

PVA (polyvinyl alcohol) =

This sizing agent is characterized by high adhesive power. Depending on the desired properties this sizing agent can provide glutinous, tear-resistant and also possible to use for achieving elasticity & transparent sizing films on the warp thread. This is a non-ionic sizing agent and easily can be combined with other sizing agents also. They are suitable for natural fibers as well as for synthetic staple fibers and their blends. Though this agent's price is comparatively higher than other sizing agents/Chemicals.

CMC (Carboxymethyl Cellulose) =

This agent is applicable on all staple fiber yarns. This agent has an excellent adhesive power. Though these sized threads have a stiff handle feel. This sizing agent's show low-dusting problem in the weaving floor. CMC sizes can be removed from the woven fabric by a simple washing treatment at low temperatures. Due to higher friction of yarn to the frame, drop wire &

held eye yarn hairiness create ball formation problems which cause several warp and weft breakages.

#### **4.13 Warp tension impact on performance**

During starting mark & wrapping mark working procedure tension on weavers' beam, fabric & selvedge side. Some time fabric design is also considerable for applied adjusted tension.

1. Looms backrest roller position up or down due to construction wise, warp count wise.
2. Short temple, Full width temple: short temple is used vastly, for uniform tension distribution; all over the full width temple are used.
3. By create tension by ELO and ETO motor (Electronic Let Off) on weaver's beam: Excessive tension by ELO and ETO motor can cause higher warp breakages.

**CHAPTER-5**  
**CONCLUSION**

## **CHAPTER-5**

### **CONCLUSION**

After devoting significant time and effort to completing this project report, I am pleased to say that I have gained a comprehensive understanding of the factors which affecting the airjet looms efficiency and productivity. Throughout my research, I have delved deep into the factors which cause productivity loss and their unavoidable act during airjet weaving process. This project has been a valuable opportunity for me to expand my knowledge and expertise in the field of textile engineering.

One of the key aspects of this project was not only to find out the factors that affect looms productivity but also discuss the solutions. These solutions are based on my 07 years job experience in weaving production floor as a Sr. Production officer. I tried to highlight the solutions which were basically used in weaving floor. During working on this thesis I came to find out the relation between weaving efficiency with section wise different factors.

In my pursuit to comprehend the inner workings of these factors, I thoroughly examined their various characteristic and parameters. Yarn ratio, weaving looms RPM, beam tension, electronic air pressure controls, fabric design wise settings were among the crucial elements I studied. By manipulating these parameters, I was able to observe their impact on weaving efficiency, CMPX, pick insertion rate and shift wise production database. This practical analysis provided me with invaluable insights into the relationship between machine settings and fabric outcomes.

Additionally, I deepened my understanding of the weaving process. After analysis the factors I was able to find out the down time of weaving process and loss of production per shift, which gives me a clear idea about confirm the delivery on time without any failure.

Throughout this project, I also gained familiarity with a range of parts found in weaving machines. Weaver's beam, Heald Frame, Heald Eye, Drop wire bar, Weft Yarn Stand, Pre-winder, Move nozzle or main nozzle, Rely nozzle, Reed, Filling Detector, Filling Cutter, Temple, Take up roller, Cloth roller, Leno bobbin Box, Tension Roller and many more were thoroughly examined. Each component plays a vital role in ensuring the smooth operation and control of the machines, further solidifying my understanding of their mechanisms.

This study holds significant importance in the field of fabric manufacturing. By highlighting the factors that affecting airjet looms weaving performance, it has shown each factors significance in higher airjet looms weaving production and efficiency. The knowledge and insights gained from this project will undoubtedly serve me well in my future career and academic pursuits within the textile industry.

In conclusion, this project has been a rewarding journey for me with a huge exploration and discovery. By unraveling the factor that affecting airjet looms weaving productivity and efficiency, and by investigating their impact on weaving, I have acquired a comprehensive understanding that will undoubtedly prove beneficial in my future endeavors. I am confident that the knowledge and skills gained from this project will empower me to excel in the dynamic and ever-evolving field of textile engineering.

## REFERENCE

- [1] <http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/8496/181-23-5349.pdf?sequence=1&isAllowed=y>
- [2] [https://www.researchgate.net/publication/315382237\\_Loom\\_Settings\\_and\\_Fabric\\_Structure\\_Two\\_Major\\_Influencing\\_Factors\\_of\\_Warp\\_Tension\\_Variation](https://www.researchgate.net/publication/315382237_Loom_Settings_and_Fabric_Structure_Two_Major_Influencing_Factors_of_Warp_Tension_Variation)
- [3] <https://www.britannica.com/technology/weaving>
- [4] <https://www.ssjacquard.com/blog/main-factors-affecting-the-weaving-efficiency-of-air-jet-loom-65739.html>
- [5] [https://textilelearner.net/air-jet-loom-working-principle-data-processing-advantages/#google\\_vignette](https://textilelearner.net/air-jet-loom-working-principle-data-processing-advantages/#google_vignette)
- [6] <https://textilelearner.net/production-calculation-of-loom/>
- [7] <https://anuprerna.com/blogs/3-types-of-basic-weaves-their-impact-on-fabric-property/79286>
- [8] <https://textileexplainer.com/revelation-and-classification-of-weaving-loom/#:~:text=There%20are%20two%20kinds%20of,of%20threads%20at%20right%20angles.>
- [9] [https://www.textileflowchart.com/2014/12/process-flow-chart-of-weaving-technology.html#google\\_vignette](https://www.textileflowchart.com/2014/12/process-flow-chart-of-weaving-technology.html#google_vignette)
- [10] [https://www.textileflowchart.com/2021/03/flow-chart-of-loomng-process-in-weaving.html#google\\_vignette](https://www.textileflowchart.com/2021/03/flow-chart-of-loomng-process-in-weaving.html#google_vignette)
- [11] <https://textilelearner.net/textile-finis>
- a. <http://dspace.daffodilvarsity.edu.bd:808>
- b. <http://dspace.daffodilvarsity.edu.bd:8080/bitstream/handle/20.500.11948/1381/P04799.pdf?sequence=1&isAllowed=y>
- [12] <https://www.update-adtex.com/2019/05/21/>

- [13] <https://www.smartpatternmaking.com/blogs/pattern-making-news-articles-and-tips/how-to-calculate-fabric-shrinkage-in-3-easy-steps>
- a. (
- [14] <https://www.textileflowchart.com/2015/08>
- [15] <https://textilelearner.net/parameters-of-sewing-embroidery-thread/>
- [16] <https://textilemerchandising.com/top-12-samples-apparel-industry/>
- [17] <https://www.slideshare.net/morshed15/pro>
- [18] <https://www.textileadvisor.com/2019/02/e>
- [19] <https://textilelearner.net/stenter-machine-types-functions/>
- [20] [https://www.academia.edu/39778038/UNIT\\_I](https://www.academia.edu/39778038/UNIT_I)
- [21] <https://www.textileschool.com/242/weaving-calculations/>